CONTRACT BETWEEN
JACKSONVILLE TRANSPORTATIAON AUTHORITY
AND
GILLIG, LLC.

THIS CONTRACT is made this 22nd day of November, 2024, by and between the **JACKSONVILLE TRANSPORTATION AUTHORITY** (the "Authority" or the "JTA"), a public body corporate and politic whose principal business address in 100 LaVilla Center Drive, Jacksonville, FL 32204 and **GILLIG, LLC.** (the "Supplier"), a California Limited Liability Company whose principal business address is 451 Discovery Drive, Livermore, California 94551. The Authority and the Supplier may hereinafter be referred to individually as a "Party" or collectively as the "Parties"

W I T N E S S E T H

WHEREAS, the Authority has publicly advertised the Request for Proposals, RFP P-23-030 (as amended, the "RFP" or the "Solicitation") and the entire Solicitation package is incorporated herein; and

WHEREAS, the Supplier has prepared and submitted its Proposal, dated May 16, 2024 (the "Proposal"), which is incorporated herein; and

WHEREAS, the Authority has selected the Supplier, in accordance with all applicable laws, to provide the specific scope of work, services, and goods (and all other items necessary, proper for or incidental thereto) that are described in the Technical Specifications (**"Exhibit B"**) and made a part hereof, on the terms herein contained; and

WHEREAS, the Supplier hereby represents and warrants to the Authority that the Supplier is a legal entity organized under the laws of the State of California, is authorized to conduct business in the State of Florida, has taken all entity action necessary with respect to the execution and delivery of its obligations under this Contract and the officer of the Supplier who has executed and delivered this Contract is duly authorized with respect thereto; and

WHEREAS, the Supplier hereby represents and warrants to the Authority that the Supplier is qualified and responsible regarding the goods and/or services to be provided hereunder, that all Supplier's licenses required and regulated by the Florida Department of Business and Professional Regulation are active and current, that each of the officers, employees, and agents of the Supplier who will perform services in connection with this Contract on behalf of the Supplier meet the conditions of this clause, and that all individuals performing services are properly licensed when required by law;

NOW THEREFORE, for good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the Authority and the Supplier do hereby agree as follows:

I. Scope of Work

1. The Supplier hereby agrees to provide the scope of work, perform the services, and furnish the goods and materials (and provide all other items necessary, proper for, or incidental thereto) that are set forth in the Solicitation and **"Exhibit C."** Throughout this Contract, all references to the term "work" include all requirements of the specifications, regardless of whether it involves the provision of goods or services or both.

2. Performance of Services. All of the services shall be performed by the Supplier and its authorized subSuppliers as identified by the Supplier in the Schedule of Subsuppliers/SubSuppliers Form. Notwithstanding the use of one or more subSuppliers by the Supplier, the Supplier acknowledges and agrees that all of the services performed and to be performed hereunder shall be the sole responsibility of the Supplier, and Supplier hereby agrees that it warrants all such work as if such work had been performed directly by the Supplier.

3. Order of Precedence. All of the terms and conditions of the Solicitation are hereby incorporated herein in full. In the event of a conflict between the terms of any of the following, the more stringent requirement shall apply. If the conflict cannot be resolved by following the most stringent requirement, the following order of precedence shall govern: (1) Exhibit 'A" of the Solicitation that contains the required clauses for federally- assisted contracts, when applicable; (2) properly authorized written Contract Amendments; (3) properly authorized Purchase Orders; (4) this Contract; (5) the Specifications; (6) Special Conditions; (7) the Solicitation Addenda, if any; and (8) the Solicitation. As between the drawings and other specifications, the drawings take precedence over other specifications as to quantity and location and the specifications take precedence over drawings as to quality of materials and workmanship.

4. Review of Work. Any review of the work by the Authority, its other suppliers, or its partner agencies, including the City of Jacksonville, Florida Department of Transportation (FDOT), Federal Highway Administration (FHWA), and Federal Transit Administration (FTA), is for the sole benefit of the Authority. No such review, acceptance, or approval to proceed to the next level of service, nor the payment of any invoice (including the last invoice, release of retainage, or acceptance of final reports or plans and specifications) shall be deemed to constitute: (1) detailed review or checking of design, details, or accuracy of the Supplier's work; (2) a professional approval by the Authority; or (3) a release of the Supplier from any of its obligations and responsibilities for the accuracy of the plans and specifications. The Authority's review, approval, acceptance of, or payment for any of the services under this Contract shall not constitute a waiver of any of the Authority's rights under this Contract or any cause of action it may have arising out of this Contract.

5. Contract Amendment(s). If any modification to the Contract or a Purchase Order is required, the Parties shall execute an Amendment before the Supplier begins performing any additional or changed tasks associated therewith. Reference herein to the Contract includes all Amendments, if any. The Supplier will only be entitled to adjustments to compensation and/or contract time if such adjustments are included in an Amendment. When possible, all Amendments shall be based upon the previously agreed-to hourly rates or unit costs. In the event that the Supplier and the Authority are not able to reach an agreement as to the amount of compensation to be paid to the Supplier for supplemental or reduced work desired by the Authority, the Supplier shall continue to proceed with the supplemental or reduced work in a timely manner for the amount determined by the Authority to be reasonable. In such event, the Supplier will have the right to submit the dispute to the Vice President of Administration for resolution in accordance with the Disputes Section 9 Paragraph 5 below; however, in no event will the resolution of the dispute

through the courts or otherwise, relieve the Supplier from the obligation to timely perform the supplemental work. Notwithstanding the foregoing, the Authority has the right to terminate the Contract if the Parties fail to reach an agreement on an Amendment.

6. Standard of Care and Quality of Goods. The Supplier shall perform (and cause all subSuppliers to perform) all services in a manner that is consistent with the level of reasonable care, skill, judgment, and ability provided by others providing a similar type of service in the same geographic area. The standard of care shall not be altered by the application, interpretation, or construction of any other provision of this Contract, or any document incorporated or referenced herein, including the Solicitation. Unless otherwise expressly allowed by the specifications, all items furnished by the Supplier in connection with the work performed hereunder must be completely new and free from defects.

7. Personnel. All of the personnel assigned by the Supplier and all subSuppliers shall be qualified and authorized under state and local laws to perform the applicable services, whether by appropriate license, registration, certification, or other authorization. The Supplier shall not change its assigned Project management staff, delete any of the identified subSuppliers, or engage additional companies as subSuppliers hereunder, without prior written approval of the Authority. Supplier agrees that it will remove from assignment under this Contract any employee or sub-Supplier, upon request by the Authority, which may be with or without cause. Any such removal shall not necessarily reflect on the capability or competence of the individual or entity so removed. Nothing herein shall affect the status or responsibilities of the Supplier as an independent Supplier solely responsible for the method, manner, and means chosen by it to perform hereunder.

8. Schedule(s). The Supplier agrees that time is of the essence for the performance of each of the Supplier's obligations hereunder. The Supplier shall complete the work in accordance with the schedule set forth in the Solicitation and provide schedule progress reports, if applicable, in a format acceptable to the Authority and at intervals established by the Authority. The Authority will be entitled at all times to be advised, at its request, as to the status of work being performed by the Supplier and of the details thereof. Either Party may request and be granted a conference. If, at any time prior to completion of the work, the Supplier determines that the work is not progressing according to the schedule, the Supplier shall immediately notify the Authority in writing and shall provide a description of the cause of the delay, the effect on the schedule, and the recommended action to meet the schedule. An extension of time for performance shall be the Supplier's sole and exclusive remedy for any delay of any kind or nature caused by the Authority.

9. Corrections and Clarifications. Upon request by the Authority, the Supplier shall promptly make any revisions or corrections that resulted from any error and/or omission by the Supplier or subSuppliers, and shall clarify any ambiguities, without additional compensation. Acceptance of the work by the Authority shall not relieve the Supplier of the responsibility for subsequent corrections and clarifications. At any time during any phase of work for which the Supplier or any of its subSuppliers has performed services for the Authority, or during any phase of work performed by others, based on data furnished by the Supplier to the

Authority, the Supplier shall confer with the Authority for the purpose of interpreting the information furnished and/or to correct any errors and/or omissions made by the Supplier or its subSuppliers. The Supplier shall perform all services necessary to correct it's or its subSuppliers errors and/or omissions without additional compensation, even though final payment may have been received, therefore. If any work or service contains an error, omission, deficiency, or mistake, the Authority may back-charge against the Supplier all reasonable costs incurred in identifying, documenting, and remedying any such error, omission, deficiency, or mistake. Such back-charge amounts may be deducted from any payment(s) due the Supplier. If the payment(s) due the Supplier are not sufficient to cover such amount(s), the Supplier shall pay the difference to the Authority. The Supplier shall be liable, and shall reimburse the Authority, for any and all expenses incurred by the Authority, above those that would normally be experienced if the Supplier's or its subSuppliers' errors and/or omissions had not occurred.

II. Compensation, Invoices, and Terms of Payment

1. Compensation under this Contract shall be based on the total cost of all requirements which will be based on Fixed Unit Prices for the total bus and its related components. The Authority shall be provided with a pricing sheet at the time of order that shall follow the requirements of the contract.

2. The Supplier shall hold all pricing referenced in "Exhibit F" for One Hundred Eighty (180) day from the effective date of the contract. After the 180 day period, all prices shall be subject to the US Bureau of Labor Statistics Producer Price Index (PPI) Series ID: WPU1413 Truck and bus Bodies and will be capped at Eight percent (8%) per year. Price quotes will be valid for ninety (90) days. The JTA may request price justification for escalation or de-escalation of contract prices.

3. The Supplier shall deliver invoices to the Authority within One (1) week of bus delivery in detail sufficient for a proper pre-audit and post-audit thereof. A written progress report, in format and detail approved by the JTA Project Manager, shall accompany each invoice. Gillig will invoice each bus separately within One (1) week of leaving the Gillig manufacturing plant for delivery to the Ordering Agency. Documents that are required for registering the buses are included with the invoice such as the weight slip and the MSO (manufacturers Statement of Origin). The MSO document is approved in all 50 states for registering buses and has successfully been used by Florida Transit Agencies during the previous State of Florida contract to register buses.

4. Within Fifteen (15) days after arrival at the designated point of delivery, each coach shall undergo the Ordering Agency tests. If the coach passes these tests, acceptance of the coach by the Agency occurs on the Fifteenth (15^{th}) day after delivery. Acceptance may occur earlier if the Agency notifies the Supplier of early acceptance or places the coach in revenue service. If the coach fails these tests, Gillig requests a letter of discrepancies for resolution be issued by the Fifteenth (15^{th}) day after delivery.

5. DELIVERY AND ACCEPTANCE: Delivery and Acceptance shall be defined as a bus delivered to the designated Ordering Agency's location, a Post-Delivery Inspection (PDI) has been performed and completed by an authorized

GILLIG representative, and the bus is assessed to be in conformance as defined by the Customer Meeting notes for that bus and all deficiencies have corrected. Should a bus be put into revenue service, it will be deemed accepted by the Ordering Agency effective on the in-service date.

6. CONDITIONAL ACCEPTANCE: _Ordering Agencies may conditionally accept a bus subject to the correction of minor deficiencies within the scope of the Customer Meeting notes and withhold 2% of the full payment value until such deficiencies are corrected. Conditionally accepted buses may be put into revenue service.

7. PAYMENT TERMS: Notwithstanding any progress payments between the contractor and the Ordering Agency, full payment of each unit shall be paid within thirty (30) business days after delivery and acceptance of each bus.

8. OVERDUE PAYMENTS Pursuant to the Prompt Payment Act, any payments not received within the payment timeframe above, may be subject to a one and a half percent (1.5%) per month penalty on any bus that does not comply with the Payment Terms above.

9. The Supplier agrees to comply with Pre-Award and Post-Delivery Audits 49 USC § 5323(1) and FTA's implementing regulation at 49 CFR Part 663 and to submit the following certifications: 1.) Buy America requirements: The Supplier shall complete and submit a declaration certifying either compliance or noncompliance with Buy America. If the recommended Proposer certifies compliance with Buy America, it shall submit documentation that lists (1) component and subcomponent Parts of the rolling stock to be purchased identified by manufacturer of the parts, their country of origin and costs; and (22) the location of the final assembly point for the rolling stock, including a description of the activities that will take place at the final assembly point and the cost of final assembly. 2). Solicitation specification requirements: The Supplier shall submit evidence that it will be capable of meeting the bid specifications. 3.) Federal Motor Vehicle Safety standards (FMVSS): The Supplier shall submit (1) manufacturer's FMVSS self-certification, Federal Motor Vehicle Safety Standards, that the vehicle complies with relevant FMVSS or (2) manufacturer's certified statement that the contracted buses will not be subject to FMVSS regulations.

10. All invoices shall reflect the applicable Proposal prices and shall show details of the computation of the amount requested in a form satisfactory to the Authority. Invoices shall be as needed depending on the purchase of the buses which is not currently scheduled unless the invoice is for the final payment of a work, is a final Purchase Order, or is the fiscal year-end invoice. To assist the Authority with annual financial close-out, the Supplier shall also submit an end-of-the-fiscal-year invoice not later than October 10 of each year for all unbilled services, fees, and costs performed through September 30 of that calendar year.

11. Invoicing for any travel expenses, when authorized by the terms of this Contract and by the Authority's Project Manager, will be in accordance with Section 112.061, Florida Statutes.

12. The Supplier shall provide the Authority with Certificates of Origin for any

and all steel, iron, and/or manufactured goods delivered or utilized by the Supplier in any work or Project contemplated herein, regardless of the individual value of such steel, iron, and/or manufactured goods, when the overall Contract value meets or exceeds Fifty Thousand dollars ($50,000). The Supplier shall also provide separate Certificates of Origin for each component part contained in any and all manufactured goods delivered or utilized by the Supplier in any work or Project under this Contract. Certificates of Origin must accompany all related invoices that the Supplier submits to the Authority for payment. If the Supplier fails to submit required Certificates of Origin with its invoices, the Authority may withhold payments due the Supplier until the Supplier has complied therewith.

13. The general cost principles and procedures for the negotiation and administration, and the determination or allowance of costs under this Contract will be as set forth in the Code of Federal Regulations, Titles 23, 48, 49, Rule Chapter 14-75, Florida Administrative Code, and other pertinent federal and state regulations, as applicable, with the understanding that there is no conflict between state regulations and federal regulations in that the more restrictive of the applicable regulations will govern.

14. Records of costs incurred under the terms of this Contract shall be maintained by the Supplier and upon written request, made available to the Authority at all times during the period of this Contract and for five (5) years after final payment is made for the work pursuant to this Contract. Copies of these documents and records shall be furnished to the Authority upon request.

15. Records of costs incurred will include: (1) the Supplier's general accounting records and Project records; (2) supporting documents and records of the Supplier and all subSuppliers within the scope of this Contract; and (3) all other records related to the Contract that are considered necessary by the Authority for a proper audit of costs.

16. The Authority will have the right to retain, out of any payment due the Supplier under this Contract, an amount sufficient to satisfy any amount due and owing to the Authority by the Supplier on this Contract or any other agreement between the Supplier and the Authority. The Authority may withhold payment on any invoice in accordance with the Liquidated Damages provision, if any, or if none, the Authority may withhold the amount of its actual damages when the Supplier is in default under any provision of this Contract, or when the Authority determines that the schedule cannot be met, and an extension of time is not warranted. The Authority may also withhold payment when payment from the Supplier is due in connection with indemnification or any other agreement between the Supplier and the Authority. This right to withhold payments will continue until such time as the Authority has been made whole.

17. All invoices requesting payment for subSupplier services, supplier's services, reimbursable items, or expense items, must have copies of actual invoices or receipts attached which support the amounts invoiced, in such form and with such supporting detail as the Authority may require.

18. The Authority shall have the right, but not the obligation, based upon sworn statements of accounts from the subSuppliers, and in accordance with the

Supplier's written request, to pay a specific amount directly to a subSupplier. In such event, the Supplier agrees that any such payments shall be treated as a direct payment to the Supplier's account.

19. The Authority shall make payments to the Supplier based upon the approved invoices and supporting documentation and deliverables within thirty (30) days of the receipt by the Authority of a complete invoice All invoices shall be sent to the attention of the Accounts Payable Office at accountspayable@jtafla.com, and shall include back-up documentation as required by the Authority, including the applicable Supplier Request for Payment Form ("Exhibit C"). Invoice payment requirements do not start until a properly completed invoice is provided to the Authority. If an invoice is not approved, in whole or in part, the Authority will inform the Supplier of the issue and Supplier will not be paid until the issue has been resolved to the satisfaction of the Authority.

20. Prompt Payment Discounts. Discounts for early payment may be offered either in the original Proposal or on individual invoices submitted under the Contract. Discounts that are included in the Proposal become a part of the Contract and are binding on the Supplier for all invoices submitted under the Contract. If the Supplier has offered a prompt payment discount, the Authority will only apply discounts that equal or exceed two percent (2%) of the invoice amount for payments that are made between ten (10) and twenty-nine (29) days after the Authority's receipt of a complete, acceptable invoice. For purposes of this Paragraph, time shall be computed from the date the invoice was received by the Authority and payment shall be considered to have been made on the date which appears on the payment check.

21. All compensation for services under a particular work or Purchase Order is subject to and contingent upon the availability of the federal, state, and/or local funding source that is applicable to the work or Purchase Order.

22. The acceptance of final payment by the Supplier shall be a full release from the Authority and its members, officers, agents, and employees for any and all claims arising out of or relating to this Contract. The Supplier hereby waives all indirect, incidental, special, and consequential damages in any proceeding arising out of or relating to this Contract.

23. PROGRESS PAYMENTS

Should progress payments be exercised by the Ordering Agency, GILLIG will provide a Payment Bond covering the full amount of the progress payment being requested. The percentage of progress payments shall be as follows:

1. Ordering Agencies shall make a payment of fifteen percent (15%) of the total amount of the executed purchase order.

2. Ordering Agencies shall make a payment of thirty-five percent (35%) for buses that are approved for shipment.

3. Ordering Agencies shall pay the remaining balance within thirty (30) business days after delivery and acceptance of each bus as stated in Section II, Compensation, Invoices and Terms of Payment, Paragraph 7.

Other Progress Payment arrangements may be negotiated with the Ordering Agency at the time of Order with the Supplier.

III. Ownership of Documents and Inspection of Work

1. When the Contract requires services, all correspondence, documents, drafts, data compilations and tabulations, research, analysis, plans, reports, and work product of any kind, in any medium, submitted to or prepared by or for the Supplier in connection with this Contract, are the sole property of the Authority and shall be scanned into electronic format and provided to the Authority in an indexed, logical, searchable format on computer Compact Disks (CDs) or other format acceptable to the Authority. Such correspondence must be provided to the Authority within thirty (30) days of the close-out of the assigned Project and must be received before the Authority will release final payment to the Supplier. The original documents shall be maintained by the Supplier for a period of five (5) years after the completion of final payment by the Authority. Thereafter, or upon termination of this Contract for any reason, such records shall immediately be delivered to the Authority.

2. The Authority will have the right to visit the Supplier's site for inspection of the Supplier's work at any time during reasonable work hours. In addition to the inspection and audit rights set forth herein, the Authority, its agents, and employees may perform inspections of the work at any reasonable time and at any stage of production. Such inspection or failure to inspect on any occasion shall not affect the Authority's rights, or the Supplier's obligations, under warranty or other provisions of this Contract, nor shall such inspection be deemed acceptance of services.

IV. Term of Contract and Termination

1. This Contract shall commence upon execution by the Authority and shall be effective for the following Five (5) years.

2. The Authority may terminate this Contract, in whole or in part, by delivering to the Supplier a written Notice of Termination. The Authority may terminate the Contract for its convenience or for failure of the Supplier to fulfill any of its obligations hereunder, including without limitation, the Supplier's failure to complete work within the required time or the Supplier's failure to diligently proceed with the work to the satisfaction of the Authority. The Supplier shall have the opportunity to affect a remedy within fifteen (15) days of the Notice of Termination. Upon the Supplier's receipt of a written Notice of Termination from the Authority, the Supplier shall: (1) immediately stop all further work unless otherwise directed in writing by the Authority as no compensation shall be paid for any work performed after receipt of such notice (provided however that expense of a nature which cannot be immediately terminated shall be reimbursed at the minimum amount which may reasonably be arranged for such termination, if the Authority concurs); and (2) deliver to the Authority's Project Manager copies of all data, drawings, specifications, reports, estimates, summaries, and other information and materials prepared while performing this Contract, whether completed or in process, in both paper and electronic formats acceptable to the Authority. In addition, if the Supplier has possession of Authority goods, it shall

immediately provide the Authority with an accounting of same and protect and preserve those goods until surrendered to the Authority or its agent(s) or otherwise disposed of as directed by the Authority.

3. These termination provisions shall be made a part of all subcontracts under this Contract.

4. After the effective date of the Notice of Termination, the Authority will only pay for work/services already performed and goods already delivered and accepted in accordance with the terms of the Contract. At the discretion of the Authority, the Authority may make an equitable adjustment to the compensation due to the Supplier, but under no circumstances shall the Supplier be entitled to payment for any anticipatory profit, for work/services not yet performed, or for goods not accepted by the Authority.

5. The Supplier's obligations to the Authority that arise from the Supplier's improper acts or omissions shall survive the termination of this Contract.

6. In the event that termination is due to default or breach by the Supplier, the Authority may take over and complete the work. In such case, the Supplier shall be liable to the Authority for any additional cost occasioned thereby.

7. Should the Supplier: (1) fail to comply with any federal, state, or local law or regulation, including FTA circular 4220.1F as revised, and 49 CFR Part 18, if applicable; (2) fail to comply with any condition of this Contract; or (3) fail to complete the required work or furnish the required materials within the time required, the Authority reserves the right to purchase in the open market, or to take over and complete, the required item/work at the expense of the Supplier without waiving any right against the Supplier or its Surety, if any.

8. If the total value of the Contract exceeds one million dollars ($1,000,000.00), the Authority may terminate the Contract if the Authority determines that the Supplier: submitted a false certification required by Florida Statutes § 287.135; (2) has been placed on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List; or (3) has been engaged in business operations in Syria.

9. For the purposes of this Contract, an event of insolvency with respect to either Party hereto shall be deemed to be a default under this Contract by such Party. The term "event of insolvency" shall mean any of the following:

   A. The insolvency;
   B. The making of a general assignment for the benefit of creditors, the appointment of a receiver for the business or assets of such entity, or the application for the appointment of a receiver therefore;
   C. The filing of a petition by or on behalf of, or against such person or business in any bankruptcy court or under any bankruptcy or insolvency law; or
   D. The dissolution, liquidation or winding up of business.

V. Records and Audit

1. The Supplier agrees to maintain appropriate records with respect to work performed and other items reimbursable hereunder, and such records shall be supported by payrolls, invoices, vouchers, and other documents evidencing in proper detail the nature and propriety of the charges. All checks, payrolls, invoices, and other documents pertaining in whole or in part to the work shall be clearly identified, readily accessible, and to the extent feasible, kept separate and apart from all other such documents not related to the work.

2. The Supplier shall provide access to records and reports in accordance with the following which are incorporated herein by reference: 49 U.S.C. 5325, 49 CFR 18.36(i), and 49 CFR 633.17, as applicable.

3. The Supplier shall permit the Authority, the FDOT, the FHWA, the FTA, the State of Florida, the U.S. Government, and the authorized representatives of these agencies to inspect and audit all technical and economic Project data and records of the Supplier relating to its performance and its subcontracts under this Contract from the date of Contract through and until the expiration of five (5) years after completion or termination of the Contract, except in the event of litigation or settlement of claims arising from performance of this Contract, in which case the Supplier agrees to maintain same until all said and affected agencies and their authorized representatives have disposed of all such litigation, appeals, claims, or exceptions related thereto.

4. The Supplier shall provide, upon receipt of reasonable notice, free access to its books and records by the proper officers and representatives of the Authority, the FDOT, the FHWA, the FTA, the State of Florida, the U.S. Government, and the authorized representatives of these agencies during reasonable business hours. Further, the said agencies and their authorized representatives shall have the right, pursuant to an inspection, to review, audit, reproduce, or copy excerpts and transcriptions therefrom as necessary, and to inspect all work data, documents, proceedings, and activities related to this Contract. The Supplier shall include provisions similar to this Paragraph in all subcontracts which it awards, including, but not limited to, the additional provisions of allowing the Supplier, the Authority, the FDOT, the FHWA, the FTA, the State of Florida, the U.S. Government, and the authorized representatives of these agencies equal access to subSuppliers' books and records.

VI. Conflict of Interest

1. The Supplier shall not promise any employee of the Authority, whose duties include matters relating to or affecting the subject matter of this Contract, compensation of any kind or nature from the Supplier, while such employee is employed by the Authority, or for one (1) year thereafter.

2. The Supplier affirms that it will not take part in any activities that will be a conflict of interest with the Authority or that would appear to compromise the integrity of the Authority. The Supplier shall provide written notice to the Authority immediately upon occurrence or first identification of any potential conflict-of-interest situation.

3. Upon request by the Authority, the Supplier shall execute any Conflict-of-Interest Certification that may be required.

VII. Debarred Proposers

The Supplier has a continuing obligation to inform the Authority whether it is or has been placed on any debarred, suspended, or excluded parties list maintained by the United States Government or the State of Florida. Should the Supplier, including any of its officers or holders of a controlling interest, be included on such a list during the performance of this Contract, the Supplier shall immediately inform the Authority. This obligation must be included in all subcontracts.

VIII. Indemnification

1. To the fullest extent permitted by law, the Supplier shall indemnify and hold harmless the Authority and its Board of Directors, officers, and employees, from liabilities, damages, losses, and costs, including but not limited to reasonable attorneys' fees, to the extent caused by the negligence, recklessness, or intentionally wrongful conduct of the Supplier and other persons or entities employed or utilized by Supplier in the performance of this Contract. The provisions of this Paragraph shall survive the termination of this Contract. The indemnification obligation hereunder shall not be limited in any way by amount or type of damages, compensation or benefits payable under workers' compensation acts, disability benefits acts, or other employee benefit acts.

2. In the event applicable law renders any provision of this Section unenforceable, then solely to the extent necessary to conform such provision to the requirements of law to remedy such unenforceable matter, such provision is deemed revised so as to be enforceable under law.

3. In addition to the Supplier's indemnification obligation, the Supplier shall be responsible for all liability for loss or damages, and it shall also be responsible for the payment of any fines imposed by any federal, state, or local agency as a result of the Supplier's actions or failure to act. Supplier shall not be responsible to indemnify, defend, keep and save harmless the agency, its officials, employees and agents against injuries, deaths, loss, damages, claims, patent claims, suits, liabilities, judgements, costs and expenses which arise or accrue against the agency solely as the result of intentional or negligent acts on the part of the Ordering agency, its agents, officials or employees.

IX. Disputes, Defaults and Remedies

1. Liquidated Damages. The Parties recognize that it is of utmost importance for the Supplier to complete the Contract within the time specified herein. The Supplier understands and agrees that its failure to complete the Contract within the required time will significantly impact the Authority, and that the impacts, costs, and other damages resulting from that failure are impossible to reasonably quantify in advance. The Supplier therefore agrees as follows: if the Supplier fails to perform the services within the time specified in this

Contract, the Supplier shall pay Liquidated Damages to the Authority of one hundred dollars ($100.00) per calendar day of delay. If the Authority terminates this Contract, in whole or in part, under the Disputes, Defaults, and Remedies Section of this Contract, the Supplier shall be liable for Liquidated Damages accruing until the Authority reasonably obtains delivery or performance of similar supplies or services from a substitute vendor. These Liquidated Damages are in addition to, not in lieu of, the excess costs to the Authority of repurchase that the Supplier will also be liable for. The Supplier will not be charged with Liquidated Damages if there is a delay in delivery or performance beyond the control and without the fault or negligence of the Supplier, as defined in the Force Majeure clause in this Contract. The Authority may withhold all payments due under the Contract until the Supplier's liability for Liquidated Damages has been satisfied in full. The Authority's receipt of payment for Liquidated Damages does not preclude the Authority from pursuing any other rights or remedies available to it under the Contract, in accordance with Article 2 of the Uniform Commercial Code, or otherwise in accordance with Florida law.

2. Upon a breach of any of the obligations of the Supplier or the Authority hereunder, the non-breaching Party shall have all of the rights and remedies provided under law, including, but not limited to the rights and remedies under the Uniform Commercial Code as in effect in the State of Florida, if applicable, as well as those referenced in 49 CFR Part 18 and FTA Circular 4220.1F, as revised. In addition, the non-breaching Party shall have all of the other rights and remedies specified elsewhere in this Contract.

3. During any dispute, unless otherwise directed by the Authority, the Supplier shall continue to diligently perform the work while matters in dispute are outstanding, unless a Notice of Termination has been issued by the Authority.

4. Should the Supplier suffer injury or damage to person or property because of any act or omission of the Authority, or any of the Authority's employees, agents, or others for whose acts the Authority is legally liable, a claim for damages therefore shall be made in writing to the Authority within fourteen (14) days after the first observance of such injury or damage. The failure to timely submit a written claim shall result in a waiver the Supplier's claim.

5. Disputes arising in the performance of this Contract shall be decided in writing by the Authority's Vice President of Administration, and the decision rendered shall be final and conclusive for the Authority.

6. Mandatory Mediation. All disputes arising out of or relating to this Contract shall be subject to mandatory pre-suit mediation under the auspices of a mediator to be selected by the Parties. Mediation must occur before a lawsuit is filed. Discovery prior to the scheduled mediation shall be limited to one (1) request for production of documents and two (2) depositions per Party not exceeding eight (8) hours total time per deposition. Each Party shall equally bear the costs of mediation and shall be solely responsible for its own attorneys' fees and other legal costs prior to and during the mediation process. In the event the case does not settle at mediation, the Parties may re-depose either or both witnesses on non-repetitive matters. The Supplier acknowledges that the Authority may not have present at any such mediation

a person or persons authorized to bind the Authority. If the mediation fails to produce a settlement, and the amount in controversy is below seventy-five thousand dollars ($75,000.00), the Parties may agree to submit the dispute to fast-track arbitration with an AAA arbitration panel.

X. Insurance

Gillig will provide the attached standard Certificate of Liability Insurance and Umbrella Certificate of Liability Insurance in compliance with the requirements of this section. Risk of loss of the bus transfers to the Ordering Agency upon delivery of each bus to the Ordering Agency's receiving facility and confirmed by a signed receipt from the Ordering Agency's designated agent. Any defects or damage noted on this receipt will be the Supplier's responsibility.

General Information and Insurance Requirements

1. Commercial General Liability Insurance

   The Supplier/Vendor shall purchase and maintain at the Supplier/Vendor's expense Commercial General Liability insurance coverage (ISO or comparable Occurrence Form) for the life of this Contract. Modified Occurrence or Claims Made forms are not acceptable.

The Limits of this insurance shall not be less than the following limits:

Each Occurrence Limit	$1,000,000
Personal & Advertising Injury Limit	$1,000,000
Fire Damage Limit (any one fire)	$ 300,000
Medical Expense Limit (any one person)	$ 10,000
Products & Completed Operations Aggregate Limit	$2,000,000
General Aggregate Limit (other than Products & Completed Operations) Applies Per Project	$2,000,000

General liability coverage shall continue to apply to "bodily injury" and to "property damage" occurring after all work on the Site of the covered operations to be performed by or on behalf of the additional insureds has been completed and shall continue after that portion of "your work" out of which the injury or damage arises has been put to its intended use.

2. Workers' Compensation And Employer's Liability Insurance

The Supplier/Vendor shall purchase and maintain at the Supplier/Vendor's expense Workers' Compensation and Employer's Liability insurance coverage for the life of this Contract.

The Limits of this insurance shall not be less than the following limits:

Part One – Workers' Compensation Insurance – Unlimited Statutory Benefits as provided in the Florida Statutes and

Part Two – Employer's Liability Insurance

Bodily Injury By Accident	$500,000 Each Accident
Bodily Injury By Disease	$500,000 Policy Limit
Bodily Injury By Disease	$500,000 Each Employee

*If leased employees are used, policy must include an Alternate Employer's Endorsement.

3. Automobile Liability Insurance

The Supplier/Vendor shall purchase and maintain at the Supplier/Vendor's expense Automobile Liability insurance coverage for the life of this Contract.

The Limits of this insurance shall not be less than the following limits:

Combined Single Limit – Each Accident $1,000,000

Covered Automobiles shall include any auto owned or operated by the insured Supplier/Vendor, insured Sub-Sub-Supplier/Vendor including autos which are leased, hired, rented or borrowed, including autos owned by their employees which are used in connection with the business of the respective Supplier/Vendor or Sub-Sub-Supplier/Vendor.

4. Excess Liability Insurance

The Supplier/Vendor shall purchase and maintain at the Supplier/Vendor's expense Excess Liability (Umbrella Form) insurance coverage for the life of this Contract.

The Limits of this insurance shall not be less than the following limits:

Each Occurrence Limit	$5,000,000
Aggregate Limit	$5,000,000

5. General Conditions

Supplier/Vendor shall require each of his Sub-Supplier/Vendors to likewise purchase and maintain at their expense Commercial General Liability insurance, Workers' Compensation and Employer's Liability coverage, Automobile Liability insurance and Excess Liability insurance coverage meeting the same limit and requirements as the Supplier/Vendors insurance.

Certificates of Insurance acceptable to Jacksonville Transportation Authority for the Supplier/Vendor's insurance must be received within five (5) days of Notification of Selection and at time of signing Agreement.

Certificates of Insurance and the insurance policies required for this Agreement shall contain an endorsement that coverage afforded under the policies will not be cancelled or allowed to expire until at least thirty (30) days prior written notice has been given to Jacksonville Transportation Authority.

Certificates of Insurance and the insurance policies required for this Agreement will include a provision that policies, except Workers' Compensation, are primary and noncontributory to any insurance maintained by the Supplier/Vendor.

Jacksonville Transportation Authority must be named as an Additional Insured and endorsed onto the Commercial General Liability (CGL), Auto Liability and Excess Liability policy (ies). A copy of the endorsement(s) must be supplied to Jacksonville Transportation Authority ten (10) days following the execution of the agreement or prior to the first date of services, whichever comes first.

CGL policy Additional Insured Endorsement must include Ongoing and Completed Operations (Form CG2010 11 84 **OR** Form CG2010 04 13 and GC2037 04 13 edition or equivalent). Other Additional Insured forms might be acceptable but only if
modified to delete the word "ongoing" and insert the sentence "Operations include ongoing and completed operations."
CGL policy shall not be endorsed with Exclusion - Damage to Work performed by Sub-Supplier/Vendors on Your Behalf (CG2294 or CG2295)
CGL policy shall not be endorsed with Contractual Liability Limitation Endorsement (CG2139) or Amendment of Insured Contract Definition (CG 2426)
CGL policy shall not be endorsed with Exclusion - Damage to Premises Rented to you (CG 2145)
CGL policy shall include broad form contractual liability coverage for the Supplier/Vendors covenants to and indemnification of the Authority under this Contract

Certificates of Insurance and the insurance policies required for this Agreement shall contain a provision under General Liability, Auto Liability and Workers' Compensation to include a Waiver of Subrogation clause in favor of Jacksonville Transportation Authority.

All Certificates of Insurance shall be dated and shall show the name of the insured Supplier/Vendor, the specific job by name and job number, the name of the insurer, the policy number assigned its effective date and its termination date and a list of any exclusionary endorsements.

All Insurers must be authorized to transact insurance business in the State of Florida as provided by Florida Statute 624.09(1) and the most recent Rating Classification/Financial Category of the insurer as published in the latest edition of "Best's Key Rating Guide' (Property-Casualty) must be at least A- or above.

All of the above referenced Insurance coverage is required to remain in force for the duration of this Agreement and for the duration of the warranty period. Accordingly, at the time of submission of final application for payment, Supplier/Vendor shall submit an additional Certificate of Insurance evidencing continuation of such coverage.

If the Supplier/Vendor fails to procure, maintain or pay for the required

insurance, Jacksonville Transportation Authority shall have the right (but not the obligation) to secure same in the name of and for the account of Supplier/Vendor, in which event, Supplier/Vendor shall pay the cost thereof and shall furnish upon demand, all information that may be required to procure such insurance. Jacksonville Transportation Authority shall have the right to back-charge Supplier/Vendor for the cost of procuring such insurance. The failure of Jacksonville Transportation Authority to demand certificates of insurance and endorsements evidencing the required insurance or to identify any deficiency in Supplier/Vendors coverage based on the evidence of insurance provided by the Supplier/Vendor shall not be construed as a waiver by Jacksonville Transportation Authority of Supplier/Vendor's obligation to procure, maintain and pay for required insurance.

The insurance requirements set forth herein shall in no way limit Supplier/Vendors liability arising out of the work performed under the Agreement or related activities. The inclusions, coverage and limits set forth herein are minimum inclusion, coverage, and limits. The required minimum policy limits set forth shall not be construed as a limitation of Supplier/Vendor's right under any policy with higher limits, and no policy maintained by the Supplier/Vendor shall be construed as limiting the type, quality, or quantity of insurance coverage that Supplier/Vendor should maintain. Supplier/Vendor shall be responsible for determining appropriate inclusions, coverage, and limits, which may be in excess of the minimum requirements set forth herein.

If the insurance of any Supplier/Vendor or any Sub-Supplier/Vendor contains deductible(s), penalty(ies) or self-insured retention(s), the Supplier/Vendor or Sub-Supplier/Vendor whose insurance contains such provision(s) shall be solely responsible for payment of such deductible(s), penalty(ies) or self-insured retention(s).

The failure of Supplier/Vendor to fully and strictly comply at all times with the insurance requirements set forth herein shall be deemed a material breach of the Agreement.

6. All Coverages:

   a. Each insurance policy required by this Contract shall be endorsed to state that no material change or cancellation, including expiration and non-renewal of coverage, shall be effective until after at least Thirty (30) days written notice has been given to: Jacksonville Transportation Authority, ATTN: Chief Procurement Officer/AVP – Administrative Services, 100 LaVilla Center Drive, Jacksonville, FL 32204

   b. Failure to maintain a current Certificate of Insurance on file with the Authority will be grounds for withholding or rejecting payment of invoices.

   c. Notwithstanding the prior submission of a Certificate of Insurance, if requested by the Authority, the Supplier shall, within thirty (30) days after receipt of a written request from the Authority, provide the Authority with a certified complete copy of the policies providing the coverage required.

   d. If Supplier, for any reason, fails to maintain insurance coverage, which is

required pursuant to this Contract, such event shall be deemed a material breach of this Contract. The Authority, at its sole discretion, may terminate this Contract and obtain damages from the Supplier resulting from said breach. Alternatively, the Authority may purchase such required insurance (but has no special obligation to do so) and without further notice to Supplier, the Authority may deduct from sums due to Supplier any premium costs advanced by the Authority for such insurance.

e. It is the Supplier's responsibility to ensure that its subSuppliers are covered under the required insurance limits. The Supplier may either require its subSuppliers to purchase insurance coverage set forth herein individually, or it may include the subSupplier under the Supplier's insurance program.

f. Neither approval by the Authority nor failure to disapprove the insurance furnished by the Supplier shall relieve the Supplier of the Supplier's full responsibility to obtain and maintain the insurance policies as required by this Contract.

g. Compliance with the insurance requirements of this Contract shall not limit the liability of the Supplier. Any remedy provided to the Authority, members of its Board of Directors, committees, officers, agents, employees, and volunteers by the insurance policies shall be in addition to and not in lieu of any other remedy available under this Contract or otherwise.

h. The cost of insurance shall be included in the Supplier's fees, and there shall not be any further compensation or reimbursement, therefore.

XI. Public Entity Crimes

The Authority reserves the right to terminate this Contract effective immediately upon written notice in the event that the Supplier or any of its affiliate(s) are placed on the State of Florida convicted vendor list pursuant to Section 287.133, Florida Statutes.
For purposes hereof, "affiliate" shall have the meaning set forth in Section 287.133(1)(a), Florida Statutes. The Supplier shall advise the Authority promptly after conviction of any "public entity crime" as defined in Section 287.133(1)(g), Florida Statutes, applicable to the Supplier or any of its affiliate(s).

XII. Equal Employment Opportunity and Nondiscrimination

1. The Supplier will comply with all federal, state, and local laws and ordinances applicable to the work or payment for work thereof, and will not discriminate on the grounds of race, creed, color, sex, sexual orientation, gender identity, pregnancy, genetic information, national origin, age, disability, religion, family status or other protected class in the performance of work under this Contract. The Supplier assures that it will comply with pertinent statutes, executive orders, and such rules as are promulgated to assure that no person shall, on the grounds of race, creed, color, sex, sexual orientation, gender identity, pregnancy, genetic information, national origin, age, disability, religion, family status or other protected class be excluded

from participating in any activity conducted under this Contract. This provision binds the Supplier from the Solicitation period through the completion of the Contract.

2. The Supplier shall permit access to its books, records, accounts, other sources of information, and its facilities, as may be determined by the Authority to be pertinent to ascertain compliance with this Section.

XIII. Disadvantaged Business Enterprise (DBE) Participation

1. Disadvantaged Business Enterprise Participation. The DBE requirements of 49 CFR Part 26 do apply to this Solicitation. The Supplier, a Primary Transit Vehicle Manufacturer, hereby certifies that it has complied with the requirements of 49 CFR Section 26.49, as amended, by submitting an annual DBE goal, as amended, to the Federal Transit Administration (FTA). The goal has either been approved or not disapproved by the FTA.

2. Affirmative Steps and Records. In accordance with 49 CFR 18.36(e), the Supplier shall take all necessary affirmative steps to assure that minority firms and women's business enterprises are used when possible. Affirmative steps shall include: (i) placing qualified small and minority businesses and women's business enterprises on solicitation lists; (ii) assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources; (iii) dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority business, and women's business enterprises; (iv) establishing delivery schedules, where the requirement permits, which encourage participation by small and minority business, and women's business enterprises; and (v) using the services and assistance of the Small Business Administration, and the Minority Business Development Agency of the Department of Commerce.

   The Supplier must maintain the following records concerning DBE participation with respect to this Contract for at least five (5) years following the completion of the work:

   A. All subSupplier/supplier subcontracts, including subcontracts with DBEs;
   B. Documentation developed during the identification and award of such subcontracts to DBE firms, including, but not limited to, copies of executed subcontracts enacted with Project participants.

3. Financial Reporting Requirements. When a DBE goal has been established, the Supplier shall submit monthly reports detailing payments to all subSuppliers and suppliers, both DBE and non-DBE, in a format that is acceptable to the Authority. The Supplier shall fully cooperate with all audits, whenever performed. Failure to comply with these mandates may result in an unsatisfactory audit analysis and may have a bearing on future consideration for the award of Authority agreements.

"Exhibit C", the Supplier Request for Payment Form, must be submitted with every invoice presented for progress or final payment, and must show the portion

of the invoice due to each subSupplier (DBE and Non-DBE). In addition, when applicable, the Supplier must submit a report detailing the following information as it relates to invoices received from its DBE-certified subSuppliers:

A. The value of the work actually performed by the DBE employees and representatives; and
B. The entire amount of the DBE sub-Supplier's portion of the invoice. This includes, but is not limited to, the cost of supplies and materials obtained for work on the subcontract, including supplies and equipment leased and/or purchased from sources other than the Supplier and/or its affiliates.

When applicable, the Supplier shall also report the entire amount of compensation paid to each DBE for the following:

A. All bona fide services, including professional, technical, supplier, and managerial services; and
B. The costs of providing bonds or insurance specifically required for the performance of the subcontract, provided these fees do not exceed what is deemed reasonable and customary for services of this type.

All supporting DBE documentation including but not limited to the invoice, the monthly reports detailing payments made to DBE subSuppliers, and the Supplier Request for Payment Form included as "Exhibit C" must be emailed to DBE1@JTAfla.com. Failure to submit the required documentation may result in a delay in payment.

This contract is subject to contract compliance payment tracking, and the prime Supplier and any DBE subSuppliers shall provide any noted and/or requested contract compliance-related payment data electronically in the B2GNow Contract Compliance Program System. The prime Supplier and all DBE subSuppliers are responsible for responding by any noted response audit date or due date to any instructions or request for information, and to check the B2GNow Contract Compliance Program System on a regular basis. The prime Supplier is responsible for ensuring all DBE subSuppliers have completed all requested items and that their contact information is up to date.

Access information related to Supplier access to the system will be provided to a designated point of contact with each Supplier upon award of the contract. The B2GNow Contract Compliance Program System is web-based and Contract Compliance Reporting – Vendor Training and can be accessed at the following Internet address: https://JTAfla.dbesystem.com/FrontEnd/EventList.asp).

4. DBE sub subSuppliers. At times, due to the size of a subcontract, a DBE may choose to enter into alternate arrangements with other businesses. Reporting of work done and applied towards DBE goals for the Project is limited by the following constraints:

   A. If a DBE subcontracts a portion of its contracted responsibilities to another business, that business must also be a DBE in order for the value of the work to be counted towards the DBE participation goals established by the Authority.

B. If the DBE participates in the work as part of a joint venture, only that portion of the work done by the DBE shall be reported towards DBE goals.

5. Modifications and Substitutions. The Supplier shall not make any modification, change or substitution of subSuppliers as outlined in the Proposal, without the knowledge and consent of the Authority's DBE Office. In the event that any of such firms identified by the Supplier in its Supplier in the Schedule of Sub-suppliers Form become unavailable therefore, the Supplier shall replace such firm with another similarly designated firm. Such replacement, including by the Supplier's own forces, may only be made with the prior written approval of the Authority, which may be withheld in the event that the Authority determines, in its sole discretion, that the Supplier has not made good faith efforts to either work with the subSupplier for whom replacement is sought or to find a minority certified replacement (under the appropriate program) for such subSupplier.

   If the Supplier desires to terminate or substitute a DBE subSupplier listed in its "Supplier in the Schedule of Sub-suppliers Form" and intends to perform the work of the terminated DBE subSupplier with either its own forces or those of another subSupplier, it must first submit to the Authority's DBE Office a Request for Approval of Change to Original List of SubSuppliers, along with written documentation explaining the specific reasons for the change. The Supplier must obtain approval from the Authority prior to the substitution of the original DBE subSupplier. If a terminated DBE subSupplier is substituted by another DBE subSupplier, the Supplier should include the name, address, certification number, and principal office of the proposed DBE business. The Supplier must make good faith efforts to replace one DBE with another.

   In the event that the Supplier is unable to contract with another DBE business, Good Faith Effort documentation must be provided to the Authority, describing the attempts to locate a substitute DBE. In all situations, the Supplier may not terminate or substitute a DBE subSupplier without the prior written consent of the Authority's DBE Office. If the Authority approves the proposed substitution in writing, the Supplier shall execute a subcontract with the proposed DBE business upon receipt of the substitution approval. If the change involves a modification to the original list of subSuppliers, the Supplier must submit, if applicable, a completed Intent to Perform as a DBE SubSupplier Form for any DBE subSupplier added by the change.

6. Compliance and Enforcement. Before final payment is made by the Authority, the Supplier shall provide the final accounting of DBE participation. The Authority may withhold payment to the Supplier pending compliance with this closeout requirement. Any reduction or change by the Supplier in a DBE subcontract, in the total DBE participation, or in DBE subSuppliers, without the prior written approval of the Authority's DBE Office, will be considered an unauthorized DBE subSupplier substitution and will not be counted as participation. A DBE subcontract dollar value that is decreased by a change order or Amendment issued by the Authority will not constitute an unauthorized subSupplier substitution. The Supplier's failure to comply with the DBE participation requirements or any other part of the DBE program may result in termination of the Contract and may also result in the Authority issuing an unfavorable performance review of the Supplier. The Authority may consider the Supplier's failure to comply when evaluating the Supplier for subsequent contracts and work orders. The Supplier may submit an explanation to

be retained with the Contract file to document the reasons for its failure to comply with the DBE requirements.

XIV. Drug-Free Workplace

The Supplier and its subSuppliers shall maintain a drug-free workplace and otherwise comply with the provisions of the Drug-Free Workplace Act, 41 U.S.C. §§ 701-707. Without in any way limiting the foregoing, the Supplier and its subSuppliers shall provide a drug- free workplace by:

1. Publishing a statement: (1) notifying employees that unlawfully manufacturing, distributing, dispensing, possessing, or using a controlled substance in the Supplier's (subSuppliers') workplace is prohibited; and (2) specifying the actions that will be taken against employees for violation of such prohibition;

2. Establishing a drug-free awareness program to inform employees about:

   A. The dangers of drug abuse in the workplace;
   B. The Supplier's (subSuppliers') policy of maintaining a drug-free workplace;
   C. Any drug counseling, rehabilitation, and employee assistance programs that are available; and
   D. The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

3. Making it a requirement that each employee to be engaged in the performance of this Contract be given a copy of the statement required by Paragraph (1);

4. Notifying the employee in the statement required by Paragraph (1) that, as a condition of employment under this Contract, the employee will abide by the terms of the statement and notify the employer of any criminal drug statute conviction for a violation occurring in the workplace no later than five (5) days after such a conviction;

5. Notifying the Authority within ten (10) days of receiving notice under Paragraph (4) from an employee, or within ten (10) days of otherwise receiving actual notice of an employee's conviction;

6. Taking one of the following actions, within thirty (30) days of receiving notice under Paragraph (5), with respect to any employee so convicted:

   A. Taking appropriate personnel action against such an employee, up to and including termination; or
   B. Requiring such an employee to satisfactorily participate in and complete a drug- abuse assistance or rehabilitation program that is approved by a federal, state, or local health or law enforcement agency, or other appropriate agency as may be the case; and

7. Making a good faith effort to continue to maintain a drug-free workplace through implementation of Paragraphs (1), (2), (3), (4), (5) and (6).

XV. Subcontracts

1. The Supplier shall be fully responsible for the performance of all services under this Contract, including when the services are performed by a subSupplier or supplier. At all times, the Supplier shall be responsible for the effort, activity, and quality of services of its subSuppliers and suppliers, and at no time shall the Authority have any responsibility for or contractual relationship with any such subSuppliers or suppliers, whether by reason of the above-stated references, consent, approval, or otherwise.

2. The Supplier shall utilize those subSuppliers who were identified in its Proposal, except that the Supplier shall not subcontract with a proposed person or entity to whom the Authority has made reasonable and timely objection.

3. When the subcontract is to provide services, the subcontract shall include the specific key staff members, man-hours, rates, tasks assigned, and all other costs and compensation associated with carrying out the services.

4. The Supplier shall maintain records of payments to all subSuppliers for five (5) years following the completion or termination of this Contract, and records of such shall be made available to the Authority immediately upon request. The Supplier shall report to the Authority, on the form included as **Attachment C**, the portion of each payment made by the Authority (directly or indirectly) which is owed by the Supplier to a subSupplier, and whether such subSupplier is or is not a DBE firm.

5. Prompt Payment (49-CFR Part 26.29). Prime Suppliers are required to pay all subSuppliers, to include DBE subSuppliers, for satisfactory performance of their contracts within seven (7) business days from receipt of each payment from the JTA. Failure to comply may result in future withholdings of prime Supplier's reimbursements and/or other sanctions until the prime Supplier ensure all subSuppliers are being promptly paid for all work performed.

6. The Supplier shall insert the appropriate provisions of the Solicitation and this Contract in all subcontracts under this Contract. Including all clauses found in Section VI of this solicitation, the Required Clauses For FTA-Assisted Contracts and the clauses set forth in paragraphs (18) through (22) of Section XIX of this contract. The prime Supplier or Supplier shall also require all subSuppliers of any tier to insert these clauses into all lower tier subcontracts, without modification. The prime Supplier or Supplier shall be responsible for compliance by any subSupplier or any lower tier subSupplier with the clauses and shall ensure that this contract and all subcontracts of any tier are performed in accordance with the provisions of 49 CFR Part 26, as may be amended from time to time.

XVI. Non-exclusive Contract

This Contract is not exclusive. The Authority expressly reserves the right to contract for performance of services such as those described herein, and in the Solicitation, with other Suppliers.

XVII. No Waiver

Failure by either Party to insist upon strict performance of any of the provisions herein; failure or delay by either Party in exercising any rights or remedies provided herein or by law; the Authority's payment in whole or in part for services hereunder; or any purported oral modification or rescission of this Contract by an employee or agent of either Party shall not:

(1) release either Party of any of its obligations hereunder; (2) be deemed a waiver of the rights of either Party to insist upon strict performance hereof; (3) be deemed a waiver of any of either Party's rights or remedies under this Contract or by law; or (4) operate as a waiver of any of the provisions hereof or constitute acquiescence therein. No waiver of any default or breach hereunder shall extend to or affect any subsequent or existing default or breach.

XVIII. Public Records and Related Inquiries

1. The Supplier acknowledges that the Authority is subject to the Florida Public Records Law, the Government in the Sunshine Act, and possibly the Freedom of Information Act (FOIA), and that in compliance therewith, at the sole discretion of the Authority, the Authority may disseminate or make available to any person, without the consent of the Supplier, information regarding this Contract, including but not limited to information in the: responses; requirements; specifications; drawings; sketches; schematics; models; samples; tools; computer or other apparatus programs; or technical information or data, whether electronic, written, or oral, furnished by the Supplier to the Authority under this Contract, and that copies of work products and related materials prepared or received by the Supplier under this Contract are public records.

2. The Supplier shall allow public access to all documents, papers, letters, or other material subject to the provisions of Chapter 119, Florida Statutes, made or received by the Supplier in conjunction with this Contract. Specifically, if the Supplier is acting on behalf of the Authority, the Supplier shall:

   A. Keep and maintain public records that ordinarily and necessarily would be required by the Authority in order to perform the services being performed by the Supplier;
   B. Provide the public with access to public records on the same terms and conditions that the Authority would provide the records and at a cost that does not exceed the cost provided in chapter 119, Florida Statutes, or as otherwise provided by law;
   C. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law; and
   D. Meet all requirements for retaining public records; transfer, at no cost to the Authority, all public records in possession of the Supplier upon termination of this Contract; and destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. All records stored electronically must be

provided to the Authority in a format that is compatible with the information technology systems of the Authority.

3. The Supplier shall immediately provide the Authority with a copy of any Request to Inspect or Copy Public Records in possession of the Supplier and the Supplier shall also promptly provide the Authority with a copy of the proposed response to each such request. No release of any such records by the Supplier shall be made without approval of the Authority. The Supplier's failure to grant approved public access will be grounds for immediate termination of this Contract by the Authority.

4. **IF THE SUPPLIER HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE SUPPLIER'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT:**

   - **VIA MAIL TO: JTA PUBLIC RECORDS CUSTODIAN, 100 LAVILLA CENTER DRIVE, 5TH FLOOR, JACKSONVILLE, FLORIDA 32204;**
   - **VIA TELEPHONE AT: (904) 632-5510;**
   - **VIA EMAIL TO: PUBLICRECORDS@JTAFLA.COM**

5. Media and Other Inquiries. All media and other inquiries concerning the services shall be directed to the Authority's Vice President, External Affairs. The Supplier shall not make any statements, press releases, or publicity releases concerning this Contract or its subject matter or otherwise disclose or permit to be disclosed any of the data or other information obtained or furnished in compliance with this Contract, or any particulars thereof, without the Authority's written consent. However, the Supplier may communicate directly with public agencies when required to do so as part of the services to be performed hereunder.

XIX. Contract Administration

1. Notices. Except as otherwise provided herein, any notices or demands that are required by law or under the terms of this Contract shall be given or made by the Supplier or the Authority in writing and shall be given by hand delivery, telegram, or similar communication, or by certified or registered mail (return receipt requested) and addressed to the respective Parties set forth below. Such notices shall be deemed to have been given in the case of telegrams or similar communications when sent, and in the case of certified or registered mail, on the Third (3rd) day after such communication has been deposited in the United States mail with postage prepaid.

To Authority: Jacksonville Transportation Authority
Procurement Department
100 LaVilla Center Drive
Jacksonville, Florida 32204

To Supplier: GILLIG LLC
William F. Fay, Jr., Vice President Sales
451 Discovery Drive
Livermore, CA 94551

The above addresses may be changed at any time by giving thirty (30) days prior notice as provided above.

2. Entire Agreement. This Contract shall constitute the entire agreement between the Authority and the Supplier relating to the work.

3. Supplier is not Authority's Agent. The Supplier is not authorized to act as the Authority's agent and shall have no authority, expressed or implied, to act for or bind the Authority, unless otherwise expressly set forth for a particular purpose in a separate writing by the Authority.

4. Compliance with Supplier Code of Business Conduct. The Supplier shall, at all times throughout the duration of this Contract, comply with the Authority's Supplier Code of Business Conduct which is made a part hereof by reference. Failure of the Supplier to abide by the Supplier Code of Business Conduct may lead to disciplinary measures commensurate with the violation, including but not limited to termination of this Contract.

5. Compliance with Nondiscrimination and Other Laws. The Supplier shall comply with the regulations relative to nondiscrimination in federally assisted programs of the DOT Title 49, CFR, Part 21, as they may be amended from time to time, which are hereby incorporated herein by reference and made a part of this Contract. The Supplier shall also comply with the following civil rights regulations, as may be amended from time to time, which are incorporated herein by reference: 29 U.S.C. § 623, 42 U.S.C. § 2000, 42 U.S.C. § 6102, 42 U.S.C. § 12112, 42 U.S.C. § 12132, 49 U.S.C. § 5332, 29 CFR Part 1630, and 41 CFR Part 60. The Supplier, at its sole cost and expense, shall comply with applicable laws, regulations, ordinances, and rules of governmental agencies (including as applicable, the FHWA, FTA, OSHA, applicable State of Florida agencies, including the FDOT, the St. Johns River Water Management District (SJRWMD), the Authority, and the City of Jacksonville (CoJ)). Supplier shall secure all required licenses and permits necessary to the performance of the work at its sole cost and expense.

6. Compliance with Federal Regulations. The Supplier shall comply with all federal lobbying regulations as referenced in the Solicitation, including but not limited to 31 U.S.C. 1352, 49 CFR Part 19, and 49 CFR Part 20. The Supplier shall comply with all federal clean air regulations including but not limited to 42 U.S.C. 7401, 40 CFR 15.61, and 49 CFR Part 18. The Supplier shall also comply with all energy conservation requirements including but not limited to 42 U.S.C. 6321 and 49 CFR Part 18. In addition, the Supplier shall comply with all cargo preference requirements as referenced in the Solicitation, including but not limited

to 46 U.S.C. 1241 and 46 CFR 381. The Supplier shall also comply with all clean water regulations issued pursuant to 33 U.S.C. 1251. Lastly, the Supplier shall abide by all federal change requirements as explained in 49 CFR Part 18 which is incorporated herein by reference.

7. Governing Laws. This Contract and the rights of all Parties hereunder shall be construed and enforced in accordance with the laws of the State of Florida.

8. Severability. If any provision of this Contract is declared by a court of competent jurisdiction to be invalid, void, or unenforceable, the remaining provisions shall continue in full force and effect.

9. Advertising. Supplier will not use the name of the Authority or quote the opinion of any employees of the Authority or refer to the Authority directly or indirectly in any promotional literature or correspondence, news release, advertisement, or release to any professional or trade publications without receiving specific written approval for such use or release from the Authority. However, this Paragraph will in no way limit the Supplier's ability to satisfy any governmental required disclosure of its relationship with the Authority.

10. Assignments. This Contract is binding upon the Parties hereto and their respective successors and assigns. The Supplier shall not assign, sell, or transfer its interest in this Contract without the Authority's express written consent. Any such assignment by the Supplier must contain a provision allowing the Authority to assert against any assignee, any and all defenses, setoffs, or counterclaims which the Authority would be entitled to assert against the Supplier.

11. Modifications. This Contract may be modified or amended only by a writing signed by each of the Parties hereto. Neither electronic mail nor instant messaging shall be considered a "writing" for purposes of amending, supplementing, or modifying this Contract. No additional services shall be performed until such additional services are provided for in an Amendment executed by both Parties.

12. Force Majeure. Neither the Authority nor the Supplier shall be liable for any delay or failure in performance solely caused by acts beyond such Party's control, including, without limitation, acts of God, war, vandalism, strikes, labor disputes, sabotage, hurricanes, fires, floods, acts of governmental agencies, or unforeseen interruptions of utility services.

13. Consent to Jurisdiction. The Supplier and the Authority agree that any suit, action, or other legal proceeding arising out of or relating to this Contract shall be brought in the Circuit Court of Duval County, and each Party hereby consents to the jurisdiction of each such court over any such suit, action, or proceeding, and waives any objection which it or they may have to the laying of venue of any such suit, action, or proceeding, and any of such courts. This provision is a material inducement for the Authority and the Supplier entering into the transactions contemplated hereby.

14. Prevailing Party Attorneys' Fees. In the event one Party shall prevail in any action (including appellate proceedings) at law or in equity arising hereunder, the losing Party will pay all costs, expenses, reasonable attorneys' fees, and all other actual and reasonable expenses incurred in the defense and/or prosecution of any legal proceeding, including, but not limited to, those for paralegal, investigative, and legal support services, and actual fees charged by expert witnesses for testimony and analysis incurred by the prevailing Party referable thereto.

15. Member Protection. No recourse under or upon any obligation, covenant, or agreement contained in this Contract or any other agreements or documents pertaining to the work, as such may from time to time be altered or amended in accordance with the provisions hereof, or under any judgment obtained against the Authority or by the enforcement of any assessment or by any legal or equitable proceeding by virtue of any statute or otherwise, whether under or independent of this Contract, shall be had against any Board Member, officer, employee or agent, as such, past, present or future, of the Authority either directly or indirectly, for any claim arising out of this Contract, or for any sum that may be due and unpaid by the Authority. Any and all personal liability of every nature, whether at common law, in equity, by statute, by constitution or otherwise, of any Authority member, officer, employee, or agent as such, to respond by reason of any act or omission on his or her part or otherwise for any claim arising out of this Contract, or for the payment for or to the Authority, or any receiver therefore or otherwise, of any sum that may remain due and unpaid by the Authority, is hereby expressly waived and released as a condition of and as consideration for the execution of this Contract.

16. No Third-Party Beneficiaries. The Parties hereby set forth their intention that there are not and never shall be any third-party beneficiaries of this Contract or of any work or Purchase Order authorized hereunder. The Parties expressly intend that the Authority has no obligation to or relationship with any subSupplier that may be utilized by Supplier.

17. The Supplier shall insert the appropriate provisions from the Solicitation and this Contract in all subcontracts under this Contract. Including all clauses found in Section VI of this solicitation, the Required Clauses For FTA-Assisted Contracts and the clauses set forth in paragraphs (18) through (22) of Section XIX of this contract. The prime Supplier or Supplier shall also require all subSuppliers of any tier to insert these clauses into all lower tier subcontracts, without modification. The prime Supplier or Supplier shall be responsible for compliance by any subSupplier or any lower tier subSupplier with the clauses and shall ensure that this contract and all subcontracts of any tier are performed in accordance with the provisions of 49 CFR Part 26, as may be amended from time to time.

18. Contract Assurance (49-CFR Part 26.13). The Supplier, sub recipient or subSupplier shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Supplier shall carry out applicable requirements of 49-CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the Supplier to carry out these requirements is a material breach of this contract, which may result in the

termination of this contract or such other remedy as the recipient deems appropriate.

19. Prompt Payment (49-CFR Part 26.29). Prime Suppliers are required to pay all subSuppliers, to include DBE subSuppliers, for satisfactory performance of their contracts within seven (7) business days from receipt of each payment from the JTA. Failure to comply may result in future withholdings of prime Supplier's reimbursements and/or other sanctions until the prime Supplier ensure all subSuppliers are being promptly paid for all work performed.

20. Return of Retainage (49-CFR Part 26.29). Prime Suppliers are required to ensure prompt and full payment of retainage to all subSuppliers within thirty (30 days) after the sub-Suppliers' work is satisfactorily completed. Prime Suppliers are prohibited from holding retainage from subSuppliers until the project is completed. A sub-Supplier' s work is satisfactorily completed when all the tasks called for in the subcontract have been accomplished and documented as required by the JTA. When JTA has made an incremental acceptance of a portion of a prime contract, the work of a sub-supplier covered by that acceptance is deemed to be satisfactorily completed.

21. Monitoring the Performance of other Program Participants (49-CFR Part 26.37). The JTA will monitor each DOT funded contract with DBE participation to ensure that all work committed to DBEs at contract award or subsequently (as a result of contract modification) is actually performed by the DBEs to which the work was committed. Site visit will be conducted periodically by staff. Supplier's Request for Payment forms will be monitored to ensure that DBEs are being paid in accordance to their signed agreements.

All Prime Suppliers will be required to self-report all payments received from the JTA into the B2GNow (Contract Compliance Tracking System). This system tracks payments made to the prime Supplier and all payments made by the prime to any subSuppliers, to include DBEs, and the timeliness of those payments in accordance to JTA's Prompt Payment Clause.

22. Termination for Convenience (49-CFR Part 26.53). No prime Supplier will terminate for convenience a DBE subSupplier that was listed and agreed to perform a project task (or an approved substitute DBE firm) and then perform the work of the terminated subcontract with its own forces or those of an affiliate, without prior written consent from JTA's Diversity & Equity Program Office.

The prime Supplier shall utilize the specific DBEs listed to perform the work and supply the materials for which each is listed unless the prime Supplier obtains written consent form JTA's Diversity & Equity Program Office; and unless the consent is provided the Supplier shall not be entitled to any payment for work or material unless it is performed or supplied by the listed DBE.

Appropriate administrative remedies will be invoked to any Prime Supplier that terminates and/or removes a DBE firm/s for convenience. Those remedies may include requirement to pay terminated DBE firm/s; withholding of future payments and/or retainage; and/or disbarment from future consideration of project awards with the JTA.

23. Counterparts. This Contract may be executed in one or more counterparts, each of which will be deemed an original, but all such counterparts will together constitute one and the same instrument.

24. Exhibits. The following Exhibits are hereby incorporated into this Contract as part hereof as though fully set forth herein.

Exhibit A, Federal Clauses
Exhibit B, Technical Specifications
Exhibit C, Scope of Work
Exhibit D, Schedule of Suppliers/SubSuppliers Form
Exhibit E, Required Forms
Exhibit F, Pricing
Exhibit G, Warranty Requirements

IN WITNESS WHEREOF, each of the Parties hereto have caused its duly authorized officer to execute and deliver this Contract on or as of the date first above written.

GILLIG, INC.:

By: _____

Printed Name: WILLIAM F. FAY, JR.

Title: VICE PRESIDENT SALES

JACKSONVILLE TRANSPORTATION AUTHORITY:

By: _____

Printed Name: Nathaniel P. Ford. Sr.

Title: Chief Executive Officer

APPROVED AS TO FORM:

By: _____

Printed Name: Cleveland Ferguson III

Title: EVP/Chief Administrator Officer

Execute in Triplicate Distribution:

1. Gilling, Inc.
2. JTA Procurement Department
3. JTA Project Manager

Exhibit 'A' – Required Clauses for Federally Assisted Contracts

(On the following pages)

MATRIX OF FTA THIRD-PARTY CONTRACT CLAUSES

(This matrix does not apply to micro-purchases,[1] except that Davis Bacon requirements apply to all federal construction contracts over $2,000)

Last revised: December 1, 2023

This Matrix is not meant to be all inclusive. Please review the specific funding source, as well as all clauses for applicability to the type of contract and flow down requirements.

Highlighted column has been added for convenience in identifying which clauses are applicable to the solicitation/contract.

	CLAUSE	*TYPE OF PROCUREMENT*				
		Professional Services/A&E	***Operations/ Management/ Subrecipients***	***Rolling Stock Purchase***	***Construction* (*See Note Below)***	***Materials & Supplies***
1.	No Federal Government Obligations to Third Parties (by use of a Disclaimer)	*All*	*All*	*All*	*All*	*All*
2.	False Statement or Claims: Civil and Criminal Fraud	*All*	*All*	*All*	*All*	*All*
	Notice to FTA and U.S. DOT Inspector General of Information Related to	*$25,000 or More. Prime and Subs*	*$25,000 or More. Prime and Subs*	*$25,000 or More. Prime and Subs*	*$25,000 or More. Prime and Subs*	*$25,000 or More. Prime and Subs*

[1] Currently set at $10,000. 2 CFR § 200.320.

* Per 41 CFR Part 60- 1.3, *Construction work* means the construction, rehabilitation, alteration, conversion, extension, demolition or repair of buildings, highways, or other changes or improvements to real property, including facilities providing utility services. The term also includes the supervision, inspection, and other onsite functions incidental to the actual construction.

	CLAUSE	TYPE OF PROCUREMENT				
		Professional Services/A&E	***Operations/ Management/ Subrecipients***	***Rolling Stock Purchase***	***Construction* (*See Note Below)***	***Materials & Supplies***
	Fraud, Waste, Etc.					
3.	Access to Third Party Contract Records	*All*	*All*	*All*	*All*	*All*
4.	Changes to Federal Requirements	*All*	*All*	*All*	*All*	*All*
5.	Equal Employment Opportunity (Except Special DOL EEO clauses for construction projects	*All*	*All*	*All*	*All*	*All*
6.	Incorporation of FTA Terms	*All*	*All*	*All*	*All*	*All*
7.	Energy Conservation	*All*	*All*	*All*	*All*	*All*
8.	Termination (not required of states)	*>$10,000*	*>$10,000*	*>$10,000*	*>$10,000*	*>$10,000*
9.	Debarment and Suspension	*>$25,000*	*>$25,000*	*>$25,000*	*>$25,000*	*>$25,000*
10.	Buy America			*>$150,000*	*>$150,000*	*>$150,000*
11.	Resolution of Disputes, Breaches, or Other Litigation	*>$250,000 (see Note)*	*>$250,000 (see Note)*	*>$250,000 (see Note)*	*>$250,000 (see Note)*	*>$250,000 (see Note)*

	CLAUSE	TYPE OF PROCUREMENT				
		Professional Services/A&E	***Operations/ Management/ Subrecipients***	***Rolling Stock Purchase***	***Construction* (*See Note Below)***	***Materials & Supplies***
12.	Lobbying	*>$100,000*	*>$100,000*	*>$100,000*	*>$100,000*	*>$100,000*
13.	Clean Air	*>$150,000*	*>$150,000*	*>$150,000*	*>$150,000*	*>$150,000*
14.	Clean Water	*>$150,000*	*>$150,000*	*>$150,000*	*>$150,000*	*>$150,000*
15.	Cargo Preference			*Involving property that may be transported by ocean vessel*	*Involving property that may be transported by ocean vessel*	*Involving property that may be transported by ocean vessel*
16.	Fly America	*Involving foreign transport or travel by air*	*Involving foreign transport or travel by air*	*Involving foreign transport or travel by air*	*Involving foreign transport or travel by air*	*Involving foreign transport or travel by air*
17.	Davis Bacon Act and Copeland Anti-Kickback Act				*>$2,000 (including ferry vessels)*	
18.	Contract Work Hours & Safety Standards Act		*Contracts >$250,000 (transportation services excepted.)*	*>$250,000*	*>$250,000 (also ferries.)*	
19.	Bonding				*>$250,000*	

	CLAUSE	TYPE OF PROCUREMENT				
		Professional Services/A&E	***Operations/ Management/ Subrecipients***	***Rolling Stock Purchase***	***Construction* (*See Note Below)***	***Materials & Supplies***
20.	Seismic Safety	*A&E for new buildings & additions*			*New buildings & additions*	
21.	Transit Employee Protective Arrangements		*FTA programs involving public transportation operations funded with 5307-5312, and 5316*			
22.	Charter Service Operations		***All** transit operations contracts involving FTA funding under 49 USC 5307, 5309, 5311 or 5316 funds*			
23.	School Bus Operations		***All** transit operations contracts*			
24.	Drug Use and Testing/ Alcohol Misuse and Testing		*All transit operations contracts*			

	CLAUSE	TYPE OF PROCUREMENT				
		Professional Services/A&E	***Operations/ Management/ Subrecipients***	***Rolling Stock Purchase***	***Construction* (*See Note Below)***	***Materials & Supplies***
25.	Patent Rights, and Rights in Data and Copyrights	*Research & development*				
26.	Special DOL EEO clause for construction projects				>$10,000	
27.	Disadvantaged Business Enterprises (DBEs)	*All*	*All*	*All*	*All*	*All*
28.	Recycled Products (Solid Wastes)		*Contracts for items designated by EPA, when procuring $10,000 or more per year*		*Contracts for items designated by EPA, when procuring $10,000 or more per year*	*Contracts for items designated by EPA, when procuring $10,000 or more per*
29.	ADA Access	*A&E*	*All*	*All*	*All*	*All*
30.	Veterans Preference				*>$150,000*	
31.	Motor Carrier Safety	*All*	*All*	*All*	*All*	*All*
32.	Seat Belt Use and Distracted Driving	*All*	*All*	*All*	*All*	*All*
33.	Protection of Sensitive and Personally	*All*	*All*	*All*	*All*	*All*

	CLAUSE	TYPE OF PROCUREMENT				
		Professional Services/A&E	***Operations/ Management/ Subrecipients***	***Rolling Stock Purchase***	***Construction* (*See Note Below)***	***Materials & Supplies***
	Identifiable Information					
34.	Trafficking in Persons	*All*	*All*	*All*	*All*	*All*
35.	Tax Liability and Recent Felony Convictions	*All*	*All*	*All*	*All*	*All*
36.	Construction Site Safety				*all*	
37.	Domestic Preferences for Procurements	*All*	*All*	*All*	*All*	*All*
38.	Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment	*All*	*All*	*All*	*All*	*All*
39.	Bus Testing			*All, except minivans*		
40.	Pre-Award and Post-Delivery Audit Requirements			*All*		
41.	FTA Clauses Required when DBE threshold has been met	*If DBE threshold has been met*	*DBE threshold has been met*	*DBE threshold has been met*	*DBE threshold has been met*	*DBE threshold has been met*
42.	Conformance with ITS	*ITS Projects*	*ITS Projects*	*ITS Projects*	*ITS Projects*	*ITS Projects*

	CLAUSE	TYPE OF PROCUREMENT				
		Professional Services/A&E	***Operations/ Management/ Subrecipients***	***Rolling Stock Purchase***	***Construction* (*See Note Below)***	***Materials & Supplies***
	National Architecture					

REQUIRED CLAUSES FOR FTA-ASSISTED CONTRACTS

These requirements do not apply to micro-purchases ($10,000 or less), except that Davis-Bacon and Copeland Anti-Kickback Act requirements apply to contracts over $2,000 for Construction, including Ferry Vessels.

Applicability data is found on the table above and with each clause below. Please review your specific funding source for additional applicability and requirements. Any updates to these clauses by the FTA not reflected here shall be considered in full force and effect.

---

1. No Federal Government Obligation to Third Parties.

Authority - FTA Master Agreement (30) at Section 3(*l*)

Applicability - all contracts

> Except as the Federal Government expressly consents in writing, the Authority and Contractor agrees that:
>
> (1) The Federal Government does not and shall not have any commitment or liability related to the Contract, to any Contractor or Subcontractor at any tier, or to any other person or entity that is not a party (FTA or the Authority) to the Contract; and
>
> (2) Notwithstanding that the Federal Government may have concurred in or approved any Solicitation or Third Party Agreement at any tier that may affect the Contract, the Federal Government does not and shall not have any commitment or liability to any Third Party Participant or other entity or person that is not a party (FTA or the Authority) to the Contract.

Flow Down Requirements - This requirement flows down to all subcontracts at every tier.

2. Program Fraud and False or Fraudulent Statements and Related Acts.

Authority - 49 U.S.C. § 5323(l) (1), 31 U.S.C. §§ 3801-3812, 18 U.S.C. § 1001 and 49 CFR. Part 31, FTA Master Agreement (30) at Section 39(b).

Applicability - all contracts

> The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § 3801 et seq. and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 CFR. Part 31, apply to its actions pertaining to this Project. Upon execution of the underlying contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract or

the FTA assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the Contractor further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on the Contractor to the extent the Federal Government deems appropriate.

The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 U.S.C. chapter 53, the Government reserves the right to impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5323(l) on the Contractor, to the extent the Federal Government deems appropriate.

Notification to FTA. If a current or prospective legal matter that may affect the Federal Government emerges, the Authority must promptly notify the FTA Chief Counsel and FTA Regional Counsel for the Region in which the Authority is located. The Authority must include a similar notification requirement in its Contracts that must require each Contractor to include an equivalent provision in its sub agreements at every tier, for any agreement that is a "covered transaction" according to 2 CFR §§180.220 and 1200.220.

(1) The types of legal matters that require notification include, but are not limited to, a major dispute, breach, default, litigation, or naming the Federal Government as a part to litigation or legal disagreement in any forum for any reason.

(2) Matters that may affect the Federal Government include, but are not limited to, the Federal Government's interests in the Award, the accompanying Contract, and any Amendments thereto, or the Federal Government's administration or enforcement of federal laws, regulations, and requirements.

Additional Notice to U.S. DOT Inspector General. The Authority or Contractor must promptly notify the U.S. DOT Inspector General in addition to the FTA Chief Counsel or Regional Counsel for the Region in which the Project is located, if the Authority or Contractor has knowledge of potential fraud, waste, or abuse occurring on any project receiving assistance from FTA. The notification provision applies if a person has or may have submitted a false claim under the False Claims Act, 31 U.S.C. § 3729 et seq., or has or may have committed a criminal or civil violation of law pertaining to such matters as fraud, conflict of interest, bid rigging, misappropriation or embezzlement, bribery, gratuity, or similar misconduct involving federal assistance. This responsibility occurs regardless of whether the project is related to this Contract or another agreement between the Authority and FTA, or an agreement involving a principal, officer, employee, agent, or Third Party Participant of the Authority. It also applies to subcontractors at any tier. "Knowledge," as used in this paragraph, includes, but is not limited to, knowledge

of a criminal or civil investigation by a Federal, state, or local law enforcement or other investigative agency, a criminal indictment or civil complaint, or probable cause that could support a criminal indictment, or any other credible information in the possession of the Authority or Contractor. In this paragraph, "promptly" means to refer information without delay and without change. This notification provision applies to all divisions of the Authority, including divisions tasked with law enforcement or investigatory functions.

The Contractor agrees to include the above clauses in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions.

Flow Down Requirements - The Program Fraud clause extends to all contractors and their subcontracts at every tier who make, present, or submit covered claims and statements.

3. Access to Records and Reports.

Authority - 49 U.S.C. § 5325(g), 2 CFR. § 200.333 and 49 CFR. part 633, 49 CFR part 630, FTA Master Agreement (30) at Sections 8(c).

Applicability – all contracts

a. *Record Retention*. The Contractor will retain and will require its subcontractors of all tiers to retain, complete and readily accessible records related in whole or in part to the contract, including, but not limited to, data, documents, reports, statistics, sub-agreements, leases, subcontracts, arrangements, other third party agreements of any type, and supporting materials related to those records.

b. *Retention Period*. The Contractor agrees to comply with the record retention requirements in accordance with 2 CFR. § 200.333. The Contractor shall maintain all books, records, accounts and reports required under this Contract for a period of at not less than three (3) years after the date of termination or expiration of this Contract, except in the event of litigation or settlement of claims arising from the performance of this Contract, in which case records shall be maintained until the disposition of all such litigation, appeals, claims or exceptions related thereto.

c. *Access to Records*. The Contractor agrees to provide sufficient access to FTA and its contractors to inspect and audit records and information related to performance of this contract as reasonably may be required. Contractor is notified that the Authority may be subject to the Single Audit Act, set forth in 2 CFR Part 200, Subpart F – Audit Requirements, as amended.

d. *Access to the Sites of Performance*. The Contractor agrees to permit FTA and its contractor's access to the sites of performance under this contract as reasonably may be required.

e. *National Transit Database.* For each fiscal year the Authority receives or provides to any public transportation operation federal assistance appropriated or made available for 49 U.S.C. §5307 (including Passenger Ferry Grant Program) or any provision of 40 U.S.C. §5311:

(1) *Reporting Requirements:* The Authority agrees to, and assures that it will require any person that receives benefits directly from its Award (including the public transportation operators participating in its Award), the accompanying Contract, and any Amendments thereto:

(i) To facilitate compliance with 49 U.S.C. §5335(a), which authorizes the National Transit Database (NTD);

(ii) To conform to the NTD reporting system and the Uniform System of Accounts and Records;

(iii) To comply with FTA regulations, "Uniform System of Accounts and Records and Reporting System," 49 CFR Part 630;

(iv) To report when required to the NTD in accordance with FTA regulations 49 CFR Part 630, "National Transit Database," and applicable FTA instructions:

(A) Any information relating to a transit asset inventory or condition assessment conducted by the Authority;

(B) Any data on assaults on transit workers of the Authority;

(C) Any data on fatalities that result from an impact with a bus; and

(D) Such other information as FTA may require; and

(v) To comply with another applicable reporting regulations, and requirements, and

(vi) To follow FTA guidance.

(2) *Voluntary Compliance.* FTA encourages any Authority that is not required to provide information for the NTD, to provide that information voluntarily.

Flow Down Requirements - This requirement flows down to all subcontracts at every tier.

4. Federal Changes.

Authority – 49 CFR Part 18

Applicability – all contracts

Contractor shall at all times comply with all applicable FTA regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the Master Agreement between the Authority and FTA, Super Circular 2 CFR Part 200 and FTA Circular 4220.1F as they may be amended or promulgated from time to time during the term of the contract. Contractor's failure to comply shall constitute a material breach of the contract.

Flow Down Requirements - This requirement flows down to all subcontracts at every tier.

5. Civil Rights (Title VI, EEO, ADA).

Authority – Appendix II to Part 200, FTA Master Agreement (30) at Section 12(b)-(d), FTA Best Procurement Practices Manual

Applicability - all contracts

The JTA is an Equal Opportunity Employer. As such, the JTA agrees to comply with all applicable Federal civil rights laws and implementing regulations. Apart from inconsistent requirements imposed by Federal laws or regulations, the JTA agrees to comply with the requirements of 49 U.S.C. § 5323(h) (3) by not using any Federal assistance awarded by FTA to support procurements using exclusionary or discriminatory specifications.

Under this Agreement, the Contractor shall at all times comply with the following requirements and shall include these requirements in each subcontract entered into as part thereof.

1. **Nondiscrimination in Federal Public Transportation Programs**. In accordance with Federal transit law at 49 U.S.C. § 5332, the Contractor agrees that it will:

A. Prohibit discrimination based on race, color, religion, national origin, sex (including sexual orientation and gender identify), disability, or age. In addition, the Contractor agrees to comply with applicable Federal implementing regulations and other implementing requirements FTA may issue.

B. Prohibit the:

(i) Exclusion from participation in employment or a business opportunity for reasons identified in 49 U.S.C. § 5332;

(ii) Denial of program benefits in employment or a business opportunity identified in 49 U.S.C. § 5332; or

(iii) Discrimination identified in 49 U.S.C. § 5332, including discrimination in employment or a business opportunity identified in 49 U.S.C. § 5332.

C. Follow the most recent edition of FTA Circular 4702.1, "Title VI Requirements and Guidelines for Federal Transit Administration Recipients," to the extent consistent with applicable federal laws, regulations, requirements, and guidance.

2. **Nondiscrimination – Title VI of the Civil Rights Act.** The Contractor will:

A. Prohibit discrimination based on race, color, or nation origin;

B. Comply with:

(i) Title VI of the Civil Rights Act of 1964, as amended, 42 U.S.C. § 2000d, et seq.;

(ii) U.S. DOT regulations, "Nondiscrimination in Federally-Assisted Programs of the Department of Transportation – Effectuation of Title VI of the Civil Rights Act of 1964," 49 CFR Part 21; and

(iii) Federal transit law, specifically 49 U.S.C. § 5332; and

C. Follow:

(i) The most recent edition of FTA Circular 4702.1, "Title VI Requirements and Guidelines for Federal Transit Administration Recipients," to the extent consistent with applicable federal laws, regulations, requirements, and guidance;

(ii) U.S. DOJ, "Guidelines of the enforcement of Title VI, Civil Rights Act of 1964," 28 CFR § 50.3; and

(iii) All other applicable federal guidance that may be issued.

3. **Equal Employment Opportunity**.

(1) *Federal Requirements and Guidance*. The Contractor agrees to prohibit discrimination based on race, color, religion, sex, sexual orientation, gender identity, or national origin, and:

(i) Comply with Title VII of the Civil Rights Act of 1964, as amended, 42 U.S.C. § 2000e, et seq.;

(ii) Comply with Title I of the Americans with Disabilities Act of 1990, as amended, 42 U.S.C. §§ 12101, et seq.;

(iii) Facilitate compliance with Executive Order No. 11246, "Equal Employment Opportunity" September 24, 1965 (42 U.S.C. § 2000e note), as amended by any later Executive Order that amends or supersedes it in part and is applicable to federal assistance programs;

(iv) Comply with federal transit law, specifically 49 U.S.C. § 5332, as provided in section 12 of this Master Agreement;

(v) FTA Circular 4704.1 "Equal Employment Opportunity (EEO) Requirements and Guidelines for Federal Transit Administration Recipients;" and

(vi) Follow other federal guidance pertaining to EEO laws, regulations, and requirements.

(2) *Specifics*. The Contractor agrees to:

(i) *Affirmative Action*. If required to do so by U.S. DOT regulations (49 CFR Part 21) or U.S. Department of Labor regulations (41 CFR. chapter 60), take affirmative action that includes, but is not limited to:

(A) Recruitment advertising, recruitment, and employment;

(B) Rates of pay and other forms of compensation;

(C) Selection for training, including apprenticeship, and upgrading; and

(D) Transfers, demotions, layoffs, and terminations; but (ii) Indian Tribe. Recognize that Title VII of the Civil Rights Act of 1964, as amended, exempts Indian Tribes under the definition of "Employer;" and

(3) *Equal Employment Opportunity Requirements for Construction Activities*. Comply, when undertaking "construction" as recognized by the U.S. Department of Labor (U.S. DOL), with:

(i) U.S. DOL regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 CFR. chapter 60; and

(ii) Executive Order No. 11246, "Equal Employment Opportunity in Federal Employment," September 24, 1965, 42 U.S.C. § 2000e note (30 Fed. Reg. 12319, 12935), as amended by any later Executive Order that amends or supersedes it, referenced in 42 U.S.C. § 2000e note.

The Contractor agrees to take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, national origin, or sex (including sexual orientation and gender identity). Such action shall include, but not be limited to, the following: employment, promotion, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

3. **Age**. In accordance with the Age Discrimination in Employment Act, 29 U.S.C. §§ 621-634, U.S. Equal Employment Opportunity Commission (U.S. EEOC) regulations, "Age Discrimination in Employment Act," 29 CFR. Part 1625, the Age Discrimination Act of 1975, as amended, 42 U.S.C. § 6101 et seq., U.S. Health and Human Services regulations, "Nondiscrimination on the Basis of Age in Programs or Activities Receiving Federal Financial Assistance," 45 CFR. Part 90, and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

4. **Disabilities**. In accordance with section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 794, the Americans with Disabilities Act of 1990, as amended, 42 U.S.C. § 12101 et seq., the Architectural Barriers Act of 1968, as amended, 42 U.S.C. § 4151 et seq., and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees that it will not discriminate against individuals on the basis of disability. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

Sanctions for Noncompliance. In the event of the Contractor's noncompliance with the nondiscrimination provisions of this Contract, the Authority shall impose such contract sanctions as it, the FTA, FDOT or the U.S. DOT may determine to be appropriate, including, but not limited to: withholding of payments to the Contractor under the Contract until the Contractor complies and/or cancellation, termination or suspension of the Contract, in whole or in part.

Flow Down Requirements - This requirement flows down to all subcontracts at every tier. In all solicitations made by the Contractor and all subcontractors, either by competitive bidding or negotiation for work to be performed under a subcontract, including procurements of materials

and leases of equipment, each potential subcontractor or supplier shall be notified in writing by the Contractor of the Contractor's obligations under this Contract and the Regulations relative to nondiscrimination on the basis of race, creed, color, sex, sexual orientation, gender identity, national origin, religion, age, disability, or family status and that these same obligations extend to any subcontractor, supplier or lessor.

6. Incorporation of Federal Transit Administration (FTA) Terms.

Authority – FTA Master Agreement (30) at Section 3(i)(5)-(6)

Applicability - all contracts

All contractual provisions required by FTA, as set forth in FTA Circular 4220.1F and the Super Circular 2 CFR Part 200, are hereby incorporated by reference. Anything to the contrary herein notwithstanding, all FTA mandated terms shall be deemed to control in the event of a conflict with other provisions contained in this Agreement. The Contractor shall not perform any act, fail to perform any act, or refuse to comply with any State requests, which would cause the State to be in violation of the FTA terms and conditions.

Federal requirements that apply to the Authority or the Award, the FTA Master Agreement, and any Amendments thereto may change due to changes in federal law, regulation, other requirement, or guidance, or changes in the FTA Master Agreement including any information incorporated by reference and made part of that FTA Master Agreement and applicable changes to those federal requirements will apply to each Contract and parties thereto at any tier.

Flow Down Requirements - This requirement flows down to all subcontracts at every tier.

7. Energy Conservation.

Authority - 42 U.S.C. 6321 et seq. and 49 CFR. Part 622, subpart C

Applicability - all contracts

Contractor shall comply with mandatory standards and policies relating to energy efficiency, stated in the state energy conservation plan issued in compliance with the Energy Policy & Conservation Act, as amended, 42 U.S.C. § 6321 et seq., and perform an energy assessment for any building constructed, reconstructed, or modified with federal assistance required under FTA regulations, "Requirements for Energy Assessments," 49 CFR. Part 622, subpart C.

Flow Down Requirements - This requirement flows down to all subcontracts at every tier.

8. Termination Provisions.

Authority - 2 CFR. § 200.339 and 2 CFR. Part 200, Appendix II (B), FTA Master Agreement (30) Section 16(d)(2)

Applicability – all contracts

For all contracts in excess of $10,000, termination provisions are referenced in Section IV. **Term of Contract and Termination** of the Contract under Section IV of this solicitation package. These termination provisions address termination for cause and for convenience by the non-federal entity and includes the manner by which it will be effected and the basis for settlement.

Flow Down Requirements – none.

9. Government-Wide Debarment and Suspension.

Authority - 2 CFR. Part 180, 2 CFR. § 180.300, 2 CFR Part 1200, 2 CFR. § 200.213, 2 CFR. Part 200 Appendix II (I), Executive Order 12549 and Executive Order 12689, FTA Master Agreement (30) at Section 4(h), FTA Best Procurement Practices Manual

Applicability - All contracts over $25,000

The Contractor shall comply and facilitate compliance with U.S. DOT regulations, "Nonprocurement Suspension and Debarment," 2 CFR. Part 1200, which adopts and supplements the U.S. Office of Management and Budget (U.S. OMB) "Guidelines to Agencies on Government-wide Debarment and Suspension (Nonprocurement)," 2 CFR. Part 180. These provisions apply to each contract at any tier of $25,000 or more, and to each contract at any tier for a federally required audit (irrespective of the contract amount), and to each contract at any tier that must be approved by an FTA official irrespective of the contract amount. As such, the Contractor shall verify that its principals, affiliates, and subcontractors are eligible to participate in this federally funded contract and are not presently declared by any Federal department or agency to be:

a) Debarred from participation in any federally assisted Award;
b) Suspended from participation in any federally assisted Award;
c) Proposed for debarment from participation in any federally assisted Award;
d) Declared ineligible to participate in any federally assisted Award;
e) Voluntarily excluded from participation in any federally assisted Award; or
f) Disqualified from participation in ay federally assisted Award.

By signing and submitting its bid or proposal, the bidder or Bidder certifies as follows:

The certification in this clause is a material representation of fact relied upon by the JTA. If it is later determined by the JTA that the bidder or Bidder knowingly rendered an erroneous certification, in addition to remedies available to the JTA, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment. The bidder or Bidder agrees to comply with the requirements of 2 CFR. Part 180, subpart C, as supplemented by 2 CFR. Part 1200, while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or Bidder further agrees to

include a provision requiring such compliance in its lower tier covered transactions.

Flow Down Requirements - Recipients, contractors, and subcontractors who enter into covered transactions with a participant at the next lower level, must require that participant to: (a) comply with subpart C of 2 CFR. Part 180, as supplemented by 2 CFR. Part 1200; and (b) pass the requirement to comply with subpart C of 2 CFR. Part 180 to each person with whom the participant enters into a covered transaction at the next lower tier.

10. Buy America Requirements.

Authority - 49 U.S.C. 5323(j) and 49 CFR. Part 661 (49 CFR. § 661.13(b) and 49 CFR. § 661.6), FTA Master Agreement (30) at Sections 3(h), 16(d)(1) and 15 (a)-(b), FTA Best Procurement Practices Manual

Applicability – Construction Contracts and Acquisition of Goods or Rolling Stock valued at more than $150,000. Work orders and small purchases of less than one hundred fifty thousand dollars ($150,000.00) made with capital, operating, or planning funds are waived from Buy America requirements.

The Contractor agrees to comply with the domestic procurement requirements of 49 U.S.C. 5323(j), and FTA regulations, "Buy America Requirements," 49 CFR Part 661, to the extent consistent with 40 U.S.C. § 5323(j), which provide that Federal funds may not be obligated unless all steel, iron, and manufactured products used in FTA funded projects are produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general waiver. General waivers are listed in 49 CFR. § 661.7. Separate requirements for rolling stock are set out at 49 U.S.C. 5323(j)(2)(C) and 49 CFR. § 661.11.

The Bidder/Proposer must submit to JTA the appropriate Buy America certification below with its Bid(s) or Proposal(s). Offers that are not accompanied by a completed Buy America certification will be rejected as nonresponsive.

The JTA presumes that any Contractor who submitted such certificate is complying with the Buy America provisions. A false certification is a criminal act in violation of 18 U.S.C. § 1001. A Contractor who certifies that it will comply with the applicable Buy America requirement is bound by its original certification (in the case of a sealed bidding procurement) or the certification it submitted with its final offer (in the case of a negotiated procurement) and is not permitted to change its certification after bid opening or submission of its final offer. Where a Contractor certifies that it will comply with Buy America requirements, the Contractor is not eligible for a waiver of those requirements. The JTA reserves the right to request additional information, and/or to conduct both pre-award and post-award audits to ensure that the Contractor is in compliance with Buy America requirements.

In addition to the aforementioned Buy America Requirements, the Infrastructure Investment and Jobs Act ("IIJA"), Pub. L. No. 117-58 that includes the Build America,

Buy America Act ("the Act") Pub. L. No. 117-58, Div G, Title IX, §§ 70911-27 (2021), as implemented by the U.S. Office of Management and Budget, the U.S. Department of Transportation, and FTA. The Authority and Contractor acknowledges that this agreement is neither a waiver of §70914(a) nor a finding under § 70914(b). The Act, requires the following Buy America Act preference:

1. All iron and steel used in the project are produced in the United States. This means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.

2. All manufacturer products used in the project are produced in the United States. This means the manufactured product was manufactured in the United States, and the cost of the components of the manufacturer product that are mined, produced or manufactured in the United States is greater than 55 percent (55%) of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established in applicable law or regulation.

3. All construction materials are manufactured in the United States. This means that all manufacturing processes for the construction material occurred in the United States (IIJA §70912(2) and (6)(B)(ii)).

The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment that are used at or within the finished infrastructure project but are not an integral part of the structure or permanently affixed to the infrastructure project.

Definitions

"Construction materials" include an article, material, or supply – other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives – that is or consists primarily of:

- Non-ferrous metals;
- Plastic and polymer-based products (including polyvinylchloride, composite building materials and polymers used in fiber optic cables);
- Glass (including optic glass);
- Lumber; or
- Drywall.

"Domestic content procurement preference' means all iron and steel used in the project are produced in the United States; the manufactured products used in the project are produced in the Unites States; or the construction materials used in the project are produced in the United States.

"Infrastructure" includes, at a minimum, the structures, facilities, and equipment for, in the United States, roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property. Infrastructure includes facilities that generate, transport, and distribute energy.

"Project" means the construction, alteration, maintenance, or repair of infrastructure in the United States.

Flow Down Requirements - The Buy America requirements flow down from FTA recipients and subrecipients to first tier contractors, who are responsible for ensuring that lower tier contractors and subcontractors are in compliance.

11. Provisions for resolution of disputes, breaches, or other litigation.

Authority – FTA Master Agreement (30) at Section 39(b).

Applicability – all contracts

> If a current or prospective legal matter that may affect the Federal Government emerges, the Contractor must promptly notify the Authority who must promptly notify the FTA Chief Counsel and FTA Regional Counsel for the Region in which the Authority is located. The Authority must include a similar notification requirement in its Contractor Agreements and must require each Contractor to include a similar notification requirement in its sub agreements at every tier for any agreement that is a "covered transaction" according to 2 CFR. §§ 180.220 and 1200.220.
>
> (1) The types of legal matters that require notification include, but are not limited to, a major dispute, breach, default, litigation, or naming the Federal Government as a party to litigation or a legal disagreement in any forum for any reason.
>
> (2) Matters that may affect the Federal Government include, but are not limited to, the Federal Government's interests in the Award, the accompanying Underlying Agreement, and any Amendments thereto, or the Federal Government's administration or enforcement of federal laws, regulations, and requirements.
>
> (3) Additional Notice to U.S. DOT Inspector General. The Authority must promptly notify the U.S. DOT Inspector General in addition to the FTA Chief

Counsel or Regional Counsel for the Region in which the Authority is located, if the Authority has knowledge of potential fraud, waste, or abuse occurring on a Project receiving assistance from FTA. The notification provision applies if a person has or may have submitted a false claim under the False Claims Act, 31 U.S.C. §3729, et seq., or has or may have committed a criminal or civil violation of law pertaining to such matters as fraud, conflict of interest, bid rigging, misappropriation or embezzlement, bribery, gratuity, or similar misconduct involving federal assistance. This responsibility occurs whether the Project is subject to this Agreement or another agreement between the Authority and FTA, or an agreement involving a principal, officer, employee, agent, or Third Party Participant of the Authority. It also applies to subcontractors at any tier. Knowledge, as used in this paragraph, includes, but is not limited to, knowledge of a criminal or civil investigation by a Federal, state, or local law enforcement or other investigative agency, a criminal indictment or civil complaint, or probable cause that could support a criminal indictment, or any other credible information in the possession of the Authority. In this paragraph, "promptly" mean to refer information without delay and without change. This notification provision applies to all divisions of the Authority, including division tasked with law enforcement or investigatory functions.

Flow Down Requirements - The Contractor must include a similar notification requirement in its subcontracts at every tier for any agreement that is a "covered transaction" according to 2 CFR. §§ 180.220 and 1200.220.

12. Lobbying Restrictions.

Authority - 31 U.S.C. § 1352, 2 CFR. § 200.450, 2 CFR. Part 200 Appendix II (I) and 49 CFR. Part 20, Appendix A, FTA Master Agreement (30) at Section 4(c)

Applicability - All contracts over $100,000

The Authority agrees that neither it nor any Contractor will use federal assistance to influence any officer or employee of a federal agency, member of Congress or an employee of a member of Congress, or officer or employee of Congress on matters that involve the Contract, including any extension of modification, according to the following:

A. Byrd Anti-Lobbying Amendment, 31 U.S.C. 1352, as amended by the Lobbying Disclosure Act of 1995, P.L. 104-65 [to be codified at 2 U.S.C. § 1601, et seq.] - Contractors who apply or bid for an award of $100,000 or more shall file the certification required by 49 CFR Part 20, "New Restrictions on Lobbying." Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier shall also disclose any lobbying with non-Federal funds that takes place in

connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

B. The lobbying requirements mandate the maximum flow down pursuant to Byrd Anti-Lobbying Amendment, 31 U.S.C. § 1352(b)(5). The Contractor agrees to include the above clause in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions.

C. Contractors that apply or bid for an award exceeding $100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

Flow Down Requirements - The lobbying requirements mandate the maximum flow down pursuant to Byrd Anti-Lobbying Amendment, 31 U.S.C. § 1352(b)(5).

13. Clean Air

Authority - 42 U.S.C. 7401–7671q and FTA Master Agreement (30) at Section 16(d)(7)

Applicability - All contracts over $150,000

The Contractor agrees:
1) It will not use any violating facilities;
2) It will report the use of facilities placed on or likely to be placed on the U.S. EPA "List of Violating Facilities;"
3) It will report violations of use of prohibited facilities to FTA; and
4) It will comply with the inspection and other requirements of the Clean Air Act, as amended, (42 U.S.C. §§ 7401 – 7671q); and the Federal Water Pollution Control Act as amended, (33 U.S.C. §§ 1251-1387).

Flow Down Requirements - The Clean Air Act requirements flow down to all subcontracts over $150,000 at every tier.

14. Clean Water.

Authority - 33 U.S.C. 1251–1388, the Federal Water Pollution Control Act 33 U.S.C. 1251-1387, as amended, FTA Master Agreement (30) at Section 16(d)(7)

Applicability - All contracts over $150,000

> Contractor shall comply with all applicable standards, orders or regulations issued pursuant to Section 508 of the Clean Water Act, as amended, 33 U.S.C. § 1368, and other requirements of the Clean Water Act, as amended, 33 U.S.C. §§ 1251 – 1377. Contractor shall report each violation to the recipient and understands and agrees that the recipient shall, in turn, report each violation as required to FTA and the appropriate EPA Regional Office. Contractor shall include these requirements in each subcontract exceeding $150,000 financed in whole or in part with FTA assistance.

Flow Down Requirements - The Clean Water requirements flow down to all subcontracts over $150,000 at every tier.

15. Cargo Preference - Use of United States-Flag Vessels.

Authority - 46 U.S.C. § 55305 and 46 CFR. Part 381.7, FTA Master Agreement (30) at Section 15(c), FTA C 4220.1F at Appendix D

Applicability - Contracts involving equipment, materials or commodities which may be transported by ocean vessels.

> Contractor shall: (a) use privately owned US-Flag commercial vessels to ship at least 50% of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners and tankers) involved, whenever shipping any equipment, material or commodities pursuant to the underlying contract to the extent such vessels are available at fair and reasonable rates for US flag commercial vessels; (b) furnish within 20 working days following the loading date of shipments originating within the US or within 30 working days following the loading date of shipments originating outside the US, a legible copy of a rated, "on-board" commercial bill-of-lading in English for each shipment of cargo described herein to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590 and to the recipient (through contractor in the case of a subcontractor's bill-of-lading.); (c) include these requirements in all subcontracts issued pursuant to this contract when the subcontract involves the transport of equipment, material or commodities by ocean vessel.

Flow Down Requirements - The Cargo Preference requirements flow down to all subcontracts involved with the transport of equipment, material, or commodities by ocean vessel.

16. Fly America.

Authority - 49 U.S.C. § 40118, and 41 CFR.§§ 301-10, FTA Master Agreement (30) at Section 15(d), FTA C 4220.1F at Appendix D

Applicability - All contracts involving transportation of persons or property, by air between the U.S. and/or places outside the U.S.

a) Definitions. As used in this clause--
"International air transportation" means transportation by air between a place in the United States and a place outside the United States or between two places both of which are outside the United States.
"United States" means the 50 States, the District of Columbia, and outlying areas.
"U.S.-flag air carrier" means an air carrier holding a certificate under 49 U.S.C. Chapter 411.
b) When Federal funds are used to fund travel, Section 5 of the International Air Transportation Fair Competitive Practices Act of 1974 (49 U.S.C. 40118) (Fly America Act) requires contractors, recipients, and others use U.S.-flag air carriers for U.S. Government-financed international air transportation of personnel (and their personal effects) or property, to the extent that service by those carriers is available. It requires the Comptroller General of the United States, in the absence of satisfactory proof of the necessity for foreign-flag air transportation, to disallow expenditures from funds, appropriated or otherwise established for the account of the United States, for international air transportation secured aboard a foreign-flag air carrier if a U.S.-flag air carrier is available to provide such services.
c) If available, the Contractor, in performing work under this contract, shall use U.S.-flag carriers for international air transportation of personnel (and their personal effects) or property.
d) In the event that the Contractor selects a carrier other than a U.S.-flag air carrier for international air transportation, the Contractor shall include a statement on vouchers involving such transportation essentially as follows:

Statement of Unavailability of U.S.-Flag Air Carriers
International air transportation of persons (and their personal effects) or property by U.S.-flag air carrier was not available or it was necessary to use foreign-flag air carrier service for the following reasons. See FAR § 47.403. [State reasons]:

_____
(End of statement)

e) The Contractor shall include the substance of this clause, including this paragraph (e), in each subcontract or purchase under this contract that may involve international air transportation.

Flow Down Requirements - The Fly America requirements flow down from FTA recipients and subrecipients to first tier contractors who are responsible for ensuring that lower tier contractors and subcontractors are in compliance.

17. Davis-Bacon and Copeland Anti-Kickback Acts.

Authority – Appendix II to Part 200, 49 U.S.C. § 5333(a), 40 U.S.C. §§ 3141 – 3148, 29 CFR. Part 5, 18 U.S.C. § 874, and 29 CFR. Part 5 (29 CFR. § 5.5), 29 CFR. § 3.1 and 3.11, 18 U.S.C. § 874, 40 U.S.C. § 3145, FTA Master Agreement (30) at Section 16(d)(4), FTA C 4220.1F at Appendix D

Applicability - Construction contracts and subcontracts, including actual construction, alteration and/or repair, including decorating and painting, over $2,000.

For all prime construction, alteration or repair contracts in excess of $2,000 awarded by FTA, the Contractor shall comply with the Davis-Bacon Act and the Copeland "Anti-Kickback" Act. Under 49 U.S.C. § 5333(a), prevailing wage protections apply to laborers and mechanics employed on FTA assisted construction, alteration, or repair projects. The Contractor will comply with the Davis-Bacon Act, 40 U.S.C. §§ 3141-3144, and 3146-3148 as supplemented by DOL regulations at 29 CFR. Part 5, "Labor Standards Provisions Applicable to Contracts Governing Federally Financed and Assisted Construction." In accordance with the statute, the Contractor shall pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, the Contractor agrees to pay wages not less than once a week. The Contractor shall also comply with the Copeland "Anti-Kickback" Act (40 U.S.C. § 3145), as supplemented by DOL regulations at 29 CFR. Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in part by Loans or Grants from the United States." The Contractor is prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The Contractor must report all suspected or reported violations to the federal awarding agency.

Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the (write in the name of the Federal agency) may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

Certification of eligibility. (i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis–Bacon Act or 29 CFR 5.12(a)(1). (ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis–Bacon Act or 29 CFR

5.12(a)(1). (iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

Flow Down Requirements - These requirements extend to all third party contractors and their subcontracts at every tier and subrecipients and their subcontracts at every tier.

18. Contract Work Hours and Safety Standards Act

Authority – Appendix II to Part 200, 40 U.S.C. §§ 3701-3708 and 29 CFR. Part 1926, FTA Master Agreement (30) at Section 16(d)(5), FTA C 4220.1F at Appendix D

Applicability - Contracts over $100,000 that involve the employment of mechanics or laborers.

For all contracts in excess of $100,000 that involve the employment of mechanics or laborers, the Contractor shall comply with the Contract Work Hours and Safety Standards Act (40 U.S.C. §§ 3702-3704), as supplemented by the DOL regulations at 29 CFR. Part 5. Under 40 U.S.C. § 3702 of the Act, the Contractor shall compute the wages of every mechanic and laborer, including watchmen and guards, on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. § 3704 are applicable to construction work and provide that no laborer or mechanic be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchase of supplies or materials or articles ordinarily available on the open market, or to contracts for transportation or transmission of intelligence.

In the event of any violation of the clause set forth herein, the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, the Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of this clause in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by this clause.

The FTA shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same prime Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor,

such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in this section.

The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in this agreement.

Contract Work Hours and Safety Standards for Awards Not Involving Construction

The Contractor shall comply with all federal laws, regulations, and requirements providing wage and hour protections for non-construction employees, in accordance with 40 U.S.C. § 3702, Contract Work Hours and Safety Standards Act, and other relevant parts of that Act, 40 U.S.C. § 3701 et seq., and U.S. DOL regulations, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction (also Labor Standards Provisions Applicable to Non-construction Contracts Subject to the Contract Work Hours and Safety Standards Act)," 29 CFR. Part 5.

The Contractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three (3) years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid.

Such records maintained under this paragraph shall be made available by the Contractor for inspection, copying, or transcription by authorized representatives of the FTA and the Department of Labor, and the Contractor will permit such representatives to interview employees during working hours on the job.

The contractor shall require the inclusion of the language of this clause within subcontracts of all tiers.

Flow Down Requirements - This requirement flows down to all subcontracts at every tier.

19. Bonding.

Authority - 2 CFR 200.325, FTA Master Agreement (30) at Section 16(n), FTA C 4220.1F at Appendix D

Applicability – For all FTA Funded construction or facility improvement contracts or subcontracts exceeding the simplified acquisition threshold (currently $250,000), the federal awarding agency may accept the bonding policy and requirements of JTA if the federal awarding agency has made a determination that the federal interest is adequately protected.

The Authority agrees to comply with the following bonding requirements and restrictions as provided in federal regulations and guidance:

(1) Construction. As provided in federal regulations and modified by FTA guidance, for each Project or related activities implementing the Contract that involve construction, it will provide bid guarantee bonds, contract performance bonds, and payment bonds.

(2) Activities Not Involving Construction. For each Project or related activities implementing the Contract not involving construction, the Authority will not impose excessive bonding and will follow FTA guidance.

20. Seismic Safety.

Authority - 42 U.S.C. 7701 et seq., 49 CFR. § 41.117 and Executive Order (E.O.) 12699, FTA C 4220.1F at Appendix D

Applicability – Design and construction of new buildings and additions to existing buildings.

Contractor agrees that any new building or addition to an existing building shall be designed and constructed in accordance with the standards required in USDOT Seismic Safety Regulations 49 CFR 41 and shall certify compliance to the extent required by the regulation. Contractor shall also ensure that all work performed under this contract, including work performed by subcontractors, complies with the standards required by 49 CFR 41 and the certification of compliance issued on the project.

Flow Down Requirements - The Seismic Safety requirements flow down from FTA recipients and subrecipients to first tier contractors to assure compliance with the applicable building standards for Seismic Safety, including the work performed by all subcontractors.

21. Public Transportation Employee Protective Arrangements.

Authority - 49 U.S.C. § 5333(b) ("13(c)") and 29 CFR. Part 215, FTA Master Agreement (30) at Section 24(d)

Applicability - Each contract for transit operations performed by employees of a Contractor recognized by FTA to be a transit operator.

The Contractor agrees to comply with the following employee protective arrangements of

49 U.S.C. § 5333(b):

A. *U.S. DOL Certification*. Under this Contract or any Amendments thereto that involve public transportation operations that are supported with federal assistance appropriated or made available for 49 U.S.C. §§ 5307-5312, 5316, 5318, 5323(a)(1), 5323(b), 5323(d), 5328, 5337, 5338(b), or 5339, or former 49 U.S.C. §§ 5308, 5309, 5312, or other provision of law as required by the Federal Government, U.S. DOL must provide a certification of employee protective arrangements before FTA may provide federal assistance for that Award. The Contractor agrees that the certification issued by U.S. DOL is a condition of the Contract and that the Contractor must comply with its terms and conditions.

B. *Special Warranty*. When the Contract involves public transportation operations and is supported with federal assistance appropriated or made available for 49 U.S.C. § 5311, U.S. DOL will provide a Special Warranty for its Award, including its Award of federal assistance under the Tribal Transit Program. The U.S. DOL Special Warranty is a condition of the Contract, and the Contractor must comply with its terms and conditions.

C. *Special Arrangements for Contracts for Federal Assistance Authorized under 49 U.S.C. § 5310*. The Authority agrees, and assures that any Contractor providing public transportation operations will agree, that although pursuant to 49 U.S.C. § 5310, the former 49 U.S.C. §§ 5310 or 5317, FTA has determined that it was not "necessary or appropriate" to apply the conditions of 49 U.S.C. § 5333(b) to any Subrecipient participating in the program to provide public transportation for seniors (elderly individuals) and individuals with disabilities, FTA reserves the right to make case-by-case determinations of the applicability of 49 U.S.C.§ 5333(b) for all transfers of funding authorized under title 23, United States Code (flex funds), and make other exceptions as it deems appropriate.

Flow Down Requirements – This requirement flows down to all subcontracts at every tier.

22. Charter Service Operations.

Authority - 49 U.S.C. 5323(d), (g) and (r) and 49 CFR. Part 604, FTA Master Agreement (30) at Section 28

Applicability – all transit operations contracts involving FTA funding under 49 USC 5307, 5309, 5311 or 5316 funds

(a) Prohibitions. The Contractor agrees to not engage in charter service, except as permitted under federal transit laws, specifically 49 U.S.C. 5323(d), (g) and (r), FTA regulations, "Charter Service," and 49 CFR Part 604, any other federal Charter Service regulations, federal requirements, or federal guidance.

(b) *Exceptions.* Apart from exceptions to the Charter Service restrictions in FTA's Charter Service regulations, FTA has established the following additional exceptions to those restrictions:

(1) FTA's Charter Service restrictions do not apply to equipment or facilities supported with federal assistance appropriated or made available for 49 U.S.C. §5307 to support a Job Access and Reverse Commute (JARC) –type Project or related activities that would have been eligible for assistance under repealed 40 U.S.C. § 5316 in effect in Fiscal Year 2012 or a previous fiscal year, provided that the Authority uses that federal assistance for FTA program purposes only; and

(2) FTA's Charter Service restrictions do not apply to equipment or facilities supported with the federal assistance appropriated or made available for 49 U.S.C. § 5310 to support a New Freedom-type Project or related activities that would have been eligible for federal assistance under repealed 49 U.S.C. § 5317 in effect in Fiscal Year 2012 or a previous fiscal year, provided the Authority uses that federal assistance for FTA program purposes only.

(c) *Violations*. The Contractor agrees that if it engages in a pattern of violations of FTA's Charter Service regulations, FTA may require corrective measures and remedies, including withholding an amount of federal assistance as provided in FTA's Charter Service regulations, 49 CFR Part 604, appendix D, or barring it or any subcontractor from receiving federal assistance provided in 49 U.S.C. chapter 53, 23 U.S.C. § 133, or 23 U.S.C. § 142.

Flow Down Requirements - The Charter Bus requirements flow down from FTA recipients and subrecipients to first tier service contractors.

23. School Bus Operations.

Authority - 49 U.S.C. 5323(f) and 49 CFR. Part 605, FTA Master Agreement (30) at Section 29

Applicability - Contracts for operating public transportation service.

(a) *Prohibitions.* The Contractor agrees to not engage in school bus operations exclusively for the transportation of students or school personnel in competition with private school bus operators, except as permitted by federal transit laws, 49 U.S.C. 5323(f) or (g), FTA regulations, "School Bus Operations," 49 CFR .Part 605, and any other applicable federal "School Bus Operations" laws, regulations, requirements, or applicable federal guidance

(b) *Violations.* If the Contractor has operated school bus service in violation of FTA's School Bus laws, regulations, or requirements, FTA may require the Authority or Contractor to take such remedial measures as FTA considers appropriate, or bar the Authority or Contractor from receiving federal transit assistance.

Flow Down Requirements - The School Bus requirements flow down from FTA recipients and subrecipients to first tier service contractors.

24. Substance Abuse – Alcohol Misuse and Prohibited Drug Use Requirements.

Authority - 49 U.S.C. § 5331, 49 CFR. Part 655 and 49 CFR. Part 40.11(c), FTA Master Agreement (30) at Section 35, FTA C 4220.1F at Appendix D

Applicability – all transit operations contracts

Any Contractor that performs safety-sensitive functions must comply with Federal transit laws, specifically 409 U.S.C. § 5331, FTA regulations, "Prevention of Alcohol Misuse and Prohibited Drug Use in Transit Operations" under 49 CFR. Part 655, "Prevention of Alcohol Misuse and Prohibited Drug Use in Transit Operations" and applicable provisions of U.S. DOT regulations, "Procedures for Transportation Workplace Drug and Alcohol Testing Programs," 49 CFR Part 40. Under 49 CFR. § 655.4, Safety-sensitive function means any of the following duties, when performed by employees of recipients, subrecipients, operators, or contractors:

1) Operating a revenue service vehicle, including when not in revenue service;
2) Operating a nonrevenue service vehicle, when required to be operated by a holder of a Commercial Driver's License;
3) Controlling dispatch or movement of a revenue service vehicle;
4) Maintaining (including repairs, overhaul and rebuilding) a revenue service vehicle or equipment used in revenue service. This section does not apply to the following: an employer who receives funding under 49 U.S.C. § 5307 or § 5309, is in an area less than 200,000 in population, and contracts out such services; or an employer who receives funding under 49 U.S.C. § 5311 and contracts out such services;
5) Carrying a firearm for security purposes.

The Contractor agrees to comply with the following Federal substance abuse regulations:

(A) Drug-Free Workplace. U.S. DOT regulations, "Drug-Free Workplace Requirements (Grants)," 49 CFR. Part 32, that implements the Drug-Free Workplace Act of 1988 as amended, 41 U.S.C. §§ 8103 et seq., and 2 CFR Part 182,

(B) Alcohol Misuse and Prohibited Drug Use. FTA Regulations, "Prevention of Alcohol Misuse and Prohibited Drug Use in Transit Operations," 49 USC 5331, as amended by Map-21, 49 CFR Part 40, 49 USC chapter 53, 49 CFR Part 655, to the extent applicable.

The Contractor shall establish an anti-drug use and alcohol misuse program that includes the following:

(A) A statement describing the employer's policy on prohibited drug use and alcohol misuse in the workplace, including the consequences associated with prohibited drug use and alcohol misuse. This policy statement shall include

all of the elements specified in §655.15. Each employer shall disseminate the policy consistent with the provisions of §655.16.

(B) An education and training program which meets the requirements of §655.14.

(C) A testing program, as described in Subparts C and D of this part, which meets the requirements of this part and 49 CFR Part 40.

(D) Procedures for referring a covered employee who has a verified positive drug test result or an alcohol concentration of 0.04 or greater to a Substance Abuse Professional, consistent with 49 CFR Part 40.

Flow Down Requirements -The Substance Abuse requirements flow down to all Contractors at every tier who perform a safety-sensitive function for the JTA.

25. Patent and Rights in Data.

Authority - 2 CFR. Part 200, Appendix II (F) and 37 CFR. §401.3, FTA Master Agreement (30) at Sections 17 and 18, FTA C 4220.1F at Appendix D

Applicability - Research projects in which FTA finances the purpose of the grant is to finance the development of a product or information. These patent and data rights requirements do not apply to capital projects or operating projects, even though a small portion of the sales price may cover the cost of product development or writing the user's manual or to micro-purchases (less than $3,500). If the federal award meets the definition of "funding agreement" under 37 CFR. § 401.2(a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," the recipient or subrecipient must comply with the requirements of 37 CFR. Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

Intellectual Property Rights

This Project is funded through a Federal award with FTA for experimental, developmental, or research work purposes. As such, certain Patent Rights and Data Rights apply to all subject data first produced in the performance of this Contract. The Contractor shall grant the Authority intellectual property access and licenses deemed necessary for the work performed under this Agreement and in accordance with the requirements of 37 CFR. Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by FTA or U.S. DOT. The terms of an intellectual property agreement and software license rights will be finalized prior to execution of this Agreement and shall, at a minimum, include the following restrictions: Except for its own internal use, the

Contractor may not publish or reproduce subject data in whole or in part, or in any manner or form, nor may the Contractor authorize others to do so, without the written consent of FTA, until such time as FTA may have either released or approved the release of such data to the public. This restriction on publication, however, does not apply to any contract with an academic institution. For purposes of this agreement, the term "subject data" means recorded information whether or not copyrighted, and that is delivered or specified to be delivered as required by the Contract. Examples of "subject data" include, but are not limited to computer software, standards, specifications, engineering drawings and associated lists, process sheets, manuals, technical reports, catalog item identifications, and related information, but do not include financial reports, cost analyses, or other similar information used for performance or administration of the Contract.

1. The Federal Government reserves a royalty-free, non-exclusive and irrevocable license to reproduce, publish, or otherwise use, and to authorize others to use for "Federal Government Purposes," any subject data or copyright described below. For "Federal Government Purposes," means use only for the direct purposes of the Federal Government. Without the copyright owner's consent, the Federal Government may not extend its Federal license to any other party.

a. Any subject data developed under the Contract, whether or not a copyright has been obtained; and

b. Any rights of copyright purchased by the Contractor using Federal assistance in whole or in part by the FTA.

2. Unless FTA determines otherwise, the Contractor performing experimental, developmental, or research work required as part of this Contract agrees to permit FTA to make available to the public, either FTA's license in the copyright to any subject data developed in the course of the Contract, or a copy of the subject data first produced under the Contract for which a copyright has not been obtained. If the experimental, developmental, or research work, which is the subject of this Contract, is not completed for any reason whatsoever, all data developed under the Contract shall become subject data as defined herein and shall be delivered as the Federal Government may direct.

3. Unless prohibited by state law, upon request by the Federal Government, the Contractor agrees to indemnify, save, and hold harmless the Federal Government, its officers, agents, and employees acting within the scope of their official duties against any liability, including costs and expenses, resulting from any willful or intentional violation by the Contractor of proprietary rights, copyrights, or right of privacy, arising out of the publication, translation, reproduction, delivery, use, or disposition of any data furnished under that contract. The Contractor shall be required to indemnify the Federal Government for any such liability arising out of the wrongful act of any employee, official, or agents of the Federal Government.

4. Nothing contained in this clause on rights in data shall imply a license to the Federal Government under any patent or be construed as affecting the scope of any license or other right otherwise granted to the Federal Government under any patent.

5. Data developed by the Contractor and financed entirely without using Federal assistance provided by the Federal Government that has been incorporated into work required by the underlying Contract is exempt from the requirements herein, provided that the Contractor identifies those data in writing at the time of delivery of the Contract work.

6. The Contractor agrees to include these requirements in each subcontract for experimental, developmental, or research work financed in whole or in part with Federal assistance.

Flow Down Requirements - The Patent Rights and Rights in Data requirements flow down to all third party contractors and their contracts at every tier that meet the definition of a research-type project under 37 U.S.C. § 401.2.

26. Special Department of Labor (DOL) EEO clause for Construction Projects.

Authority - Executive Order 11246, 41 CFR § 60-1.4(b), FTA Master Agreement (30) at Section 12(d), FTA C 4220.1F at Appendix D

Applicability – Federal or federally assisted construction contracts and subcontracts in excess of $10,000.

Additional Equal Opportunity Clauses for Construction Contracts.

The equal opportunity clause published at 41 CFR 60-1.4(a) and published at 41 CFR 601.4(b) in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR Part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor." are incorporated herein by reference. In addition to those clauses, the following applies to all construction contracts in excess of $10,000.

(Full language follows):

Equal Opportunity Clause

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following:

Employment, upgrading, demotion, or transfer; recruitment or recruitment

advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

(3) The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.

(4) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(5) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(6) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(7) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(8) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (8) in every

subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:

Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

Flow Down Requirements - The Special Department of Labor (DOL) EEO clause for Construction Projects requirements flow down to all third party contractors at every tier who perform a safety-sensitive function for the recipient or subrecipient.

27. Disadvantaged Business Enterprises (DBEs).

Authority - 49 CFR. Part 26, 49 CFR. § 26.13(b), FTA Master Agreement (30) at Section 12e(4)(ii), FTA C 4220.1F at Appendix D

Applicability - all contracts

This contract is subject to the requirements of Title 49, Code of Federal Regulations, Part 26, Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs and with section 1101(b) of SAFETEA LU, 23 U.S.C.§101.

The contractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of this FTA-assisted contract. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as JTA deems appropriate. Each subcontract the contractor signs with a subcontractor must include the assurance in this paragraph. The successful Bidder/Offeror will be required to report its DBE participation obtained through race-neutral means throughout the period of performance.

Flow Down Requirements - The DBE contracting requirements flow down to all third party contractors and their contracts at every tier. Note that it is the JTA's and prime contractor's responsibility to ensure the DBE requirements are applied across the board to all subrecipients/contractors/subcontractors. Should a subcontractor fail to comply with the DBE regulations, FTA would look to the JTA to make sure it intervenes to monitor compliance. The onus for compliance is on the JTA.

28. Recycled Products (Solid Wastes).

Authority - 42 U.S.C. § 6962, 40 CFR. Part 247, 2 CFR. Part § 200.323, FTA Best Procurement Practices Manual, FTA C 4220.1F at Appendix D

Applicability –All contracts over $10,000 for items designated by the EPA Contractor and subcontractor agree to comply with Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, and the regulatory provisions of 40 CFR Part 247. In the performance of this contract and to the extent practicable, the Contractor and subcontractors are to use products containing the highest percentage of recovered materials for items designated by the Environmental Protection Agency (EPA) under 40 CFR Part 247 whenever:

1. The contract requires procurement of $10,000 or more of a designated item during the fiscal year; or
2. The contractor has procured $10,000 or more of a designated item using Federal funding during the previous fiscal year.

The list of EPA-designated items is available at www.epa.gov/smm/comprehensive-procurement-guidelines-construction-products.

Section 6002(c) establishes exceptions to the preference for recovery of EPA-designated products if the contractor can demonstrate the item is:

a) Not reasonably available within a timeframe providing for compliance with the contract performance schedule;
b) Fails to meet reasonable contract performance requirements; or
c) Is only available at an unreasonable price.

The Contractor agrees to provide a preference for those products and services that conserve natural resources, protect the environment, and are energy efficient by complying with and facilitating compliance with Section 6002 of the Resource Conservation and Recovery Act, as amended, 42 U.S.C. § 6962, and U.S. Environmental Protection Agency (U.S. EPA), "Comprehensive Procurement Guideline for Products Containing Recovered Materials," 40 CFR. Part 247.

Flow Down Requirements - These requirements flow down to all applicable subcontracts at all tiers.

29. ADA Access.

Authority – 49 U.S.C. § 5301, 29U.S.C. § 794, 42 U.S.C. § 12101, FTA Master Agreement (30) at Section 12(h), FTA C 4220.1F at Appendix D-3.

Applicability – all contracts

The Contractor agrees to comply with the requirements of 49 U.S.C. § 5301(d) which expresses the federal policy that the elderly and persons with disabilities have the same right as other persons to use mass transportation service and facilities, and that special efforts shall be made in planning and designing those services and facilities to implement those policies. The Contractor also agrees to comply with all applicable requirements of sections 503 and 504 of the

Rehabilitation Act of 1973, as amended, 29 U.S.C. § 794, which prohibits discrimination on the basis of handicaps, and with the Americans with Disabilities Act of 1990 (ADA), as amended, 42 U.S.C. §§ 12101 et seq., which requires the provision of accessible facilities and services, and with the following federal regulations, including any amendments thereto:
(1) U.S. DOT regulations, "Transportation Services for Individuals with Disabilities (ADA)," 49 CFR. Part 37;
(2) U.S. DOT regulations, "Nondiscrimination on the Basis of Handicap in Programs and Activities Receiving or Benefiting from Federal Financial Assistance," 49 CFR. Part 27;
(3) Joint U.S. Architectural and Transportation Barriers Compliance Board/U.S. DOT regulations, "Americans With Disabilities (ADA) Accessibility Specifications for Transportation Vehicles," 49 CFR. Part 38;
(4) U.S. DOT regulations, "Transportation for Individuals with Disabilities: Passenger Vessels," 40 CFR Part 39;
(5) U.S. DOJ regulations, "Nondiscrimination on the Basis of Disability in State and Local Government Services," 28 CFR. Part 35;
(6) U.S. DOJ regulations, "Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities," 28 CFR. Part 36;
(7) U.S. GSA regulations, "Accommodations for the Physically Handicapped," 41 CFR. Subpart 101-19;
(8) U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 CFR. Part 1630;
(9) U.S. Federal Communications Commission regulations, "Telecommunications Relay Services and Related Customer Premises Equipment for the Hearing and Speech Disabled," 47 CFR. Part 64, Subpart F;
(10) U.S. ATBCB regulations, "Electronic and Information Technology Accessibility Standards," 36 CFR Part 1194;
(11) FTA regulations, "Transportation for Elderly and Handicapped Persons," 49 CFR. Part 609;
(12) FTA Circular 4710.a, "Americans with Disabilities Act: Guidance," and
(13) Other applicable federal civil rights and nondiscrimination regulations and guidance; and
(14) Any implementing requirements FTA may issue.

Flow Down Requirements - This section applies to subcontractors at all tiers.

30. Veterans Preference.

Authority – 49 USC § 5325(k), FTA Master Agreement (30) at Section 16(u)

Applicability – all contracts

To the extent practicable, the Contractor agrees it:

(1) Will give a hiring preference to veterans, as defined in 5 USC § 2108, who have the skills and abilities required to perform construction work required for a capital project supported with funds made available or appropriated for 49 USC chapter 53; and

(2) Will not require an employer to give a preference to any veteran over any equally qualified applicant who is a member of any racial or ethnic minority, female, an individual with a disability or a former employee.

Flow Down Requirements – None.

31. Motor Carrier Safety

Authority - FTA Master Agreement (30) at Section 33

Applicability - all contracts

Contractor agrees that it will comply with the applicable economic and insurance registration requirements of the:

(1) U.S. Federal Motor Carrier Safety Administration (U.S. FMCSA) regulations, "Minimum Levels of Financial Responsibility for Motor Carriers," 49 CFR. Part 387, if it is engaged in operations requiring compliance with 49 CFR. Part 387, it is engaged in interstate commerce, and it is not within a defined commercial zone;

(2) The provisions of 49 U.S.C. § 31138(e)(4), which supersede inconsistent provisions of 49 CFR. Part 387, and reduce the amount of insurance the Authority must obtain to the highest amount required by any state in which the public transportation provider operates, if it operates within a public transportation service area located in more than one state, and receives federal assistance under 49 U.S.C. §§ 5307, 5310, and 5311;

(3) The safety requirements of U.S. FMCSA regulations, "Federal Motor Carrier Safety Regulations," 49 CFR. Parts 390 – 397, to the extent applicable; and

(4) The driver's license requirements of U.S. FMCSA regulations, "Commercial Driver's License Standards, Requirements, and Penalties," 49 CFR. Part 383, and "State Compliance with Commercial Driver's License," 49 CFR. Part 384, to the extent applicable, with the substance abuse requirements and guidance of U.S. FMCSA's regulations, "Controlled Substances and Alcohol Use and Testing," 49 CFR. Part 382, and implementing federal guidance, to the extent applicable.

Flow Down Requirements – This requirement flows down to all subcontracts at every tier.

32. Safe Operation of Motor Vehicles.

Authority - FTA Master Agreement (30) at Section 34(a)(2) and (b)(3)

Applicability - all contracts

Contractor is to adopt and promote on-the-job seat belt use policies and programs for its employees and other personnel that operate company-owned vehicles, company rented vehicles, or personally operated vehicles. The terms "company owned" and "company-leased" refer to vehicles owned or leased either by the Contractor or JTA.

Contractor is further to adopt and enforce workplace safety policies to decrease crashes caused by distracted drivers, including policies to ban text messaging while using an electronic device supplied by an employer, and driving a vehicle the driver owns or rents, a vehicle Contactor owns, leases, or rents, or a privately-owned vehicle when on official business in connection with the work performed under this agreement.

Contractor is also to conduct workplace safety initiatives in a manner commensurate with its size, such as establishing new rules and programs to prohibit text messaging while driving, re-evaluating the existing programs to prohibit text messaging while driving, and providing education, awareness, and other outreach to employees about the safety risks associated with texting while driving.

Flow Down Requirements – This requirement flows down to all subcontracts at every tier.

33. Protection of Sensitive and Personally Identifiable Information

Authority - FTA Master Agreement (30) Section 36(c), US DOT Common Rules

Applicability - all contracts

Contractor must implement reasonable measures to safeguard protected personally identifiable information as well as any information that the FTA or pass-through entity designates as sensitive.

Flow Down Requirements – This requirement flows down to all subcontracts at every tier.

34. Trafficking in Persons

Authority - Section 106(g) of the Trafficking Victims Protection Act of 2000 (TVPA), as amended, 22 U.S.C. § 7104(g); U.S. OMB regulatory guidance, "Award Term for Trafficking in Persons," 2 CFR Part 175, per U.S. OMB's direction, FTA Master Agreement (30) at Section 4(f)

Applicability - all contracts

Contractor agrees that it and its employees that participate in the Contract, may not:

Engage in severe forms of trafficking in persons during the period of time that the Contract is in effect;

Procure a commercial sex act during the period of time that the Contract is in effect; or

Use forced labor in the performance of the Contract or subagreements thereunder.

Violation of this provision provides JTA the right to unilaterally terminate the Contract.

Flow Down Requirements – This requirement flows down to all subcontracts at every tier.

35. Federal Tax Liability and Recent Felony Convictions

Authority - 2019 Pub. L 116-6; FTA Master Agreement (30) at Section 4(g), DOT Order 4200.6.

Applicability - all contracts

By submitting a bid or otherwise attempting to enter into a contract with the JTA, the undersigned Contractor certifies that it:

(A) Does not have any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability; and

(B) Was not convicted of the felony criminal violation under any Federal law within the preceding 24 months.

Flow Down Requirements – This requirement flows down to all subcontracts at every tier.

36. Construction Site Safety

Authority - Section 107 of the Contract Work Hours and Safety Standards Act, as amended, 40 U.S.C. § 3704, 40 U.S.C. § 3701 et seq.; U.S. DOL regulations, "Recording and Reporting Occupational Injuries and Illnesses," 29 CFR. Part 1904; "Occupational Safety and Health Standards," 29 CFR. Part 1910; and "Safety and Health Regulations for Construction," 29 CFR. Part 1926, and FTA Master Agreement (30) at Section 24a(4)

Applicability - all construction contracts

The Contractor agrees that it will comply with all federal laws, regulations, and requirements providing protections for construction employees involved in the Project or related activities, including the: (i) Section 107 of the Contract Work Hours and Safety Standards Act, as amended, 40 U.S.C. § 3704, and other relevant parts of that Act, 40 U.S.C. § 3701 et seq.; and (ii) U.S. DOL regulations, "Recording and Reporting Occupational Injuries and Illnesses," 29 CFR. Part 1904;

"Occupational Safety and Health Standards," 29 CFR. Part 1910; and "Safety and Health Regulations for Construction," 29 CFR Part 1926.

Flow Down Requirements – This requirement flows down to all subcontracts at every tier.

37. Domestic Preferences for Procurements

Authority - 2 CFR Part 200 Appendix II (L); 2 CFR. § 200.322

Applicability - all contracts

As appropriate and to the extent consistent with law, the Contractor should, to the greatest extent practicable, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section must be included in all sub-awards including all contracts and purchase orders for work or products under this Contract.

Flow Down Requirements – This requirement flows down to all subcontracts at every tier.

38. Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment

Authority - 2 CFR Part 200 Appendix II (K); 2 CFR. § 200.216

Applicability - all contracts

(a) The Authority and subrecipients are prohibited from obligating or expending loan or grant funds to:

(1) Procure or obtain;

(2) Extend or renew a contract to procure or obtain; or

(3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

(i) For the purpose of public safety, security or government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company or Dahwa Technology Company (or any subsidiary or affiliate of such entities).

(ii) Telecommunications or video surveillance services provided by such

entities or using such equipment.

(iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

(b) In implementing the prohibition under Public Law 115-232, section 889, subsection (f), paragraph (1), heads of executive agencies administering loan, grant, or subsidy programs shall prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably necessary for those affected entities to transition from covered communications equipment and services, to procure replacement equipment and services, and to ensure that communications service to users and customers is sustained.

Flow Down Requirements – This requirement flows down to all subcontracts at every tier.

39. Bus Testing.

Authority - 49 U.S.C. § 5318(e) and 49 CFR. Part 665, FTA Master Agreement (30) at Section 16(m)

Applicability - Rolling stock, except minivans

Contractor shall comply with 49 U.S.C 5323 (Contract Requirements), 49 U.S.C. § 5323(j) (Buy America Requirements), 49 U.S.C. § 5323(m) (Pre-Award and Post Delivery Requirements), and 49 U.S.C. § 5318(e) (Bus Testing Requirements), 49 U.S.C. § 5323(u) (Limitation on Certain Rolling Stock Procurements), and their implementing regulations including the FTA's implementing regulation 49 CFR Part 665, to the extent they are consistent with 49 U.S.C. § 5318(e), as amended; and shall perform the following: (1) A manufacturer of a new bus model or a bus produced with a major change in components or configuration shall provide a copy of the final test report to the recipient prior to the recipient's final acceptance of the first vehicle. (2) A manufacturer who releases a report under para. 1 above shall provide notice to the operator of the testing facility that the report is available to the public. (3) If the manufacturer represents that the vehicle was previously tested, the vehicle being sold should have the identical configuration and major components as the vehicle in the test report, which must be provided to the recipient prior to the recipient's final acceptance of the first vehicle. If configuration or components are not identical, the manufacturer shall provide a description of the change and the manufacturer's basis for concluding that it is not a major change requiring additional testing. (4) If the manufacturer represents that the vehicle is "grandfathered" (has been used in mass transit service in the US before Oct. 1, 1988, and is currently being produced without a major change in configuration or components), the manufacturer shall provide the name and address of the recipient

of such a vehicle and the details of that vehicle's configuration and major components.

Flow Down Requirements - none.

40. Pre-Award and Post-Delivery Audit Requirements.

Authority - 49 U.S.C. 5323(m) and 49 CFR. Part 663, FTA Master Agreement (30) at Section 16(m)

Applicability - Rolling stock

The Contractor agrees to comply with 49 U.S.C. § 5323(m) and FTA's implementing regulation at 49 CFR .Part 663. The Contractor shall comply with the Buy America certification(s) submitted with its proposal/bid. The Contractor agrees to participate and cooperate in any pre-award and post-delivery audits performed pursuant to 49 CFR. Part 663 and related FTA guidance.

Flow Down Requirements – none.

41. FTA Clauses Required when DBE Threshold Has Been Met

Applicability – all contracts where there is DBE Participation

a. Contract Assurance. 49 CFR Part 26.13

The Contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this Contract. The Contractor shall carry out applicable requirements of 49 CFR. Part 26.13 in the award and administration of DOT-assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this Contract, which may result in the termination of this Contract or such other remedy as the Authority deems appropriate.

Flow Down Requirements - This requirement flows down to all subcontracts at every tier.

b. Monitoring the Performance of other Program Participants. 49 CFR Part 26.37

The JTA will monitor each DOT funded contract with DBE participation to ensure that all work committed to DBEs at contract award or subsequently (as a result of contract modification) is actually performed by the DBEs to which the work was committed. Site visit will be conducted periodically by staff. Contractors' Request for Payment forms will be monitored to ensure that DBEs are being paid in accordance to their signed agreements.

All Prime Contractors will be required to self-report all payments received from the JTA into the B2GNow (Contract Compliance Tracking System). This system tracks payments made to the prime contractor and all payments made by the prime to any subcontractors, to include DBEs, and the timeliness of those payments in accordance to JTA's Prompt Payment Clause.

Flow Down Requirements - This requirement flows down to all subcontracts at every tier.

c. Prompt Payment. 49 CFR Part 26.29(a)

Contractors are required to pay all subcontractors for satisfactory performance of their contracts within seven (7) business days from receipt of each payment from the JTA. Failure to comply may result in future withholdings of prime contractor's reimbursements and/or other sanctions until the prime contractor ensure all subcontractors are being promptly paid for all work performed.

Flow Down Requirements - This requirement flows down to all subcontracts at every tier.

d. Return of Retainage. 49 CFR Part 26.29(b), FY2019 FTA Procurement System Review Guide at P11.

Contractor is required to ensure prompt and full payment of retainage to all subcontractors within thirty (30 days) after the subcontractor's work is satisfactorily completed. Contractor is prohibited from holding retainage from subcontractors until the project is completed. A subcontractor's work is satisfactorily completed when all the tasks called for in the subcontract have been accomplished and documented as required by the JTA. When JTA has made an incremental acceptance of a portion of a prime contract, the work of a subcontractor covered by that acceptance is deemed to be satisfactorily completed.

Flow Down Requirements - This requirement flows down to all subcontracts at every tier.

e. Termination for Convenience (DBE). 49 CFR Part 26.53

No prime contractor will terminate for convenience a DBE subcontractor that was listed and agreed to perform a project task (or an approved substitute DBE firm) and then perform the work of the terminated subcontract with its own forces or those of an affiliate, without prior written consent from JTA's Diversity & Equity Program Office.
The prime contractor shall utilize the specific DBEs listed to perform the work and supply the materials for which each is listed unless the prime contractor obtains written consent form JTA's Diversity & Equity Program Office; and unless the consent is provided the contractor shall not be entitled to any payment for work or material unless it is performed or supplied by the listed DBE.

Appropriate administrative remedies will be invoked to any Prime Contractor that terminates and/or removes a DBE firm/s for convenience. Those remedies may include requirement to pay terminated DBE firm/s; withholding of future payments and/or retainage; and/or disbarment from future consideration of project awards with the JTA.

Flow Down Requirements - This requirement flows down to all subcontracts at every tier.

42. Conformance with ITS National Architecture

Authority - FTA Master Agreement (30) at Section 16(l), SAFETEA-LU § 5307(c), 23 U.S.C. § 512 note, FTA Notice, "FTA National ITS Architecture Policy on Transit Projects," 66 Fed. Reg. 1455

Applicability – Information Technology System (ITS) Projects

To the extent applicable, the Contractor agrees to conform to the National Intelligent Transportation Systems (ITS) Architecture and Standards as required by SAFETEA-LU § 5307(c), 23 U.S.C. § 512 note, and follow the provisions of FTA Notice, "FTA National ITS Architecture Policy on Transit Projects," 66 Fed. Reg. 1455 et seq., January 8, 2001, and any other implementing directives FTA may issue at a later date, except to the extent FTA determines otherwise in writing.

Flow Down Requirements - This requirement flows down to all subcontracts at every tier.

Other Federal Requirements

The following requirements are not federal clauses, but apply to all contracts except micro-purchases ($10,000 or less)

Full and Open Competition.

In accordance with 49 U.S.C. § 5325(a) all procurement transactions shall be conducted in a manner that provides full and open competition.

Notification of Federal Participation.

To the extent required by law, in the announcement of any third party contract award for goods and services (including construction services) having an aggregate value of $500,000 or more, contractor shall specify the amount of Federal assistance to be used in financing that acquisition of goods and services and to express that amount of Federal assistance as a percentage of the total cost of the third party contract.

Interest of Members or Delegates to Congress.

No members of, or delegates to, the US Congress shall be admitted to any share or part of this contract nor to any benefit arising therefrom.

Ineligible Contractors and Subcontractors.
Any name appearing upon the Comptroller General's list of ineligible contractors for federally-assisted contracts shall be ineligible to act as a subcontractor for contractor pursuant to this contract. If contractor is on the Comptroller General's list of ineligible contractors for federally financed or assisted construction, the recipient shall cancel, terminate or suspend this contract.

Compliance with Federal Regulations.
Any contract entered pursuant to this solicitation shall contain the following provisions: All USDOT-required contractual provisions, as set forth in FTA Circular 4220.1F, are incorporated by reference. Anything to the contrary herein notwithstanding, FTA mandated terms shall control in the event of a conflict with other provisions contained in this Agreement. Contractor shall not perform any act, fail to perform any act, or refuse to comply with any grantee request that would cause the recipient to be in violation of FTA terms and conditions. Contractor shall comply with all applicable FTA regulations, policies, procedures and directives, including, without limitation, those listed directly or incorporated by reference in the Master Agreement between the recipient and FTA, as may be amended or promulgated from time to time during the term of this contract. Contractor's failure to so comply shall constitute a material breach of this contract.

Real Property.
Any contract entered into shall contain the following provisions: Contractor shall at all times comply with all applicable statutes and USDOT regulations, policies, procedures and directives governing the acquisition, use and disposal of real property, including, but not limited to, 49 CFR 18.31-18.34, 49 CFR 19.30-19.37, 49 CFR Part 24, 49 CFR 5326 as
amended by FAST Act, 49 CFR Part 18 or 19, 49 USC 5334, applicable FTA Circular 5010, and FTA Master Agreement, as they may be amended or promulgated during the term of this contract. Contractor's failure to so comply shall constitute a material breach of this contract.

Access to Services for Persons with Limited English Proficiency.
To the extent applicable and except to the extent that FTA determines otherwise in writing, the Recipient agrees to comply with the policies of Executive Order No. 13166, "Improving Access to Services for Persons with Limited English Proficiency," 42 U.S.C. § 2000d 1 note, and with the provisions of U.S. DOT Notice, "DOT Guidance to Recipients on Special Language Services to Limited English Proficient (LEP) Beneficiaries," 70 Fed. Reg. 74087, December 14, 2005.

Environmental Justice.
Except as the Federal Government determines otherwise in writing, the Recipient agrees to promote environmental justice by following: (1) Executive Order No. 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low- Income Populations," February 11, 1994, 42 U.S.C. § 4321 note, as well as facilitating compliance with that Executive Order, and (2) DOT Order 5610.2, "Department of Transportation Actions To Address Environmental Justice in Minority Populations and Low Income Populations," 62 Fed. Reg.

18377, April 15, 1997, and (3) The most recent and applicable eedition of FTA Circular 4703.1, "Environmental Justice Policy Guidance for Federal Transit Administration Recipients," August 15, 2012, to the extent consistent with applicable Federal laws, regulations, and guidance.

Environmental Protections.
Compliance is required with any applicable Federal laws imposing environmental and resource conservation requirements for the project. Some, but not all, of the major Federal laws that may affect the project include: the National Environmental Policy Act of 1969; the Clean Air Act; the Resource Conservation and Recovery Act; the comprehensive Environmental response, Compensation and Liability Act; as well as environmental provisions with Title 23 U.S.C., and 49 U.S.C. chapter 53. The U.S. EPA, FHWA and other federal agencies may issue other federal regulations and directives that may affect the project. Compliance is required with any applicable Federal laws and regulations in effect now or that become effective in the future.

Geographic Information and Related Spatial Data.
Any project activities involving spatial data or geographic information systems activities financed with Federal assistance are required to be consistent with the National Spatial Data Infrastructure promulgated by the Federal Geographic Data Committee, except to the extent that FTA determines otherwise in writing.

Geographic Restrictions.
All project activities must be advertised without geographic preference, (except in A/E under certain circumstances, preference for hiring veterans on transit construction projects and geographic-based hiring preferences as proposes to be amended in 2 CFR Part 1201).

In-State Bus Dealer Restrictions.
The Recipient agrees that any state law requiring buses to be purchased through in-state dealers will not apply to purchases of vehicles supported with federal assistance appropriated or made available for 49 U.S.C. chapter 53, as provided in 49 U.S.C. § 5325(i).

Organizational Conflicts of Interest.
The Recipient agrees that it will not enter into a procurement that involves a real or apparent organizational conflict of interest described as follows: (1) When It Occurs. An organizational conflict of interest occurs when the Project work, without appropriate restrictions on certain future activities, results in an unfair competitive advantage: (a) To that Third Party Participant or another Third Party Participant performing the Project work, and (b) That impairs that Third Party Participant's objectivity in performing the Project work, or (2) Other. An organizational conflict of interest may involve other situations resulting in fundamentally unfair competitive conditions, (3) Disclosure Requirements. Consistent with FTA policies, the Recipient must disclose to FTA, and each of its Subrecipients must disclose to the Recipient: (a) Any instances of organizational conflict of interest, or (b) Violations of federal criminal law, involving fraud, bribery, or gratuity violations potentially affecting the federal award, and (4) Failure to Disclose. Failure to make required disclosures can result in remedies for noncompliance, including debarment or suspension.

Project Labor Agreements.
As a condition of a third party contract award, the Recipient may require the Third Party Contractor or Subcontractor to have an affiliation with a labor organization, such as a Project Labor Agreement, consistent with Executive Order No. 13502, "Use of Project Labor Agreements for Federal Construction Projects," February 6, 2009 (74 Fed. Reg. 6985).

Force Account.
The Recipient agrees that FTA may determine the extent to which Federal assistance may be used to participate in force account costs.

FTA Technical Review.
The Recipient agrees that FTA may review and approve the Recipient's technical specifications and requirements to the extent FTA believes necessary to ensure proper administration of the Underlying Agreement.

Relationship of the Award to Third Party Contract Approval.
The Recipient agrees that the terms of the Underlying Agreement do not, by themselves, constitute approval of any non- competitive third party contract associated with the Award, unless FTA indicates otherwise in writing.

Federal Single Audit Requirements for State Administered Federally Aid Funded Projects Only.
Non Federal entities that expend $750,000 or more in a year in Federal awards from all sources are required to comply with the Federal OMB Title 2 CFR Part 200, "Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards" effective December 26, 2014 as applicable. Non Federal entities that expend Federal awards from a single source may provide a program specific audit, as defined in the Uniform Guidance. Non Federal entities that expend less than the amount above in a year in Federal awards from all sources are exempt from Federal audit requirements for that year, except as noted, whereby records must be available for review or audit by appropriate officials of the cognizant Federal agency and the U.S. Governmental Accountability Office (GAO). Non- Federal entities are required to submit a copy of all audits, as described above, within 30 days of issuance of audit report, but no later than 9 months after the end of the entity's fiscal year, to the Florida Department of Transportation. Unless a time extension has been granted by the cognizant Federal Agency and has been filed with the Florida Department of Transportation's Contract Audit Bureau, failure to comply with the requirements of the Uniform Guidance may result in suspension or termination of Federal award payments.

Catalog of Federal Domestic Assistance (CFDA) Identification Number.
The municipal project sponsor is required to identify in its accounts all Federal awards received and expended, and the Federal programs under which they were received. Federal program and award identification shall include, as applicable, the CFDA title and number, award number and year, name of the Federal agency, and name of the pass through entity.

CFDA number for the Federal Transportation Administration.
Non-urbanized Area Formula (Section 5311) is 20.509. A Recipient covered by the Single Audit Act Amendments of 1996 and OMB Title 2 CFR Part 200,"Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards" (commonly known as Uniform Guidance)agrees to separately identify the expenditures for Federal awards on the Schedule of Expenditures of Federal Awards (SEFA) and the Data Collection Form (SF-SAC) required by OMB Uniform Guidance.

Exhibit 'B' – Technical Specifications

(On the following pages)

P-23-030 State of Florida Heavy Duty Buses

Technical Specifications Matrix - 30' 35' and 40' Bus

***This form must be filled out completely for each bus size. Please check the appropriate box for the proposed component technical specification to indicate whether it Exceeds, Meets, or Does Not Meet the solicitation technical specification provided in the solicitation. Please provide the technical specifications for the proposed component in the Comments section for each bus size applicable. If you have an "or equal" substitution or an alternative option to the Base Bus technical specification , Check the box for Alternative Option and provide the technical specs and information about the product for evaluation. You may add lines to the spreadsheet, as necessary, for any technical specification category that may have multiple alternative options in order to capture all available options for each specification.*

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 5.1 Weight	X			X			X			X			X			X		
TS 5.2 Capacity	X			X			X			X			X			X		
TS 5.3 Service	X			X			X			X			X			X		
TS 5.4 Maintenance & Inspection	X			X			X			X			X			X		
TS 5.5 Interchangeability	X	X		X		From Year to Year, there may and likely will be changes (emissions, discontinuations, product improvements, etc.) that are necessary and would not technically be fully interchangeable	X	X		X		From Year to Year, there may and likely will be changes (emissions, discontinuations, product improvements, etc.) that are necessary and would not technically be fully interchangeable	X	X		X		From Year to Year, there may and likely will be changes (emissions, discontinuations, product improvements, etc.) that are necessary and would not technically be fully interchangeable
TS 5.6 Training	X	X			X	Gillig personnel will be available as needed as well as always available for remote support, however cannot guarantee being physically at an agency for the specified 7 month period	X	X			X	Gillig personnel will be available as needed as well as always available for remote support, however cannot guarantee being physically at an agency for the specified 7 month period	X	X			X	Gillig personnel will be available as needed as well as always available for remote support, however cannot guarantee being physically at an agency for the specified 7 month period
TS 5.6.1 Technical/Service Representatives	X			X			X			X			X			X		
TS 5.7 Operating Environment	X			X			X			X			X			X		
TS 5.8.1 Interior Noise	X			X			X			X			X			X		
TS 5.8.2 Exterior	X			X			X			X			X			X		
TS 5.9 Fire Safety	X			X			X			X			X			X		
TS 5.9.1 - Materials	X			X			X			X			X			X		
TS 5.10 Fire Suppression	X	X		X			X	X		X			X	X		X		
TS 5.11 Respect for the Environment	X			X			X			X			X			X		
TS 6 Physical Size	X			X			X			X			X			X		
TS 6.1 Bus Length	X			X			X			X			X			X		
TS 6.2 Bus Width	X			X			X			X			X			X		
TS 6.3 Bus Height	X			X			X			X			X			X		
TS 6.4 Step Height - Transit Coach	X			X			X			X			X			X		
TS 6.5 Underbody Clearance	X			X			X			X			X			X		
TS 6.6 Ramp Clearances	X			X			X			X			X			X		
TS 6.7 Ground Clearance	X			X			X			X			X			X		
TS 6.8 Floor Height - Transit Coach	X			X			X			X			X			X		
TS 6.9 Interior Headroom	X			X			X			X			X			X		

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 7 Power Requirements	X			X			X			X			X			X		
TS 7.1 Top Speed	X			X			X			X			X			X		
TS 7.2 Gradability	X			X			X			X			X			X		
TS 7.3 Acceleration TS 7.3.1 Non Hybrid	X			X			X			X			X			X		
TS7.3.2 Acceleration Hybrid	X			X			X			X			X			X		
TS 7.4 Operating Range	X			X			X			X			X			X		
TS 7.4.1 Diesel	X			X			X			X			X			X		
TS 7.4.2 CNG	X			X			X			X			X			X		
TS 7.4.3 Hybrid	X			X			X			X			X			X		
TS 8 Fuel Economy (Design Operating Profile)				X			X			X			X			X		
TS 9 Engine	X			X			X			X			X			X		
TS 9.1 Engine (CNG)	X			X			X			X			X			X		
TS 9.2 Propulsion System (Hybrid) TS9.2.1 Propulsion System Description	X			X			X			X			X			X		
TS 9.2.2 Propulsion System Service	X			X			X			X			X			X		
TS 9.2.3 Energy Storage and Controller	X			X			X			X			X			X		
TS 9.2.4 Hybrid System Controller (HSC)	X			X			X			X			X			X		
TS 9.2.5 Engine	X			X			X			X			X			X		
TS 10 Cooling Systems	X			X			X			X			X			X		
TS 10 Cooling Systems	X			X			X			X			X			X		
TS 10.1 Engine Cooling	X			X			X			X			X			X		
TS 10.1.1 Radiator Screen	X			X			X			X			X			X		
TS 10.1.2 Coolant	X			X			X			X			X			X		
TS 10.1.3 Drive Design	X			X			X			X			X			X		
TS 10.1.4 Mounting	X			X			X			X			X			X		
TS 10.2 Charge Air Cooling	X			X			X			X			X			X		
TS 10.3 Transmission Cooling	X			X			X			X			X			X		
TS 10.4 Hybrid Drive System Cooling	X			X			X			X			X			X		
TS 11 Transmission (Conventional Powertrain)	X			X			X			X			X			X		
TS 11.1 Base Bus Voith D864.5 or Latest Model	X			X			X			X			X			X		

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 11.1.1 Nominal Brake Pedal	X			X			X			X			X			X		
TS 11.1.2 Brake Pedal Application	X			X			X			X			X			X		
TS 11.2 No Automatic Neutral Function	X			X			X			X			X			X		
TS 12 Retarder	X			X			X			X			X			X		
TS 12.1 Standard Requirement for Retarder Activation	X			X			X			X			X			X		
TS 12.2 Accessible Retarder Disable Switch	X			X			X			X			X			X		
TS 13 Mounting	X			X			X			X			X			X		
TS 13.1 Service	X			X			X			X			X			X		
TS 13.1.1 Engine Bypass	X			X			X			X			X			X		
TS 13.1.2 Engine oil Pressure and Coolant Temperature Display	X			X			X			X			X			X		
TS 14 Hydraulic Systems	X			X			X			X			X			X		
TS 14.1 Fluid Lines	X			X			X			X			X			X		
TS 14.2 Fitting and Clamps	X			X			X			X			X			X		
TS 14.3 Charge Air Piping	X			X			X			X			X			X		
TS 15 Radiator	X			X			X			X			X			X		
TS 16 Oil and Hydraulic Lines	X			X			X			X			X			X		
TS 17 Fuel TS 17.1 Fuel Lines	X			X			X			X			X			X		
TS 17.1.1 Fuel Lines, Diesel	X			X			X			X			X			X		
TS 17.1.2 Fuel Lines, CNG	X	X				Approved Equal #20 submitted and approved	X	X				Approved Equal #20 submitted and approved	X	X				Approved Equal #20 submitted and approved
TS 17.2 Design and Construction TS 17.2.1 Design and Construction, Diesel	X			X			X			X			X			X		
TS 17.2.1.1 Installation	X			X			X			X			X			X		
TS 17.2.1.2 Labeling	X			X			X			X			X			X		
TS 17.2.1.3 Fuel Filter	X			X			X			X			X			X		
TS 17.2.1.1.4 OEM	X			X			X			X			X			X		
TS 17.2.2 CNG Fuel Containers/Cylinders	X			X			X			X			X			X		
TS 17.2.2.1 Installation	X			X			X			X			X			X		
TS 17.2.2.2 Labeling	X			X			X			X			X			X		
TS 17.2.2.3 Pressure Relief Devices	X			X			X			X			X			X		
TS 17.2.2.5 Fueling System	X			X			X			X			X			X		

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 17.2.2.7 Defueling System	X			X			X			X			X			X		
TS 18 Emissions and Exhaust TS 18.1 Exhaust Emissions	X			X			X			X			X			X		
TS 18.2 Exhaust System	X			X			X			X			X			X		
TS 18.3 Exhaust After Treatment Diesel Exhaust Fluid Injection	X			X			X			X			X			X		
TS 18.4 Particulate After Treatment	X			X			X			X			X			X		
TS 19 General TS 19.1 Design	X			X			X			X			X			X		
TS 20 Altoona Testing	X			X			X			X			X			X		
TS 10.1 Structural Validation	X			X			X			X			X			X		
TS 20.1.1 Frame Material	X			X			X			X			X			X		
TS 20.1.2 Distortion	X			X			X			X			X			X		
TS 21 Resonance and Vibration	X			X			X			X			X			X		
TS 21.1 Engine Compartment Bulkheads	X			X			X			X			X			X		
TS 21.2 Crashworthiness	X			X			X			X			X			X		
TS 22 Corrosion TS 22.1 Corrosion Resistance Requirements	X			X			X			X			X			X		
TS 23 Towing	X			X			X			X			X			X		
TS 23.1 No Provision of Glad-Hand Type Connectors for Towing	X			X			X			X			X			X		
TS 23.2 Lifted (Supported) Front Axle and Flat Towing Capability	X			X			X			X			X			X		
TS 24 Jacking / Yellow Pads	X	X				**Approved Equal #22 submitted and approved**	X	X				**Approved Equal #22 submitted and approved**	X	X				**Approved Equal #22 submitted and approved**
TS 25 Hoisting	X			X			X			X			X			X		
TS 26 Floor TS 26.1 Bi-Level Floor Design	X			X			X			X			X			X		
TS 26.2 Strength	X	X				**Approved Equal #22 submitted and approved**	X	X				**Approved Equal #22 submitted and approved**	X	X				**Approved Equal #22 submitted and approved**
TS 27 Platforms TS17.2 Driver's Area	X			X			X			X			X			X		
TS 27.2 Driver's Platform	X			X			X			X			X			X		
TS 27.3 Farebox	X			X			X			X			X			X		
TS 27.4 Rear Step Area to Rear Area	X			X			X			X			X			X		
TS 28 Wheel Housing TS 28.1 Design and Construction	X			X			X			X			X			X		
TS 28.2 Design and Construction	X			X			X			X			X			X		
TS 28.3 Bellows	X	X				**N/A on Non-Artic Buses**	X	X				**N/A on Non-Artic Buses**	X	X				**N/A on Non-Artic Buses**
TS 29 Suspension TS 29.1 General Requirements	X			X			X			X			X			X		

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 29.2 Alignment	X			X			X			X			X			X		
TS 29.3 Springs and Shock Absorbers TS 29.3.1 Suspension Travel	X			X			X			X			X			X		
TS 29.3.2 Damping	X			X			X			X			X			X		
TS 29.3.3 Lubrication / Standard Grease Fittings	X			X			X			X			X			X		
TS 29.3.4 Kneeling	X			X			X			X			X			X		
TS 20 Wheels and Tires TS 30.1 Wheels / Base Bus	X			X			X			X			X			X		
TS 30.1.1 Tire Pressure	X			X			X			X			X			X		
TS 30.1.2 Standard Non-Locking Lug Nut	X			X			X			X			X			X		
TS 30.2 Tires	X			X		**Addendum #14 Item #24 deletes requirement for providing space for spare tire, #25 specifies OEM to provide Tires on Base Bus (no spare noted)**	X			X		**Addendum #14 Item #24 deletes requirement for providing space for spare tire, #25 specifies OEM to provide Tires on Base Bus (no spare noted)**	X			X		**Addendum #14 Item #24 deletes requirement for providing space for spare tire, #25 specifies OEM to provide Tires on Base Bus (no spare noted)**
TS 31 Steering	X			X			X			X			X			X		
TS 31.1 Steering Axle / Solid Beam Axle and Grease-Type Front Bearings and Seals	X			X			X			X			X			X		
TS 31.1.1 Oiled Type Front Bearings	X			X			X			X			X			X		
TS 31.2 Steering Wheel TS 31.2.1 Turning Effort	X			X			X			X			X			X		
TS 31.2.2 Steering Wheel, General	X			X			X			X			X			X		
TS 31.2.3 Steering Column Tilt	X			X			X			X			X			X		
TS 31.2.4 Steering Wheel Telescopic Adjustment	X			X		**Approved Equal #26 approves spec**	X			X		**Approved Equal #26 approves spec**	X			X		**Approved Equal #26 approves spec**
TS 32 Drive Axle / Solid Beam Axle and Grease-Type Bearings and Seals	X			X			X			X			X			X		
TS 33 Turning Radius	X			X			X			X			X			X		
TS 34 Brakes TS 34.1 Service Brake	X			X			X			X			X			X		
TS 34.2 Actuation	X			X			X			X			X			X		
TS 34.3 Friction Material	X			X			X			X			X			X		
TS 34.4 Hubs and Drums	X			X			X			X			X			X		
TS 34.5 Hubs and Discs	X			X			X			X			X			X		
TS 34.6 Parking/Emergency Brake	X			X			X			X			X			X		
TS 35 Interlocks TS 35.1 Passenger Door Interlocks	X			X			X			X			X			X		
TS 35.1.1 Accelerator and Brake Interlock	X			X			X			X			X			X		
TS 36 Pneumatic System TS 36.1 General	X			X			X			X			X			X		
TS 36.2 Air Compressor	X			X			X			X			X			X		

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 36.3 Air Lines and Fittings	X			X			X			X			X			X		
TS 36.4 Air Reservoirs	X			X			X			X			X			X		
TS 36.5 Air System Dryer	X			X			X			X			X			X		
TS 37 Overview				X						X						X		
TS 37.1 Modular Design	X			X			X			X			X			X		
TS 37.2 Network Communication Requirements	X			X			X			X			X			X		
TS 38 Environmental and Mounting Requirements	X			X			X			X			X			X		
TS 38.1 Hardware Mounting	X			X			X			X			X			X		
TS 39 General Electrical Requirements TS 39.1 Batteries TS 39.1.1 Low-Voltage Batteries (24V)	X			X			X			X			X			X		
TS 39.1.1.1 Same Size Terminal Ends	X			X			X			X			X			X		
TS 39.1.2 Battery Cables	X			X			X			X			X			X		
TS 39.1.2.1 Color Code Each Voltage	X			X			X			X			X			X		
TS 39.1.3 Jump Start Connector	X			X			X			X			X			X		
TS 39.1.4 Battery Compartment	X			X			X			X			X			X		
TS 39.1.5 Auxiliary Electronic Power Supply	X			X			X			X			X			X		
TS 39.1.6 Master Battery Switch	X			X			X			X			X			X		
TS 39.1.6.1 Single Switch	X			X			X			X			X			X		
TS 39.1.7 Low-Voltage Generation and Distribution	X			X			X			X			X			X		
TS 39.1.8 Circuit Protection	X			X			X			X			X			X		
TS 39.2 Grounds	X			X			X			X			X			X		
TS 39.3 Low Voltage/Low Current Wiring and Terminals	X			X			X			X			X			X		
TS 39.4 Electrical Components	X			X			X			X			X			X		
TS 39.5 Electrical Compartments	X			X			X			X			X			X		
TS 40 General Electronic Requirements	X			X			X			X			X			X		
TS 40.1 Wiring and Terminals	X			X			X			X			X			X		
TS 40.1.1 Discrete I/O (Inputs/Outputs)	X			X			X			X			X			X		
TS 40.1.2 Shielding	X			X			X			X			X			X		
TS 40.1.3 Communications	X			X			X			X			X			X		
TS 49.1.4 Radio Frequency (RF)	X			X			X			X			X			X		

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 40.1.5 Audio	X			X			X			X			X			X		
TS 41 Multiplexing TS 41.1 General	X			X			X			X			X			X		
TS 41.1.1.1 Base Bus	X			X			X			X			X			X		
TS 41.1.1.2 Other				X			X			X			X			X		
TS 41.2 System Configuration	X			X			X			X			X			X		
TS 41.2.1 I/O Signals	X			X			X			X			X			X		
TS 42 Data Communications TS 42.1 General	X			X			X			X			X			X		
TS 42.2 Drivetrain Level	X			X			X			X			X			X		
TS 42.2.1 Diagnostics, Fault Detection and Data Access	X			X			X			X			X			X		
TS 42.2.2 Programmability (Software)	X			X			X			X			X			X		
TS 42.3 Multiplex Level TS 42.3.1 Data Access	X			X			X			X			X			X		
TS 42.3.2 Diagnostics and Fault Detection	X			X			X			X			X			X		
TS 42.3.3 Programmability (Software)	X			X			X			X			X			X		
TS 42.4 Electronic Noise Control	X			X			X			X			X			X		
TS 43 Driver's Area Controls TS 43.1 General	X			X			X			X			X			X		
TS 43.2 Glare	X			X			X			X			X			X		
TS 43.3 Visors/Sun Shades	X			X			X			X			X			X		
TS 43.3.1 Windows Behind the Driver	X			X			X			X			X			X		
TS 43.4 Driver's Controls	X			X			X			X			X			X		
TS 43.5 Normal Bus Operation Instrumentation and Controls	X			X			X			X			X			X		
TS 43.6 Driver Foot Controls	X			X			X			X			X			X		
TS 43.6.1 Pedal Angle	X			X			X			X			X			X		
TS 43.6.2 Pedal Dimensions and Position	X			X			X			X			X			X		
TS 43.7 Brake and Accelerator Pedals	X			X			X			X			X			X		
TS 43.8 Driver Foot Switches TS 43.8.1 Turn Signal Controls	X			X			X			X			X			X		
TS 43.8.2 Foot Switch Control	X			X			X			X			X			X		
TS 44 Driver's Amenities TS 44.1 Coat Hanger	X			X			X			X			X			X		
TS 44.2 Drink Holder	X			X			X			X			X			X		
TS 44.3 Storage Box	X			X			X			X			X			X		

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 45 Windshield Wipers and Washers TS 45.1 Windshield Wipers	X			X			X			X			X			X		
TS 45.1.1 Air Operated System	X			X			X			X			X			X		
TS 45.2 Windshield Washers	X			X			X			X			X			X		
TS 46 Driver's Seat	X			X			X			X			X			X		
TS 46.1 Dimensions	X			X			X			X			X			X		
TS 46.1.1 Seat Pan Cushion Length	X			X			X			X			X			X		
TS 46.1.1.1 Seat Pan Cushion	X			X			X			X			X			X		
TS 46.1.2 Seat Pan Cushion Slope	X			X			X			X			X			X		
TS 46.1.3 Seat Base Fore/Aft Adjustment	X			X			X			X			X			X		
TS 46.1.4 Seat Pan Cushion Width	X			X			X			X			X			X		
TS 46.1.5 Seat Suspension	X			X			X			X			X			X		
TS 46.1.6 Seat Back	X			X			X			X			X			X		
TS 46.1.7 Headrests	X			X			X			X			X			X		
TS 46.1.8 Seat Back Lumbar Support	X			X			X			X			X			X		
TS 46.1.9 Seat Back Angle Adjustment	X			X			X			X			X			X		
TS 46.2 Seat Belt	X			X			X			X			X			X		
TS 46.2.1 Lap	X			X			X			X			X			X		
TS 46.4 Seat Control Locations	X			X			X			X			X			X		
TS 46.5 Seat Structure and Materials	X			X			X			X			X			X		
TS 46.6 Pedestal	X			X			X			X			X			X		
TS 46.7 Mirrors TS 46.7.1 Exterior Mirrors	X			X			X			X			X			X		
TS 46.7.1.1 Flat Mirrors on Both Sides	X			X			X			X			X			X		
TS 46.7.1.2 Curbside Mirrors	X			X			X			X			X			X		
TS 46.7.1.3 Remote Adjustment of Curbside Mirror	X			X			X			X			X			X		
TS 46.7.1.4 Street-Side Mirrors	X			X			X			X			X			X		
TS 46.7.2 Interior Mirrors	X			X			X			X			X			X		
TS 47 Windows General	X			X			X			X			X			X		
TS 48 Windshield	X			X			X			X			X			X		
TS 48.1 Glazing	X			X			X			X			X			X		

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 48.1.1 Shaded Brand	X			X			X			X			X			X		
TS 48.1.2 Two Piece Windshield	X			X			X			X			X			X		
TS 49 Driver's Side Window	X			X			X			X			X			X		
TS 49.1 Standard Driver's Side Window, Traditional Frame	X			X			X			X			X			X		
TS 50 Side Windows TS 50.1 Configuration	X			X			X			X			X			X		
TS 50.2 Emergency Exit (Egress) Configuration	X			X		**Addendum #14 Item #33 clarifies Base as Traditional Frame Full Slider. Other options to be priced separately**	X			X		**Addendum #14 Item #33 clarifies Base as Traditional Frame Full Slider. Other options to be priced separately**	X			X		**Addendum #14 Item #33 clarifies Base as Traditional Frame Full Slider. Other options to be priced separately**
TS 50.2.1 Standard Passenger Side Window Configurations	X			X		**Addendum #14 Item #34 clarifies Base as Traditional Frame Full Fixed. Other options to be priced separately**	X			X		**Addendum #14 Item #34 clarifies Base as Traditional Frame Full Fixed. Other options to be priced separately**	X			X		**Addendum #14 Item #34 clarifies Base as Traditional Frame Full Fixed. Other options to be priced separately**
TS 50.2.3 Traditional Frame	X			X			X			X			X			X		
TS 50.3 Configuration	X			X			X			X			X			X		
TS 50.4 Materials - Safety Glass Glazing Panels	X			X			X			X			X			X		
TS 50.4.1.1 The 55 % Luminous Transmittance	X			X			X			X			X			X		
TS 50.4.1.2 The 27% Luminous Transmittance	X			X			X			X			X			X		
TS 50.4.1 Safety Glass Glazing Panels	X			X			X			X			X			X		
TS 50.5 Rear Window	X			X			X			X			X			X		
TS 51 Capacity and Performance	X			X			X			X			X			X		
TS 51.1 Allow Either Roof or Rear Mounted HVAC Unit	X			X			X			X			X			X		
TS 51.2 Capacity and Performance Requirements	X			X			X			X			X			X		
TS 52 Controls and Temperature Uniformity	X			X			X			X			X			X		
TS 52.1.1.1 Manual Mode Selection of Climate Control System	X			X			X			X			X			X		
TS 52.1.1.2 Single Control Set point at 70 Degrees Fahrenheit	X			X			X			X			X			X		
TS 52.1 Auxiliary Heater	X			X			X			X			X			X		
TS 53 Air Flow TS 53.1 Passenger Area	X			X			X			X			X			X		
TS 53.1.1 No "Fresh Air" Requirements	X			X			X			X			X			X		
TS 53.2 Driver's Area	X			X			X			X			X			X		
TS 53.3 Controls for the Climate Control System (CCS)	X			X			X			X			X			X		
TS 53.4 Driver's Compartment Requirements	X			X			X			X			X			X		
TS 53.5 Driver's Cooling	X			X			X			X			X			X		
TS 54 Air Filtration	X			X			X			X			X			X		

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 55 Roof Ventilators	X			X			X			X			X			X		
TS 55.1 One Roof Ventilator	X			X			X			X			X			X		
TS 56 Maintainability	X			X			X			X			X			X		
TS 57 Entrance/Exit Area Heating	X			X			X			X			X			X		
TS 58 Floor Level heating TS 58.1 Transit Coach	X			X			X			X			X			X		
TS 59 Design	X			X			X			X			X			X		
TS 59.1 Materials	X			X			X			X			X			X		
TS 59.2 Roof Mounted Equipment	X			X			X			X			X			X		
TS 60 Pedestrian Safety	X			X			X			X			X			X		
TS 61 Repair and Replacement TS 61.1 Side Body Panels	X			X			X			X			X			X		
TS 62 Rain Gutters	X			X			X			X			X			X		
TS 63 License Plate Provisions	X			X			X			X			X			X		
TS 63.1 Rub Rails	X			X			X			X			X			X		
TS 64 Fender Skirts	X			X			X			X			X			X		
TS 65 Wheel Covers	X			X			X			X			X			X		
TS 65.1 Splash Aprons	X			X			X			X			X			X		
TS 66 Service Compartments and Access Doors TS 66.1 Access Doors	X			X			X			X			X			X		
TS 66.2 Access Door Latch/Locks	X			X			X			X			X			X		
TS 67 Bumpers TS 67.1 Location	X			X			X			X			X			X		
TS 67.2 Front Bumper	X			X			X			X			X			X		
TS 67.3 Rear Bumper	X			X			X			X			X			X		
TS 67.4 Bumper Material	X			X			X			X			X			X		
TS 68 Finish and Color TS 68.1 Appearance	X			X			X			X			X			X		
TS 68.1.1 Base Coat/Clear Coat Paint System	X			X			X			X			X			X		
TS 69 Decals Numbering and Signing	X			X			X			X			X			X		
TS 69.1 Passenger information	X			X			X			X			X			X		
TS 70 Exterior Lighting	X			X			X			X			X			X		
TS 70.1.1 Standard Lamps	X			X			X			X			X			X		
TS 70.1.1 Standard Size	X			X			X			X			X			X		

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 70.1 Doorway Lighting	X			X			X			X			X			X		
TS 70.3 Turn Signals	X			X			X			X			X			X		
TS 70.4 Headlights	X			X			X			X			X			X		
TS 70.5 Brake Lights TS 70.5.1 Transit Coach	X			X			X			X			X			X		
TS 70.6 Service Area Lighting (Interior and Exterior)	X			X			X			X			X			X		
TS 71 Panels and Finishes General Requirements	X			X			X			X			X			X		
TS 72 Interior Panels	X			X			X			X			X			X		
TS 72.1 Driver Area Barrier TS 72.1.1 Transit Coach	X			X			X			X			X			X		
TS 72.2 Modesty Panels	X			X			X			X			X			X		
TS 72.3 Front End	X			X			X			X			X			X		
TS 72.4 Rear Bulkhead	X			X			X			X			X			X		
TS 72.5 Headlining	X			X			X			X			X			X		
TS 72.6 Fastening	X			X			X			X			X			X		
TS 72.7 Insulation	X			X		**Approved Equal Item #36 Base to meet FMVSS302**	X			X		**Approved Equal Item #36 Base to meet FMVSS302**	X			X		**Approved Equal Item #36 Base to meet FMVSS302**
TS 72.8 Floor Covering	X			X			X			X			X			X		
TS 72.9 Interior Lighting	X			X			X			X			X			X		
TS 72.10 Passenger TS 72.10.1 First Row Lights	X			X			X			X			X			X		
TS 72.10.2 First Light Modules Dim/Extinguish When Front Door is Closed	X			X			X			X			X			X		
TS 72.11 Driver's Area	X			X			X			X			X			X		
TS 72.12 Seating Areas	X			X			X			X			X			X		
TS 72.13 Vestibules/Doors	X			X			X			X			X			X		
TS 72.14 Step Lighting	X			X			X			X			X			X		
TS 72.15 Ramp Lighting	X			X			X			X			X			X		
TS 72.16 Farebox Lighting	X			X			X			X			X			X		
TS 73 Pare Collection	X			X			X			X			X			X		
TS 74 Interior Access Panels and Doors	X			X			X			X			X			X		
TS 74.1 Floor Panels	X			X			X			X			X			X		
TS 75 Passenger Seating TS 75.1 Arrangements and Seat Style	X			X			X			X			X			X		
TS 75.1.1 Forward-Facing Seat Configuration	X			X			X			X			X			X		

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 75.2 Rearward Facing Seats	X			X			X			X			X			X		
TS 75.3 Padded Inserts/Cushioned Seats	X			X			X			X			X			X		
TS 75.4 Seat Back Fitness	X			X			X			X			X			X		
TS 75.5 Drain Hole in Seats	X			X			X			X			X			X		
TS 75.6 Hip-to-Knee Room	X			X			X			X			X			X		
TS 75.7 Foot Room	X			X			X			X			X			X		
TS 75.8 Aisles	X			X			X			X			X			X		
TS 75.9 Dimensions	X			X			X			X			X			X		
TS 75.10 Structure and Design	X			X			X			X			X			X		
TS 75.11 Construction and Materials	X			X			X			X			X			X		
TS 76 Passenger Assets	X			X			X			X			X			X		
TS 76.1 Assists	X			X			X			X			X			X		
TS 76.2 Front Doorway	X			X			X			X			X			X		
TS 76.3 Vestibule	X			X			X			X			X			X		
TS 76.4 Rear Doorway	X			X			X			X			X			X		
TS 76.5 Overhead	X			X			X			X			X			X		
TS 76.6 Longitudinal Seat Assists	X			X			X			X			X			X		
TS 76.7 Wheel Housing Barriers/Assists	X			X			X			X			X			X		
TS 77 Passenger Doors TS 77.1 Transit Coach	X			X			X			X			X			X		
TS 77.1.1 Front Door	X			X			X			X			X			X		
TS 77.1.2 Rear Door	X			X			X			X			X			X		
TS 77.2 Materials and Construction	X			X			X			X			X			X		
TS 77.3 Dimensions TS 77.3.1 Transit Coach	X			X			X			X			X			X		
TS 77.4 Door Glazing - Upper Section	X			X			X			X			X			X		
TS 77.4.1 Door Glazing - Front Door Panel	X			X			X			X			X			X		
TS 77.5 Door Projection TS 77.5.1 Exterior	X			X			X			X			X			X		
TS 77.5.2 Interior	X			X			X			X			X			X		
TS 77.6 Door Height Above Pavement	X			X			X			X			X			X		
TS 77.7 Closing Force	X			X			X			X			X			X		

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 77.7.1 Rear Door Closing Force	X		X	X		Addendum 14 item #37 clarifies that Vapor Class object detection will be included in the base	X		X	X		Addendum 14 item #37 clarifies that Vapor Class object detection will be included in the base	X		X	X		Addendum 14 item #37 clarifies that Vapor Class object detection will be included in the base
TS 77.8 Actuators	X			X			X			X			X			X		
TS 77.9 Emergency Operations	X			X			X			X			X			X		
TS 77.10 Door Control	X			X			X			X			X			X		
TS 77.11 Door Controller TS 77.1 Transit Coach	X			X			X			X			X			X		
TX 77.12 Door Open/Close	X			X			X			X			X			X		
TS 78 Accessibility Provisions	X			X			X			X			X			X		
TS 78.1 Loading Systems	X			X			X			X			X			X		
TS 78.2 Lift	X			X			X			X			X			X		
TS 78.3 Loading System for 30 to 40 ft Low Floor Bus	X			X			X			X			X			X		
TS 78.4 Wheelchair Accommodations	X			X			X			X			X			X		
TS 78.5 Interior Circulation	X			X			X			X			X			X		
TS 78.6 Lift Door	X	X				N/A, Ramp Design will be utilized and not Lift Design	X	X				N/A, Ramp Design will be utilized and not Lift Design	X	X				N/A, Ramp Design will be utilized and not Lift Design
TS 78.7 Lift Width	X	X				N/A, Ramp Design will be utilized and not Lift Design	X	X				N/A, Ramp Design will be utilized and not Lift Design	X	X				N/A, Ramp Design will be utilized and not Lift Design
TS 78.8 Lighting Requirements	X			X			X			X			X			X		
TS 78.9 Securement System	X			X			X			X			X			X		
TS 78.10 Roof Ventilation/Escape Hatches	X			X			X			X			X			X		
TS 79 Destination Signs	X			X			X			X			X			X		
TS 80 Passenger Information and Advertising TS 80.1 Interior Displays	X			X			X			X			X			X		
TS 80.2 Exterior Displays	X			X			X			X			X			X		
TS 81 Passenger Stop Request/Exit Signs TS 81.1 Transit Coach	X			X			X			X			X			X		
TS 81.2 Signal Chime TS 81.2.1 Transit Coach	X			X			X			X			X			X		
TS 82 Communications TS 82.1 Camera Surveillance System	X			X			X			X			X			X		
TS 82.2 Public Address System	X			X			X			X			X			X		
TS 82.2.1 Speakers	X			X			X			X			X			X		
TS 82.3 Automatic Passenger Counter (APC)	X			X			X			X			X			X		
TS 82.4 Radio Handset and Control System TS 82.4.1 Drivers Speaker	X			X			X			X			X			X		
TS 82.4.2 Handset	X			X			X			X			X			X		
TS 82.4.3 Driver Display Unit (DDU)	X			X		Addendum 14 item #39 Deletes DDU requirement	X			X		Addendum 14 item #39 Deletes DDU requirement	X			X		Addendum 14 item #39 Deletes DDU requirement

	30 Foot Bus						35 Foot Bus						40 Foot Bus					
Item	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment	Base Bus (X)	Alternative Option (X)	Exceeds	Meets	Does Not Meet	Comment
TS 82.4.4 Emergency Alarm	X			X			X			X			X			X		
TS 83 Event Data Recorders (EDR)	X			X			X			X			X			X		

Exhibit 'C' – Scope of Work

(On the following pages)

Scope of Work

STATE OF FLORIDA HEAVY DUTY TRANSIT BUSES - 30', 35', 40'

P-23-030

In submitting a proposal, please note on the Technical Matrix separate document, whether your proposal exceeds, meets, or does not meet the technical specification. Provide comments explaining your response.

Any and all references to brand names should interpreted to be a Brand Name or Equal requirement.

TECHNICAL SPECIFICATIONS GENERAL

TS 1. Scope

Technical specifications define requirements for heavy-duty transit buses and commuter coaches, which, by the selection of specifically identified alternative configurations, may be used for both suburban express service and general service on urban arterial streets. Buses shall have a minimum expected life of twelve (12) years or 500,000 miles, whichever comes first, and are intended for the widest possible spectrum of passengers, including children, adults, the elderly, and people with disabilities.

TS 2. Definitions

Alternative: An alternative specification condition to the default bus configuration. The TRANSIT AGENCY may define alternatives to the default configuration to satisfy local operating requirements. Alternatives for the default configuration will be clearly identified.
Ambient Temperature: The temperature of the surrounding air. For testing purposes, the ambient temperature must be between 16°C (50°F) and 38°C (100°F).
Analog Signals: A continuously variable signal that is solely dependent upon magnitude to express information content.
NOTE: Analog signals are used to represent the state of variable devices such as rheostats, potentiometers, temperature probes, etc.
Audible Discrete Frequency: An audible discrete frequency is determined to exist if the sound power level in any 1/3-octave band exceeds the average of the sound power levels of the two adjacent 1/3-octave bands by 4 decibels (dB) or more.
Battery Compartment: Low-voltage energy storage, i.e., 12/24 VDC batteries.
Battery Management System (BMS): Monitors energy, as well as temperature, cell or module voltages, and total pack voltage. The BMS adjusts the control strategy algorithms to maintain the batteries at uniform state of charge and optimal temperatures.
Braking Resistor: Device that converts electrical energy into heat, typically used as a retarder to supplement or replace the regenerative braking.
Burst Pressure: The highest pressure reached in a container during a burst test.
Capacity (fuel container): The water volume of a container in gallons (liters).
Cells: Individual components (i.e., battery or capacitor cells).
Code: A legal requirement.
Combination Gas Relief Device: A relief device that is activated by a combination of high pressures or high temperatures, acting either independently or together.
Composite Container for CNG: A container fabricated of two or more materials that interact to facilitate the container design criteria.

Compressed Natural Gas (CNG): Mixtures of hydrocarbon gases and vapors consisting principally of methane in gaseous form that has been compressed for use as a vehicular fuel.
Container: A pressure vessel, cylinder or cylinders permanently manifolded together, used to store CNG.
Container Appurtenances: Devices connected to container openings for safety, control, or operating purposes.
Container Valve: A valve connected directly to a container outlet.
Curb Weight: Weight of vehicle, including maximum fuel, oil, and coolant; and all equipment required for operation and required by this Specification, but without passengers or driver.
dBA: Decibels with reference to 0.0002 microbar as measured on the "A" scale.
DC to DC Converter: A module that converts a source of direct current from one voltage level to another.
Default Configuration Bus: The bus described if no alternatives are selected. Signing, colors, the destination sign reading list and other information must be provided by the TRANSIT AGENCY.
Defueling: The process of removing fuel from a tank.
Defueling Port. Device that allows for vehicle defueling, or the point at which this occurs.
Destroyed: Physically made permanently unusable.
Discrete Signal: A signal that can take only pre-defined values, usually of a binary 0 or 1 nature, where 0 is battery ground potential and 1 is a defined battery positive potential.
DPF: Diesel particulate filter.
Driver's Eye Range: The 95th-percentile ellipse defined in SAE Recommended Practice J941, except that the height of the ellipse shall be determined from the seat at its reference height.
Energy Density: The relationship between the weight of an energy storage device and its power output in units of watt-hours per kilogram (Wh/kg).
Energy Storage System (ESS): A component or system of components that stores energy and for which its supply of energy is rechargeable by the on-vehicle system (engine/regenerative braking/ generator) or an off-vehicle energy source.
Fill Pressure for CNG: The pressure attained at the actual time of filling. Fill pressure varies according to the gas temperatures in the container, which are dependent on the charging parameters and the ambient conditions. The maximum dispensed pressure shall not exceed 125 percent of service pressure.
Flow Capacity: For natural gas flow, this is the capacity in volume per unit time (normal cubic meters/minute or standard cubic feet per minute) discharged at the required flow rating pressure.
Fuel Line: The pipe, tubing, or hose on a vehicle, including all related fittings, through which natural gas passes.
Fusible Material: A metal, alloy, or other material capable of being melted by heat.
Fire Resistant: Materials that have a flame spread index of less than 150 as measured in a radiant panel flame test per ASTM-E 162-90.
Fireproof: Materials that will not burn or melt at temperatures less than 2000°F.
Free Floor Space: Floor area available to standees, excluding the area under seats, area occupied by feet of seated passengers, the vestibule area forward of the standee line, and any floor space indicated by manufacturer as non-standee areas, such as the floor space "swept" by passenger doors during operation. Floor area of 1.5 sq. ft. shall be allocated for the feet of each seated passenger protruding into the standee area.
Fuel Management System: Natural gas fuel system components that control or contribute to engine air fuel mixing and metering, and the ignition and combustion of a given air-fuel mixture. The fuel management system would include, but is not limited to, reducer/regulator valves, fuel metering equipment (e.g., carburetor, injectors), sensors (e.g., main throttle, waste gate).

GAWR (Gross Axle Weight Rated): The maximum total weight as determined by the axle manufacturer, at which the axle can be safely and reliably operated for its intended purpose.
Gross Load: 150lbs for every designed passenger seating position, for the driver, and for each 1.5 sq. ft. of free floor space.
GVW (Gross Vehicle Weight): Curb weight plus gross load.
GVWR (Gross Vehicle Weight Rated): The maximum total weight as determined by the vehicle manufacturer, at which the vehicle can be safely and reliably operated for its intended purpose.
High Pressure: Those portions of the CNG fuel system that see full container or cylinder pressure.
High Voltage (HV): Greater than 50 V (AC and DC).
Hose: Flexible line.
Hybrid: A vehicle that uses two or more distinct power sources to propel the vehicle.
Hybrid System Controller (HSC): Regulates energy flow throughout hybrid system components in order to provide motive performance and accessory loads, as applicable, while maintaining critical system parameters (voltages, currents, temperatures, etc.) within specified operating ranges.
Hybrid Drive System (HDS): The mechanical and/or electromechanical components, including the engine, traction motors and energy storage system, which comprise the traction drive portion of the hybrid propulsion system.
Intermediate Pressure: The portion of a CNG system after the first pressure regulator, but before the engine pressure regulator. Intermediate pressure on a CNG vehicle is generally from 3.5 to 0.5 MPa (510 to 70 psi)
Inverter: A module that converts DC to and from AC.
Labeled: Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization, which is acceptable to the authority having jurisdiction and concerned with product evaluation, which maintains periodic inspection of production labeled equipment or materials, and by who's labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
Leakage: Release of contents through a Defect or a crack. See *Rupture*.
Line: All tubes, flexible and hard, carry fluids.
Liner: Inner gas-tight container or gas container to which the overwrap is applied.
Local Regulations: Regulations below the state level.
Low-Floor Bus: A bus that, between at least the front (entrance) and rear (exit) doors, has a floor sufficiently low and level so as to remove the need for steps in the aisle between the doors and in the vicinity of these doors.
Low Voltage (LV):50 V or less (AC and DC).
Lower Explosive Limit: The lowest concentration of gas where, given an ignition source, combustion is possible.
Maximum Service Temperature: The maximum temperature to which a container/cylinder will be subjected in normal service.
Metallic Hose: A hose whose strength depends primarily on the strength of its metallic parts; it can have metallic liners or covers, or both.
Metering Valve: A valve intended to control the rate of flow of natural gas.
Module: An assembly of individual components
Motor (Electric): A device that converts electrical energy into mechanical energy.
Motor (Traction): An electric motor used to power the driving wheels of the bus.
Operating Pressure: The varying pressure developed in a container during service.

Physical Layer: The first layer of the seven-layer International Standards Organization (ISO) Open Systems Interconnect (OSI) reference model. This provides the mechanical, electrical, functional, and procedural characteristics required to gain access to the transmission medium (e.g., cable) and is responsible for transporting binary information between computerized systems.

Pipe: Nonflexible line.

Pressure Relief Device (PRD): A pressure and/or temperature activated device used to vent the container/cylinder contents and thereby prevent rupture of an NGV fuel container/cylinder, when subjected to a standard fire test as required by fuel container/cylinder standards.

> **NOTE:** Since this is a pressure-activated device, it may not protect against rupture of the container when the application of heat weakens the container to the point where its rupture pressure is less than the rated burst pressure of the relief device, particularly if the container is partially full.

Power: Work or energy divided by time

Power Density: Power divided by mass, volume, or area.

Propulsion System: System that provides propulsion for the vehicle proportional to operator commands. Includes, as applicable, engine, transmission, traction motors, the hybrid drive system, (HDS), energy storage system (ESS), and system controllers including all wiring and converter/inverter.

Real-Time Clock (RTC): Computer clock that keeps track of the current time.

Regenerative Braking: Deceleration of the bus by switching motors to act as generators, which return vehicle kinetic energy to the energy storage system.

Rejectable Damage: In terms of NGV fuel containers/cylinders, this is damage as outlined in CGA C-6.4, "Methods for External Visual Inspection of Natural Gas Vehicle Fuel Containers and Their Installations," and in agreement with the manufacturer's recommendations.

Retarder: Device used to augment or replace some of the functions of primary friction based braking systems of the bus.

Rupture: Sudden and unstable damage propagation in the structural components of the container resulting in a loss of contents. See *Leakage*.

Seated Load: 150lbs for every designed passenger seating position and for the driver.

SLW (Seated Load Weight): Curb weight plus seated load.

Serial Data Signals. A current loop-based representation of ASCII or alphanumeric data used for transferring information between devices by transmitting a sequence of individual bits in a prearranged order of significance.

> **NOTE:** An example is the communication that takes place between two or more electronic components with the ability to process and store information.

Service Pressure: The settled pressure at a uniform gas temperature of 21°C (70°F) and full gas content. It is the pressure for which the equipment has been constructed, under normal conditions. Also referred to as the nominal service pressure or working pressure.

Settled Pressure: The gas pressure when a given settled temperature, usually 21°C (70°F), is reached.

Settled Temperature: The uniform gas temperature after any change in temperature caused by filling has dissipated.

Solid State Alternator: A module that converts high-voltage DC to low-voltage DC (typically 12/24 V systems).

Sources of Ignition: Devices or equipment that because of their modes of use or operation, are capable of providing sufficient thermal energy to ignite flammable compressed natural gas-air mixtures when introduced into such a mixture, or when such a mixture comes into contact with them.

Special Tools: Tools not normally stocked by the TRANSIT AGENCY.

Specification: A particular or detailed statement, account or listing of the various elements, materials, dimensions, etc. involved in the manufacturing and construction of a product.
Standard: A firm guideline from a consensus group. Standards referenced in "Section 6: Technical Specifications" are the latest revisions unless otherwise stated.
Standee Line: A line marked across the bus aisle to designate the forward area that passengers may not occupy when the bus is moving.
State of Charge (SOC): Quantity of electric energy remaining in the battery relative to the maximum rated amp-hour (Ah) capacity of the battery expressed in a percentage. This is a dynamic measurement used for the energy storage system. A full SOC indicates that the energy storage system cannot accept further charging from the engine-driven generator or the regenerative braking system.
Stress Loops: The "pigtails" commonly used to absorb flexing in piping.
Structure: The basic body, including floor deck material and installation, load-bearing external panels, structural components, axle mounting provisions and suspension beams and attachment points.
Thermally Activated Gas Relief Device: A relief device that is activated by high temperatures and generally contains a fusible material.

> **NOTE:** Since this is a thermally activated device, it does not protect against over- pressure from improper charging practices.

Wheelchair: A mobility aid belonging to any class of three- or four-wheeled devices, usable indoors, designed for and used by individuals with mobility impairments, whether operated manually or powered. A "common wheelchair" is such a device that does not exceed 30 in. in width and 48 in. in length measured 2 in. above the ground and does not weigh more than 600 lbs. when occupied.

TS 3. Referenced Publications

The documents or portions thereof referenced within this specification shall be considered part of the requirements of the specification. The edition indicated for each referenced document is the current edition, as of the date of the APTA issuance of this specification.

TS 4. Legal Requirements

The Proposer shall comply with all applicable federal, state, and local regulations. These shall include but not be limited to ADA, as well as state and local accessibility, safety, and security requirements. Local regulations are defined as those below the state level.
Buses shall meet all applicable FMVSS regulations and shall accommodate all applicable FMCSR regulations in effect at the location of the TRANSIT AGENCY and the date of manufacture.
In the event of any conflict between the requirements of these specifications and any applicable legal requirement, the legal requirement shall prevail. Technical requirements that exceed the legal requirements are not considered to conflict.

TS 5. Overall Requirements

The Proposer shall ensure that the application and installation of major bus subcomponents and systems are compliant with all such subcomponent vendors' requirements and recommendations. Proposer and TRANSIT AGENCY shall identify subcomponent vendors that shall submit installation/application approval documents with the completion of a pilot or lead bus.
Components used in the vehicle shall be of heavy-duty design and proven in transit service.

TS 5.1 Weight

DEFAULT
It shall be a design goal to construct each bus as light in weight as possible without degradation of safety, appearance, comfort, traction, or performance.
Buses at a capacity load shall not exceed the tire factor limits, brake test criteria or structural design criteria.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 5.2 Capacity
DEFAULT
The vehicle shall be designed to carry the gross vehicle weight, which shall not exceed the bus GVWR.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 5.3 Service Life
DEFAULT
The minimum useful design life of the bus in transit service shall be at least twelve (12) years or 500,000 miles. It shall be capable of operating at least 40,000 miles per year, including the 12th year.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 5.4 Maintenance and Inspection
DEFAULT

Scheduled maintenance tasks shall be related and shall be in accordance with the manufacturer's recommended preventative maintenance schedule (along with routine daily service performed during the fueling operations). Test ports, as required, shall be provided for commonly checked functions on the bus, such as air intake, exhaust, hydraulic, pneumatic, charge-air and engine cooling systems. The coach manufacturer shall consider the routine problems of maintaining the vehicle. All coach components and systems, both mechanical and electrical, which will require periodic physical Work or inspection processes shall be installed so that a minimum of time is consumed in gaining access to the critical repair areas. It shall not be necessary to disassemble portions of the coach structure and/or equipment such as seats and flooring under seats to gain access to these areas. Each coach shall be designed to facilitate the disassembly, reassembly, servicing, or maintenance, using tools and equipment that are normally available as standard commercial items.
Requirements for the use of unique specialized tools will be minimized. The body and structure of the coach shall be designed for ease of maintenance and repair. Individual panels or other equipment that may be damaged in normal service shall be repairable or replaceable. Ease of repair shall be related to the vulnerability of the item to damage in service. The Proposer shall provide a list of all special tools and pricing required for maintaining this equipment. Said list shall be submitted as a supplement to the Pricing Schedule.

> **NOTE:** Tools such as compartment door keys, bellows gauges and other tools that are required for daily maintenance and inspections shall not be included in the special tool list and shall be furnished for each coach.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 5.5 Interchangeability
DEFAULT
Unless otherwise agreed, all units and components procured under this Contract, whether provided by Suppliers or manufactured by the Proposer, shall be duplicates in design, manufacture, and installation to ensure interchangeability among buses in each order group in this procurement. This interchangeability shall extend to the individual components as well as to their locations in the buses. These components shall include, but are not limited to, passenger window hardware, interior trim, lamps, lamp lenses and seat assemblies. Components with non-identical functions shall not be, or appear to be, interchangeable.

Any one component or unit used in the construction of these buses shall be an exact duplicate in design, manufacture, and assembly for each bus in each order group in this Contract. Proposer shall identify and secure approval for any changes in components or unit construction provided within a Contract.

In the event that the Proposer is unable to comply with the interchangeability requirement, the Proposer must notify the TRANSIT AGENCY and obtain the TRANSIT AGENCY's prior written approval, including any changes in pricing.

The TRANSIT AGENCY shall review proposed product changes on a case-by-case basis and shall have the right to require extended warranties to ensure that product changes perform at least as well as the originally supplied products.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 5.6 Training
DEFAULT

> **NOTE:** The following is illustrative; the TRANSIT AGENCY should carefully specify its training requirements.

The Proposer shall have at least one qualified instructor who shall be available at the TRANSIT AGENCY's property for calendar days between the hours of 7:00am-3:30pm and per month for 1 month prior to, and 6 months after, acceptance of the first bus. Instructor(s) shall conduct schools and advise the personnel of the TRANSIT AGENCY on the proper operation and maintenance of the equipment. The Proposer also shall provide visual and other teaching aids (such as manuals, slide presentations and literature) for use by the TRANSIT AGENCY's own training staff, which become the property of the TRANSIT AGENCY.

> **NOTE:** The TRANSIT AGENCY should insert language that specifies the hours when it wants the training to occur, the total number of hours of instruction it wants to be provided, what items it expects the curriculum to cover and the format in which it expects the training and teaching aids to be provided (print, DVD, etc.).

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 5.6.1 Technical/Service Representatives
DEFAULT
The Proposer shall, at its own expense, have one or more competent technical service representatives available on request to assist the TRANSIT AGENCY in the solution of engineering or design problems within the scope of the specifications that may arise during the warranty period. This does not relieve the Proposer of responsibilities under the provisions of "Section 7: Warranty Requirements."

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 5.7 Operating Environment
DEFAULT
The bus shall achieve normal operation in ambient temperature ranges of 10 ºF to 115 ºF, at relative humidity between 5 percent and 100 percent, and at altitudes up to 3000 ft. above sea level. Degradation of performance due to atmospheric conditions shall be minimized at temperatures below 10 °F, above 115 °F or at altitudes above 3000 ft. Altitude requirements above 3000 ft. will need separate discussions with the engine manufacturer to ensure that performance requirements are not compromised. Speed, gradability and acceleration performance requirements shall be met at, or corrected to, 77 °F, 29.31 in. Hg, dry air per SAEJ1995.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 5.8 Noise
TS 5.8.1 Interior Noise
DEFAULT
The combination of inner and outer panels and any material used between them shall provide sufficient sound insulation so that a sound source with a level of 80 dBA measured at the outside skin of the bus shall have a sound level of 65 dBA or less at any point inside the bus. These conditions shall prevail with all openings, including doors and windows, closed and with the engine and accessories switched off.
The bus-generated noise level experienced by a passenger at any seat location in the bus shall not exceed 80 dBA. The driver area shall not experience a noise level of more than 75 dBA. Measurements of interior noise levels shall be taken in accordance with SAEJ2805. An exception shall be made for the turntable area, which shall be considered a separate environment.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 5.8.2 Exterior Noise
DEFAULT

Airborne noise generated by the bus and measured from either side shall not exceed 80dBA under full power acceleration when operated at 0 to 35 mph at curb weight. The maximum noise level generated by the bus pulling away from a stop at full power shall not exceed 83 dBA. The bus-generated noise at curb idle shall not exceed 65dBA.If the noise contains an audible discrete frequency, a penalty of 5 dBA shall be added to the sound level measured. The Proposer shall comply with the exterior noise requirements defined in local laws and ordinances identified by the TRANSIT AGENCY andSAEJ366.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 5.9 Fire Safety
DEFAULT
The bus shall be designed and manufactured in accordance with all applicable fire safety and smoke emission regulations. These provisions shall include the use of fire-retardant/low-smoke materials, fire detection systems, bulkheads, and facilitation of passenger evacuation.
Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 5.9.1 Materials
DEFAULT
All materials used in the construction of the passenger compartment of the bus shall be in accordance with the Recommended Fire Safety Practices defined in FMVSS 302.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 5.10 Fire Suppression
DEFAULT
Fogmaker- 35 DEG Fluid. 6 Engine compartment nozzles

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 5.11 Respect for the Environment
DEFAULT
In the design and manufacture of the bus, the Proposer shall make every effort to reduce the amount of potentially hazardous waste. In accordance with Section 6002 of the Resource Conservation and Recovery Act, the Proposer shall use, whenever possible and allowed by the specifications, recycled materials in the manufacture of the bus.

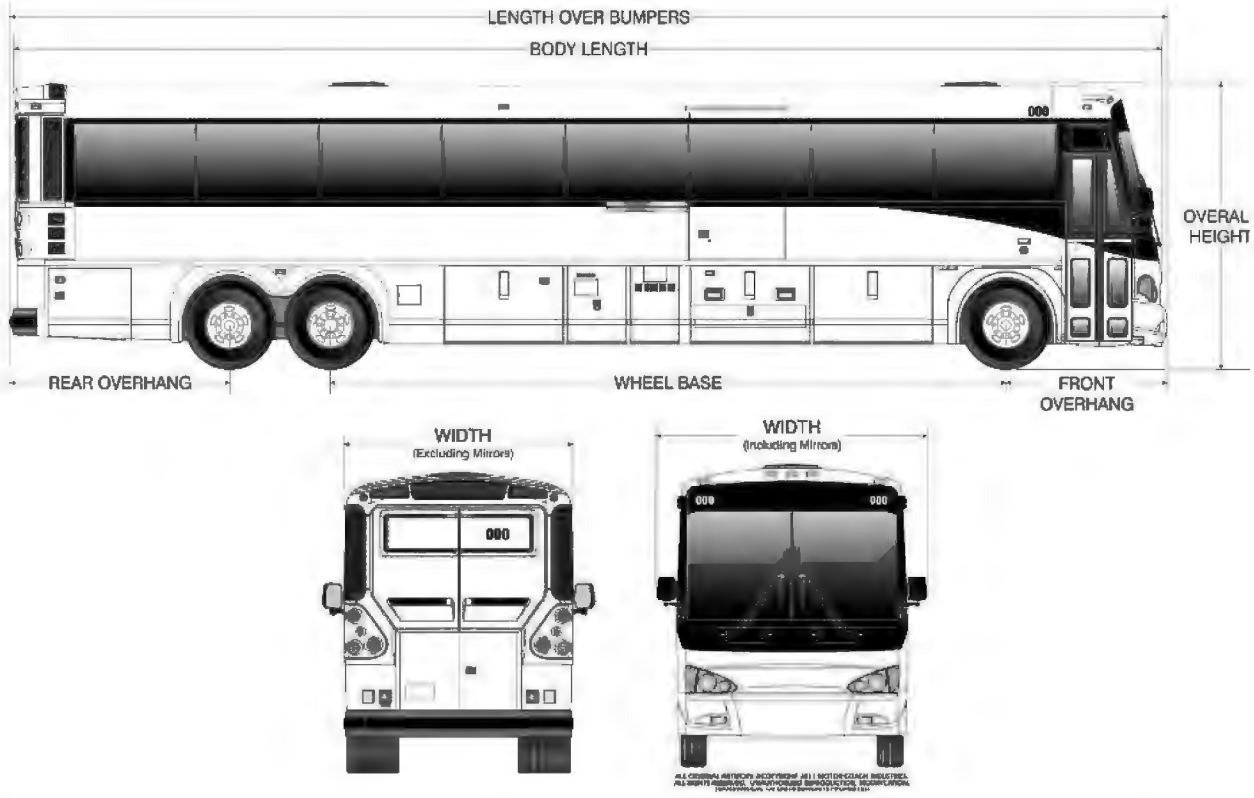
Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DIMENSIONS
TS 6. Physical Size
With exceptions such as exterior mirrors, marker and signal lights, bumpers, fender skirts, washers, wipers, ad frames, cameras, object detection systems, bicycle racks, feelers and rub rails, the bus shall have the following overall dimensions as shown in **Figure 1** at static conditions and design height.

FIGURE 1

Transit Bus Exterior Dimensions



TS 6.1 Bus Length
For ease of use, the following tolerances will be allowable for each given bus length. Bus length is determined as the measurement from bumper to bumper.

30ft bus: 29 ft., 11 in. to 34ft, 11 in.
35ft bus: 35ft to 39ft, 11 in.
40ft bus: 40ft to 44ft, 11 in.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 6.2 Bus Width
TS 6.2.1 Transit Coach
DEFAULT

102 in. Width Bus
Body width shall be 102 in. (+0, -1 in.).

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 6.3 Bus Height
DEFAULT
Maximum Overall Height
Maximum overall height shall be 140 in., including all rigid, roof-mounted items such as A/C, exhaust, fuel system and cover, etc.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 6.4 Step Height
TS 6.4.1 Transit Coach
DEFAULT

The step height shall not exceed 16.5 in. at either doorway without kneeling and shall not exceed in. at the step. A maximum of two steps are allowed to accommodate a raised aisle floor in the rear of the bus.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 6.5 Underbody Clearance
DEFAULT
The bus shall maintain the minimum clearance dimensions as defined and shown in Figure 2of SAE Standard J689, regardless of load up to the gross vehicle weight rating.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:
TS 6.6 Ramp Clearances
DEFAULT

REFER TO TABLE 2A.

The approach angle is the angle measured between a line tangent to the front tire static loaded radius arc and the initial point of structural interference forward of the front tire to the ground.

The departure angle is the angle measured between a line tangent to the rear tire static loaded radius arc and the initial point of structural interference rearward of the rear tire to the ground.

The breakover angle is the angle measured between two lines tangent to the front and rear tire static loaded radius and intersecting at a point on the underside of the vehicle that defines the largest ramp over which the vehicle can roll.

TABLE 2A
Default Breakover Angle

Angle	**30 to 40ft Bus**
Approach	8.6 deg. (min.)
Front breakover	8 deg. (min.)
Departure	8.6 deg. (min.)

Our specification being proposed for the section above (circle one below):

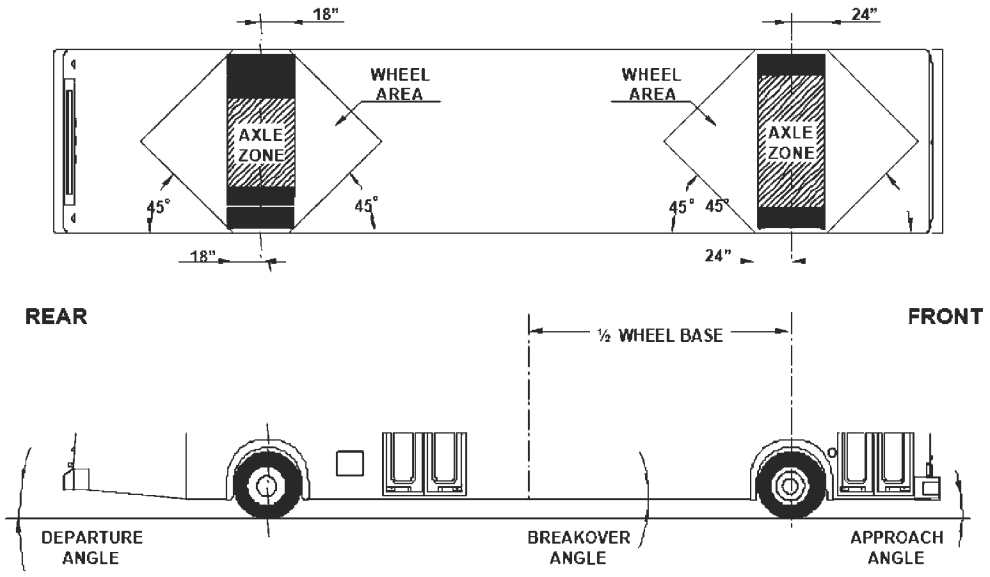
EXCEEDS MEETS DOES NOT MEET
Comment:

TS 6.7 Ground Clearance
DEFAULT
Ground clearance shall be no less than 9 in., (8 in. at jacking pad) except within the axle zone and wheel area.

Axle zone clearance, which is the projected area between tires and wheels on the same axial centerline, shall be no less than 5.4 in.

Wheel area clearance shall be no less than 8 in. for parts fixed to the bus body and 6 in. for parts that move vertically with the axles.

– **FIGURE 2**
Transit Bus Minimum Road Clearance



Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 6.8 Floor Height TS 6.8.1 Transit Coach
DEFAULT
The height of the step above the street shall be no more than 16 in. measured at the centerline of the front and rear doorway. All floor measurements shall be with the bus at the design running height and on a level surface and with the standard installed tires. A maximum of two steps are allowed to accommodate a raised aisle floor in the rear of the bus.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 6.9 Interior Headroom
DEFAULT

Headroom above the aisle and at the centerline of the aisle seats shall be no less than 78 in. in the forward half of the bus tapering to no less than 74 in. forward of the rear settee. At the centerline of the window seats, headroom shall be no lower than 65 in., except for parcel racks and reading lights, if specified. Headroom at the back of the rear bench seat may be reduced to a minimum of 56 in., but it shall increase to the ceiling height at the front of the seat cushion. In any area of the bus directly over the head of a seated passenger and positioned where a passenger entering or leaving the seat is prone to strike his or her head, padding shall be provided on the overhead paneling.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

VEHICLE PERFORMANCE
TS 7. Power Requirements
The propulsion system shall be sized to provide sufficient power to enable the bus to meet the defined acceleration, top speed and gradeability requirements, and operate all propulsion-driven accessories using actual road test results and computerized vehicle performance data.

TS 7.1 Top Speed
DEFAULT
The bus shall be capable of achieving a top speed of 65 mph on a straight, level road at GVWR with all accessories operating. The bus shall be capable of safely maintaining the vehicle speed according to the recommendations by the tire manufacturer.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 7.2 Gradeability
DEFAULT

Gradeability requirements shall be met on grades with a dry commercial asphalt or concrete pavement at GVWR with all accessories operating.

The propulsion system shall enable the bus to achieve and maintain a speed of 40 mph on a 2½ percent ascending grade and 15 mph on a 10 percent ascending grade continuous.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 7.3 Acceleration
TS 7.3.1 Non-Hybrid
DEFAULT
The acceleration shall meet the requirements in **Table 3** below and shall be sufficiently gradual and smooth to prevent throwing standing passengers off-balance. Acceleration measurement shall commence when the accelerator is depressed.

TABLE 3
Maximum Start Acceleration Times on a Level Surface[1]

Speed (mph)	**Maximum time (seconds)**
10	5
20	10
30	18
40	30
50	60
Top speed	

1. Vehicle weight = GVWR

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 7.3.2 Acceleration Hybrid
DEFAULT

The propulsion and braking systems shall meet the performance requirements of the Duty Cycle.

Braking application and performance shall remain consistent regardless of hybrid system state of charge (SOC) or other variances related to regenerative braking.

The system shall be programmable to allow optimization of acceleration and deceleration rate. Performance may be affected when reprogramming. The manufacturer shall supply the new performance data.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 7.4 Operating Range
The operating range of the coach shall be designed to meet the operating profile as stated in the "Design Operating Profile" section.

DEFAULT
TS 7.4.1 Diesel
The operating range of the coach when run on the FTA ABD Cycle shall be at least 350 miles (560 km) or 20 hours with full fuel capacity.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 7.4.2 CNG
DEFAULT
The operating range of the coach when run on the FTA ABD cycle shall be at least 350 miles or 20 hours with an initial gas-settled pressure of 3600 psi at 70°F.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 7.4.3 Hybrid
DEFAULT

The operating range of the coach when run on the design operating profile "Design Operating Profile" shall be at least 350 miles on a full tank of fuel.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 8. Fuel Economy (Design Operating Profile)
DEFAULT
Test results from the FTA ABD Cycle economy tests or other applicable test procedures shall be provided to the TRANSIT AGENCY. Results shall include vehicle configuration and test environment information. Fuel economy data shall be provided for each design operating profile. The design operating profile is assumed to be defined by the FTA ABD Cycle.

Fuel economy tests shall be run on these four duty cycles:

- Manhattan: 6.8 mph
- Orange County: 12.7 mph
- UDDS: 19 mph
- Idle time

The TRANSIT AGENCY will provide a percentage of each duty cycle that is representative of its service.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

POWERPLANT
TS 9. Engine
DEFAULT
The engine shall comply with applicable local, state and/or federal emissions and useful life requirements. The engine shall have a design life of not less than 300,000 miles without replacement or major service. The lifetime estimate is based on the design operating profile.

The engine shall be equipped with an electronically controlled management system, compatible with either 12 or 24 V power distribution. The engine control system shall be capable of transmitting and receiving electronic inputs and data from other drivetrain components and broadcasting that data to other vehicle systems. Communication between electronic drivetrain components and other vehicle systems shall be made using the communications networks. The engine's electronic management system shall monitor operating conditions and provide instantaneous adjustments to optimize both engine and bus performance. The system shall be programmable to allow optimization of programmable features.

The engine starting system shall be protected by an interlock that prevents its engagement when the engine is running. Special equipment or procedures may be employed to start the bus when exposed to temperatures less than 30 °F for a minimum of four hours without the engine in operation. All cold weather starting aids, engine heating devices and procedures shall be of the type recommended by the engine manufacturer and approved by the TRANSIT AGENCY. The integration of all systems on the vehicle relative to engine idle speed shall be the responsibility of the vehicle manufacturer to meet the requirements of the transit property.

The engine control system shall protect the engine against progressive damage. The system shall monitor conditions critical for safe operation and automatically derate power and/or speed and initiate engine shutdown as needed.

Automatic Engine Protection/Shutdown Override Feature
A control shall be available to the operator/driver that when constantly depressed and released will delay the engine shutdown or allow the bus to be moved. Override action shall be recorded. This data shall be retrievable by the TRANSIT AGENCY.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 9.1 Engine (CNG)
The engine shall meet all regulatory requirements when operating on fuel equal to CARB Specifications for Compressed Natural Gas #2292.5.The four predominant characteristics that must be met are methane, ethane, butane and propane.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 9.2 Propulsion System (Hybrid)

DEFAULT

TS 9.2.1 Propulsion System Description

The bus shall be powered by a hybrid propulsion system. Function and operation of the bus shall be transparent to the bus operator and passengers. The OEM shall ensure that the bus structure can successfully accept the installation of the propulsion system and be operated on the stated duty-cycle for a period of 12 years without a structural failure. At a minimum, the propulsion system shall comply with applicable local, state and/or federal emissions and useful life requirements. The propulsion system shall comply with local, state, and federal (maintenance) and other applicable sections.

The hybrid drive system shall be rated for the GVWR or greater of the bus.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***

Comment:

TS 9.2.2 Propulsion System Service

DEFAULT

The propulsion system shall be arranged so that accessibility for all routine maintenance is ensured. No special tools, other than dollies and hoists, shall be required to remove the
propulsion system or any subsystems. However, the TRANSIT AGENCY shall recognize that properly rated test equipment and safe electrical work practices are essential when servicing high-voltage hybrid components. The exhaust system, air cleaner, air compressor, starter (if used), alternator, radiator, all engine accessories, and any other component requiring service or replacement shall be easily removable. The Proposer shall provide all specialty tools and diagnostic equipment required for maintaining the propulsion system in accordance with the Special Tools List.

Primary Propulsion Unit and Traction Motor The propulsion system may be configured in a variety of methods dependent upon type of drive, series and/or parallel. The definition of motor in the context of this specification assumes that the device can provide or consume energy as well as provide or retard mechanical motion.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***

Comment:

TS 9.2.3 Energy Storage and Controller

DEFAULT

Design and performance shall be provided to the TRANSIT AGENCY. Energy storage shall be of a commercial design capable of operating in the TRANSIT AGENCY transit environment. The primary charging of the energy storage system shall be accomplished by the on-board hybrid system controller and regenerative braking.

Thermal management will be provided to ensure optimal life and performance of the ESS over the environmental operating range.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 9.2.4 Hybrid System Controller (HSC)
DEFAULT
The HSC regulates energy flow throughout hybrid system components in order to provide motive performance and accessory loads, as applicable, while maintaining critical system parameters (e.g., voltages, currents, temperatures, etc.) within specified operating ranges.

The controller shall monitor and process inputs and execute outputs as appropriate to control the operation of all propulsion system components.

Energy storage system SOC correction methods stated in SAE J2711 shall be utilized.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 9.2.5 Engine
The engine and related emission systems shall meet all applicable emissions and design/durability guidelines and standards.

The Proposer shall provide the TRANSIT AGENCY with expected durability of the engine and related emission systems.

NOTE: The TRANSIT AGENCY will provide desired fuel type.
DEFAULT
Cummins ISL 280 H.P. Diesel

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET

Standard Requirements for a Fast Idle Device
The engine shall be equipped with an operator-controlled fast idle device. The fast idle control shall be a two-way switch mounted on the dash or side console and shall activate only with the transmission in neutral and the parking brake applied.

TS 10. Cooling Systems
The cooling systems shall be of sufficient size to maintain all engine and transmission fluids and engine intake air at safe, continuous operating temperatures during the most severe operations possible and in accordance with engine and transmission manufacturers' cooling system requirements. The cooling system fan controls should sense the temperatures of the operating fluids and the intake air, and if either is above safe operating conditions, the cooling fan should be engaged. The fan control system shall be designed with a fail-safe mode of "fan on." The cooling system shall meet the requirements stated in the operating environment.

TS 10.1 Engine Cooling
A means of determining satisfactory engine coolant level shall be provided. A spring-loaded, push-button type valve or lever shall be provided to safely release pressure or vacuum in the cooling system with both it and the water filler no more than ±60 in. above the ground. Both shall be accessible through the same access door.

The cooling fan shall be temperature controlled, allowing the engine to reach operating temperature quickly.

DEFAULT
The radiator and charge air cooler shall be of durable, corrosion-resistant construction with non- removable tanks.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 10.1.1 Radiator Screen
DEFAULT
No screen in front of radiator

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 10.1.2 Coolant
DEFAULT
Coolant Filtration without Supplemental Additives
The engine cooling system shall be equipped with a properly sized water filter with a spin-on element. The filter shall not release or contain supplemental coolant additives.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 10.1.3 Drive Design
DEFAULT
Electric Fans
The bus shall be equipped with an electric fan drive bus cooling system. A screen guard must be installed on electric motor fans per SAE J1308.
Base Bus - EMP Gen IV MH4 Fan System
Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 10.1.4 Mounting
DEFAULT
Standard Mounting Design
Mounting location of radiator and charge air cooler shall be the Proposer's standard design.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:
TS 10.2 Charge Air Cooling
DEFAULT

The charge air cooling system, also referred to as after-coolers or inter-coolers, shall provide maximum air intake temperature reduction with minimal pressure loss. The charge air radiator shall be sized and positioned to meet engine manufacturer's requirements. The charge air radiator shall not be stacked ahead of or behind the engine radiator and shall be positioned as close to the engine as possible unless integrated with the radiator. Air ducting and fittings shall be protected against heat sources and shall be configured to minimize restrictions and maintain sealing integrity.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 10.3 Transmission Cooling
DEFAULT
The transmission shall be cooled by a dedicated heat exchanger sized to maintain operating fluid within the transmission manufacturer's recommended parameters of flow, pressure, and temperature. The transmission cooling system shall be matched to the retarder and engine cooling systems to ensure that all operating fluids remain within recommended temperature limits established by each component manufacturer. The engine cooling system should provide coolant bypass flow to the transmission cooling system with the engine thermostats closed.
Unless otherwise noted, the transmission cooler is to be the first component to see cold water from the radiator outlet. In addition, all return water piping, aside from the thermostat bypass line, is to be plumbed in after the transmission cooler.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 10.4 Hybrid Drive System Cooling
DEFAULT
The thermal management system shall maintain hybrid system components within design operating temperature limits.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:
TS 11. Transmission (Conventional Powertrain)

The transmission shall be multiple speed, automatic shift with torque converter, retarder, and electronic controls. Gross input power, gross input torque and rated input speed shall be compatible with the engine. The transmission shall be designed to operate for not less than 300,000 miles on the design operating profile without replacement or major service. The transmission should be easily removable without disturbing the engine and accessible for service.

The electronic controls shall be capable of transmitting and receiving electronic inputs and data from other drivetrain components and of broadcasting that data to other vehicle systems.
Communication between electronic drivetrain components and other vehicle systems shall be made using the communications networks. Electronic controls shall be compatible with either 12
or 24 V power distribution, provide consistent shift quality, and compensate for changing conditions, such as variations in vehicle weight and engine power. At a minimum, drivetrain components consisting of the engine, transmission, retarder, ASR, and anti-lock braking systems shall be powered by a dedicated and isolated ignition supply voltage to ensure data communication among components exists when the vehicle ignition is switched to the "on" position.

DEFAULT
Base Bus- Voith D864.5, or Latest Model

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

DEFAULT
A nominal brake pedal application of 6 to 10 psi shall be required by the driver to engage forward, or reverse range from the neutral position to prevent sudden acceleration of the bus from a parked position.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

DEFAULT
A brake pedal application of 6 to 10 psi shall be required by the driver to engage forward, or reverse range from the neutral position to prevent sudden acceleration of the bus from a parked position.

Our specification being proposed for the section above (circle one below):
EXCEEDS MEETS DOES NOT MEET
Comment:

DEFAULT
No Automatic Neutral Function
The transmission shall not incorporate an automatic neutral shift function.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 12. Retarder
DEFAULT
The powertrain shall be equipped with a retarder designed to extend brake lining service life. The application of the retarder shall cause a smooth blending of both retarder and service brake function and shall not activate the brake lights.

Actuation of ABS and/or automatic traction control (ATC) shall override the operation of the brake retarder.

Brake lights shall illuminate when the retarder is activated. Throttle Pedal Activation of the Retarder
The retarder shall become partially engaged (approximately one-third of its total application, with a resulting deceleration of no greater than 0.077g) when the throttle pedal is completely released. Maximum retarder shall be achieved when brake pedal is depressed prior to engagement of service brakes, with a maximum resulting deceleration of approximately 0.20g in an empty bus. The resulting decelerations specified include the effects of engine braking, wind resistance and rolling resistance.

The thermostatically controlled cooling fan shall be activated when the retarder is engaged, and the coolant temperature reaches the maximum operating temperature established by the engine and transmission manufacturers.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Standard Requirement for Retarder Activation
The retarder shall be adjustable within the limits of the powertrain and activated when the brake pedal is depressed. The TRANSIT AGENCY will work with the OEM/drive system manufacturer to determine retarder performance settings.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Accessible Retarder Disable Switch
The retarder disable switch shall be accessible to the seated driver.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 13. Mounting
DEFAULT
All power plant mounting shall be mechanically isolated to minimize transfer of vibration to the body structure and provide a minimum clearance of 0.75 in. Mounts shall control the movement of the power plant so as not to affect performance of belt-driven accessories or cause strain in piping and wiring connections to the power plant.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 13.1 Service
DEFAULT

The propulsion system shall be arranged for ease of access and maintenance. The Proposer shall list all special tools, fixtures or facility requirements recommended for servicing. The muffler, exhaust system, air cleaner, air compressor, starter, alternator, radiator, all accessories, and any other component requiring service or replacement shall be easily removable and independent of the engine and transmission removal. An engine oil pressure gauge and coolant temperature gauge shall be provided in the engine compartment. These gauges shall be easily read during service and mounted in an area where they shall not be damaged during minor or major repairs.

An air cleaner with a dry filter element and a graduated air filter restriction indicator shall be provided. The location of the air intake system shall be designed to minimize the entry of dust and debris and to maximize the life of the air filter. The engine air duct shall be designed to minimize the entry of water into the air intake system. Drainage provisions shall be included to allow any water/moisture to drain prior to entry into the air filter.

Engine oil and the radiator filler caps shall be hinged to the filler neck and closed with spring pressure or positive locks to prevent leakage. All fluid fill locations shall be properly labeled to help ensure that correct fluid is added. All fillers shall be easily accessible with standard funnels, pour spouts and automatic dispensing equipment. All lubricant sumps shall be fitted with magnetic-type drain plugs or magnets in pan.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
No engine bypass oil filter.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Engine Oil Pressure and Coolant Temperature Display
Engine oil pressure and coolant temperature gauges required in engine compartment.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 14. Hydraulic Systems
Hydraulic system service tasks shall be minimized and scheduled no more frequently than those of other major coach systems. All elements of the hydraulic system shall be easily accessible for service or unit replacement. Critical points in the hydraulic system shall be fitted with service ports so that portable diagnostic equipment may be connected or sensors for an off-board diagnostic system permanently attached to monitor system operation when applicable. A tamper- proof priority system shall prevent the loss of power steering during operation of the bus if other devices are also powered by the hydraulic system.

The hydraulic system shall operate within the allowable temperature range as specified by the lubricant manufacturer.

DEFAULT
No requirement for hydraulic system sensors.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 14.1 Fluid Lines
DEFAULT
All lines shall be rigidly supported to prevent chafing damage, Fatigue Failures, degradation, and tension strain. Lines should be sufficiently flexible to minimize mechanical loads on the components. Lines passing through a panel, frame or bulkhead shall be protected by grommets (or similar devices) that fit snugly to both the line and the perimeter of the hole that the line passes through to prevent chafing and wear. Pipes and fluid hoses shall not be bundled with or used to support electrical wire harnesses.

Lines shall be as short as practicable and shall be routed or shielded so that failure of a line shall not allow the contents to spray or drain onto any component operable above the auto-ignition temperature of the fluid.

All hoses, pipes, lines, and fittings shall be specified and installed per the manufacturer's recommendations.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 14.2 Fittings and Clamps
DEFAULT
All clamps shall always maintain a constant tension, expanding and contracting with the line in response to temperature changes and aging of the line material. The lines shall be designed for use in the environment where they are installed (for example, high-temperature resistant in the engine compartment, resistant to road salts near the road surface, and so on).

Compression fittings shall be standardized to prevent the intermixing of components. Compression fitting components from more than one manufacturer shall not be mixed, even if the components are known to be interchangeable.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 14.3 Charge Air Piping
DEFAULT
Charge air piping and fittings shall be designed to minimize air restrictions and leaks. Piping shall be as short as possible, and the number of bends shall be minimized. Bend radii shall be maximized to meet the pressure drop and temperature rise requirements of the engine manufacturer. The cross section of all charge air piping shall not be less than the cross section of the intake manifold inlet. Any changes in pipe diameter shall be gradual to ensure a smooth passage of air and to minimize restrictions. Piping shall be routed away from heat sources as practicable and shielded as required to meet the temperature rise requirements of the engine manufacturer.

Charge air piping shall be constructed of stainless steel, aluminized steel, anodized aluminum, or painted steel rated at minimum 1000 hours of salt spray according to ASTM B117, except between the air filter and turbocharger inlet, where piping may be constructed of flexible heat- resistant material. Connections between all charge air piping sections shall be sealed with a short section of reinforced hose and secured with stainless steel constant tension clamps that provide a complete 360deg seal.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 15. Radiator
DEFAULT
Radiator piping shall be stainless steel, brass tubing or painted steel rated at 1000 hours of salt spray according to ASTM B117 and where practicable, hoses shall be eliminated, including biodiesel. Necessary hoses shall be impervious to all bus fluids. All hoses shall be secured with stainless steel clamps that provide a complete 360deg seal. The clamps shall always maintain a constant tension, expanding and contracting with the hose in response to temperature changes and aging of the hose material.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 16. Oil and Hydraulic Lines
DEFAULT
Oil and hydraulic lines shall be compatible with the substances they carry. The lines shall be designed and intended for use in the environment where they are installed (for example, high- temperature resistant in the engine compartment, resistant to road salts near the road surface and so on). Lines within the engine compartment shall be composed of steel tubing where practicable, except in locations where flexible lines are required.

Hydraulic lines of the same size and with the same fittings as those on other piping systems of the bus, but not interchangeable, shall be tagged or marked for use on the hydraulic system only.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 17. Fuel
TRANSIT AGENCY to specify fuel type.

TS 17.1 Fuel Lines
DEFAULT

Fuel lines shall be securely mounted, braced, and supported as designed by the bus manufacturer to minimize vibration and chafing and shall be protected against damage, corrosion, or breakage due to strain or wear.

Manifolds connecting fuel containers shall be designed and fabricated to minimize vibration and shall be installed in protected locations to prevent line or manifold damage from unsecured objects or road debris.

Fuel hose and hose connections, where permitted, shall be made from materials resistant to corrosion and fuel and protected from fretting and high heat. Fuel hoses shall be accessible for ease of serviceability.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 17.1.1 Fuel Lines, Diesel
DEFAULT
TRANSIT AGENCY to specify fuel type.
Fuel lines shall be capable of carrying the type of fuel specified by the TRANSIT AGENCY (i.e., up to B20 type fuel).

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 17.1.2 Fuel Lines, CNG
DEFAULT
Fuel lines shall comply with NFPA-52. All tubing shall be a minimum of seamless Type 304 stainless steel (ASTM A269 or equivalent).Fuel lines and fittings shall not be fabricated from cast iron, galvanized pipe, aluminum, plastic or copper alloy with content exceeding 70 percent copper. Pipe fittings and hoses shall be clear and free from cuttings, burrs or scale. Pipe thread joining material that is impervious to CNG shall be utilized as required. Fuel lines shall be identifiable as fuel lines only.

High-pressure CNG lines shall be pressure tested to a minimum of 125 percent of system working pressure prior to fueling. CNG, nitrogen or clean, dry air shall be used to pressure-test the lines/assembly. The bus manufacturer shall have a documented procedure for testing the high-pressure line assembly.

Fuel lines shall be securely mounted, braced and supported using "split-block" type or stainless-steel P clamps; all mounting clamps shall be mounted to a rigid structure to minimize vibration and shall be protected against damage, corrosion, or breakage due to strain, rubbing or wear. "Floating clamps" (not mounted to a rigid structure) shall not be permitted. Fuel lines shall not be used to secure other components (wires, air lines, etc.).

Manifolds connecting fuel containers shall be designed and fabricated to minimize vibration and shall be installed in protected location(s) to prevent line or manifold damage from unsecured objects or road debris.

Fuel hose connections, where permitted, shall be less than 48 in. in length, made from materials resistant to corrosion and action of natural gas, and protected from fretting and high heat and shall be supported approximately every 12 in.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 17.2 Design and Construction
TS 17.2.1 Design and Construction, Diesel Fuel Tank(s)
DEFAULT
The fuel tank(s) shall be made of corrosion-resistant steel.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

Installation
DEFAULT
The fuel tank(s) shall be securely mounted to the bus to prevent movement during bus maneuvers.

The fuel tank(s) shall be equipped with an external, hex head, drain plug. It shall be at least a ⅜in. size and shall be located at the lowest point of the tank(s). The fuel tank(s) shall have an inspection plate or easily removable filler neck to permit cleaning and inspection of the tank(s) without removal from the bus. The tank(s) shall be baffled internally to prevent fuel-sloshing regardless of fill level. The baffles or fuel pickup location shall assure continuous full power operation on a 6 percent upgrade for 15 minutes starting with no more than 25 gal of fuel over the unusable amount in the tank(s).The bus shall operate at idle on a 6 percent downgrade for 30 minutes starting with no more than 10 gal of fuel over the unusable amount in the tank(s).

The materials used in mounting shall withstand the adverse effects of road salts, fuel oils and accumulation of ice and snow for the life of the bus.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

Labeling
DEFAULT
The capacity, date of manufacture, manufacturer name, location of manufacture, and certification of compliance to federal motor carrier safety regulations shall be permanently marked on the fuel tank(s). The markings shall be readily visible and shall not be covered with an undercoating material.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

Fuel Filler
DEFAULT
The fuel filler shall be located 7 to 32ft behind the centerline of the front door on the curbside of the bus. The filler cap shall be retained to prevent loss and shall be recessed into the body so that spilled fuel will not run onto the outside surface of the bus.

The fuel lines forward of the engine bulkhead shall be in conformance to SAE Standards.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:
DEFAULT
OEM to designate height of fuel filler.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Dry-Break Fuel Filler
The fuel filler shall accommodate a nozzle that forms a locked and sealed connection during the refueling process to eliminate spills. Fuel shall not be allowed to flow into the tank unless the nozzle has been properly coupled, locked, and sealed to the filler. With the nozzle open, fuel shall enter the tank at a fill rate of not less than 40 gal per minute of foam-free fuel without causing the nozzle to shut off before the tank is full. The nozzle shall automatically shut off when the tank is essentially full. Once disconnected, fuel shall not be allowed to flow through the nozzle at any time. Any pressure over 3 psi shall be relieved from the fuel tank automatically. An audible signal shall indicate when the tank is essentially full. The dry break system shall be compatible with the TRANSIT AGENCY's system. The fuel filler cap shall be hinged.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 17.2.2 Design and Construction, CNG
Fuel Containers/Cylinders
CNG fuel containers/cylinders must be designed, constructed, manufactured, and tested in accordance with at least one of the following:

- NFPA 52-Standard for Compressed Natural Gas (CNG) Vehicular Fuel Systems
- FMVSS 304
- Any local standard(s) specifically intended for CNG fuel containers.

The design and construction of the fuel system supplied by the OEM shall comply with federal and local regulations.

Installation
Fuel cylinders shall be installed in accordance with ANSI/IAS NGV2 - 1998, "Basic Requirements for Compressed Natural Gas Vehicles (NGV) Fuel Containers" and NFPA 52, "Compressed Natural Gas (CNG) Vehicular Fuel Systems Code," 1998 edition, Section 303.In the case of a low-floor transit bus, the placement of tanks shall be limited to the roof of the vehicle or in the compartment above the engine of the vehicle.

Fuel cylinders, attached valves, pressure relief devices, and mounting brackets should be installed and protected so that their operation is not affected by bus washers and environmental agents such as rain, snow, ice, or mud. These components should be protected from significant damage caused by road debris or collision.

The roof and area above the engine mounted tanks shall be contained within a skeletal structure resembling a roll cage and contained within an enclosure. The enclosure shall incorporate a hinged clamshell type access. The access panels shall be designed to offer protection from weather and to be sacrificial as a means of providing an escape path to atmosphere upon rapid enclosure pressure rise. The latching method shall utilize quick-release captive hardware that can be demonstrated to last the life of the bus. Additional shielding shall be provided surrounding end fittings and valves as needed. Shields shall be attached to the bus structure hinged in a manner that permits one mechanic to unlatch and swing the shield open for routine inspections. As practical, electrical components shall not be located within the roof enclosure, and if unavoidable, they shall be intrinsically safe.

CNG fueled buses shall be equipped with an active automatic gas detection system, which shall annunciate unsafe levels of methane. The automatic gas detection system shall be integrated with an onboard fire suppression system.

DEFAULT
The access panels shall not be interlocked.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

Labeling
DEFAULT
CNG fuel systems shall be labeled in accordance with NFPA 52, "Compressed Natural Gas (CNG) Vehicular Fuel Systems Code," 1998 edition.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

Pressure Relief Devices (PRDs)
DEFAULT

PRDs must be designed, constructed, manufactured, and tested in accordance with ANIS/IAS PRD1 - 1998, "Pressure Relief Devices for Natural Gas Vehicle (NGV) Fuel Containers" and ANSI/IAS NGV2-1998, "Basic Requirements for Compressed Natural Gas Vehicle (NGV) Fuel Containers." All natural gas fuel system piping, including the PRD vent line, shall be stainless steel. All PRDs must be vented to outside.

Valves
Valves must be installed in accordance with ANIS/IAS NGV2 - 1998, "Basic Requirements for Compressed Natural Gas Vehicle (NGV) Fuel Containers" and NFPA 52, "Standard for Compressed Natural Gas (CNG) Vehicular Fuel Systems."

Fuel Filler
The fuel filler shall be located 7 to 38 ft. (on a 30, 35 and 40ft coach) behind the centerline of the front door on a side determined by the TRANSIT AGENCY. The filler cap shall be retained to prevent loss and shall be recessed into the body.

The fill and vent receptacles shall be located within an enclosure on the right side of the bus. The access door shall be sized to allow full viewing of gauges, ease of hookups and maneuver of fuel nozzle.

The fuel fill receptacle and vent receptacle attachment shall be robust and capable of routine fueling connects/disconnects without deflection or metal fatigue, and capable of withstanding mechanical loads induced by a fueling drive-away incident without attachment failure.

No static ground plug shall be installed.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

Fueling System
DEFAULT
The CNG fueling port receptacle shall be an ANSI/AGA NGV1 or NGV2 certified receptacle as designated by the TRANSIT AGENCY. The coach shall be capable of being fueled by a nozzle determined by the TRANSIT AGENCY. The fueling port receptacle location shall be such that connection by fueling personnel can be performed without physical strain or interference. A dust cap shall be permanently "tethered" to the fueling port receptacle. The fueling port receptacle access door shall be equipped with an interlock sensor that disables the engine starting system when the access door is open, to prevent drive-aways. The interlock shall be of the type such that if the sensor fails, the coach will not start.

Fueling site characteristics such as pressure, flow rate and temperature shall be provided by the TRANSIT AGENCY.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET

Comment:

Defueling System
The CNG defueling port shall be an NGV-3.1/CGA-12.3 certified receptacle. The CNG defueling port shall be located on the curbside of the coach, in a location that is compatible with the TRANSIT AGENCY's defueling station operation. The defueling system shall incorporate the following characteristics:

Dust cap permanently "tethered" to the defueling port.
Device(s) to prevent inadvertent defueling. Specifications to be provided by TRANSIT AGENCY.
Components compatible with TRANSIT AGENCY's defueling operation.
The piping and fittings onboard the bus shall be sized to allow the fueling station to meet the following operating parameters:

DEFAULT
Fuel system shall be sized to allow a bus with 20,000 scf on board to defuel within 2.5 hours.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 18. Emissions and Exhaust
TS 18.1 Exhaust Emissions
The engine and related systems shall meet all applicable emission and engine design guidelines and standards.

TS 18.2 Exhaust System
The exhaust pipe shall be of sufficient height to prevent exhaust gases and waste heat from discoloring or causing heat deformation to the bus. The entire exhaust system shall be adequately shielded to prevent heat damage to any bus component, including the exhaust after treatment compartment area. The exhaust outlet shall be designed to minimize rain, snow or water generated from high-pressure washing systems from entering into the exhaust pipe and causing damage to the after treatment.

DEFAULT
Exhaust gases and waste heat shall be discharged from the roadside rear corner of the roof.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 18.3 Exhaust After treatment
An exhaust after treatment system will be provided to ensure compliance to all applicable EPA regulations in effect.

Diesel Exhaust Fluid Injection
DEFAULT
If required by the engine manufacturer to meet NOx level requirements specified by EPA, a DEF injection system will be provided. The DEF system will minimally include a tank, an injector, a pump, an ECM, and a selective catalytic converter. The tanks shall be designed to store DEF in the operating environment described in the "Operating Environment" section.

The DEF filler shall accommodate a standard nozzle. The nozzle shall automatically shut off when the tank is essentially full. The DEF filler cap shall be a screw-on cap and located curbside.

The DEF fluid lines shall be designed to prevent the DEF from freezing. The DEF injection system shall not be damaged from a cold soak at 10 °F.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 18.4 Particulate After treatment
DEFAULT
If required by the engine manufacturer to meet particulate level requirements specified by EPA, a particulate trap will be provided. The particulate trap shall regenerate itself automatically if it senses clogging. Regeneration cycles and conditions will be defined by the engine manufacturer.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

STRUCTURE
TS 19. General
TS 19.1 Design
DEFAULT

The structure of the bus shall be designed to withstand the transit service conditions typical of an urban or intercity duty cycle throughout its service life. The vehicle structural frame shall be designed to operate with minimal maintenance throughout the 12-year design operating profile. The design operating profile specified by the TRANSIT AGENCY shall be considered for this purpose.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 20. Altoona Testing
Prior to acceptance of first bus, the vehicle must have completed any FTA-required Altoona testing. Any items that require repeated repairs or replacement must undergo the corrective action with supporting test and analysis. A report clearly describing and explaining the failures and corrective actions taken to ensure that any and all such failures will not occur shall be submitted to the TRANSIT AGENCY.

DEFAULT
If available, the Altoona Test Report shall be provided to the TRANSIT AGENCY with the Proposal submittal. If not available, then the report shall be provided prior to first acceptance of bus.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 20.1 Structural Validation
DEFAULT
Baseline Structural Analysis
The structure of the bus shall have undergone appropriate structural testing and/or analysis. At minimum, appropriate structural testing and analysis shall include Altoona testing or finite element analysis (FEA).

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Frame Material
3CR12 Stainless Steel

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

Distortion
DEFAULT
The bus, loaded to GVWR and under static conditions, shall not exhibit deflection or deformation that impairs the operation of the steering mechanism, doors, windows, passenger escape mechanisms or service doors. Static conditions shall include the vehicle at rest with any one wheel or dual set of wheels on a 6 in. curb or in a 6 in. deep hole.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 21. Resonance and Vibration
DEFAULT
All structure, body, and panel-bending mode frequencies, including vertical, lateral, and torsional modes, shall be sufficiently removed from all primary excitation frequencies to minimize audible, visible, or sensible resonant vibrations during normal service.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 21.1 Engine Compartment Bulkheads
DEFAULT

The passenger and engine compartment shall be separated by fire-resistant bulkheads. The engine compartment shall include areas where the engine and exhaust system are housed. This bulkhead shall preclude or retard propagation of an engine compartment fire into the passenger compartment and shall be in accordance with the Recommended Fire Safety Practices defined in FTA Docket 90A, dated October 20, 1993. Only necessary openings shall be allowed in the bulkhead, and these shall be fire-resistant. Any passageways for the climate control system air shall be separated from the engine compartment by fire-resistant material. Piping through the bulkhead shall have fire-resistant fittings sealed at the bulkhead. Wiring may pass through the bulkhead only if connectors or other means are provided to prevent or retard fire propagation through the bulkhead. Engine access panels in the bulkhead shall be fabricated of fire-resistant material and secured with fire-resistant fasteners. These panels, their fasteners and the bulkhead shall be constructed and reinforced to minimize warping of the panels during a fire that will compromise the integrity of the bulkhead.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 21.2 Crashworthiness
The bus body and roof structure shall withstand a static load equal to 150 percent of the curb weight evenly distributed on the roof with no more than a 6 in. reduction in any interior dimension. Windows shall remain in place and shall not open under such a load. These requirements must be met without the roof-mounted equipment installed.

The bus shall withstand a 25-mph impact by a 4000lb automobile at any side, excluding doorways, along either side of the bus with no more than 3 in. of permanent structural deformation at seated passenger hip height. This impact shall not result in sharp edges or protrusions in the bus interior.

Exterior panels below 35 in. from ground level shall withstand a static load of 2000 lbs. applied perpendicular to the bus by a pad no larger than 5 sq. in. This load shall not result in deformation that prevents installation of new exterior panels to restore the original appearance of the bus.

DEFAULT
Side Impact Barriers

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 22. Corrosion
The bus flooring, sides, roof, understructure, and axle suspension components shall be designed to resist corrosion or deterioration from atmospheric conditions and de-icing materials for a period of 12 years or 500,000 miles, whichever comes first. It shall maintain structural integrity and nearly maintain original appearance throughout its service life, with the TRANSIT AGENCY's use of proper cleaning and neutralizing agents.

All materials that are not inherently corrosion resistant shall be protected with corrosion-resistant coatings. All joints and connections of dissimilar metals shall be corrosion resistant and shall be protected from galvanic corrosion. Representative samples of all materials and connections shall withstand a two-week (336-hour) salt spray test in accordance with ASTM Procedure B-117 with no structural detrimental effects to normally visible surfaces and no weight loss of over 1 percent.

DEFAULT
Corrosion-Resistance Requirements
All exposed surfaces and the interior surfaces of tubing and other enclosed members below the lower window line shall be corrosion resistant through application of a corrosion protection system.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 23. Towing
Each towing device shall withstand, without permanent deformation, tension loads up to 1.2 times the curb weight of the bus within 20 deg. of the longitudinal axis of the bus. If applicable, the rear towing device(s) shall not provide a toehold for unauthorized riders. The method of attaching the towing device shall not require the removal, or disconnection, of front suspension or steering components. Removal of the bike rack is permitted for attachment of towing devices.

DEFAULT
Shop air connectors shall be provided at the front and rear of the bus and shall be capable of supplying all pneumatic systems of the bus with externally sourced compressed air. The location of these shop air connectors shall facilitate towing operations.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
No Provision of Glad-Hand Type Connectors for Towing
No glad-hand type connector shall be provided.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Lifted (Supported) Front Axle and Flat Towing Capability
The front towing devices shall allow attachment of adapters for a rigid tow bar and shall permit the lifting of the bus until the front wheels are clear off the ground in order to position the bus on the towing equipment by the front wheels. These devices shall also permit common flat towing.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 24. Jacking
It shall be possible to safely jack up the bus, at curb weight, with a common 10-ton floor jack with or without special adapter, when a tire or dual set is completely flat and the bus is on a level, hard surface, without crawling under any portion of the bus. Jacking from a single point shall permit raising the bus sufficiently high to remove and reinstall a wheel and tire assembly. Jacking pads located on the axle or suspension near the wheels shall permit easy and safe jacking with the flat tire or dual set on a 6 in. high run-up block not wider than a single tire. The bus shall withstand such jacking at any one or any combination of wheel locations without permanent deformation or damage.

DEFAULT
Yellow Pads
Jacking pads shall be painted safety yellow.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 25. Hoisting
DEFAULT
The bus axles or jacking plates shall accommodate the lifting pads of a two-post hoist system. Jacking plates, if used as hoisting pads, shall be designed to prevent the bus from falling off the hoist. Other pads or the bus structure shall support the bus on jack stands independent of the hoist.

The vehicle shall be capable of lifting by the wheels, and, as necessary to meet tire load requirements, the proper number for wheel lifts and/or adapters must be used.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 26. Floor
TS 26.1 Design
The floor shall be essentially a continuous plane, except at the wheel housings and platforms. Where the floor meets the walls of the bus, as well as other vertical surfaces such as platform risers, the surface edges shall be blended with a circular section of radius not less than ¼ in. or installed in a fully sealed butt joint. Similarly, a molding or cover shall prevent debris accumulation between the floor and wheel housings. The vehicle floor in the entrance and exit doors shall have a lateral slope not exceeding 2degto allow for drainage.
DEFAULT
Bi-Level Floor Design
The floor design shall consist of two levels (bi-level construction). Aft of the rear door extending to the rear settee riser, the floor height may be raised to a height no more than 21 in. above the lower level, with equally spaced steps. An increase slope shall be allowed on the upper level, not to exceed 3.5 deg. off the horizontal.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 26.2 Strength
DEFAULT

The floor deck may be integral with the basic structure or mounted on the structure securely to prevent chafing or horizontal movement and designed to last the life of the bus. Sheet metal screws shall not be used to retain the floor, and all floor fasteners shall be serviceable from one side only. Any adhesives, bolts or screws used to secure the floor to the structure shall last and remain effective throughout the life of the coach. Tapping plates, if used for the floor fasteners, shall be no less than the same thickness as a standard nut, and all floor fasteners shall be secured and protected from corrosion for the service life of the bus.

The floor deck shall be reinforced as needed to support passenger loads. At GVWR, the floor shall have an elastic deflection of no more than 0.60 in. from the normal plane. The floor shall withstand the application of 2.5 times gross load weight without permanent detrimental deformation. The floor, with coverings applied, shall withstand a static load of at least 150 lbs. applied through the flat end of a ½ in. diameter rod, with 1/32 in. radius, without permanent visible deformation.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 26.3 Construction
The floor shall consist of the subfloor and the floor covering that will last the life of the bus. The floor as assembled, including the sealer, attachments and covering, shall be waterproof, non- hygroscopic and resistant to mold growth. The subfloor shall be resistant to the effects of moisture, including decay (dry rot). It shall be impervious to wood-destroying insects such as termites.

DEFAULT
Pressure-Preserved Plywood Panel
Plywood shall be certified at the time of manufacturing by an industry-approved third-party inspection TRANSIT AGENCY such as APA – The Engineered Wood Association (formerly the American Plywood Association).Plywood shall be of a thickness adequate to support design loads, manufactured with exterior glue, satisfy the requirements of a Group I Western panel as defined in PS 1-95 (Voluntary Product Standard PS 1-95, "Construction and Industrial Plywood") and be of a grade that is manufactured with a solid face and back. Plywood shall be installed with the highest-grade, veneer side up. Plywood shall be pressure-treated with a preservative chemical and process such as alkaline copper quaternary (ACQ) that prevents decay and damage by insects. Preservative treatments shall utilize no EPA-listed hazardous chemicals. The concentration of preservative chemicals shall be equal to or greater than required for an above ground level application. Treated plywood will be certified for preservative penetration and retention by a third-party inspection TRANSIT AGENCY. Pressure-preservative treated plywood shall have a moisture content at or below 15 percent.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 27. Platforms

TS 27.1 Driver's Area
The covering of platform surfaces and risers, except where otherwise indicated, shall be the same material as specified for floor covering. Trim shall be provided along top edges of platforms unless integral nosing is provided.

DEFAULT
No specific trim material specified.

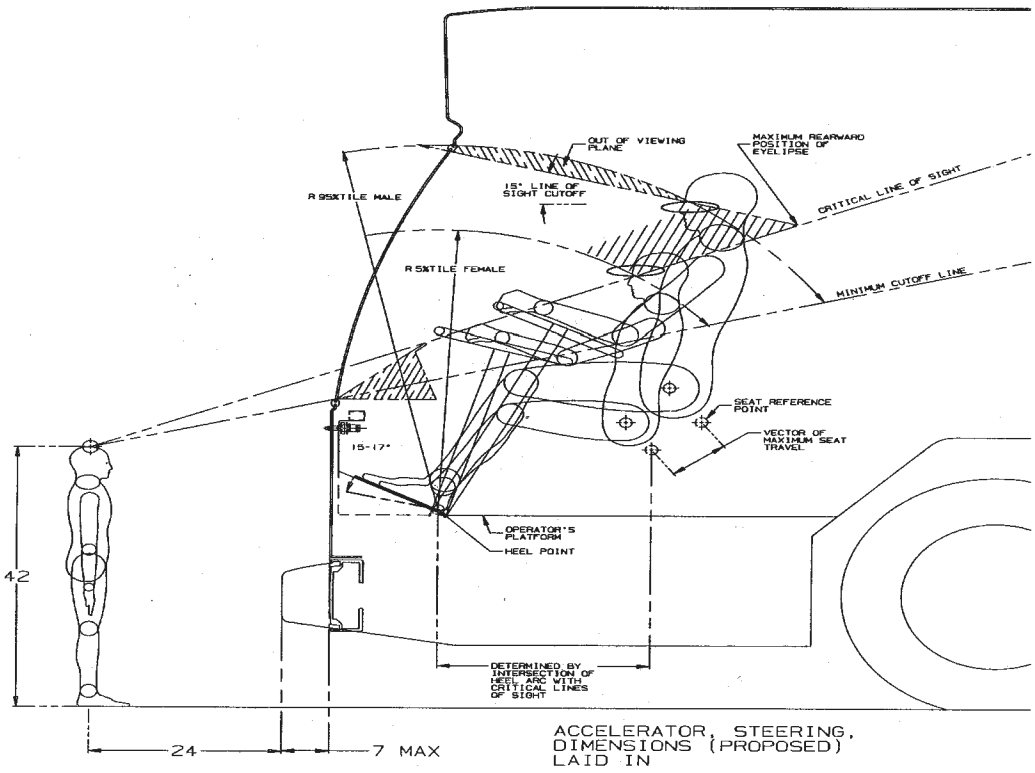
Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 27.2 Driver's Platform
DEFAULT
The driver's platform shall be of a height such that, in a seated position, the driver can see an object located at an elevation of 42 in. above the road surface, 24 in. from the leading edge of the bumper. Notwithstanding this requirement, the platform height shall not position the driver such that the driver's vertical upward view is less than 15 deg. A warning decal or sign shall be provided to alert the driver to the change in floor level.

Figure 2illustrates a means by which the platform height can be determined, using the critical line of sight.

FIGURE 2
Determining Platform Height



Our specification being proposed for the section above (circle one below)

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 27.3 Farebox
Farebox placement should minimize impact to passenger access and minimize interference with the driver's line of sight.

DEFAULT
Driver Interface Required; Platform Needed to Bring Height to Driver Access
If the driver's platform is higher than 12 in., then the farebox is to be mounted on a platform of suitable height to provide accessibility for the driver without compromising passengers' access. Base Bus- Prewire to TRANSIT AGENCY specifications

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET

Comment:

TS 27.4 Rear Step Area to Rear Area
DEFAULT
If the vehicle is of a bi-level floor design, then a rear step area shall be provided along the center aisle of the bus to facilitate passenger traffic between the upper and lower floor levels. This step area shall be cut into the rear platform and shall be approximately the aisle width, a minimum 12 in. deep and approximately half the height of the upper level relative to the lower level. The horizontal surface of this platform shall be covered with skid-resistant material with a visually contrasting nosing and shall be sloped slightly for drainage. A warning decal or sign shall be provided at the immediate platform area to alert passengers to the change in floor level.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 28. Wheel Housing
TS 28.1 Design and Construction
DEFAULT
Sufficient clearance and air circulation shall be provided around the tires, wheels, and brakes to preclude overheating when the bus is operating on the design operating profile. Wheel housings shall be constructed of corrosion-resistant and fire-resistant material.

Wheel housings, as installed and trimmed, shall withstand impacts of a 2in. steel ball with at least 200 ft-lbs. of energy without penetration.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 28.2 Design and Construction

Interference between the tires and any portion of the bus shall not be possible in maneuvers up to the limit of tire adhesion with weights from curb weight to GVWR. Wheel housings shall be adequately reinforced where seat pedestals are installed. Wheel housings shall have sufficient sound insulation to minimize tire and road noise and meet all noise requirements of this specification.

Design and construction of front wheel housings shall allow for the installation of a radio or electronic equipment storage compartment on the interior top surface, or its use as a luggage rack.

The finish of the front wheel housings shall be scratch-resistant and complement interior finishes of the bus to minimize the visual impact of the wheel housing. If fiberglass wheel housings are provided, then they shall be color-impregnated to match interior finishes. The lower portion extending to approximately 10 to 12 in. above the floor shall be equipped with scuff-resistant coating or stainless-steel trim.

Wheel housings not equipped with seats or equipment enclosure shall have a horizontal assist mounted on the top portion of the housing no more than 4 in. higher than the wheel well housing.

DEFAULT
No provision shall be made to chain buses.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 28.3 Bellows
Replacement fabric type bellows with draft-free, no-sag bottom closure and water drains shall be provided between the lead and trailing sections to seal the bus interior and keep it free of water, dirt, and drafts. Bellows hardware shall be corrosion resistant, and the under-floor area of the bellows shall be easy to clean when necessary. The passageway between the lead unit and trailing unit shall have an inside cross section that is as nearly equal as possible to the inside cross section of the bus bodies, with no tripping or pinching hazards created by the turntable cross section or closeouts. The bellows shall be durable, and its supporting structure and stiffeners shall support the bellows material in a neat, sag-free manner. The Proposer shall supply information on the actual service life achieved by the type of bellows being proposed. A sample of the bellows and attaching hardware may be requested for evaluation at the TRANSIT AGENCY's option. Bellows shall be approved by the TRANSIT AGENCY.

DEFAULT
No bellows liner required.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

CHASSIS
TS 29. Suspension
TS 29.1 General Requirements
DEFAULT
The front, rear and mid suspensions shall be pneumatic type. The basic suspension system shall last the service life of the bus without major overhaul or replacement. Adjustment points shall be minimized and shall not be subject to a loss of adjustment in service. Routine adjustments shall be easily accomplished by limiting the removal or disconnecting the components.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 29.2 Alignment
DEFAULT
All axles should be properly aligned so the vehicle tracks accurately within the size and geometry of the vehicle.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 29.3 Springs and Shock Absorbers
TS 29.3.1 Suspension Travel
DEFAULT

The suspension system shall permit a minimum wheel travel of 2.75 in. jounce-upward travel of a wheel when the bus hits a bump (higher than street surface), and 2.75 in. rebound-downward travel when the bus comes off a bump and the wheels fall relative to the body. Elastomeric bumpers shall be provided at the limit of jounce travel. Rebound travel may be limited by elastomeric bumpers or hydraulically within the shock absorbers. Suspensions shall incorporate appropriate devices for automatic height control so that regardless of load the bus height relative to the centerline of the wheels does not change more than ½ in. at any point from the height required. The safe operation of a bus cannot be impacted by ride height up to 1 in. from design normal ride height.
Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 29.3.2 Damping
DEFAULT
Vertical damping of the suspension system shall be accomplished by hydraulic shock absorbers mounted to the suspension arms or axles and attached to an appropriate location on the chassis. Damping shall be sufficient to control coach motion to three cycles or less after hitting road perturbations. The shock absorber bushing shall be made of elastomeric material that will last the life of the shock absorber. The damper shall incorporate a secondary hydraulic rebound stop.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 29.3.3 Lubrication
DEFAULT
Standard Grease Fittings
All elements of steering, suspension and drive systems requiring scheduled lubrication shall be provided with grease fittings conforming to SAE Standard J534.These fittings shall be located for ease of inspection and shall be accessible with a standard grease gun from a pit or with the bus on a hoist. Each element requiring lubrication shall have its own grease fitting with a relief path. The lubricant specified shall be standard for all elements on the bus serviced by standard fittings and shall be required no less than every 6000 miles.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 29.3.4 Kneeling
DEFAULT
A kneeling system shall lower the entrance(s) of the bus a minimum of 2 in. during loading or unloading operations regardless of load up to GVWR, measured at the longitudinal centerline of the entrance door(s) by the driver. The kneeling control shall provide the following functions:
Downward control must be held to allow downward kneeling movement.
Release of the control during downward movement must completely stop the lowering motion and hold the height of the bus at that position.
Upward control actuation must allow the bus to return to normal floor height without the driver having to hold the control.

The brake and throttle interlock shall prevent movement when the bus is kneeled. The kneeling control shall be disabled when the bus is in motion. The bus shall kneel at a maximum rate of
1.25 in. per second at essentially a constant rate. After kneeling, the bus shall rise within 4 seconds to a height permitting the bus to resume service and shall rise to the correct operating height within 7 seconds regardless of load up to GVWR. During the lowering and raising operation, the maximum vertical acceleration shall not exceed 0.2g, and the jerk shall not exceed 0.3g/second.
An indicator visible to the driver shall be illuminated until the bus is raised to a height adequate for safe street travel. An audible warning alarm will sound simultaneously with the operation of the kneeler to alert passengers and bystanders. A warning light mounted near the curbside of the front door, a minimum 2.5 in. diameter amber lens, shall be provided that will blink when the kneel feature is activated. Kneeling shall not be operational while the wheelchair ramp is deployed or in operation.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 30. Wheels and Tires
TS 30.1 Wheels
All wheels shall be interchangeable except for the middle axle of an artic where a super single tire size is used and shall be removable without a puller. Wheels shall be compatible with tires in size and load-carrying capacity. Front wheels and tires shall be balanced as an assembly per SAE J1986.

DEFAULT
Base Bus- Alcoa Dura Bright EVO Full Polished

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
No tire-pressure monitoring system.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Standard non-locking lug nut.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 30.2 Tires
Tires shall be suitable for the conditions of transit service and sustained operation at the maximum speed capability of the bus. Load on any tire at GVWR shall not exceed the tire supplier's rating.

Sufficient space shall be provided to allow the TRANSIT AGENCY to carry a spare tire, if required.

DEFAULT
TRANSIT AGENCY specified standard size tires.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 31. Steering
DEFAULT

Hydraulically assisted steering shall be provided. The steering gear shall be an integral type with the number and length of flexible lines minimized or eliminated. Engine-driven hydraulic pump shall be provided for power steering.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 31.1 Steering Axle
DEFAULT
Solid Beam Axle and Grease-Type Front Bearings and Seals
The front axle shall be solid beam, non-driving with a load rating sufficient for the bus loaded to GVWR and shall be equipped with grease type front wheel bearings and seals.
Base Bus- Arvin Meritor

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

DEFAULT
Oiled-Type Front Bearings
The front axle shall be non-driving with a load rating sufficient for the bus loaded to GVWR and shall be equipped with sealed, oiled-type front wheel bearings.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 31.2 Steering Wheel
TS 31.2.1 Turning Effort
DEFAULT
Steering effort shall be measured with the bus at GVWR, stopped with the brakes released and the engine at normal idling speed on clean, dry, level, commercial asphalt pavement and the tires inflated to recommended pressure.

Under these conditions, the torque required to turn the steering wheel 10 deg. shall be no less than 5 ft.-lbs. and no more than 10 ft.-lbs. Steering torque may increase to 70 ft.-lbs. when the wheels are approaching the steering stops, as the relief valve activates.

Power steering failure shall not result in loss of steering control. With the bus in operation, the steering effort shall not exceed 55 lbs. at the steering wheel rim, and perceived free play in the steering system shall not materially increase as a result of power assist failure. Gearing shall require no more than seven turns of the steering wheel lock-to-lock.

Caster angle shall be selected to provide a tendency for the return of the front wheels to the straight position with minimal assistance from the driver.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 31.2.2 Steering Wheel, General
DEFAULT
The steering wheel diameter shall be approximately 18 to 20 in.; the rim diameter shall be ⅞ to 1¼ in. and shaped for firm grip with comfort for long periods of time.

Steering wheel spokes and wheel thickness shall ensure visibility of the dashboard so that vital instrumentation is clearly visible at center neutral position (within the range of a 95th-percentile male, as described in SAE 1050a, Sections 4.2.2 and 4.2.3). Placement of steering column must be as far forward as possible, but either in line with or behind the instrument cluster.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:
TS 31.2.3 Steering Column Tilt
DEFAULT
The steering column shall have full tilt capability with an adjustment range of no less than 40 deg. from the vertical and easily adjustable by the driver and shall be accessible by a 5th percentile female and 95th percentile male.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 31.2.4 Steering Wheel Telescopic Adjustment

DEFAULT
The steering wheel shall have full telescoping capability and have a minimum telescopic range of 2 in. and a minimum low-end adjustment of 29 in., measured from the top of the steering wheel rim in the horizontal position to the cab floor at the heel point.

TABLE 4

Steering Wheel Height[1] Relative to Angle of Slope

At Minimum Telescopic Height Adjustment (29 in.)		**At Maximum Telescopic Height Adjustment (5 in.)**	
Angle of Slope	**Height**	**Angle of Slope**	**Height**
0 deg.	29 in.	0 deg.	34 in.
15 deg.	26.2 in.	15 deg.	31.2 in.
25 deg.	24.6 in.	25 deg.	29.6 in.
35 deg.	22.5 in.	35 deg.	27.5 in.

1. Measured from bottom portion closest to driver.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 32. Drive Axle
The bus shall be driven by a heavy-duty axle with a load rating sufficient for the bus loaded to GVWR. The drive axle shall have a design life to operate for not less than 300,000 miles on the design operating profile without replacement or major repairs. The lubricant drain plug shall be magnetic type. If a planetary gear design is employed, the oil level in the planetary gears shall be easily checked through the plug or sight gauge. The axle and driveshaft components shall be rated for both propulsion and retardation modes with respect to duty cycle.

NOTE: The retardation duty cycle can be more aggressive than propulsion.

The drive shaft shall be guarded to prevent hitting any critical systems, including brake lines, coach floor or the ground, in the event of a tube or universal joint failure.

DEFAULT

Solid Beam Axle and Grease-Type Bearings and Seals
Base Bus- Arvin Meritor

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

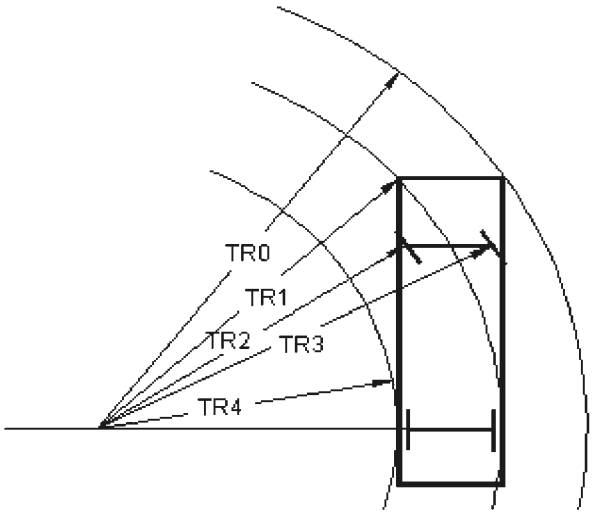
TS 33. Turning Radius
DEFAULT
TABLE 5
Maximum Turning Radius

Bus Length (approximate)	**Maximum Turning Radius (see Figure 3)**	**TRANSIT AGENCY Requirement**
30 ft.	31 ft. (TR0)	
35 ft.	39 ft. (TR0)	
40 ft.	44 ft. (TR0)	

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

FIGURE 3
Turning Radius



TS 34. Brakes
TS 34.1 Service Brake
DEFAULT
Brakes shall be self-adjusting. Brake wear indicators visible on linings.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 34.2 Actuation
DEFAULT
Service brakes shall be controlled and actuated by a compressed air system. Force to activate the brake pedal control shall be an essentially linear function of the bus deceleration rate and shall not exceed 75 lbs. at a point 7 in. above the heel point of the pedal to achieve maximum braking. The heel point is the location of the driver's heel when his or her foot is rested flat on the pedal and the heel is touching the floor or heel pad of the pedal. The ECU for the ABS system shall be protected, yet in an accessible location to allow for ease of service.

The total braking effort shall be distributed among all wheels in such a ratio as to ensure equal friction material wear rate at all wheel locations. The manufacturer shall demonstrate compliance by providing a copy of a thermodynamic brake balance test upon request.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
No automatic traction control.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 34.3 Friction Material
The brake linings shall be made of non-asbestos material. In order to aid maintenance personnel in determining extent of wear, a provision such as a scribe line or a chamfer indicating the thickness at which replacement becomes necessary shall be provided on each brake lining. The complete brake lining wear indicator shall be clearly visible from the hoist or pit without removing backing plates.

DEFAULT
No remote brake wear indicator shall be required.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 34.4 Hubs and Drums/Discs
Replaceable wheel bearing seals shall run on replaceable wear surfaces or be of an integral wear surface sealed design. Wheel bearing and hub seals and unitized hub assemblies shall not leak or weep lubricant when operating on the design operating profile for the duration of the initial manufacturer's warranty.

DEFAULT
Drum Brakes
The bus shall be equipped with brake drums. Brake drums shall allow machining for oversized linings per manufacturer's specifications. Base Bus 16.5" x 8 5" riveted lining cast plus.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 34.5 Hubs and Drums
DEFAULT
Replaceable wheel bearing seals shall run on replaceable wear surfaces or be of an integral wear surface sealed design. Wheel bearing and hub seals and unitized hub assemblies shall not leak or weep lubricant when operating on the design operating profile for the duration of the initial manufacturer's warranty.

The bus shall be equipped with disc brakes on all axles, and the brake discs shall allow machining of each side of the disc to obtain smooth surfaces per manufacturer's specifications.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 34.6 Parking/Emergency Brake
DEFAULT
Air Brakes
The parking brake shall be a spring-operated system, actuated by a valve that exhausts compressed air to apply the brakes. The parking brake may be manually enabled when the air pressure is at the operating level per FMVSS 121.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 35. Interlocks
TS 35.1 Passenger Door Interlocks
To prevent opening mid and rear passenger doors while the bus is in motion, a speed sensor shall be integrated with the door controls to prevent the mid/rear doors from being enabled or opened unless the bus speed is less than 2 mph.

To preclude movement of the bus, an accelerator interlock shall lock the accelerator in the closed position, and a brake interlock shall engage the service brake system to stop movement of the bus when the driver's door control is moved to a mid/rear door enable or open position, or a mid
or rear door panel is opened more than 3 in. from the fully closed position (as measured at the leading edge of the door panel). The interlock engagement shall bring the bus to a smooth stop and shall be capable of holding a fully loaded bus on a 6 percent grade, with the engine at idle and the transmission in gear, until the interlocks are released. These interlock functions shall be active whenever the vehicle master run switch is in any run position.

All door systems employing brake and accelerator interlocks shall be supplied with supporting failure mode effects analysis (FEMA) documentation, which demonstrates that failure modes are of a failsafe type, thereby never allowing the possibility of release of interlock while an interlocked door is in an unsecured condition, unless the door master switch has been actuated to intentionally release the interlocks.

DEFAULT
Non-adjustable brake interlock regulator.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
No requirements for accelerator and brake interlocks whenever front doors are open.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 36. Pneumatic System TS 36.1 General
DEFAULT
The bus air system shall operate the air-powered accessories and the braking system with reserve capacity. New buses shall not leak down more than 5psi over a 15-minute period of time as indicated on the dash gauge.

Provision shall be made to apply shop air to the bus air systems. A quick disconnect fitting shall be easily accessible and located in the engine compartment and near the front bumper area for towing. Retained caps shall be installed to protect the fitting against dirt and moisture when not in use. The air for the compressor shall be filtered. The air system shall be protected per FMVSS 121.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:
TS 36.2 Air Compressor
DEFAULT
The engine-driven air compressor shall be sized to charge the air system from 40psi to the governor cut-off pressure in less than 4 minutes while not exceeding the fast idle speed setting of the engine.
Base Bus – Cummins 30.4 CFM Air Compressor

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 36.3 Air Lines and Fittings
Air lines, except necessary flexible lines, shall conform to the installation and material requirements of SAE Standard J1149 for copper tubing with standard, brass, flared or ball sleeve fittings, or SAE Standard J844 for nylon tubing if not subject to temperatures over 200 °F. The air on the delivery side of the compressor where it enters nylon housing shall not be above the maximum limits as stated in SAE J844. Nylon tubing shall be installed in accordance with the
following color-coding standards:

DEFAULT
- **Green:** Indicates primary brakes and supply.
- **Red:** Indicates secondary brakes.
- **Brown:** Indicates parking brake.
- **Yellow:** Indicates compressor governor signal.
- **Black:** Indicates accessories.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 36.4 Air Reservoirs
DEFAULT
All air reservoirs shall meet the requirements of FMVSS Standard 121 and SAE Standard J10 and shall be equipped with drain plugs and guarded or flush type drain valves. Major structural members shall protect these valves and any automatic moisture ejector valves from road hazards. Reservoirs shall be sloped toward the drain valve. All air reservoirs shall have drain valves that discharge below floor level with lines routed to eliminate the possibility of water traps and/or freezing in the drain line.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 36.5 Air System Dryer

An air dryer shall prevent accumulation of moisture and oil in the air system. The air dryer system shall include one or more replaceable desiccant cartridges.

DEFAULT
No requirements for additional oil separator provision.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

ELECTRICAL, ELECTRONIC AND DATA COMMUNICATION SYSTEMS
TS 37. Overview
The electrical system will consist of vehicle battery systems and components that generate, distribute and store power throughout the vehicle. (e.g., generator, voltage regulator, wiring, relays, and connectors).

Electronic devices are individual systems and components that process and store data, integrate electronic information or perform other specific functions.

The data communication system consists of the bi-directional communications networks that electronic devices use to share data with other electronic devices and systems. Communication networks are essential to integrating electronic functions, both onboard the vehicle and off.

Information level systems that require vehicle information for their operations or provide information shall adhere to J1939 data standard.

Data communications systems are divided into three level store the use of multiple data networks:

- **Powertrain level:** Components related to the powertrain, including the propulsion system components (engine, transmission, and hybrid units) and anti-lock braking system (ABS), which may include traction control. At a minimum, powertrain components consisting of the engine, transmission, retarder, ASR, and anti-lock braking systems shall be powered by a dedicated and isolated ignition supply voltage to ensure data communication between components exists when the vehicle ignition is switched to the "on" position.
- **Information level:** Components whose primary function is the collection, control or display of data that is not necessary to the safe drivability of the vehicle (i.e., the vehicle will continue to operate when those functions are inoperable). These components typically consist of those required for automatic vehicle location (AVL) systems, destination signs, fareboxes, passenger counters, radio systems, automated voice and signage systems, video surveillance and similar components.

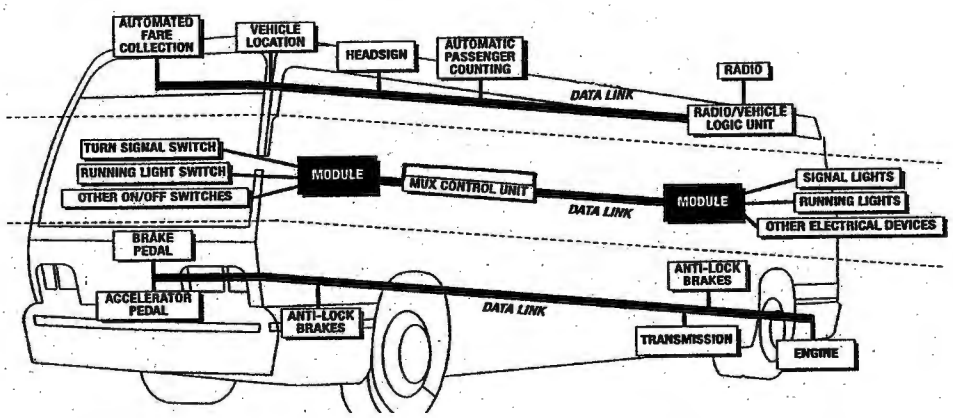
- **Multiplex level:** Electrical or electronic devices controlled through input/output signals such as discrete, analog, and serial data information (i.e., on/off switch inputs, relay, or relay control outputs). Multiplexing is used to control components not typically found on the drivetrain or information levels, such as lights; wheelchair lifts; doors; heating, ventilation, and air conditioning (HVAC) systems (if applicable); and gateway devices.

FIGURE 4
Data Communications Systems Levels

Information level

Multiplex level

Drivetrain level



TS 37.1 Modular Design
DEFAULT
Design of the electrical, electronic and data communication systems shall be modular so that each electronic device, apparatus panel, or wiring bundle is easily separable from its interconnect by means of connectors. Power plant wiring shall be an independent wiring harness. Replacement of the engine compartment wiring harness (es) shall not require pulling wires through any bulkhead or removing any terminals from the wires.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 37.2 Network Communication Requirements
DEFAULT
Regardless of the communication protocol utilized, ***ALL data, including all faults and performance points externalized by any onboard computer or component*** shall be provided to and be capable of being monitored and reported by the Vehicle Logic Unit (VLU).

All fault codes and performance data shall be configured in ***SAE compliant, non-proprietary*** format.

If a gateway or an interface is used between the VLU and other onboard communication systems, the gateway or interface shall output all fault codes and data to the VLU and shall not filter or impede the transmission of fault codes or data in any manner.

Any subsystem, computer, or monitoring device installed on the bus that is capable of interfacing on a network must be physically connected to the network.

Any signal address or data ***changes*** (monitoring points, PIDs, SIDs, etc.) that occur *throughout the life of the vehicle* must be communicated in writing to the ordering Transit Agency and to the VLU vendor by the bus manufacturer prior to the change being enabled.

Any ***new*** signals, faults or performance data that become available, or modifications to monitoring strategies that occur *throughout the life of the vehicle* must be communicated in writing to the ordering Transit Agency and to the VLU vendor by the bus manufacturer prior to the change being enabled.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 38. Environmental and Mounting Requirements
DEFAULT
The electrical system and its electronic components shall be capable of operating in the vehicle in which they will be installed, as recommended in SAE J1455.

Electrical and electronic equipment shall not be in an environment that will reduce the performance or shorten the life of the component or electrical system when operating within the design operating profile. As a recommendation, no vehicle component shall generate, or be affected by, electromagnetic interference or radio-frequency interference (EMI/RFI) that can disturb the performance of electrical/electronic equipment as defined in SAEJ1113and UNECE Council Directive 95/54(R10).

The TRANSIT AGENCY shall follow recommendations from bus manufacturers and subsystem suppliers regarding methods to prevent damage from voltage spikes generated from welding, jumpstarts, shorts, etc.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 38.1 Hardware Mounting
DEFAULT
The mounting of the hardware shall not be used to provide the sole source ground, and all hardware shall be isolated from potential EMI/RFI, as referenced in SAE J1113.

All electrical/electronic hardware mounted in the interior of the vehicle shall be in accessible to passengers and hidden from view unless intended to be viewed. The hardware shall be mounted in such a manner as to protect it from splash or spray.

All electrical/electronic hardware mounted on the exterior of the vehicle that is not designed to be installed in an exposed environment shall be mounted in a sealed enclosure.

All electrical/electronic hardware and its mounting shall comply with the shock and vibration requirements of SAE J1455.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 39. General Electrical Requirements
TS 39.1 Batteries
TS 39.1.1 Low-Voltage Batteries (24V)

DEFAULT
Two 8D Maintenance-Free Batteries
Each battery shall have a purchase date no more than 120 days from date of release and shall be fully maintained prior to shipment to the TRANSIT AGENCY. Battery compartment must be well ventilated to prevent hydrogen build up while protecting the compartment from road spray, water intrusion and de-icing chemicals.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Same Size Terminal Ends
Positive and negative terminal ends shall be the same size.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 39.1.2 Battery Cables
The battery terminal ends, and cable ends shall be color-coded with red for the primary positive, black for negative and another color for any intermediate voltage cables. Positive and negative battery cables shall not cross each other, if at all possible, shall be flexible and shall be sufficiently long to reach the batteries with the tray in the extended position without stretching or pulling on any connection and shall not lie directly on top of the batteries. Except as interrupted by the master battery switch, battery and starter wiring shall be continuous cables with connections secured by bolted terminals and shall conform to specification requirements of SAE Standard J1127–Type SGR, SGT, SGX or GXL and SAE Recommended Practice J541, with 2100 strand 4/0 cable or greater recommended.

DEFAULT
Color code each voltage.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 39.1.3 JumpStart DEFAULT
Jump-Start Connector
A jump-start connector, red for 24V and blue for 12V, shall be provided in the engine compartment, equipped with dust cap, and adequately protected from moisture, dirt, and debris.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 39.1.4 Battery Compartment
DEFAULT
The battery compartment shall prevent accumulation of snow, ice, and debris on top of the batteries and shall be vented and self-draining. It shall be accessible only from the outside of the vehicle. All components within the battery compartment, and the compartment itself, shall be protected from damage or corrosion from the electrolyte. The inside surface of the battery compartment's access doors hall be electrically insulated, as required, to prevent the battery terminals from shorting on the door if the door is damaged in an accident or if a battery comes loose. The battery compartment temperature should not exceed manufacturers' specification.

The vehicle shall be equipped with a12VDC and 24VDC quick disconnect switch(es). The battery compartment door shall conveniently accommodate operation of the12VDC and 24VDC quick disconnect switch (es).

The battery quick disconnect access door shall be identified with a decal. The decal size shall not be less than3.5 × 5in. (8.89 × 12.7cm).

The battery hold-down bracket shall be constructed of a nonconductive and corrosion-resistant material (plastic or fiberglass).

This access door shall not require any special locking devices to gain access to the switch, and it shall be accessible without removing or lifting the panel. The door shall be flush-fitting and incorporate a spring tensioner or equal to retain the door in a closed position when not in use.

The batteries shall be securely mounted on a stainless steel or equivalent tray that can accommodate the size and weight of the batteries. The battery tray, if applicable, shall pull out easily and properly support the batteries while they are being serviced. The tray shall allow each battery cell to be easily serviced. A locking device shall retain the battery tray to the stowed position.

If not located in the engine compartment, the same fire-resistant properties must apply to the battery compartment. No sparking devices should be located within the battery box.
Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 39.1.5 Auxiliary Electronic Power Supply
DEFAULT
If required, gel-pack, or any form of sealed (non-venting) batteries used for auxiliary power are allowed to be mounted on the interior of the vehicle if they are contained in an enclosed, non-airtight compartment and accessible only to maintenance personnel. This compartment shall contain a warning label prohibiting the use of lead-acid batteries.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 39.1.6 Master Battery Switch
DEFAULT
The location of the master battery switch shall be clearly identified on the exterior access panel, be accessible in less than10 seconds for deactivation and prevent corrosion from fumes and battery acid when the batteries are washed of for are in normal service.

Turning the master switch off with the power plant operating, during an emergency, shall shut off the engine and shall not damage any component of the electrical system. The master switch shall be capable of carrying and interrupting the total circuit load.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

DEFAULT
Single Switch
The batteries shall be equipped with a single switch for disconnecting both12V and 24Vpower.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:
TS 39.1.7 Low-Voltage Generation and Distribution
DEFAULT
The low-voltage generating systems shall maintain the charge on fully charged batteries, except when the vehicle is at standard idle to allow-voltage generator load exceeding 70 percent of the low-voltage generator name plate rating.

Voltage monitoring and over-voltage output protection (recommended at 32V) shall be provided.

Dedicated power and ground shall be provided as specified by the component or system manufacturer. Cabling to the equipment must be sized to supply the current requirements with no greater than a 5 percent volt drop across the length of the cable.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 39.1.8 Circuit Protection
DEFAULT

All branch circuits, except battery-to-starting motor and battery-to-generator/alternator circuits, shall be protected by current-limiting devices such as circuit breakers, fuses or solid-state devices sized to the requirements of the circuit. Electronic circuit protection for the cranking motor shall be provided to prevent engaging of the motor for more than 30 seconds at a time to prevent overheating. The circuit breaker fuses shall be easily accessible for authorized personnel. Fuses shall be used only where it can be demonstrated that circuit breakers are not practicable. This requirement applies to in-line fuses supplied by either the Proposer or a supplier. Fuse holders shall be constructed to be rugged and waterproof. All manual reset circuit breakers critical to the operation of the bus shall be mounted in a location convenient to the TRANSIT AGENCY mechanic with visible indication of open circuits. The TRANSIT AGENCY shall consider the application of automatic reset circuit breakers on a case-by-case basis. The Proposer shall show all in-line fuses in the final harness drawings. Any manually resettable circuit breakers shall provide a visible indication of open circuits. Any manually resettable circuit breaker s shall provide a visible indication of open circuits.

Circuit breakers or fuses shall be sized to a minimum of 15 percent larger than the total circuit load. The current rating for the wire used for each circuit must exceed the size of the circuit protection being used.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 39.2 Grounds
DEFAULT

The battery shall be grounded to the vehicle chassis/frame at one location only, as close to the batteries as possible. When using a chassis ground system, the chassis hall be grounded to the frame in multiple locations, evenly distributed throughout the vehicle to eliminate ground loops. No more than /spade terminal connections shall be made per ground stud with spacing between studs ensuring conductivity and serviceability. Electronic equipment requiring an isolated ground of the battery (i.e., electronic ground) shall not be grounded through the chassis.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 39.3 Low Voltage/Low Current Wiring and Terminals
DEFAULT

All power and ground wiring shall conform to specification requirements of SAE Recommended Practice J1127, J1128 and J1292.Double insulations hall be maintained as close to the junction box, electrical compartment, or terminals as possible. The requirement for double insulations hall be met by wrapping the harness with plastic electrical tape or by sheathing all wires and harnesses with non-conductive, rigid, or flexible conduit.

Wiring shall be grouped, numbered and/or color-coded. Wiring harnesses shall not contain wires of different voltage classes unless all wires within the harness are insulated for the highest voltage presenting the harness. Kinking, grounding at multiple points, stretching, and exceeding minimum bend radius shall be prevented.

Strain-relief fittings shall be provided at all points where wiring enters electrical compartments. Grommets or other protective material shall be installed at points where wiring penetrates metal structures outside of electrical enclosures. Wiring supports shall be protective and non- conductive at areas of wire contact and shall not be damaged by heat, water, solvents, or chafing.

To the extent practicable, wiring shall not be located in environmentally exposed locations under the vehicle. Wiring and electrical equipment necessarily located under the vehicle shall be insulated from water, heat, corrosion, and mechanical damage. Where feasible, front-to-rear electrical harnesses should be installed above the window line of the vehicle.

All wiring harnesses over 5 ft. long and containing at least five wires hall include10 percent (minimum one wire) excess wires for spares. This requirement for spare wires does not apply to data links and communication cables. Wiring harness length shall allow end terminals to be replaced twice without pulling, stretching, or replacing the wire. Terminals shall be crimped to the wiring according to the connector manufacturer's recommendations for techniques and tools. All cable connectors shall be locking type, keyed and sealed, unless enclosed in watertight cabinets or vehicle interior. Pins shall be removable, crimp contact type, of the correct size and rating for the wire being terminated. Unused pin positions shall be sealed with sealing plugs. Adjacent connectors shall use either different inserts or different insert orientations to prevent incorrect connections.

Terminals shall be crimped, corrosion-resistant and full ring type or interlocking lugs with insulating ferrules. When using pressure type screw terminal strips, only stranded wire shall be used. Insulation clearance shall ensure that wires have a minimum of "visible clearance" and a maximum of two times the conductor diameter or1/16 in., whichever is less. When using shielded or coaxial cable, upon stripping of the insulation, the metallic braid shall be free from frayed strands that can penetrate the insulation of the inner wires.

Ultra-sonic and T-splices may be used with 8AWG or smaller wire. When a T-splice is used, it shall meet these additional requirements:

- It shall include a mechanical clamp in addition to solder on the splice.
- The wire shall support no mechanical load in the area of the splice.
- The wire shall be supported to prevent flexing.

All splicing shall be staggered in the harness so that no two splices are positioned in the same location within the harness.

Wiring located in the engine compartment shall be routed away from high-heatsourcesorshieldedand/orinsulatedfromtemperaturesexceedingthewiringandconnector operating requirements.

The instrument panel and wiring shall be easily accessible for service from the driver's seat or top of the panel. The instrument panel shall be separately removable and replaceable without damaging the instrument panel or gauges. Wiring shall have sufficient length and be routed to permit service without stretching or chafing the wires.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 39.4 Electrical Components
DEFAULT
All electrical components, including switches, relays, flashers, and circuit breakers, shall be heavy-duty designs with either a successful history of application in heavy-duty vehicles or design specifications for an equivalent environment.

All electric motors shall be heavy-duty brushless type where practical and have a continuous duty rating of no less than40,000hours (except cranking motors, washer pumps, auxiliary heater pumps, defroster, and wiper motors). All electric motors shall be easily accessible for servicing.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 39.5 Electrical Compartments
DEFAULT
All relays, controllers, flashers, circuit breakers and other electrical components shall be mounted in easily accessible electrical compartments. All compartments exposed to the outside environment shall be corrosion-resistant and sealed. The components and their functions in each electrical compartment shall be identified and their location permanently recorded on a drawing attached to the inside of the access panel or door. The drawing shall be protected from oil, grease, fuel, and abrasion.

The front compartment shall be completely service able from the driver's seat, vestibule or from the outside. "Rear start and run" controls shall be mounted in an accessible location in the engine compartment and shall be protected from the environment.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 40. General Electronic Requirements
DEFAULT
If an electronic component has an internal real-time clock, it shall provide its own battery backup to monitor time when battery power is disconnected, and/or it may be updated by a network component. If an electronic component has an hour meter, it shall record accumulated service time without relying on battery backup.

All electronic component suppliers shall ensure that their equipment is self-protecting in the event of shorts in the cabling, and in over-voltage (over 32V DC on a 24V DC nominal voltage rating with a maximum of 50V DC) and reverse polarity conditions. If an electronic component is required to interface with other components, it shall not require external pull-up and/or pull-down resistors. Where this is not possible, the use of a pull-up or pull-down resistor shall be limited as much as possible and easily accessible and labeled.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 40.1 Wiring and Terminals
DEFAULT
Kinking, grounding at multiple points, stretching and reducing the bend radius below the manufacturer's recommended minimum shall not be permitted.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 40.1.1 Discrete I/O (Inputs/Outputs)
DEFAULT
All wiring to I/O devices, either at the harness level or individual wires, shall be labeled, stamped, or color-coded in a fashion that allows unique identification at a spacing not exceeding 4 in. Wiring for each I/O device shall be bundled together. If the I/O terminals are the same voltages, then jumpers may be used to connect the common nodes of each I/O terminal.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 40.1.2 Shielding
DEFAULT
All wiring that requires shielding shall meet the following minimum requirements. A shield shall be generated by connecting to a ground, which is sourced from a power distribution bus bar or chassis. A shield shall be connected at one location only, typically a tone end of the cable.
However, certain standards or specific requirements, such as SAE J1939 or RF applications, have separate shielding techniques that also shall be used as applicable.

> **NOTE:** A shield grounded at both end forms a ground loop, which can cause intermittent control or faults.

When using shielded or coaxial cable, upon stripping of the insulation, the metallic braid shall be free from frayed strands, which can penetrate the insulation of the inner wires. To prevent the introduction of noise, the shield shall not be connected to the common side of a logic circuit.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 40.1.3 Communications
DEFAULT
The data network cabling shall be selected and installed according to the selected protocol requirements. The physical layer of all network communication systems shall not be used for any purpose other than communication between the system components, unless provided for in the network specifications.

Communications networks that use power line carriers (e.g., data modulated on a 24V power line) shall meet the most stringent applicable wiring and terminal specifications.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 40.1.4 Radio Frequency (RF)
DEFAULT
RF components, such as radios, video devices, cameras, global positioning systems (GPS), etc., shall use coaxial cable to carry the signal. All RF systems require special design consideration for losses along the cable. Connectors shall be minimized since each connector and crimp has a loss that will at tribute to attenuation of the signal. Cabling should allow for the removal of antennas or attached electronics without removing the installed cable between them. If this cannot be done, then a conduit of sufficient size shall be provided for ease of attachment of antenna and cable assembly. The corresponding component vendors shall be consulted for proper application of equipment, including installation ofcables.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 40.1.5 Audio
DEFAULT
Cabling used for microphone level and line level signals shall be 22AWG minimum with shielded twisted pair. Cabling used for amplifier level signals shall be18AWG minimum.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 41. Multiplexing
TS 41.1 General
The primary purpose of the multiplexing system is control of components necessary to operate the vehicle. This is accomplished by processing information from input devices and controlling output devices using an internal logic program.

Versatility and future expansion shall be provided for by expandable system architecture. The multiplex system shall be capable of accepting new inputs and outputs thought head edition of new modules and/or the utilization of no existing spare inputs and outputs. All like components in the multiplex system shall be modular and interchangeable with self-diagnostic capabilities. The modules shall be easily accessible for troubleshooting electrical failures and performing system maintenance. Multiplex input/output modules shall use solid-state devices to provide extended service life and individual circuit protection.

DEFAULT
Ten percent of the total number of inputs and outputs, or at least one each for each voltage type utilized (0V, 12V, 24V) at each module location shall be designated as spares.
Base Bus-I/O controls G4 System

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Ten percent of the total number of inputs and outputs, or at least one each for each voltage type utilized (0V, 12V, 24V) at each module location shall be designated as spares.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 41.2 System Configuration
DEFAULT
Multiplexing may either be distributed or centralized. A distributed system shall process information on multiple control modules within the network. A centralized system shall process the information on a single control module. Either system shall consist of several modules connected to form a control network.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 41.2.1 I/O Signals
DEFAULT
The input/output for the multiplex system may contain four types of electrical signals: discrete, modulating, analogue, serial data.

Discrete signals shall reflect the on/off status of switches, levers, limit switches, lights, etc. Analog signals shall reflect numerical data as represented by a voltage signal (0–12V, 10–24V, etc.) or current signal (4–20 mA). Both types of analog signals shall represent the status of variable devices such as rheostats, potentiometers, temperature probes, etc. Serial data signals shall reflect ASCII or alphanumeric data used in the communication between other on-board components.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 42. Data Communications
TS 42.1 General
DEFAULT
All data communication networks shall be either in accordance with a nationally recognized interface standard, such as those published by SAE, IEEE, or ISO, or shall be published to the TRANSIT AGENCY with the following minimum information:

- Protocol requirements for all timing issues (bit, byte, packet, inter-packet timing, idle line timing, etc.) packet sizes, error checking and transport (bulk transfer of data to/from the device).
- Data definition requirements that ensure access to diagnostic information and performance characteristics.
- The capability and procedures for uploading new application or configuration data.
- Access to revision level of data, application software and firmware.
- The capability and procedures for uploading new firmware or application software.
- Evidence that applicable data shall be broadcast to the network in an efficient manner such that the overall network integrity is not compromised.

Any electronic vehicle components used on a network shall be conformance tested to the corresponding network standard.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 42.2 Drivetrain Level
DEFAULT
Drivetrain components, consisting of the engine, transmission, retarder, anti-lock braking system and all other related components, shall be integrated and communicate fully with respect to vehicle operation with data using SAE Recommended Communications Protocols such as J1939 and/or J1708/J1587 with forward and backward compatibilities or other open protocols. At a minimum, drivetrain components consisting of the engine, transmission, retarder ASR, and anti- lock braking systems shall be powered by a dedicated and isolated ignition supply voltage to ensure data communication among components exists when the vehicle ignition is switched to the "on" position.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 42.2.1 Diagnostics, Fault Detection and Data Access
DEFAULT
Drive train performance, maintenance and diagnostic data, and other electronic messages shall be formatted and transmitted on the communications networks.

The drivetrain level shall have the ability to record abnormal events in memory and provide diagnostic codes and other information to service personnel. At a minimum, this network level shall provide live/fail status, current hardware serial number, software/data revisions and uninterrupted timing functions.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 42.2.2 Programmability (Software)
DEFAULT
The drivetrain level components shall be programmable by the TRANSIT AGENCY with limitations as specified by the subsystem Supplier.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 42.3 Multiplex Level TS 42.3.1 Data Access
DEFAULT
At a minimum, information shall be made available via a communication port on the multiplex system. The location of the communication port shall be easily accessible. A hardware gateway and/or wireless communications system are options if requested by the TRANSIT AGENCY. The communication port(s) shall be located as specified by the TRANSIT AGENCY.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 42.3.2 Diagnostics and Fault Detection
The multiplex system shall have a proven method of determining its status (system health and input/output status) and detecting either active (online) or inactive (offline) faults using on-board visual/audible indicators.

In addition to the indicators, the system shall employ an advanced diagnostic and fault detection system, which shall be accessible via either a personal computer or a handheld unit. Either unit shall have the ability to check logic function. The diagnostic data can be incorporated into the information level network or the central data access system.

DEFAULT
No requirement for mock-up board.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 42.3.3 Programmability (Software)

The multiplex system shall have security provisions to protect its software from unwanted changes. This shall be achieved through any or all of the following procedures:

- Password protection
- Limited distribution of the configuration software
- Limited access to the programming tools required to change the software
- Hardware protection that prevents undesired changes to the software

Provisions for programming the multiplex system shall be possible through a PC or laptop. The multiplex system shall have proper revision control to ensure that the hardware and software are identical on each vehicle equipped with the system. Revision control shall be provided by all the following:

- Hardware component identification where labels are included on all multiplex hardware to identify components.
- Hardware series identification where all multiplex hardware displays the current hardware serial number and firmware revision employed by the module.
- Software revision identification where all copies of the software in service display the version number.
- A method of determining which version of software is currently in use in the multiplex system.

DEFAULT
Revision control labels shall be electronic.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 42.4 Electronic Noise Control
DEFAULT
Electrical and electronic subsystems and components on all buses shall not emit electromagnetic radiation that will interfere with on-board systems, components or equipment, telephone service, radio, or TV reception, or violate regulations of the Federal Communications Commission.

Electrical and electronic subsystems on the coaches shall not be affected by external sources of RFI/EMI. This includes, but is not limited to, radio and TV transmission, portable electronic devices including computers in the vicinity of or onboard the buses, AC or DC power lines and RFI/EMI emissions from other vehicles.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DRIVER PROVISIONS, CONTROLS, AND INSTRUMENTATION
TS 43. Driver's Area Controls
TS 43.1 General
DEFAULT
In general, when designing the driver's area, it is recommended that SAE J833, "Human Physical Dimensions," be used.

Switches and controls shall be divided into basic groups and assigned to specific areas, in conformance with SAE Recommended Practice J680, Revised 1988, "Location and Operation of Instruments and Controls in Motor Truck Cabs," and be essentially within the hand reach envelope described in SAE Recommended Practice J287, "Driver Hand Control Reach."

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 43.2 Glare
DEFAULT
The driver's work area shall be designed to minimize glare to the extent possible. Objects within and adjacent to this area shall be matte black or dark gray in color wherever possible to reduce the reflection of light onto the windshield. The use of polished metal and light-colored surfaces within and adjacent to the driver's area shall be avoided.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 43.3 Visors/Sunshades
DEFAULT
Front and Side Sunshade/Visor

Adjustable sun visor(s) shall be provided for the driver's windshield and the driver's side window. Visors shall be shaped to minimize light leakage between the visor and windshield pillars. Visors shall store out of the way and shall not obstruct airflow from the climate control system or interfere with other equipment, such as the radio handset or the destination control. Deployment of the visors shall not restrict vision of the rearview mirrors. Visor adjustments shall be made easily by hand with positive locking and releasing devices and shall not be subject to damage by over-tightening. Sun visor construction and materials shall be strong enough to resist breakage during adjustments. Visors may be transparent but shall not allow a visible light transmittance in excess of 10 percent. Visors, when deployed, shall be effective in the driver's field of view at angles more than 5 deg. above the horizontal.

TS 43.3.1 2023 FLORIDA STATUES (INCLUDING 2023C). 316.2954 Windows behind the driver; restrictions on sun screening material.

a. A person shall not operate any motor vehicle on any public highway, road, or street on which vehicle any windows behind the driver as composed of, covered by, or treated with any sun screening material, or other product or material which has the effect of making the window nontransparent or which would alter the window's color, increase its reflectivity, or reduce its light transmittance except as specified below:

   i. Sun screening material consisting of film which, when applied to and tested on the rear window glass of the specific motor vehicle, has a total solar reflectance of visible light of not more than 35 percent as measured on the nonfilm side and a light transmittance of at least 15 percent in the visible light range; however, sun screening material which, when applied to and tested on the rear window glass of the specific motor vehicle, has a total solar reflectance of visible light of not more than 35 percent as measured on the nonfilm side and a light transmittance of at least 6 percent in the visible light range may be used on multipurpose passenger vehicles.

   ii. Perforated sun screening material which, when tested in conjunction with exiting glazing or film material, has a total reflectance of visible light of not more than 35 percent and a light transmittance of no less than 30 percent. For those products or materials having different levels of reflectance, the highest reflectance from the product or material will be measured by dividing the area into 16 equal sections and averaging the overall reflectance. The measured reflectance of any of those sections may not exceed 50 percent.

   iii. Louvered materials, if the installation of the materials does not reduce driver visibility by more than 50 percent.

   iv. Privacy drapes, curtains, and blinds, provided such covering is in an open and secure position when the motor vehicle is being operated on any public highway, road, or street.

b. A person shall not operate any motor vehicle upon any public highway, road, or street, on which vehicle the rear window is composed of, covered by, or treated with any material which has the effect of making the window nontransparent, unless the vehicle is equipped with side mirrors on both sides that meet the requirements of s.316.294.

c. A violation of this section is a noncriminal traffic infraction, punishable as a nonmoving violation as provided in chapter 318.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 43.4 Driver's Controls
Frequently used controls must be in easily accessible locations. These include the door control, kneel control, windshield wiper/washer controls, ramp, and lift and run switch. Any switches and controls necessary for the safe operation of the bus shall be conveniently located and shall provide ease of operation. They shall be identifiable by shape, touch, and permanent markings. Controls also shall be located so that passengers may not easily tamper with control settings.

All panel-mounted switches and controls shall be marked with easily read identifiers. Graphic symbols shall conform to SAE Recommended Practice J2402, "Road Vehicles – Symbols for Controls, Indicators, and Tell Tales," where available and applicable. The color of switches and controls shall be dark with contrasting typography or symbols.

Mechanical switches and controls shall be replaceable, and the wiring at these controls shall be serviceable from a convenient location. Switches, controls, and instruments shall be dust- and water-resistant.

DEFAULT
All switches/controls in the driver's controls area shall be mounted in an angled panel steep enough to discourage drivers from using it as a personal storage area for items like food, drinks, cell phones, etc.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 43.5 Normal Bus Operation Instrumentation and Controls

The following list identifies bus controls used to operate the bus. These controls are either frequently used or critical to the operation of the bus. They shall be located within easy reach of the operator. The operator shall not be required to stand or turn to view or actuate these controls unless specified otherwise.

Systems or components monitored by onboard diagnostics system shall be displayed in clear view of the operator and provide visual and/or audible indicators. The intensity of indicators shall permit easy determination of on/off status in bright sunlight but shall not cause a distraction or visibility problem at night. All indicators shall be illuminated using backlighting.

The indicator panel shall be located in Area 1 or Area 5, within easy view of the operator instrument panel. All indicators shall have a method of momentarily testing their operation. The audible alarm shall be tamper-resistant and shall have an outlet level between 80 and 83 dBA when measured at the location of the operator's ear.

On-board displays visible to the operator shall be limited to indicating the status of those functions described herein that are necessary for the operation of the bus. All other indicators needed for diagnostics and their related interface hardware shall be concealed and protected from unauthorized access. **Table 6** represents instruments and alarms. The intent of the overall physical layout of the indicators shall be in a logical grouping of systems and severity nature of the fault.

Consideration shall be provided for future additions of spare indicators as the capability of onboard diagnostic systems improves. Blank spaces shall contain LEDs.

TABLE 6
Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/ Audible
Master run switch	Rotary, four-position detent	Side console	Master control for bus, off, day run, night run and clearance ID lights	
Engine start, front	Approved momentary switch	Side console	Activates engine starter motor	
Engine start, rear	Approved momentary switch	Engine compartment	Activates engine starter motor	
Engine run, rear	Three-position toggle switch	Engine compartment	Permits running engine from rear start, normal front run position and off	Amber light
Drive selector	Touch panel switch	Side console	Provides selection of propulsion: forward, reverse, and neutral	Gear selection
HVAC	Switch or switches to control HVAC	Side console	Permits selection of passenger ventilation: off, cool, heat, low fan, high fan, or full auto with on/off only	

TABLE 6
Transit Bus Instruments and Alarms (Continued)

Device	Description	Location	Function	Visual/ Audible
Driver's ventilation	Rotary, three-position detent	Side console or dash left wing	Permits supplemental ventilation: fan off, low, or high	
Defroster fan	Rotary, three-position detent	Side console or dash left wing	Permits defroster: fan off, low, medium, or high	
Defroster temperature	Variable position	Side console or dash left wing	Adjusts defroster water flow and temperature	
Windshield wiper	One-variable rotary position operating both wipers	Dash left wing	Variable speed control of left and right windshield wipers	
Windshield washer	Push button	Dash left wing	Activates windshield washers	
Dash panel lights	Rotary rheostat or stepping switch	Side console or dash left wing	Provides adjustment for light intensity in night run position	
Interior lights	Three-position switch	Side console	Selects mode of passenger compartment lighting: off, on, normal	
Fast idle	Two-position switch	Side console	Selects high idle speed of engine	
WC ramp/ kneel enable	Two-position switch[1]	Side console or dash right wing	Permits operation of ramp and kneel operations at each door remote panel	Amber light
Front door ramp/kneel enable	Two-position keyed switch[1]	Front door remote or dash right wing	Permits ramp and kneel activation from front door area, key required[1]	Amber light

Front door ramp	Three-position momentary switch	Right side of steering wheel	Permits deploy and stow of front ramp	Red light
Front kneel	Three-position momentary switch	Front door remote	Permits kneeling activation and raise and normal at front door remote location	Amber or red dash indicator; exterior alarm and amber light

TABLE 6
Transit Bus Instruments and Alarms (Continued)

Device	Description	Location	Function	Visual/ Audible
Rear door ramp/kneel enable	Two-position keyed switch[1]	Rear door remote	Permits ramp and kneel activation from rear door area; key required[1]	Red light
Rear door ramp	Three-position momentary switch	Rear door remote	Permits deploy and stow of rear ramp	
Rear kneel	Three-position momentary switch	Rear door remote	Permits kneeling activation and raise and normal at rear door remote location	
Silent alarm	Recessed push button, NO and NC contacts momentary	Side console	Activates emergency radio alarm at dispatch and permits covert microphone and/or enables destination sign emergency message	
Video system event switch	Momentary on/off momentary switch with plastic guard	Side console	Triggers event equipment, triggers event light on dash	Amber light
Left remote mirror	Four-position toggle type	Side console	Permits two-axis adjustment of left exterior mirror	
Right remote mirror	Four-position toggle type	Side console	Permits two-axis adjustment of right exterior mirror	
Mirror heater	Switch or temperature activated	Side console	Permits heating of outside mirrors when required	

Passenger door control	Five-position handle type detent or two momentary push buttons	Side console, forward	Permits open/close control of front and rear passenger doors	Red light
Rear door override	Two-position switch in approved location	Side console, forward	Allows driver to override activation of rear door passenger tape switches	
Engine shutdown override	Momentary switch with operation protection	Side console	Permits driver to override auto engine shutdown	
Hazard flashers	Two-position switch	Side console or dash right wing	Activates emergency flashers	Two green lights

TABLE 6
Transit Bus Instruments and Alarms (Continued)

Device	Description	Location	Function	Visual/ Audible
Fire suppression	Red push button with protective cover	Dash left wing or dash center	Permits driver to override and manually discharge fire suppression system	Red light
Mobile data terminal	Mobile data terminal coach operator interface panel	Above right dash wing	Facilitates driver interaction with communication system and master log-on	LCD display with visual status and text messages
Farebox interface	Farebox coach operator interface panel	Near farebox	Facilitates driver interaction with farebox system	LCD display
Destination sign interface	Destination sign interface panel	In approved location	Facilitates driver interaction with destination sign system, manual entry	LCD display
Turn signals	Momentary push button (two required) raised from other switches	Left foot panel	Activates left and right turn signals	Two green lights and optional audible indicator
PA manual	Momentary push button	In approved location	Permits driver to manually activate public address microphone	
Low- profile microphone	Low-profile discrete mounting	Steering column	Permits driver to make announcements with both hands on the wheel and focusing on road conditions	

High beam	Detected push button	In approved location	Permits driver to toggle between low and high beam	Blue light
Parking brake	Pneumatic PPV	Side console or dash left wing	Permits driver to apply and release parking brake	Red light
Park brake release	Pneumatic PPV	Vertical side of the side consoler dash center	Permits driver to push and hold to release brakes	

TABLE 6
Transit Bus Instruments and Alarms (Continued)

Device	Description	Location	Function	Visual/ Audible
Hill holder	Two-position momentary switch	Side console	Applies brakes to prevent bus from rolling	
Remote engine speed	Rotary rheostat	Engine compartment	Permits technician to raise and lower engine RPM from engine compartment	
Master door/ interlock	Multi-pole toggle, detected	Out of operator's reach	Permits driver override to disable door and brake/throttle interlock	Red light
Warning interlocks deactivated	Red indicator light	Dash panel center	Illuminates to warn driver that interlocks have been deactivated	Red light
Retarder disable	Multi-pole switch detented	Within reach of operator or approved location	Permits driver override to disable brake retardation/regeneration	Red light
Alarm acknowledge	Push button momentary	Approved location	Permits driver to acknowledge alarm condition	
Rear door passenger sensor disable	Multi-pole toggle, detented	In sign compartment or driver's barrier compartment	Permits driver to override rear door passenger sensing system	

Indicator/ alarm test button	Momentary switch or programming[1]	Dash center panel	Permits driver to activate test of sentry, indicators, and audible alarms	All visuals and audibles
Auxiliary power	110 V power receptacle	Approved location	Property to specify what function to supply	
Speedometer	Speedometer, odometer, and diagnostic capability, 5-mile increments	Dash center panel	Visual indication of speed and distance traveled, accumulated vehicle mileage, fault condition display	Visual
Air pressure gauge	Primary and secondary, 5 psi increments	Dash center panel	Visual indication of primary and secondary air systems	Red light and buzzer

TABLE 6
Transit Bus Instruments and Alarms (Continued)

Device	Description	Location	Function	Visual/ Audible
Fire detection	Coach operator display	Property specific or dash center	Indication of fire detection activation by zone/location	Buzzer and red light
Door obstruction	Sensing of door obstruction	Dash center	Indication of rear door sensitive edge activation	Red light and buzzer
Door ajar	Door not properly closed	Property specific or dash center	Indication of rear door not properly closed	Buzzer or alarm and red light
Low system air pressure	Sensing low primary and secondary air tank pressure	Dash center	Indication of low air system pressure	Buzzer and red light
Methane detection function	Detection of system integrity	Property specific or dash center	Detects system failure	No start condition, amber light
Methane detection	Indication of 20% LED emergency light (LEL)	Property specific or dash center	Detects levels of methane	Flashing red at 20% LEL
Methane detection	Indication of 50% LEL	Property specific or dash center	Detects levels of methane	Solid red at 50% LEL

Engine coolant indicator	Low coolant indicator may be supplied as audible alert and visual and/or text message	Within driver's sight	Detects low coolant condition	Amber light
Hot engine indicator	Coolant temperature indicator may be supplied as audible alert and visual and/or text message	Within driver's sight	Detects hot engine condition and initiates time delay shutdown	Red light
Low engine oil pressure indicator	Engine oil pressure indicator may be supplied as audible alert and visual and/or text message	Within driver's sight	Detects low engine oil pressure condition and initiates time-delayed shutdown	Red light
ABS indicator	Detects system status	Dash center	Displays system failure	Amber light

TABLE 6
Transit Bus Instruments and Alarms (Continued)

Device	Description	Location	Function	Visual/ Audible
HVAC indicator	Detects system status	Dash center	Displays system failure	Amber or red light
Charging system indicator (12/24 V)	Detect charging system status	Dash center	Detects no charge condition and optionally detects battery high, low, imbalance, no charge condition, and initiates time-delayed shutdown	Red light flashing or solid based on condition
Bike rack deployed indicator	Detects bike rack position	Dash center	Indication of bike rack not being in fully stowed position	Amber or red light
Fuel tank level	Analog gauge, graduated based on fuel type	Dash center	Indication of fuel tank level/pressure	
DEF gauge	Level Indicator	Center dash	Displays level of DEF tank and indicates with warning light when low	Red light

Active regeneration	Detects status	Dash center	Indication of electric regeneration	Amber or red light
Turntable	Detects status	Dash center	Warning indication for hinge locking	Audible and amber warning and red light if locked
Turntable	Interlock momentary switch	Side console	Momentarily release interlock brakes due to over angled condition	

1. Indicate area by drawing. Break up switch control from indicator lights.

TABLE 6 (ALTERNATIVE)
Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/ Audible
[Proposer to provide]				

TS 43.6 Driver Foot Controls
DEFAULT
The accelerator and brake pedals shall be designed for ankle motion. Foot surfaces of the pedals shall be faced with wear-resistant, nonskid, replaceable material.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 43.6.1 Pedal Angle
DEFAULT
The vertical angle of the accelerator and brake pedals shall be determined from a horizontal plane regardless of the slope of the cab floor. The accelerator and brake pedals shall be positioned at an angle of 37 to 50deg at the point of initiation of contact and extend downward to an angle of 10 to 18deg at full throttle.

The location of the brake and accelerator pedals shall be determined by the manufacturer, based on space needs, visibility, lower edge of windshield and vertical H-point.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 43.6.2 Pedal Dimensions and Position
DEFAULT
The floor-mounted accelerator pedal shall be 10 to 12 in. long and 3 to 4 in. wide. Clearance around the pedal must allow for no interference precluding operation.

The accelerator and brake pedals shall be positioned such that the spacing between them, measured at the heel of the pedals, is between 1 and 2 in. Both pedals should be located approximately on the same plane coincident to the surface of the pedals.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 43.7 Brake and Accelerator Pedals
DEFAULT
Brake Pedal
Non-adjustable brake pedal.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 43.8 Driver Foot Switches
Floor-Mounted Foot Control Platform
The angle of the turn signal platform shall be determined from a horizontal plane, regardless of the slope of the cab floor. The turn signal platform shall be angled at a minimum of 10 deg. and a maximum of 37 deg. It shall be located no closer to the seat front than the heel point of the accelerator pedal.

DEFAULT
Turn Signal Controls
Turn signal controls shall be floor-mounted, foot-controlled, water-resistant, heavy-duty, momentary contact switches.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Foot Switch Control
The control switches for the turn signals shall be mounted on an inclined, floor-mounted stainless-steel enclosure or metal plate mounted to an incline integrated into the driver's platform, located to the left of the steering column. The location and design of this enclosure shall be such that foot room for the operator is not impeded. The inclined mounting surface shall be skid resistant. All other signals, including high beam and public address system, shall be in approved locations.

The foot switches shall be UL-listed, heavy-duty type, of a rugged, corrosion-resistant metal construction. The foot switches for the directionals shall be momentary type, while those for the

PA system and the high beam shall be latching type. The spacing of the switches shall be such that inadvertent simultaneous deflection of switches is prevented.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 44. Driver's Amenities TS 44.1 Coat Hanger DEFAULT
Coat Hanger
A suitable hanger shall be installed in a convenient, approved location for the driver's coat.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 44.2 Drink Holder
DEFAULT
No drink holder.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 44.3 Storage Box
DEFAULT
Storage Box
An enclosed driver storage area shall be provided with a positive latching door and/or lock. 44"H x 22.5" W x 20"D, 2 Doors

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 45. Windshield Wipers and Washers
TS 45.1 Windshield Wipers
The bus shall be equipped with a windshield wiper for each half of the windshield. At 60 mph, no more than 10 percent of the wiped area shall be lost due to windshield wiper lift. For two- piece windshields, both wipers shall park along the center edges of the windshield glass. For single-piece windshields, wipers shall park along the bottom edge of the windshield. Windshield wiper motors and mechanisms shall be easily accessible for repairs or service. The fastener that secures the wiper arm to the drive mechanism shall be corrosion resistant.

DEFAULT
Single-control, electric two-speed intermittent wiper.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Single control for air-operated system.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

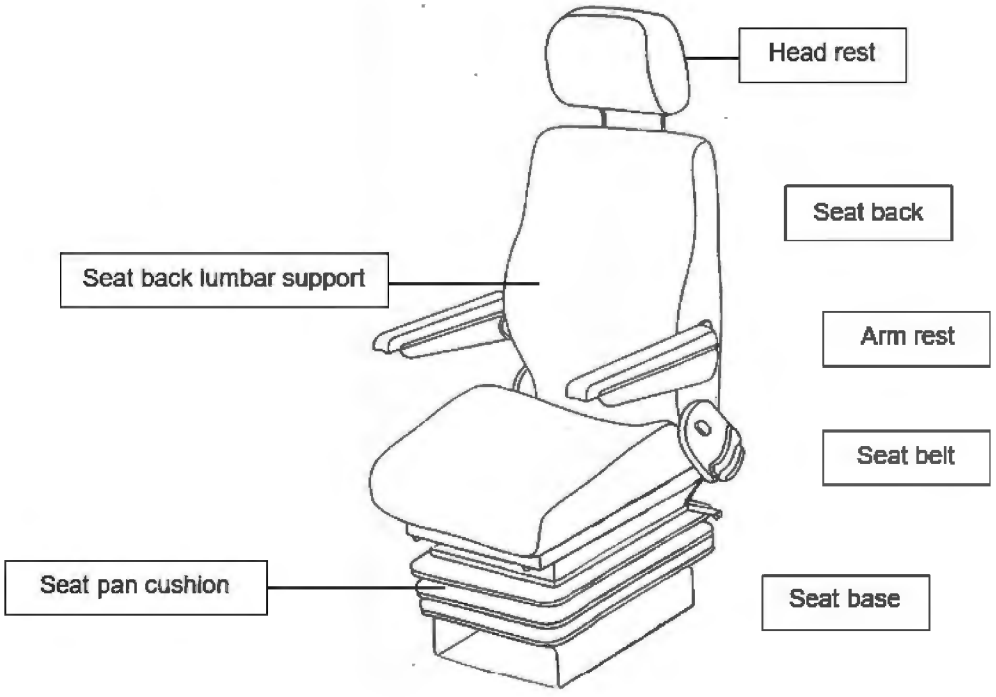
TS 45.2 Windshield Washers
DEFAULT
The windshield washer system, when used with the wipers, shall deposit washing fluid evenly and completely wet the entire wiped area.

The windshield washer system shall have a minimum 3-gallon reservoir, located for easy refilling from outside the bus. Reservoir pumps, lines and fittings shall be corrosion-resistant and must include a means to determine fluid level.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46. Driver's Seat
FIGURE 5
Driver's Seat



DEFAULT
USSC G2A

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 46.1 Dimensions
DEFAULT
The driver's seat shall be comfortable and adjustable so that people ranging in size from a 95th- percentile male to a 5th-percentile female may operate the bus.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 46.1.1 Seat Pan Cushion Length
DEFAULT
Measurement shall be from the front edge of the seat pan to the rear at its intersection with the seat back. The adjustment of the seat pan length shall be no less than 16.5 in.at its minimum length and no more than 20.5 in.at its maximum length.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

SP 1.1.1 Seat Pan Cushion Height
DEFAULT
Dimensions
Measurement shall be from the cab floor to the top of the level seat at its center midpoint. The seat shall adjust in height from a minimum of14 in., with a minimum 6 in. vertical range of adjustment.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 46.1.2 Seat Pan Cushion Slope
DEFAULT
Measurement is the slope of the plane created by connecting the two high points of the seat, one at the rear of the seat at its intersection with the seat back and the other at the front of the seat just before it waterfalls downward at the edge. The slope can be measured using an inclinometer and shall be stated in degrees of incline relative to the horizontal plane (0 deg). The seat pan shall adjust in its slope from no less than plus 12 deg (rearward "bucket seat" incline) to no less than minus 5 deg (forward slope).

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46.1.3 Seat Base Fore/Aft Adjustment
DEFAULT
Measurement is the horizontal distance from the heel point to the front edge of the seat. The minimum and maximum distances shall be measured from the front edge of the seat when it is adjusted to its minimum seat pan depth (approximately 15 in.). On all low-floor buses, the seat base shall travel horizontally a minimum of 9 in. It shall adjust no closer to the heel point than 6 in. On all high-floor buses, the seat base shall travel a minimum of 9 in. and adjust no closer to the heel point than 6 in.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46.1.4 Seat Pan Cushion Width
DEFAULT
Measurement is the horizontal distance across the seat cushion. The seat pan cushion shall be 17 to 21 in. across at the front edge of the seat cushion and 20 to 23 in. across at the side bolsters.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46.1.5 Seat Suspension

DEFAULT
The driver's seat shall be appropriately dampened to support a minimum weight of 380 lbs. The suspension shall be capable of dampening adjustment in both directions.

Rubber bumpers shall be provided to prevent metal-to-metal contact.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46.1.6 Seat Back
DEFAULT
Width
Measurement is the distance between the outermost points of the front of the seat back, at or near its midpoint in height. The seat back width shall be no less than 19 in. Seat back will include dual recliner gears on both sides of the seat.

Height
Standard height seat back.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46.1.7 Headrests
DEFAULT
Adjustable headrest.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46.1.8 Seat Back Lumbar Support

DEFAULT
Measurement is from the bottom of the seat back at its intersection with the seat pan to the top of the lumbar cushioning. The seat back shall provide adjustable-depth lumbar back support with three individual operating lumbar cells within a minimum range of 7 to 11 in.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46.1.9 Seat Back Angle Adjustment
DEFAULT
The seat back angle shall be measured relative to a level seat pan, where 90 deg is the upright position and 90 deg-plus represents the amount of recline.

The seat back shall adjust in angle from a minimum of no more than 90 deg (upright) to at least 105 deg (reclined), with infinite adjustment in between.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46.2 Seat Belt
The belt assembly should be an auto-locking retractor (ALR). All seat belts should be stored in automatic retractors. The belts shall be mounted to the seat frame so that the driver may adjust the seat without resetting the seat belt.

The seat and seatbelt assemblies as installed in the bus shall withstand static horizontal forces as required in FMVSS 207 and 210.

DEFAULT
Orange three-point seatbelt webbing.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

Lap Belt Length

DEFAULT
72 in.
The lap belt assembly shall be a minimum of 72 in. in length.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46.3 Adjustable Armrest
DEFAULT
No armrests.
Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46.4 Seat Control Locations
DEFAULT
While seated, the driver shall be able to make seat adjustments by hand without complexity, excessive effort or being pinched. Adjustment mechanisms shall hold the adjustments and shall not be subject to inadvertent changes.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46.5 Seat Structure and Materials Cushions
Cushions shall be fully padded with at least 3 in. of materials in the seating areas at the bottom and back.

Cushion Materials
DEFAULT
Open-cell polyurethane (FMVSS 302).

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46.6 Pedestal
DEFAULT
Powder-coated steel.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:
TS 46.7 Mirrors
TS 46.7.1 Exterior Mirrors
The bus shall be equipped with corrosion-resistant, outside rearview mirrors mounted with stable supports to minimize vibration. Mirrors shall be firmly attached to the bus to minimize vibration and to prevent loss of adjustment with a breakaway mounting system. Mirrors shall permit the driver to view the roadway along the sides of the bus, including the rear wheels. Mirrors should be positioned to prevent blind spots.

Mirrors shall retract or fold sufficiently to allow bus washing operations but avoid contact with windshield.

DEFAULT
Exterior mirrors shall be installed without a breakaway mounting system.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Flat Mirrors on Both Sides
The bus shall be equipped with two flat outside mirrors, each with not less than 50 sq. in. of reflective surface. The mirrors shall be located as to provide the driver a view to the rear along both sides of the bus and shall be adjustable both in the horizontal and vertical directions to view the rearward scene. The roadside rearview mirror shall be positioned so that the driver's line of sight is not obstructed.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

Curbside Mirrors
The curbside rearview mirror shall be mounted so that its lower edge is no less than 80 in. above the street surface. A lower mount may be required due to mirror configuration requests.

DEFAULT
Remote Adjustment of Curbside Mirror
The driver shall be able to adjust the curbside mirror remotely while seated in the driving position. The control for remote positioning of the mirror shall be a single switch or device.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

Street-Side Mirrors
DEFAULT
Standard mirror, not heated, no remote adjustment.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 46.7.2 Interior Mirrors
DEFAULT
Mirrors shall be provided for the driver to observe passengers throughout the bus without leaving the seat and without shoulder movement. The driver shall be able to observe passengers in the front/entrance and rear/exit areas (if applicable), anywhere in the aisle, and in the rear seats.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

WINDOWS
TS 47. General

Use with 30ft length: A minimum of 6000 sq. in. of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

Use with 35ft length: A minimum of 8000 sq. in. of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

Use with 40ft length: A minimum of 10,000 sq. in. of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

TS 48. Windshield
DEFAULT
The windshield shall permit an operator's field of view as referenced in SAE Recommended Practice J1050.The vertically upward view shall be a minimum of 14deg, measured above the horizontal and excluding any shaded band. The vertically downward view shall permit detection of an object 3½ft high no more than 2 ft. in front of the bus. The horizontal view shall be a minimum of 90 deg above the line of sight. Any binocular obscuration due to a center divider may be ignored when determining the 90deg requirement, provided that the divider does not exceed a 3deg angle in the operator's field of view. Windshield pillars shall not exceed 10 deg of binocular obscuration. The windshield shall be designed and installed to minimize external glare as well as reflections from inside the bus.

The windshield shall be easily replaceable by removing zip-locks from the windshield retaining moldings. Bonded-in-place windshields shall not be used. Winglets may be bonded.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 48.1 Glazing
The windshield glazing material shall have a ¼ in. nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping AS-1 and the recommended practices defined in SAE J673.

DEFAULT
Shaded Band
The upper portion of the windshield above the driver's field of view shall have a dark, shaded band and marked AS-3, with a minimum luminous transmittance of 5 percent when tested in accordance to ASTM D-1003.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

DEFAULT
Two-piece windshield.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 49. Driver's Side Window

The driver's side window shall be the sliding type, requiring only the rear half of the sash to latch upon closing, and shall open sufficiently to permit the seated operator to easily adjust the street-side outside rearview mirror. When in an open position, the window shall not rattle or close during braking. This window section shall slide in tracks or channels designed to last the service life of the bus. The operator's side window shall not be bonded in place and shall be easily replaceable. The glazing material shall have a single-density tint.

The driver's view, perpendicular through operator's side window glazing, should extend a minimum of 33 in. (840 mm) to the rear of the heel point on the accelerator, and in any case must accommodate a 95th percentile male operator. The view through the glazing at the front of the assembly should begin not more than 26 in. (560 mm) above the operator's floor to ensure visibility of an under-mounted convex mirror. Driver's window construction shall maximize ability for full opening of the window.

DEFAULT

The driver's side window glazing material shall have a ¼ in. nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1-1996 Test Grouping AS-2 and the recommended practices defined in SAE J673.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

DEFAULT
Standard Driver's Side Window, Traditional Frame

TRANSIT AGENCY to choose from the following options:

- Full slider
  - Egress
  - Non-egress
- Top fixed over bottom slider
  - Egress
  - Non-egress

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 50. Side Windows TS 50.1 Configuration DEFAULT
Side windows shall not be bonded in place but shall be easily replaceable without disturbing adjacent windows and shall be mounted so that flexing or vibration from engine operation or normal road excitation is not apparent. All aluminum and steel material will be treated to prevent corrosion.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 50.2 Emergency Exit (Egress) Configuration
DEFAULT
Minimum Egress
All side windows shall be fixed in position, except as necessary to meet the emergency escape requirements.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Standard Passenger Side Window Configurations
TRANSIT AGENCY to choose from the following options:

- Traditional frame
  - Full fixed
  - Openable windows with inward-opening transom panels
  - Openable windows with sliding transom panels
  - Openable windows with a fixed transom panel and sliding lower panels
  - Openable windows with full-height sliding panels Hidden frame (flush "Euro-look")

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

DEFAULT
Traditional Frame
TRANSIT AGENCY to choose from the following options:

- Full fixed
- Openable windows with inward-opening transom panels
- Openable windows with sliding transom panels
- Openable windows with a fixed transom panel and sliding lower panels
- Openable windows with full height sliding panels

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 50.3 Configuration
DEFAULT
Fixed Side Windows
All side windows shall be fixed in position, except as necessary to meet the emergency escape requirements.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 50.4 Materials
Safety Glass Glazing Panels
Side windows glazing material shall have a minimum of 3/16 in. nominal thickness tempered safety glass. The material shall conform to the requirements of ANSI Z26.1-1996 Test Grouping 2 and the recommended practices defined in SAE J673.

DEFAULT
Windows on the bus sides and in the rear door shall be tinted a neutral color, complementary to the bus exterior. The maximum solar energy transmittance shall not exceed 37 percent, as measured by ASTM E-424. Luminous transmittance shall be measured by ASTM D-1003.
Windows over the destination signs shall not be tinted.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT (LIGHT)
55 percent luminous transmittance.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT (DARK)
27 percent luminous transmittance.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Safety Glass Glazing Panels
Side windows glazing material shall have a minimum of 3/16 in. nominal thickness tempered safety glass. The material shall conform to the requirements of ANSI Z26.1 Test Grouping 2 and the recommended practices defined in SAE J673.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

> **NOTE:** All glass treatments must be permanent, within the glass and/or in the center membrane. Surface films are not permitted.

SHGC and light transmission performance shall be defined by the National Fenestration Rating Council.

TS 50.5 Rear Window
DEFAULT
No requirement for rear window.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

HEATING, VENTILATING AND AIR CONDITIONING
TS 51. Capacity and Performance
The HVAC climate control system shall be capable of controlling the temperature and maintaining the humidity levels of the interior of the bus as defined in the following paragraphs.

DEFAULT
Rear Mounted Thermo-King X430 407C

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Allow Either Roof- or Rear-Mounted HVAC Unit
The HVAC unit may either be roof or rear mounted. Note that a rear-mounted unit will preclude a rear window and that the term "roof-mounted unit" includes units mounted on top of or beneath the roof surface.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Capacity and Performance Requirements
The air-conditioning portion of the HVAC system shall be capable of reducing the passenger compartment temperature from 115 to 95 °F in less than 20 minutes after engine start-up. Engine temperature shall be within the normal operating range at the time of start-up of the cool-down test, and the engine speed shall be limited to fast idle, which may be activated by a driver- controlled device. During the cool-down period, the refrigerant pressure shall not exceed safe high-side pressures, and the condenser discharge air temperature, measured 6 in. from the surface of the coil, shall be less than 45 °F above the condenser inlet air temperature. The appropriate solar load as recommended in the APTA "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System," representing 4 p.m. on August 21, shall be used. There shall be no passengers on board, and the doors and windows shall be closed.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 52. Controls and Temperature Uniformity
The HVAC system excluding the driver's heater/defroster shall be centrally controlled with an advanced electronic/diagnostic control system with provisions for extracting/reading data. The system shall be compliant with J1939 Communication Protocol for receiving and broadcasting of data.

Hot engine coolant water shall be delivered to the HVAC system driver's defroster/heater and other heater cores by means of an auxiliary coolant pump, sized for the required flow, which is brushless and seal less having a minimum maintenance-free service life for both the brushless motor and the pump of at least 40,000 hours at full power.

DEFAULT
Manual Mode Selection of Climate Control System
After manual selection and/or activation of climate control system operation mode, all interior climate control system requirements for the selected mode shall be attained automatically to within ±2 °F of specified temperature control set point.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Single Control Set point at 70 °F
The temperature control set point for the system shall be 70 °F.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 52.1 Auxiliary Heater
DEFAULT
No auxiliary heater.

Auxiliary Heater
An auxiliary heater fired by diesel fuel shall be provided to supplement the heat supplied by the engine and shall have an output necessary to meet the performance criteria. The heater shall be equipped with safety devices to prevent over fueling, overheating due to loss of coolant or water pump failure, and operation during conditions of low battery voltage. The auxiliary heater shall have capability of functioning in the supplemental mode and preheat mode. The supplemental mode shall automatically cycle the auxiliary heater "on" and "off" according to the coolant temperature. No driver input shall be required when the engine is running. The preheat mode shall be enabled through a single-pole double-throw momentary switch. With the master run switch in the "off" position, toggling the switch to its momentary upward ("on") position shall enable the auxiliary heater to operate in preheat. Once in preheat, the unit shall continue to operate and cycle until either the preheat switch is toggled to its momentary downward ("off") position, or the master run switch is turned "on," or the time elapsed exceeds 60 minutes, at which time the preheat mode will automatically be disabled. The supplement mode will always override the preheat mode.

The auxiliary heater coolant pump shall shut down when the coolant is up to temperature during the supplemental mode. With the engine running, there shall be coolant flow through the heater all the time. The temperature sensor shall constantly measure the coolant temperature and cycle "on" if required, at which time the coolant pump turns on.

The auxiliary heater shall be equipped with a self-priming fuel pump. The unit shall be electronically controlled with appropriate diagnostics for troubleshooting. Operation, as well as diagnostic data, shall be stored and shall be retrievable through an IBM compatible PC. The auxiliary heater maintenance/diagnostic information shall be communicated through the appropriate protocol, SAE J1708 or J1939.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 53. Air Flow
TS 53.1 Passenger Area
The cooling mode of the interior climate control system shall introduce air into the bus at or near the ceiling height at a minimum rate of 25 cubic ft. per minute (cfm) per passenger based on the standard configuration bus carrying a number of passengers equal to 150 percent of the seated load. Airflow shall be evenly distributed throughout the bus, with air velocity not exceeding 100 ft. per minute on any passenger. The ventilating mode shall provide air at a minimum flow rate of 20 cfm per passenger.

Airflow may be reduced to 15 cfm per passenger (150 percent of seated load) when operating in the heating mode. The fans shall not activate until the heating element has warmed sufficiently to ensure at least 70 °F air outlet temperature. The heating air outlet temperature shall not exceed 120 °F under any normal operating conditions.

The climate control blower motors and fan shall be designed such that their operation complies with the interior noise level requirements.

DEFAULT
No "Fresh Air" Requirements
To be used by agencies that have an operating profile where the door opening cycle results in effectively providing an adequate "fresh air" mixture.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 53.2 Driver's Area
DEFAULT
The bus interior climate control system shall deliver at least 100 cfm of air to the driver's area when operating in the ventilating and cooling modes. Adjustable nozzles shall permit variable distribution or shutdown of the airflow. Airflow in the heating mode shall be reduced proportionally to the reduction of airflow into the passenger area. The windshield defroster unit shall meet the requirements of SAE Recommended Practice J382, "Windshield Defrosting Systems Performance Requirements," and shall have the capability of diverting heated air to the driver's feet and legs. The defroster or interior climate control system shall maintain visibility through the driver's side window.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 53.3 Controls for the Climate Control System (CCS)
DEFAULT

The controls for the driver's compartment for heating, ventilation and cooling systems shall be integrated and shall meet the following requirements:

- The heat/defrost system fan shall be controlled by a separate switch that has an "off" position and at least two positions for speed control. All switches and controls shall preclude the possibility of clothing becoming entangled, and shields shall be provided, if required. If the fans are approved by the TRANSIT AGENCY, an "on/off" switch shall be located to the right of or near the main defroster switch.
- A manually operated control valve shall control the coolant flow through the heater core.
- If a cable-operated manual control valve is used, then the cable length shall be kept to a minimum to reduce cable seizing. Heater water control valves shall be "positive" type, closed or open. The method of operating remote valves shall require the concurrence of the TRANSIT AGENCY project manager.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 53.4 Driver's Compartment Requirements
DEFAULT
A separate heating, ventilation and defroster system for the driver's area shall be provided and shall be controlled by the driver. The system shall meet the following requirements:

The heater and defroster system shall provide heating for the driver and heated air to completely defrost and defog the windshield, driver's side window, and the front door glasses in all operating conditions. Fan(s) shall be able to draw air from the bus body interior and/or exterior through a control device and pass it through the heater core to the defroster system and over the driver's feet. A minimum capacity of 100 cfm shall be provided. The driver shall have complete control of the heat and fresh airflow for the driver's area. The defroster supply outlets shall be located at the lower edge of the windshield. These outlets shall be durable and shall be free of sharp edges that can catch clothes during normal daily cleaning. The system shall be such that foreign objects such as coins or
tickets cannot fall into the defroster air outlets. Adjustable ball vents or louvers shall be provided at the left of the driver's position to allow direction of air onto the side windows.

A ventilation system shall be provided to ensure driver comfort and shall be capable of providing fresh air in both the foot and head areas. Vents shall be controllable by the driver from the normal driving position. Decals shall be provided, indicating "operating instructions" and "open" and "closed" positions. When closed, vents shall be sealed to prevent the migration of water or air into the bus.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET

Comment:

TS 53.5 Driver's Cooling
DEFAULT
No dedicated evaporator.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 54. Air Filtration
Air shall be filtered before entering the AC system and being discharged into the passenger compartment. The filter shall meet the ANSI/ASHRAE 52.1 requirement for 5 percent or better atmospheric dust spot efficiency, 50 percent weight resistant, and a minimum dust holding capacity of 120 g per 1000 cfm cell. Air filters shall be easily removable for service.

DEFAULT
Cleanable Filters
Air filters shall be cleanable.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 55. Roof Ventilators
Each ventilator shall be easily opened and closed manually. When open with the bus in motion, this ventilator shall provide fresh air inside the bus. The ventilator shall cover an opening area no less than 425 sq. in. and shall be capable of being positioned as a scoop with either the leading or trailing edge open no less than 4 in., or with all four edges raised simultaneously to a height of no less than 3½ in. An escape hatch shall be incorporated into the roof ventilator. Roof ventilator(s) shall be sealed to prevent entry of water when closed.

DEFAULT
One Roof Ventilator
One ventilator shall be provided in the roof of the bus.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 56. Maintainability
Manually controlled shut-off valves in the refrigerant lines shall allow isolation of the compressor and dehydrator filter for service. To the extent practicable, self-sealing couplings utilizing O-ring seals shall be used to break and seal the refrigerant lines during removal of major components, such as the refrigerant compressor. Shut-off valves may be provided in lieu of self- sealing couplings. The condenser shall be located to efficiently transfer heat to the atmosphere and shall not ingest air warmed above the ambient temperature by the bus mechanical equipment, or to discharge air into any other system of the bus. The location of the condenser shall preclude its obstruction by wheel splash, road dirt or debris. HVAC components located within 6 in. of floor level shall be constructed to resist damage and corrosion.

DEFAULT
High and low refrigerant pressure electronic gauges to be located in the return air area.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 57. Entrance/Exit Area Heating
DEFAULT
No requirements for entrance/exit area heating.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 58. Floor-Level Heating
TS 58.1 Transit Coach
DEFAULT
No requirements for floor-level heating.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

EXTERIOR PANELS, FINISHES AND EXTERIOR LIGHTING
TS 59. Design
DEFAULT
The bus shall have a clean, smooth, simple design, primarily derived from bus performance requirements and passenger service criteria. The exterior and body features, including grilles and louvers, shall be shaped to facilitate cleaning by automatic bus washers without snagging washer brushes. Water and dirt shall not be retained in or on anybody feature to freeze or bleed out onto the bus after leaving the washer. The body and windows shall be sealed to prevent leaking of air, dust, or water under normal operating conditions and during cleaning in automatic bus washers for the service life of the bus.

Exterior panels shall be sufficiently stiff to minimize vibration, drumming or flexing while the bus is in service. When panels are lapped, the upper and forward panels shall act as a watershed. However, if entry of moisture into the interior of the vehicle is prevented by other means, then rear cap panels may be lapped otherwise. The windows, hatches and doors shall be able to be sealed. Accumulation of spray and splash generated by the bus's wheels shall be minimized on windows and mirrors.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 59.1 Materials
Body materials shall be selected, and the body fabricated to reduce maintenance, extend durability, and provide consistency of appearance throughout the service life of the bus. Detailing shall be kept simple, and add-on devices and trim shall be minimized and integrated into the basic design.

DEFAULT
No requirement for protection against graffiti/vandalism for body material surfaces.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 59.2 Roof-Mounted Equipment
DEFAULT
A non-skid, clearly marked walkway or steps shall be incorporated on the roof to provide access to equipment without damaging any system or bus paneling.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 60. Pedestrian Safety
DEFAULT
Exterior protrusions along the side and front of the bus greater than ½ in. and within 80 in. of the ground shall have a radius no less than the amount of the protrusion. The exterior rearview mirrors, cameras and required lights and reflectors are exempt from the protrusion requirement. Advertising frames shall protrude no more than ⅞ in. from the body surface. Grilles, doors, bumpers and other features on the sides and rear of the bus shall be designed to minimize toeholds or handholds. Exterior protrusions shall not cause a line-of-sight blockage for the driver.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 61. Repair and Replacement
TS 61.1 Side Body Panels
Structural elements supporting exterior body panels shall allow side body panels below the windows to be repaired in lengths not greater than 12.5 ft.

DEFAULT
Standard attachment of side body panels.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:
TS 62. Rain Gutters
DEFAULT
Rain gutters shall be provided to prevent water flowing from the roof onto the passenger doors and driver's side window. When the bus is decelerated, the gutters shall not drain onto the windshield, driver's side window or door boarding area. Cross sections of the gutters shall be adequate for proper operation.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 63. License Plate Provisions
DEFAULT
Provisions shall be made to mount standard-size U.S./Canada license plates per SAE J686 on the front and rear of the bus. These provisions shall direct-mount or recess the license plates so that they can be cleaned by automatic bus-washing equipment without being caught by the brushes. The rear license plate provision shall be illuminated per SAE J587.

DEFAULT
No plate or holder provision is required.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 63.1 Rub rails
DEFAULT
No requirement for rub rails.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 64. Fender Skirts
DEFAULT
Features to minimize water spray from the bus in wet conditions shall be included in wheel housing design. Any fender skirts shall be easily replaceable. They shall be flexible if they extend beyond the allowable body width. Wheels and tires shall be removable with the fender skirts in place.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 65. Wheel Covers
DEFAULT
Wheel covers are not required.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 65.1 Splash Aprons
DEFAULT
Standard Splash Aprons
Splash aprons, composed of ¼ in. minimum composition or rubberized fabric, shall be installed behind and/or in front of wheels as needed to reduce road splash and to protect underfloor components. The splash aprons shall extend downward to within 6 in. off the road surface at static conditions. Apron widths shall be no less than tire widths. Splash aprons shall be bolted to the bus understructure. Splash aprons and their attachments shall be inherently weaker than the structure to which they are attached. The flexible portions of the splash aprons shall not be included in the road clearance measurements. Splash apron shall be installed as necessary to protect the wheelchair loading device from road splash. Other splash aprons shall be installed where necessary to protect bus equipment.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 66. Service Compartments and Access Doors
TS 66.1 Access Doors
DEFAULT

Conventional or pantograph hinged doors shall be used for the engine compartment and for all auxiliary equipment compartments, including doors for checking the quantity and adding to the engine coolant, engine lubricant and transmission fluid. Access openings shall be sized for easy performance of tasks within the compartment, including tool operating space. Access doors shall be of rugged construction and shall maintain mechanical integrity and function under normal operations throughout the service life of the bus. They shall close flush with the body surface.
All doors shall be hinged at the top or on the forward edge and shall be prevented from coming loose or opening during transit service or in bus washing operations. All access doors shall be retained in the open position by props or counterbalancing with over-center or gas-filled springs with safety props and shall be easily operable by one person. Springs and hinges shall be corrosion resistant. Latch handles shall be flush with, or recessed behind, the body contour and shall be sized to provide an adequate grip for opening. Access doors, when opened, shall not restrict access for servicing other components or systems.

If precluded by design, the manufacturer shall provide door design information specifying how the requirements are met.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 66.2 Access Door Latch/Locks
DEFAULT
Requirement for Latches on Access Doors
Access doors larger than 100 sq. in. in area shall be equipped with corrosion-resistant flush- mounted latches or locks except for coolant and fuel fill access doors. All such access doors that require a tool to open shall be standardized throughout the vehicle and will require a nominal 5/16 in. square male tool to open or lock.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 67. Bumpers
TS 67.1 Location
DEFAULT

Bumpers shall provide impact protection for the front and rear of the bus with the top of the bumper being 27 in., ±2 in., above the ground. Bumper height shall be such that when one bus is parked behind another, a portion of the bumper faces will contact each other.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 67.2 Front Bumper
No part of the bus, including the bumper, shall be damaged as a result of a 5mph impact of the bus at curb weight with a fixed, flat barrier perpendicular to the bus's longitudinal centerline. The bumper shall return to its pre-impact shape within 10 minutes of the impact. The bumper shall protect the bus from damage as a result of 6.5 mph impacts at any point by the common carriage with contoured impact surface defined in Figure 2 of FMVSS 301 loaded to 4000lbs parallel to the longitudinal centerline of the bus. It shall protect the bus from damage as a result of 5.5mph impacts into the corners at a 30deg angle to the longitudinal centerline of the bus. The energy absorption system of the bumper shall be independent of every power system of the bus and shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 in.

DEFAULT
Standard bumper.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 67.3 Rear Bumper
DEFAULT

No part of the bus, including the bumper, shall be damaged as a result of a 2mph impact with a fixed, flat barrier perpendicular to the longitudinal centerline of the bus. The bumper shall return to its pre-impact shape within 10 minutes of the impact. When using a yard tug with a smooth, flat plate bumper 2 ft. wide contacting the horizontal centerline of the rear bumper, the bumper shall provide protection at speeds up to 5 mph, over pavement discontinuities up to 1 in. high, and at accelerations up to 2 mph/sec. The rear bumper shall protect the bus when impacted anywhere along its width by the common carriage with contoured impact surface defined in Figure 2 of FMVSS 301 loaded to 4000 lbs., at 4 mph parallel to or up to a 30degangle to the longitudinal centerline of the bus. The rear bumper shall be shaped to preclude unauthorized riders standing on the bumper. The bumper shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 in.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 67.4 Bumper Material
DEFAULT
Bumper material shall be corrosion-resistant and withstand repeated impacts of the specified loads without sustaining damage. These bumper qualities shall be sustained throughout the service life of the bus.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 68. Finish and Color
TS 68.1 Appearance

All exterior surfaces shall be smooth and free of wrinkles and dents. Exterior surfaces to be painted shall be properly prepared as required by the paint system Supplier prior to application of paint to ensure a proper bond between the basic surface and successive coats of original paint for the service life of the bus. Drilled holes and cutouts in exterior surfaces shall be made prior to cleaning, priming, and painting, where possible, to prevent corrosion. The bus shall be painted prior to installation of exterior lights, windows, mirrors, and other items that are applied to the exterior of the bus. Body filler materials may be used for surface dressing, but not for repair of damaged or improperly fitted panels.
Paint shall be applied smoothly and evenly with the finished surface free of visible dirt and the following other imperfections:

- blisters or bubbles appearing in the topcoat film
- chips, scratches, or gouges of the surface finish
- cracks in the paint film
- craters where paint failed to cover due to surface contamination
- overspray
- peeling
- runs or sags from excessive flow and failure to adhere uniformly to the surface
- chemical stains and water spots
- dry patches due to incorrect mixing of paint activators
- buffing swirls

All exterior finished surfaces shall be impervious to diesel fuel, gasoline, and commercial cleaning agents. Finished surfaces shall resist damage by controlled applications of commonly used graffiti-removing chemicals.

Proper adhesion between the basic surface and successive coats of the original paint shall be measured using an Elcometer adhesion tester as outlined in ASTM D4541-85. Adhesion shall be a minimum 300 ft.-lbs. The bus manufacturer shall supply test samples of the exterior surface for each step of the painting process that may be subject to adhesion testing per ASTM G4541-87 and ASTM D4145-85. ASTM D4541-93 may be used for inspection testing during assembly of the vehicle.

DEFAULT
Standard Proposer exterior paint finish quality.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Base coat/clear coat paint system.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 69. Decals, Numbering and Signing
DEFAULT
Monograms, numbers, and other special signing shall be applied to the inside and outside of the bus as required. Signs shall be durable and fade-, chip- and peel-resistant. They may be painted signs, decals, or pressure-sensitive appliqués. All decals shall be installed per the decal Supplier recommendations. Signs shall be provided in compliance with the ADA requirements defined in 49 CFR Part 38, Subpart B, 38.27.

> **NOTE:** The TRANSIT AGENCY should supply a list of interior and exterior decals including size and location.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 69.1 Passenger Information DEFAULT
ADA priority seating signs as required and defined by 49 CFR shall be provided to identify the seats designated for passengers with disabilities.

Requirements for a public information system in accordance with 49 CFR shall be provided.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 70. Exterior Lighting
All exterior lights shall be designed to prevent entry and accumulation of moisture or dust. Lamps, lenses, and fixtures shall be interchangeable to the extent practicable. Two hazard lamps at the rear of the bus shall be visible from behind when the engine service doors are opened.
Light lenses shall be designed and located to prevent damage when running the vehicle through an automatic bus washer.

DEFAULT
Commercially available LED-type lamps shall be utilized at all exterior lamp locations.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Standard Lamps
All LED lamps shall be standard installation of the OEM. The entire assembly shall be specifically coated to protect the light from chemical and abrasion degradation.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
Standard Size
Size of LED lamps used for tail, brake and turn signal lamps shall be standard installation of OEM.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 70.1 Backup Light/Alarm
DEFAULT
Visible and audible warnings shall inform following vehicles or pedestrians of reverse operation. Visible reverse operation warning shall conform to SAE Standard J593. Audible reverse operation warning shall conform to SAE Recommended Practice J994 Type C or D.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:
TS 70.2 Doorway Lighting
DEFAULT

Lamps at the front and rear passenger doorways (if applicable) shall comply with ADA requirements and shall activate only when the doors open. These lamps shall illuminate the street surface to a level of no less than 1 foot-candle for 3 ft. outward from the outboard edge of the door threshold. The lights may be positioned above or below the lower daylight opening of the windows and shall be shielded to protect passengers' eyes from glare.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 70.3 Turn Signals
DEFAULT
Standard Turn Signals
Turn-signal lights shall be provided on the front, rear, curb, and street sides of the bus in accordance with federal regulations.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 70.4 Headlights
Headlamps shall be designed for ease of replacement.

DEFAULT
Standard Installation
Standard OEM headlight installation shall be provided in accordance with federal regulations.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 70.5 Brake Lights
TS 70.5.1 Transit Coach

Brake lights shall be provided in accordance with federal regulations.

DEFAULT
No High/Center Mount Brake Lamp or Deceleration Warning Lamps
Bus shall not include a high/center mount brake lamp and/or deceleration warning indicator lamps.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 70.6 Service Area Lighting (Interior and Exterior)
DEFAULT
LED lamps shall be provided in the engine and all other compartments where service may be required to generally illuminate the area for night emergency repairs or adjustments. These service areas shall include, but not be limited to, the engine compartment, the communication box, junction/apparatus panels and passenger door operator compartments. Lighting shall be adequate to light the space of the service areas to levels needed to complete typical emergency repairs and adjustments. The service area lamps shall be suitable for the environment in which they are mounted.

Engine compartment lamps shall be controlled by a switch mounted near the rear start controls. All other service area lamps shall be controlled by switches mounted on or convenient to the lamp assemblies. Power to the service area lighting shall be programmable. Power shall latch on
with activation of the switch and shall be automatically discontinued (timed out) after 30 minutes to prevent damage caused by inadvertently leaving the service area lighting switch in the "on" position after repairs are made.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

INTERIOR PANELS AND FINISHES
TS 71. General Requirements
Materials shall be selected on the basis of maintenance, durability, appearance, safety, flammability, and tactile qualities. Materials shall be strong enough to resist everyday abuse and be vandalism and corrosion resistant. Trim and attachment details shall be kept simple and unobtrusive. Interior trim shall be secured to avoid resonant vibrations under normal operational conditions.

Interior surfaces more than 10 in. below the lower edge of the side windows or windshield shall be shaped so that objects placed on them fall to the floor when the coach is parked on a level surface. Any components and other electrical components within close proximity to these surfaces shall also be resistant to this cleaning method.

DEFAULT
No requirement for anti-graffiti/vandalism surface treatments.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 72. Interior Panels
Panels shall be easily replaceable and tamper resistant. They shall be reinforced, as necessary, to resist vandalism and other rigors of transit bus service. Individual trim panels and parts shall be interchangeable to the extent practicable.

DEFAULT
Interior panel required to meet FMVSS 302.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 72.1 Driver Area Barrier
TS 72.1.1 Transit Coach
A barrier or bulkhead between the driver and the street-side front passenger seat shall be provided. The barrier shall minimize glare and reflections in the windshield directly in front of the barrier from interior lighting during night operation. Location and shape must permit full seat travel and reclining possibilities that can accommodate the shoulders of a 95th-percentile male. The partition shall have a side return and stanchion to prevent passengers from reaching the driver by standing behind the driver's seat. The lower area between the seat and panel must be accessible to the driver. The partition must be strong enough in conjunction with the entire partition assembly for mounting of such equipment as flare kits, fire extinguishers (1.2kg), microcomputer, public address amplifier, etc. The panel should be properly attached to minimize noise and rattles.

DEFAULT

No Driver Barrier

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 72.2 Modesty Panels
Sturdy divider panels constructed of durable, unpainted, corrosion-resistant material complementing the interior shall be provided to act as both a physical and visual barrier for seated passengers.

Design and installation of modesty panels located in front of forward-facing seats shall include a handhold or grab handle along its top edge. These dividers shall be mounted on the sidewall and shall project toward the aisle no farther than passenger knee projection in longitudinal seats or the aisle side of the transverse seats. Modesty panels shall extend from at least the window opening of the side windows, and those forward of transverse seats shall extend downward to 1 and 1½ in. above the floor. Panels forward of longitudinal seats shall extend to below the level of the seat cushion. Dividers positioned at the doorways, where applicable, shall provide no less than a 2½ in. clearance between the modesty panel and a fully open, inward opening door, or the path of a deploying flip-out ramp to protect passengers from being pinched. Modesty panels installed at doorways shall be equipped with grab rails if passenger assists are not provided by other means.

The modesty panel and its mounting shall withstand a static force of 250 lbs. applied to a 4 × 4 in. area in the center of the panel without permanent visible deformation.

DEFAULT
Modesty panels shall be installed as stated.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 72.3 Front End
DEFAULT
The entire front end of the bus shall be sealed to prevent debris accumulation behind the dash and to prevent the driver's feet from kicking or fouling wiring and other equipment. The front end shall be free of protrusions that are hazardous to passengers standing at the front of the standee line area of the bus during rapid decelerations. Paneling across the front of the bus and any trim around the driver's compartment shall be formed metal or composite material.

Composite dash panels shall be reinforced as necessary, vandal-resistant, and replaceable. All colored, painted, and plated parts forward of the driver's barrier shall be finished with a surface that reduces glare. Any mounted equipment must have provision to support the weight of equipment.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 72.4 Rear Bulkhead
DEFAULT
The rear bulkhead and rear interior surfaces shall be material suitable for exterior skin; painted and finished to exterior quality; or paneled with melamine-type material, composite, scratch- resistant plastic or carpeting and trimmed with stainless steel, aluminum, or composite.

The rear bulkhead paneling shall be contoured to fit the ceiling, side walls and seat backs so that any litter or trash will tend to fall to the floor or seating surface when the bus is on a level surface. Any air vents in this area shall be louvered to reduce airflow noise and to reduce the probability of trash or liter being thrown or drawn through the grille. If it is necessary to remove the panel to service components located on the rear bulkhead, then the panel shall be hinged or shall be able to be easily removed and replaced. Grilles where access to or adjustment of equipment is required shall be heavy duty and designed to minimize damage and limit unauthorized access.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 72.5 Headlining
DEFAULT
Ceiling panels shall be made of durable, corrosion resistant, easily cleanable material. Headlining shall be supported to prevent buckling, drumming, or flexing and shall be secured without loose edges. Headlining materials shall be treated or insulated to prevent marks due to condensation where panels are in contact with metal members. Moldings and trim strips, as required to make the edges tamperproof, shall be stainless steel, aluminum, or plastic, colored to complement the ceiling material. Headlining panels covering operational equipment that is mounted above the ceiling shall be on hinges for ease of service but retained to prevent inadvertent opening.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 72.6 Fastening
DEFAULT
Interior panels shall be attached so that there are no exposed unfinished or rough edges or rough surfaces. Fasteners should be corrosion resistant. Panels and fasteners shall not be easily removable by passengers. Exposed interior fasteners should be minimized, and where required shall be tamper resistant.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 72.7 Insulation
DEFAULT
Any insulation material used between the inner and outer panels shall minimize the entry and/or retention of moisture. Insulation properties shall be unimpaired during the service life of the bus. Any insulation material used inside the engine compartment shall not absorb or retain oils or water and shall be designed to prevent casual damage that may occur during maintenance operations.

The combination of inner and outer panels on the sides, roof, wheel wells and ends of the bus, and any material used between these panels, shall provide a thermal insulation sufficient to meet the interior temperature requirements. The bus body shall be thoroughly sealed so that the driver or passengers cannot feel drafts during normal operations with the passenger doors closed.

FTA Docket 90-A
All insulation materials shall comply with the Recommended Fire Safety Practices defined in FTA Docket 90-A, dated October 20, 1993.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 72.8 Floor Covering
DEFAULT

Floor covering shall be slip resistant vinyl flooring, constructed with aluminum oxide, silicon carbide and optional PVC chip blended throughout a high-quality vinyl wear surface (top coating is not acceptable). Backing to be polyester/cellulose material with fiberglass fiber reinforced center scrim for additional durability. Minimum thickness of 2.7 millimeters or approved equal will be acceptable.

The whole floor will be a uniform thickness throughout the vehicle, eliminating the need for ribbed surfaces, while exceeding the ADA minimum slip resistance standard rating of .06 static coefficient of friction under dry or wet conditions. Coving material is to be installed to support floor when rolling floor covering up the sidewall of vehicle to the seat track.

Seams are to be heat welded to provide a permanent waterproof seal against water penetration leading to premature sub-floor failure or curling leading to possible tripping hazards.

Landing area and step edgings are to be yellow safety vinyl edging. Edging is to heat welded to the main floor and step tread to provide for a long-lasting seam.

Manufacturer is required to provide batch-testing results upon request on each production run of the flooring product used on this procurement to ensure compliance to the specifications. This includes providing written documentation that a PTV pendulum test-rating equal to or greater than 36 is achieved.

Flooring shall carry a 15 year non prorated warranty.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 72.9 Interior Lighting
DEFAULT
The light source shall be located to minimize windshield glare, with distribution of the light focused primarily on the passengers' reading plane while casting sufficient light onto the advertising display. The lighting system may be designed to form part of or the entire air distribution duct.

The lens material shall be translucent polycarbonate. Lenses shall be designed to effectively "mask" the light source. Lenses shall be sealed to inhibit incursion of dust and insects yet be easily removable for service. Access panels shall be provided to allow servicing of components located behind light panels. If necessary, the entire light fixture shall be hinged.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 72.10 Passenger First Row Lights
The first light on each side (behind the driver and the front door) is normally turned on only when the front door is opened, in "night run" and "night park." As soon as the door closes, these lights shall go out. These lights shall be turned on at any time if the switch is in the "on" position.

DEFAULT
LED lights.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

DEFAULT
First Light Modules Dim/Extinguish When Front Door is Closed
When the master switch is in the "run" or "night/run" mode, the first light module on each side of the coach shall automatically extinguish or dim when the front door is in the closed position and illuminate when the door is opened.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 72.11 Driver's Area
DEFAULT
The driver's area shall have a light to provide general illumination, and it shall illuminate the half of the steering wheel nearest the driver to a level of 5 to 10 foot-candles.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 72.12 Seating Areas
DEFAULT

The interior lighting system shall provide a minimum 15 foot-candle illumination on a 1 sq. ft. plane at an angle of 45 degrees from horizontal, centered 33 in. above the floor and 24 in. in front of the seat back at each seat position. Allowable average light level for the rear bench seats shall be 7 foot-candles.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 72.13 Vestibules/Doors
DEFAULT
Floor surface in the aisles shall be a minimum of 10 foot-candles, and the vestibule area a minimum of 4 foot-candles with the front doors open and a minimum of 2 foot-candles with the front doors closed. The front entrance area and curb lights shall illuminate when the front door is open and master run switch is in the "lights" positions. Rear exit area and curb lights shall illuminate when the rear door is unlocked.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 72.14 Step Lighting
DEFAULT
Step lighting for the intermediate steps between lower and upper floor levels shall be a minimum of 4 foot-candles and shall illuminate in all engine run positions. The step lighting shall be low profile to minimize tripping and snagging hazards for passengers and shall be shielded as necessary to protect passengers' eyes from glare.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 72.15 Ramp Lighting
DEFAULT
Exterior and interior ramp lighting shall comply with federal regulations.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 72.16 Farebox Lighting
DEFAULT
None required.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 73. Fare Collection
Space and structural provisions shall be made for installation of currently available fare collection devices, which shall be as far forward as practicable. Location of the fare collection device shall not restrict traffic in the vestibule, including wheelchairs if a front door loading device is used, and shall allow the driver to easily reach the farebox controls and to view the fare register. The farebox shall not restrict access to the driver area, shall not restrict operation of driver controls and shall not—either by itself or in combination with stanchions, transfer mounting, cutting, and punching equipment, or route destination signs—restrict the driver's field of view per SAE Recommended Practice J1050. The location and mounting of the fare collection device shall allow use, without restriction, by passengers. The farebox location shall permit accessibility to the vault for easy manual removal or attachment of suction devices. Meters and counters on the farebox shall be readable on a daily basis. The floor under the farebox shall be reinforced as necessary to provide a sturdy mounting platform and to prevent shaking of the farebox.

Proposer shall provide fare collection installation layout to the TRANSIT AGENCY for approval.

Transfer mounting, cutting, and punching equipment shall be located in a position convenient to the driver.

DEFAULT
TRANSIT AGENCY will install its own fare box.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 74. Interior Access Panels and Doors
Access for maintenance and replacement of equipment shall be provided by panels and doors that appear to be an integral part of the interior. Access doors shall be hinged with gas props or over-center springs, where practical, to hold the doors out of the mechanic's way. Panels shall prevent entry of mechanism lubricant into the bus interior. All fasteners that retain access panels shall be captive in the cover.

DEFAULT
Access Doors that Do Not Require Tools or Keys to Open
Access doors shall be secured with hand screws or latches. All fasteners that retain access panels shall be captive in the cover.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 74.1 Floor Panels
DEFAULT
Access openings in the floor shall be sealed to prevent entry of fumes and water into the bus interior. Flooring material at or around access openings shall be flush with the floor and shall be edge-bound with stainless steel or another material that is acceptable to the TRANSIT AGENCY to prevent the edges from coming loose. Access openings shall be asymmetrical so that reinstalled flooring shall be properly aligned. Fasteners shall tighten flush with the floor.

The number of special fastener tools required for panel and access door fasteners shall be minimized.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

PASSENGER ACCOMMODATIONS
TS 75. Passenger Seating
TS 75.1 Arrangements and Seat Style

The passenger seating arrangement in the bus shall be such that seating capacity is maximized and in compliance to the following requirements.

NOTE: The TRANSIT AGENCY recognizes that ramp location, foot room, hip-to-knee room, doorway type, width, seat construction, floor level type, seat spacing requirements, ramp or lift, number of wheelchair positions, etc. ultimately affect seating capacity and layout.

DEFAULT
Forward-Facing Seat Configuration
Passenger seats shall be arranged in a transverse, forward-facing configuration, except at the wheel housings and turntable, if applicable, where aisle-facing seats may be arranged as appropriate with due regard for passenger access and comfort. Other areas where aisle-facing seats may be provided are at wheelchair securement areas and platforms (such as for fuel tank storage space).
Base Bus-USSC Gemini

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 75.2 Rearward Facing Seats
DEFAULT
Rearward facing seats not allowed.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 75.3 Padded Inserts/Cushioned Seats
DEFAULT
Non-Padded Inserts – un-upholstered
The passenger seats shall be equipped with un upholstered inserts throughout the bus.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 75.4 Seat back fitness
DEFAULT
Back insert Seat Configuration
The seat back insert thickness shall not exceed 1in. in the knee room area.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 75.5 Drain Hole in Seats
DEFAULT
No requirements for drain hole provision in seat inserts.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 75.6 Hip-to-Knee Room
DEFAULT
Hip-to-knee room measured from the center of the seating position, from the front of one seat back horizontally across the highest part of the seat to a vertical surface immediately in front, shall be a minimum of 26 in. At all seating positions in paired transverse seats immediately behind other seating positions, hip-to-knee room shall be no less than 27 in.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 75.7 Foot Room
DEFAULT
Foot room, measured at the floor forward from a point vertically below the front of the seat cushion, shall be no less than 14 in. Seats immediately behind the wheel housings and modesty panels may have foot room reduced.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

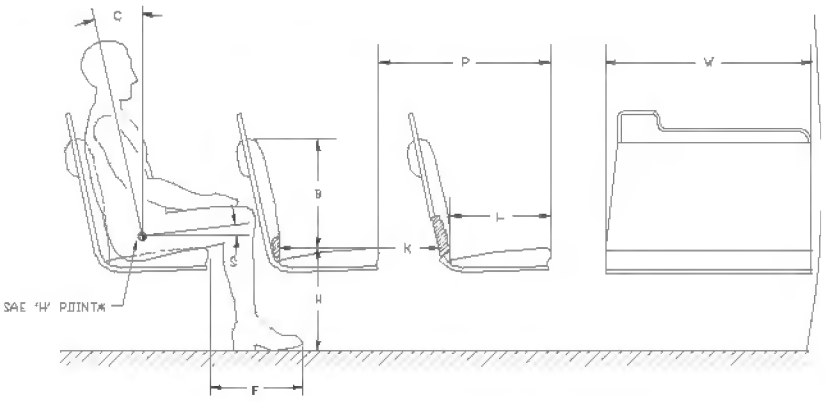
TS 75.8 Aisles
DEFAULT
The aisle between the seats shall be no less than 20 in. wide at seated passenger hip height. Seat backs shall be shaped to increase this dimension to no less than 24 in. at 32 in. above the floor (standing passenger hip height).

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 75.9 Dimensions

FIGURE 6
Seating Dimensions and Standard Configuration



DEFAULT
Seat dimensions for the various seating arrangements shall have the dimensions as follows (refer to **Figure 6**):

- The width, W, of the two-passenger transverse seat shall be a minimum 35 in.
- The length, L, shall be 17 in., ±1 in.
- The seat back height, B, shall be a minimum of 15 in.

- The seat height, H, shall be 17 in., ± 1 in. For the rear lounge (or settee) and longitudinal seats, and seats located above raised areas for storage of under-floor components, a cushion height of up to 18 in., ±2 in., will be allowed. This shall also be allowed for limited transverse seats, but only with the expressed approval of the TRANSIT AGENCY.
- Foot room = F.
- The seat cushion slope, S, shall be between 5 and 11 deg.
- The seat back slope, C, shall be between 8 and 17 deg.
- Hip to knee room = K.
- The pitch, P, is shown as reference only.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 75.10 Structure and Design
DEFAULT
The passenger seat frame and its supporting structure shall be constructed and mounted so that space under the seat is maximized and is completely free of obstructions to facilitate cleaning.

Seats, structures, and restraints around the securement area should not infringe into the mobility device envelope or maneuverability.
The transverse seat structure shall be fully cantilevered from the sidewall with sufficient strength for the intended service. The lowest part of the seat assembly that is within 12 in. of the aisle shall be at least 10 in. above the floor.

In locations at which cantilevered installation is precluded by design and/or structure, other seat mounting may be allowed.

All transverse objects—including seat backs, modesty panels, and longitudinal seats—in front of forward-facing seats shall not impart a compressive load in excess of 1000lbs onto the femur of passengers ranging in size from a 5th-percentile female to a 95th-percentile male during a 10g deceleration of the bus. This deceleration will peak at 0.05 to0.015 seconds from initiation.
Permanent deformation of the seat resulting from two 95th-percentile males striking the seat back during this 10g deceleration shall not exceed 2 in., measured at the aisle side of the seat frame at height H. The seat back should not deflect more than 14 in., measured at the top of the seat back, in a controlled manner to minimize passenger injury. Structural failure of any part of the seat or sidewall shall not introduce a laceration hazard.

The seat assembly shall withstand static vertical forces of 500 lbs. applied to the top of the seat cushion in each seating position with less than ¼in. permanent deformation in the seat or its mountings. The seat assembly shall withstand static horizontal forces of 500 lbs. evenly distributed along the top of the seat back with less than ¼in. permanent deformation in the seat or its mountings. The seat backs at the aisle position and at the window position shall withstand repeated impacts of two 40-lb sandbags without visible deterioration. One sandbag shall strike the front 40,000 times and the other sandbag shall strike the rear 40,000 times. Each sandbag shall be suspended on a 36in. pendulum and shall strike the seat back 10,000 times each from distances of 6, 8, 10 and 12 in. Seats at both seating positions shall withstand 4000 vertical drops of a 40-lb sandbag without visible deterioration. The sandbag shall be dropped 1000 times each from heights of 6, 8, 10 and 12 in. Seat cushions shall withstand 100,000 randomly positioned 3½ in. drops of a squirming, 150-lb, smooth-surfaced, buttocks-shaped striker with only minimal wear on the seat covering and no failures to seat structure or cushion suspension components.

The back of each transverse seat shall incorporate a handhold no less than ⅞ in. in diameter for standees and seat access/egress. The handhold shall not be a safety hazard during severe decelerations. The handhold shall extend above the seat back near the aisle so that standees shall have a convenient vertical assist, no less than 4 in. long, that may be grasped with the full hand. This handhold shall not cause a standee using this assist to interfere with a seated 50th-percentile male passenger. The handhold shall also be usable by a 5th-percentile female, as well as by larger passengers, to assist with seat access/egress for either transverse seating position. The upper rear portion of the seat back and the seat back handhold immediately forward of transverse seats shall be padded and/or constructed of energy-absorbing materials. During a 10g deceleration of the bus, the HIC number (as defined by SAE Standard J211a) shall not exceed 400 for passengers ranging in size from a 5th percentile female through a 95th percentile male.

The seat back handhold may be deleted from seats that do not have another transverse seat directly behind and where a vertical assist is provided.

Longitudinal seats shall be the same general design as transverse seats but without seat back handholds. Longitudinal seats may be mounted on the wheelhouses. Armrests shall be included on the ends of each set of longitudinal seats except on the forward end of a seat set that is immediately to the rear of a transverse seat, the driver's barrier, or a modesty panel, when these fixtures perform the function of restraining passengers from sliding forward off the seat.
Armrests are not required on longitudinal seats located in the wheelchair parking area that fold up when the armrest on the adjacent fixed longitudinal seat is within 3½ in. of the end of the seat cushion. Armrests shall be located from 7 to 9 in. above the seat cushion surface. The area between the armrest and the seat cushion shall be closed by a barrier or panel. The top and sides of the armrests shall have a minimum width of 1 in. and shall be free from sharp protrusions that form a safety hazard.

Seat back handhold and armrests shall withstand static horizontal and vertical forces of 250 lbs. applied anywhere along their length with less than ¼ in. permanent deformation. Seat back handhold and armrests shall withstand 25,000 impacts in each direction of a horizontal force of 125 lbs. with less than ¼in. permanent deformation and without visible deterioration.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET

Comment:

TS 75.11 Construction and Materials
Selected materials shall minimize damage from vandalism and shall reduce cleaning time. The seats shall be attached to the frame with tamper-resistant fasteners. Coloring shall be consistent throughout the seat material, with no visually exposed portion painted. Any exposed metal touching the sides, or the floor of the bus shall be stainless steel. The seat, pads and cushions shall be contoured for individuality, lateral support and maximum comfort and shall fit the framework to reduce exposed edges.

The minimum radius of any part of the seat back, handhold or modesty panel in the head or chest impact zone shall be a nominal ¼in.The seat back and seat back handhold immediately forward of transverse seats shall be constructed of energy-absorbing materials to provide passenger protection and, in a severe crash, to allow the passenger to deform the seating materials in the impact areas. Complete seat assemblies shall be interchangeable to the extent practicable.

DEFAULT
TRANSIT AGENCY to select seat fabric.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 76. Passenger Assists
DEFAULT
Passenger assists in the form of full grip, vertical stanchions or handholds shall be provided for the safety of standees and for ingress/egress. Passenger assists shall be convenient in location, shape, and size for both the 95th-percentile male and the 5th-percentile female standee. Starting from the entrance door and moving anywhere in the bus and out the exit door, a vertical assist shall be provided either as the vertical portion of the seat back assist or as a separate item so that a 5th-percentile female passenger may easily move from one assist to another using one hand and the other without losing support. All handholds and stanchions at the front doorway, around the farebox, and at interior steps for bi-level designs shall be powder-coated in a high-contrast yellow color.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:
TS 76.1 Assists
DEFAULT

Excluding those mounted on the seats and doors, the assists shall have a cross-sectional diameter between 1¼ and 1½ in. or shall provide an equivalent gripping surface with no corner radii less than ¼ in. All passenger assists shall permit a full hand grip with no less than 1½ in. of knuckle clearance around the assist. Passenger assists shall be designed to minimize catching or snagging of clothes or personal items and shall be capable of passing the NHTSA Drawstring Test.

Any joints in the assist structure shall be underneath supporting brackets and securely clamped to prevent passengers from moving or twisting the assists. Seat handholds may be of the same construction and finish as the seat frame. Door-mounted passenger assists shall be of anodized aluminum, stainless steel, or powder-coated metal. Connecting tees and angles may be powder- coated metal castings. Assists shall withstand a force of 300 lbs. applied over a 12in. lineal dimension in any direction normal to the assist without permanent visible deformation. All passenger assist components, including brackets, clamps, screw heads and other fasteners used on the passenger assists shall be designed to eliminate pinching, snagging and cutting hazards and shall be free from burrs or rough edges.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 76.2 Front Doorway
DEFAULT
Front doors, or the entry area, shall be fitted with ADA-compliant assists. Assists shall be as far outward as practicable but shall be located no farther inboard than 6 in. from the outside edge of the entrance step and shall be easily grasped by a 5th-percentile female boarding from street level. Door assists shall be functionally continuous with the horizontal front passenger assist and the vertical assist and the assists on the wheel housing or on the front modesty panel.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 76.3 Vestibule
DEFAULT

The aisle side of the driver's barrier, the wheel housings and when applicable the modesty panels shall be fitted with vertical passenger assists that are functionally continuous with the overhead assist and that extend to within 36 in. of the floor. These assists shall have sufficient clearance from the barrier to prevent inadvertent wedging of a passenger's arm.

A horizontal passenger assist shall be located across the front of the bus and shall prevent passengers from sustaining injuries on the fare collection device or windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the fare collection procedure. The assist shall be no less than 36 in. above the floor. The assists at the front of the bus shall be arranged to permit a 5th-percentile female passenger to easily reach from the door assist to the front assist, to vertical assists on the driver's barrier, wheel housings or front modesty panel.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 76.4 Rear Doorway
DEFAULT
Vertical assists that are functionally continuous with the overhead assist shall be provided at the aisle side of the transverse seat immediately forward of the rear door and on the aisle side of the rear door modesty panel(s). Passenger assists shall be provided on modesty panels that are functionally continuous with the rear door assists. Rear doors, or the exit area, shall be fitted with assists having a cross-sectional diameter between 1¼ and 1½ in. or providing an equivalent gripping surface with no corner radii less than ¼ in., and shall provide at least 1½ in. of knuckle clearance between the assists and their mounting. The assists shall be designed to permit a 5th- percentile female to easily move from one assist to another during the entire exiting process. The assists shall be located no farther inboard than 6 in. from the outside edge of the rear doorway step.

> **NOTE:** For an articulated bus, passenger assists will be provided to aid in the transition between the front and rear sections of the bus.

TS 76.5 Overhead
Except forward of the standee line and at the rear door, a continuous, full-grip, overhead assist shall be provided. This assist shall be located over the center of the aisle seating position of the transverse seats. The assist shall be no less than 70 in. above the floor.

DEFAULT
No requirements for overhead grab straps/extensions.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

DEFAULT
Grip rails shall be stainless steel.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 76.6 Longitudinal Seat Assists
DEFAULT
Longitudinal seats shall have vertical assists located between every other designated seating position, except for seats that fold/flip up to accommodate wheelchair securement. Assists shall extend from near the leading edge of the seat and shall be functionally continuous with the overhead assist. Assists shall be staggered across the aisle from each other where practicable and shall be no more than 52 in. apart or functionally continuous for a 5th percentile female passenger.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 76.7 Wheel Housing Barriers/Assists
DEFAULT
Unless passenger seating is provided on top of wheel housings, passenger assists shall be mounted around the exposed sides of the wheel housings (and propulsion compartments if applicable), which shall also be designed to prevent passengers from sitting on wheel housings. Such passenger assists shall also effectively retain items, such as bags and luggage, placed on top of wheel housings.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 77. Passenger Doors TS 77.1 Transit Coach
DEFAULT

Doorways will be provided in the locations and styles as follows. Passenger doors and doorways shall comply with ADA requirements.

TS 77.1.1 Front door
Door shall be forward of the front wheels and under direct observation of the driver.

TS 77.1.2 Rear Door

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

Front	Street-Side Rear
Closed	Closed
Open	Closed
Open	Closed
Open	Open
Open	Open
Closed	Closed
Closed	Open
Closed	Open

DEFAULT
If air-powered, the door system shall operate per specification at air pressures between 90 and 130 psi.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 77.2 Materials and Construction

Structure of the doors, their attachments, inside and outside trim panels and any mechanism exposed to the elements shall be corrosion resistant. Door panel construction shall be of corrosion-resistant metal or reinforced non-metallic composite materials. When fully opened, the doors shall provide a firm support and shall not be damaged if used as an assist by passengers during ingress or egress. Door edges shall be sealed to prevent infiltration of exterior moisture, noise, dirt, and air elements from entering the passenger compartment, to the maximum extent possible based on door types.

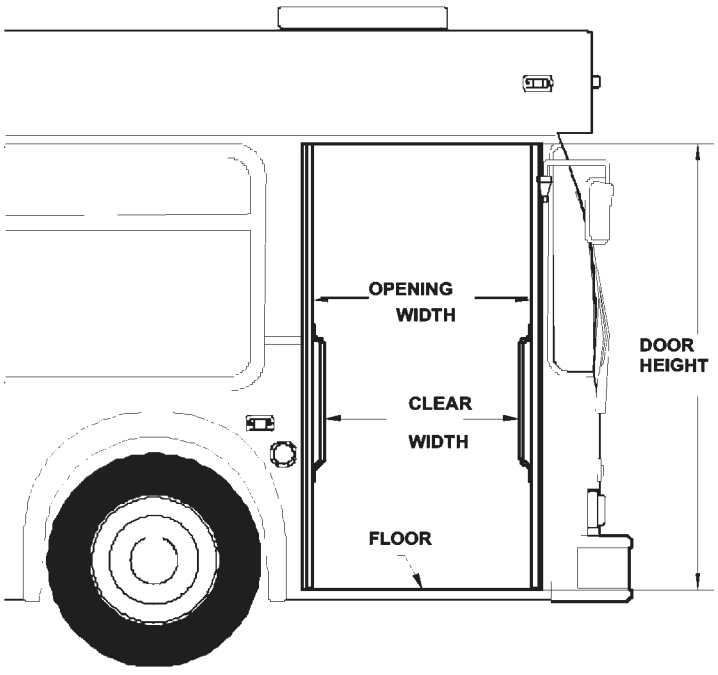
The closing edge of each door panel shall have no less than 2 in. of soft weather stripping. The doors, when closed, shall be effectively sealed, and the hard surfaces of the doors shall be at least 4 in. apart (not applicable to single doors).The combined weather seal and window glazing elements of the front door shall not exceed 10 deg of binocular obstruction of the driver's view through the closed door.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 77.3 Dimensions
TS 77.3.1 Transit Coach

FIGURE 7
Transit Bus Minimum Door Opening



When open, the doors shall leave an opening no less than 75 in. in height.

DEFAULT

31¾in.Minimum Doorway Clear Width
Front door clear width shall be a minimum of 31¾ in. with the doors fully opened. Rear door opening clear width shall be a minimum of 24 in. with the doors fully opened. If arear door ramp or lift is provided, then the clear door opening width shall be a minimum of31¾ in. with door fully opened.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 77.4 Door Glazing
The upper section of both front and rear doors shall be glazed for no less than 45 percent of the respective door opening area of each section. The lower section of the front door shall be glazed for no less than 25 percent of the door opening area of the section.

Door glazing shall be easily replaceable.

DEFAULT
Zip type glazing rubber.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

DEFAULT
The front door panel glazing material shall have a nominal ¼ in. thick laminated safety glass conforming with the requirements of ANSI Z26.1 Test Grouping 2 and the recommended practices defined in SAE J673.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 77.5 Door Projection TS 77.5.1 Exterior
DEFAULT

The exterior projection of the front doors beyond the side of the bus shall be minimized and shall not block the line of sight of the rear exit door via the curb side mirror when the doors are fully open. The exterior projection of both doors shall be minimized and shall not exceed 14 in. during the opening or closing cycles or when doors are fully opened.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 77.5.2 Interior
DEFAULT
Projection inside the bus shall not cause an obstruction of the rear door mirror or cause a hazard for standees.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 77.6 Door Height Above Pavement
DEFAULT
It shall be possible to open and close either passenger door when the bus loaded to gross vehicle weight rating is not knelt and parked with the tires touching an 8in. high curb on a street sloping toward the curb so that the street-side wheels are 5 in. higher than the right-side wheels.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 77.7 Closing Force
DEFAULT
The closing door edge speed shall not exceed 12 in. per second, and opening door speed shall not exceed 19 in. per second. Power doors shall not slam closed under any circumstance, even if the door is obstructed during the closing cycle. If a door is obstructed during the closing cycle, the pressure exerted on the obstruction shall not increase once initial contact has been made.

Doors closed by a return spring or counterweight-type device shall be equipped with an obstruction-sensing device that, at a minimum, alerts the driver if an obstruction is detected between the closing doors. Doors closed by a return spring or counterweight type device, when unlocked, shall be capable of being pushed to the point where the door starts to open with a force not to exceed 25 lbs. applied to the center edge of the forward door panel.

Whether or not the obstruction-sensing system is present or functional, it shall be possible to withdraw a 1½ in. diameter cylinder from between the center edges of a closed and locked door with an outward force not greater than 35 lbs.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 77.7.1 Rear Door Closing Force
DEFAULT
Power-close rear doors shall be equipped with an obstruction-sensing system such that if an obstruction is within the path of the closing doors, the doors will stop and/or reverse direction prior to imparting a 10-lb force on 1 sq. in. of that obstruction. If a contactless obstruction sensing system is employed, it shall be capable of discriminating between the normal doorway environment and passengers or other obstructions within the doorway, and of altering the zones of detection based upon the operating state of the door system.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 77.8 Actuators
Doors shall open or close completely in not more than 3.5 seconds from the time of control actuation and shall be subject to the closing force requirements.

Door actuators shall be adjustable so that the door opening and closing speeds can be independently adjustable to satisfy the above requirements. Actuators and the complex door mechanism shall be concealed from passengers but shall be easily accessible for servicing. The door actuators shall be rebuildable. If powered by compressed air, exhaust from the door system shall be routed below the floor of the bus to prevent accumulation of any oil that may be present in the air system and to muffle sound.

Door actuators and associated linkages shall maximize door holding forces in the fully open and fully closed positions to provide firm, non-rattling, non-fluttering door panels while minimizing the force exerted by the doors on an obstruction midway between the fully open and closed positions.

DEFAULT
The rear door actuator(s) shall be under the complete control of the vehicle operator and shall open and close in response to the position of the driver's door control.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 77.8.1 Rear Door Interlocks
See "Hardware Mounting" for door system interlock requirements.

TS 77.9 Emergency Operation
DEFAULT
In the event of an emergency, it shall be possible to manually open doors designated as emergency exits from inside the bus using a force of no more than 25 lbs. after actuating an unlocking device. The unlocking device shall be clearly marked as an emergency-only device and shall require two distinct actions to actuate. The respective door emergency unlocking device shall be accessible from the doorway area. The unlocking device shall be easily reset by the operator without special tools or opening the door mechanism enclosure. Doors that are required to be classified as "emergency exits" shall meet the requirements of FMVSS 217.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 77.10 Door Control
The door control shall be located in the operator's area within the hand reach envelope described in SAE Recommended Practice J287, "Driver Hand Control Reach." The driver's door control shall provide tactile feedback to indicate commanded door position and resist inadvertent door actuation.

DEFAULT
Door control located on street side. The front door shall remain in commanded state position even if power is removed or lost.
Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***

Comment:

TS 77.11 Door Controller TS 77.11.1 Transit Coach
DEFAULT
Five-Position Driver's Door Controller
The control device shall be protected from moisture. Mounting and location of the door control device handle shall be designed so that it is within comfortable, easy arm's reach of the seated driver. The door control device handle shall be free from interference by other equipment and have adequate clearance so as not to create a pinching hazard.

Base Bus-Vapor Door Controller
Position of the door control handle shall result in the following operation of the front and rear doors:

- **Center position:** Front door closed, rear door closed or set to lock.
- **First position forward:** Front door open, rear door closed or set to lock.
- **Second position forward:** Front door open, rear door open or set to open.
- **First position back:** Front door closed, rear door open or set to open.
- **Second position back:** Front door open, rear door open or set to open.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 77.12 Door Open/Close
DEFAULT
A control or valve in the operator's compartment shall shut off the power to, and/or dump the power from, the front door mechanism to permit manual operation of the front door with the bus shut down. A master door switch, which is not within reach of the seated operator, when set in the "off" position shall close the rear door, deactivate the door control system, release the interlocks, and permit only manual operation of the rear door.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 78. Accessibility Provisions
DEFAULT
Space and body structural provisions shall be provided at the front or rear door of the bus to accommodate a wheelchair loading system.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 78.1 Loading Systems
There are three options:

- high-floor lift
- low-floor ramp
- platform (boarding bridge plate) level boarding

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 78.2 Lift
The wheelchair lift control system must be capable of receiving multiplex commands from vehicle interlocks.

An automatically controlled, power-operated wheelchair lift system compliant to requirements defined in 49 CFR 571.403(FMVSS 403) shall provide ingress and egress quickly, safely, and comfortably, both in forward and rearward directions, for a passenger in a wheelchair from a level street or curb.

DEFAULT
Wheelchair Ramp mounted in front step well. Base Bus-Lift U LU 18

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 78.3 Loading System for 30 to 40 ft. Low-Floor Bus
An automatically controlled, power-operated ramp system compliant to requirements defined in 49 CFR Part 38, Subpart B, §38.23c shall provide ingress and egress quickly, safely, and comfortably, both in forward and rearward directions, for a passenger in a wheelchair from a level street or curb.

DEFAULT
Front Door Location of Loading System, Flip-Out Design Ramp with 6:1 Slope
The wheelchair loading system shall be located at the front door, with the ramp being of a simple hinged, flip-out type design being capable of deploying to the ground at a maximum 6:1 slope.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 78.4 Wheelchair Accommodations
NOTE: TRANSIT AGENCY will approve acceptable securement system.
DEFAULT
Two Forward-Facing Wheelchair Securement Locations
Two forward-facing locations, as close to the wheelchair loading system as practical, shall provide parking space and securement system compliant with ADA requirements for a passenger in a wheelchair.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 78.5 Interior Circulation
DEFAULT
The maneuvering room inside the bus shall accommodate easy travel for a passenger in a wheelchair from the loading device and from the designated securement area. It shall be designed so that no portion of the wheelchair protrudes into the aisle of the bus when parked in the designated parking space(s). When the positions are fully utilized, an aisle space of no less than 20 in. shall be maintained. As a guide, no width dimension should be less than 34 in. Areas requiring 90deg. turns of wheelchairs should have a clearance arc dimension no less than 45 in., and in the parking area where 180deg turns are expected, space should be clear in a full 60in.diameter circle. A vertical clearance of 12in. above the floor surface should be provided on the outside of turning areas for wheelchair footrests.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 78.6 Lift Door
DEFAULT
The lift door shall be a single leaf design that operates in a sliding track mounted both above and below the door leaf. The door shall open by sliding to the rear of the coach and shall remain on a horizontal plane throughout the opening and closing process. No pin-hinged doors shall be provided. The transmission must be in neutral, and the parking brake activated for the lift to operate. The accelerator shall be automatically disabled, and the fast idle system activated when either the lift master switch is turned on or the lift door is open in order to provide maximum safety and security. These features shall be wired to the lift master switch to allow activation only when the transmission is in neutral. The coach directional (hazard) lights will also flash on/off. After the lift operation is completed, the lift shall be properly stored and secured, with the access door closed and the lift master switch at the dash in the "off" position in order to move the coach.

The lift door shall have a window in line with the other passenger windows and shall not detract from the appearance of the coach. The door latch mechanism shall be located in the lower section of the door so that operators in the 5th percentile female range can operate the lift door.

The lift storage door shall not block the visual observation to the lift assembly while utilizing the manual override mode of the lift. A lift door design consisting of a horizontally hinged lift platform egress door mounted within a vertical motion pantograph luggage door is a preferred design.

Our specification being proposed for the section above (circle one below):

EXCEEDS MEETS DOES NOT MEET
Comment:

TS 78.7 Lift Width
DEFAULT
The installation of the lift to the coach structure as well as the installation of the lift door into the side wall of the coach shall not affect the structural integrity of the coach.

The parcel rack module above the wheelchair lift platform area shall be permanently removed to provide additional headroom. The modified rack shall be professionally finished at all ends.

A threshold warning module with a red warning light and an acoustic sensor shall be mounted in the ceiling structure above the wheelchair lift entrance doorway.

The heating and air ducts shall be rerouted around the lift area to ensure proper interior air conditioning/heating airflow and distribution.

A passenger chime tape switch shall be mounted on the sidewall at the two wheelchair securement positions.

Each coach shall have adequate information decals installed that detail the proper lift operation in both the normal and manual modes of operation.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 78.8 Lighting Requirements
DEFAULT
Lighting for the lift areas shall be designed to meet Title 13 and ADA and FMVSS 404 standards. Lighting shall be provided to effectively illuminate the lift area. Light shall be wired through the lift master toggle switch on the driver's dash and shall automatically illuminate when this switch is in the "on" position. The lighting design shall minimize the effect of glare on passengers entering the bus through the wheelchair lift door. During lift operation, the street surface shall be illuminated to a minimum of 6 candlepower a distance of 3 ft. beyond the external dimensions of the lift platform once deployed and lowered. Additional lighting shall be provided to ensure illumination of the instruction placard and the manual override pump when it is in use.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 78.9 Securement System
DEFAULT
The vehicle interior shall permit the securement of two forward-facing wheelchair passengers in which the primary position shall be on the street side of the coach directly across from the lift.
Securement areas shall be a minimum 30 × 48 in. as required by the ADA.

A separate three-point belt securement shall be provided to effectively secure wheelchair passengers. To further secure the passenger during the lift operation, a retractable seat belt strap shall be provided at the ingress/egress area of the lift platform. A minimum 10.5 in. high barrier shall also be provided at the rear of the lift area for additional passenger protection.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 78.10 Roof Ventilation/Escape Hatches

DEFAULT
Two roof ventilators shall be provided and designed to perform as escape hatches. One ventilator/escape hatch shall be located in the roof at the front of the coach, another in the roof at the rear of the coach.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

SIGNAGE AND COMMUNICATION
TS 79. Destination Signs
DEFAULT
A destination sign system shall be furnished on the front, on the right side near the front door. The driver shall be able to access the sign while seated.
The destination sign compartments shall meet the following minimum requirements:

- Compartments shall be designed to prevent condensation and entry of moisture and dirt.
- Compartments shall be designed to prevent fogging of both compartment window and glazing on the unit itself.
- Access shall be provided to allow cleaning of inside compartment window and unit glazing.
- The front window shall have an exterior display area of no less than 8.5 in. high by 56 in. wide.

Base Bus-Hanover White

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 80. Passenger Information and Advertising
TS 80.1 Interior Displays
DEFAULT
Provisions shall be made on the rear of the driver's barrier or equipment box located on the wheel well for a frame to retain information such as routes and schedules.

Advertising media 11 in. high and 0.09 in. thick shall be retained near the juncture of the bus ceiling and sidewall. The retainers may be concave and shall support the media without adhesives. The media shall be illuminated by the interior light system.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 80.2 Exterior Displays
DEFAULT
Provisions shall be made to integrate advertising into the exterior design of the bus. Advertising media, frames or supporting structures shall not detract from the readability of destination signs and signal lights and shall not compromise passenger visibility. Advertising provisions shall not cause pedestrian hazards or foul automatic bus washing equipment, and shall not cover or interfere with doors, air passages, and vehicle fittings or in any other manner restrict the operation or serviceability of the bus.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 81. Passenger Stop Request/Exit Signal
TS 81.1 Transit Coach
DEFAULT
Pull Cord
A passenger "stop requested" signal system that complies with applicable ADA requirements defined in 49 CFR, Part 38.37, shall be provided. The system shall consist of a touch tape, chime, and interior sign message. The touch tape shall be accessible to all seated passengers, with provisions for standees. It will be easily accessible to all passengers, seated or standing. Vertical touch tape shall be provided at each window mullion and adjacent to each wheelchair parking position and priority seating positions.

Our specification being proposed for the section above (circle one below):

EXCEEDS *MEETS* *DOES NOT MEET*
Comment:

TS 81.2 Signal Chime TS 81.2.1 Transit Coach DEFAULT
A single "stop requested" chime shall sound when the system is first activated. A double chime shall sound anytime the system is activated from wheelchair passenger areas.

Exit signals located in the wheelchair passenger area shall be no higher than 4 ft. above the floor. Instructions shall be provided to clearly indicate function and operation of these signals.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 82. Communications
TS 82.1 Camera Surveillance System
DEFAULT
Base Bus- Apollo 8 camera 6TB HD

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 82.2 Public Address System
DEFAULT
A public address system shall be provided on each bus for facilitating radio system and driver- originated announcements to passengers.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 82.2.1 Speakers
DEFAULT
Interior loudspeakers shall be provided, semi-flush mounted, on alternate sides of the bus passenger compartment, installed with proper phasing. Total impedance seen at the input connecting end shall be 8 Ohms. Mounting shall be accomplished with riv-nuts and machine screws.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 82.3 Automatic Passenger Counter (APC) DEFAULT

Base Bus -UTA An infrared APC system shall be installed. TRANSIT AGENCY to provide details of APC system, including installation locations and number of buses to be equipped.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 82.4 Radio Handset and Control System
TS 82.4.1 Drivers Speaker
DEFAULT
Each bus shall have a recessed speaker in the ceiling panel above the driver. This speaker shall be the same component used for the speakers in the passenger compartment. It shall have 8 Ohms of impedance.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 82.4.2 Handset
DEFAULT
Proposer will install a handset for driver use.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:
TS 82.4.3 Driver Display Unit (DDU)
DEFAULT
Proposer shall install a driver display unit as close to the driver's instrument panel as possible.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 82.4.4 Emergency Alarm
DEFAULT
Proposer shall install an emergency alarm that is accessible to the driver but hidden from view.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

TS 83. Event Data Recorders (EDR)
DEFAULT
No EDR shall be installed.

Our specification being proposed for the section above (circle one below):

EXCEEDS ***MEETS*** ***DOES NOT MEET***
Comment:

Exhibit 'D' – Schedule of Suppliers/SubSuppliers Form

(On the following pages)

JACKSONVILLE TRANSPORTATION AUTHORITY

SCHEDULE OF SUBCONSULTANTS/SUBCONTRACTORS

Contractor: GILLIG LLC ☐ DBE ☑ NON-DBE

Description of Project: STATE OF FLORIDA HEAVY DUTY TRANSIT BUS PROCUREMENT

Solicitation No.: P-23-030 Contract Date: PROPOSAL DUE DATE MAY 3, 2024

As part of the procedures for the submission of Proposals/Bids, all Contractors are required to identify **ALL** participating SUBCONSULTANTS/SUBCONTRACTORS. Please identify such areas for above project, if applicable. Use additional sheets if necessary.

Name of Business Performing Work	Certification Status (check one box)		Description of Commodity, Material, or Service	To be completed for DBE Supply Providers only, check applicable boxes			Dollar Amount Of Spend (if known)	Anticipated DBE Percentage Based on Supply Provider Checked
	DBE	NON-DBE		Manufacturer 100% of Spend	Regular Dealer 60% of Spend	Broker 100% Fees & Commissions		
NOT APPLICABLE - GILLIG DOES NOT SUB-CONTRACT THE MANUFACTURE OF OUR VEHICLES.							$	
							$	
							$	
							$	
							$	
Dollar Amount or Anticipated Percentage of Work to be Completed by Non-DBE SUBCONSULTANTS/SUBCONTRACTORS							$	
Dollar Amount or Anticipated Percentage of Work to be Completed by DBE SUBCONSULTANTS/SUBCONTRACTORS							$	
Total							$	

All **DBE** SUBCONSULTANTS/SUBCONTRACTORS must be certified as such by the JTA, FDOT or one of the designated certifying members of the Florida UCP DBE program. It is understood and agreed that, if awarded a Contract by the JTA, the Contractor will not make additions, deletions, or substitutions to this certified list without the consent of the JTA Diversity & Equity Program Manager or designee through the submittal of *Request for Approval of Change to Original Certified List of SUBCONSULTANTS/SUBCONTRACTORS*. It is understood that the JTA may audit any and/or all records of the Contract/vendor and conduct interviews of owners, principals, officers, employees and applicable SUBCONSULTANTS/SUBCONTRACTORS participating on the Contract. The Diversity & Equity Program Office reserves the right to ensure compliance with the JTA's **DBE** program to include status reports and audit of submitted **DBE** information as deemed necessary.

CONTRACTOR'S CERTIFICATION

The above information is true and complete, to the best of my knowledge and belief. I further understand and agree that if awarded the Contract, this certification shall be attached thereto and become a part thereof. Failure to provide accurate information or exercise positive, good faith efforts (as defined by the JTA's **DBE** Program) in support of the JTA's DBE's intent and objective may result in being considered non-responsive to the JTA's requirements. The Diversity & Equity Program Office reserves the right to recommend an audit on the submitted **DBE** information as deemed necessary.

Name and Title: WILLIAM F. FAY, JR., VICE PRESIDENT SALES
(Please print or type)

Signature: _____ Date: MAY 1, 2024

As defined in 49 CFR Part-26 - Revised: August 1, 2017

THIS PAGE MUST BE COMPLETED AND RETURNED WITH YOUR PROPOSAL
DO NO ALTER FORMAT - COMPLETE IN FULL

Exhibit 'E' – Required Forms

(On the following pages)

Acknowledgement of Receipt of Addenda

I hereby certify that I have read and understand and certify the truthfulness of the required statements of the Solicitation and acknowledge receipt of the following Addenda issued during the advertisement period for this Solicitation.

Addendum	Dated	Signature/Title
No. 1	2/5/2021	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 2	2/6/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 3	2/8/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 4	2/9/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 5	2/23/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 6	2/26/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 7	2/28/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 8	3/8/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 9	3/13/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 10	3/15/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 11	3/18/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 12	3/20/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 13	3/21/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 14	4/15/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No. 15	4/25/2024	WILLIAM F. FAY, JR. VICE PRESIDENT SALES
No.		
No.		
No.		

Signature of Proposer's Authorized Representative: _____

Typed/Printed Name: WILLIAM F. FAY, JR.

Title: VICE PRESIDENT SALES Date: MAY 1, 2024

THIS PAGE MUST BE COMPLETED AND RETURNED WITH YOUR PROPOSAL
DO NO ALTER FORMAT COMPLETE IN FULL

CONFIDENTIALITY AND NONDISCLOSURE TERMS

1. Definition of Confidential Information. For purposes of this Agreement, "Confidential Information" shall include all information or material that has or could have commercial value or other utility in the business in which Disclosing Party is engaged. Additionally, "Confidential Information" shall also include any and all personal, protected or otherwise sensitive information which the Receiving Party might be exposed to during the day to day operations of the Disclosing Party.

2. Exclusions from Confidential Information. Receiving Party's obligations under this Agreement do not extend to information that is: (a) publicly known at the time of disclosure or subsequently becomes publicly known through no fault of the Receiving Party; (b) discovered or created by the Receiving Party before disclosure by Disclosing Party; (c) learned by the Receiving Party through legitimate means other than from the Disclosing Party or Disclosing Party's representatives; or (d) is disclosed by Receiving Party with Disclosing Party's prior written approval.

3. Obligations of Receiving Party. Receiving Party shall hold and maintain the Confidential Information in strictest confidence for the sole and exclusive benefit of the Disclosing Party. Receiving Party shall carefully restrict access to Confidential Information to employees, contractors and third parties as is reasonably required and shall require those persons to sign nondisclosure restrictions at least as protective as those in this Agreement. Receiving Party shall not, without prior written approval of Disclosing Party, use for Receiving Party's own benefit, publish, copy, or otherwise disclose to others, or permit the use by others for their benefit or to the detriment of Disclosing Party, any Confidential Information. Receiving Party shall return to Disclosing Party any and all records, notes, and other written, printed, or tangible materials in its possession pertaining to Confidential Information immediately if Disclosing Party requests it in writing.

4. Time Periods. The nondisclosure provisions of this Agreement shall survive the termination of this Agreement and Receiving Party's duty to hold Confidential Information in confidence shall remain in effect until the Confidential Information no longer qualifies as confidential or until Disclosing Party sends Receiving Party written notice releasing Receiving Party from this Agreement, whichever occurs first.

5. Relationships. Nothing contained in this Agreement shall be deemed to constitute either party a partner, joint venturer or employee of the other party for any purpose.

6. Severability. If a court finds any provision of this Agreement invalid or unenforceable, the remainder of this Agreement shall be interpreted so as best to effect the intent of the parties.

7. Integration. This Agreement expresses the complete understanding of the parties with respect to the subject matter and supersedes all prior proposals, agreements, representations and understandings. This Agreement may not be amended except in a writing signed by both parties.

8. Waiver. The failure to exercise any right provided in this Agreement shall not be a waiver of prior or subsequent rights.

(signature page follows)

This Agreement and each party's obligations shall be binding on the representatives, assigns, and successors of such party. Each party has signed this Agreement through its authorized representative.

(Firm Name): GILLIG LLC

By: _____

Printed Name: WILLIAM F. FAY, JR.

Title: VICE PRESIDENT SALES

JACKSONVILLE TRANSPORTATION AUTHORITY:

By: _____

Printed Name: Nathaniel P. Ford Sr.

Title: Chief Executive Officer

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Conflict of Interest Certification

Proposers must execute either Section 1 **or** 2 to certify compliance with Florida Statutes §112.313, 2 CFR 200.112, FTA Circular C 4220.1F,VI,2.a.(4)(h), and the FTA Master Agreement Section 4 (Ethics) hereinafter collectively the ("Conflict of Interest Regulations").

No Jacksonville Transportation Authority ("JTA") Board Member, employee, officer, agent or any immediate family member or partner thereof, of any of the above, or an organization which employs or is about to employ any of the above, that has a financial or other interest in the Proposer may participate in the selection for award or award funding or administer the Contract involving the Proposer. None of the above has received any gift from the Proposer. The Contractor shall obtain this certification from all subcontractors and forward it to the JTA if Section 2 has been completed by the subcontractor.

SECTION 1 – Conflict of Interest DOES NOT Exist

The Proposer/Subcontractor acknowledges and understands the requirements of the Conflict of Interest Regulations and certifies that **no** real, apparent or potential conflict of interest exists.

Name of Proposer/Subcontractor: GILLIG LLC

Signature of Proposer's/Subcontractor's Authorized Official: _____

Printed Name: WILLLIAM F. FAY, JR. Title: VICE PRESIDENT SALES

Date: MAY 1, 2024 FEI/EIN #: 26-3085365

SECTION 2 – Conflict of Interest EXISTS

The Proposer/Subcontractor acknowledges and understands the requirements of the Conflict of Interest Regulations and certifies that a real, apparent or potential conflicts of interest may exists and is hereby disclosed in full.

Printed Name of Proposer/Subcontractor: ------

Names of individuals and nature of their interest in Proposer/Subcontractor:

Signature of Proposer's/Subcontractor's Authorized Official: _____

Printed Name: ------ Title: _____

Date: ------ FEI/EIN #: _____

THIS PAGE MUST BE COMPLETED AND RETURNED WITH YOUR PROPOSAL
DO NO ALTER FORMAT COMPLETE IN FULL

CERTIFICATION OF PROPOSER REGARDING DEBARMENT

The Proposer must complete the following certification statement. The Proposer must indicate its response by inserting a checkmark (☐) in the space following the applicable response.

Certification:

The Proposer certifies that it, its principals, and any key team members:

☐ are
☑ are not

presently suspended, debarred, excluded, or otherwise disqualified from participation in this federally assisted project by any federal department or agency.

If a Proposer responds in the affirmative to the above certification, and the contract exceeds or is expected to exceed $25,000, the Proposer is ineligible to receive an award.

Lower Tier Contractors:
The successful Proposer, by administering each lower tier subcontract for this project that exceeds $25,000, must verify that each lower tier subcontractor, at any tier, is not presently suspended, debarred, excluded, or otherwise disqualified from participation in this federally assisted project.

The successful Proposer certifies that it will accomplish this by:

1. Checking the System for Award Management at website: http://www.sam.gov;
2. Collecting a certification statement similar to the Certification of Proposer Regarding Debarment, above; and,
3. Inserting a clause or condition in the covered transaction with the lower tier contract.

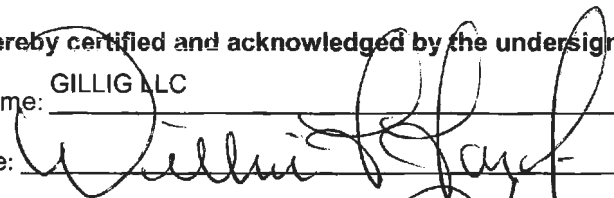
On-Going Obligation of Successful Proposer:
The successful Proposer must provide immediate written notice to the Authority if it learns either that:

a) it failed to disclose information earlier, as required by 2 C.F.R. § 180.355; or,
b) (b) due to changed circumstances, it or any of the principals or any of its key team members for this project now meet any of the criteria in 2 C.F.R. § 180.355.

Termination for Failure to Disclose:
If the Authority later determines that the successful Proposer failed to disclose to the Authority that either it, **its principals, or its key team members** were suspended, debarred, excluded, or otherwise disqualified at the time it made this certification or entered the contract for this project, the Authority will terminate the contract.

The foregoing is hereby certified and acknowledged by the undersigned.

Proposer's Legal Name: GILLIG LLC

Proposer's Signature: 

Business Structure of Proposer (corp, jv, llc, etc.): LIMITED LIABILITY COMPANY

Primary Address: 451 DISCOVERY DRIVE, LIVERMORE, CA 94551

Name and Telephone Number of Contact Person: WILLIAM F. FAY, JR., VICE PRESIDENT SALES

800-735-1500

BUY AMERICA ACT CERTIFICATION

The Buy America requirements apply to federally assisted construction contracts, and acquisition of goods or rolling stock contracts valued at more than $150,000.

(a) By submission of this Offer, the Offeror certifies, and in the case of a joint offer, each party thereto certifies as to its own organization, that in connection with this procurement it will comply with 49 U.S.C. 5323(j) and 49 C.F.R. Part 661, which provide that Federal funds may not be obligated unless steel, iron, and manufactured products used in FTA-funded projects are produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general waiver. This certification also includes compliance with the Infrastructure Investment and Jobs Act, Pub. L. No. 117-58 which includes the Build America, Buy America Act ("Act"), Pub. L. No. 117-58, §§ 70901-52. General waivers are listed in 49 C.F.R. 661.7 and 70914(c) of the Act. Separate requirements for rolling stock are set out at 49 U.S.C. 5323(j)(2)(C) and 49 C.F.R. 661.11.

(b) An Offeror must submit to the Authority the appropriate Buy America certification (below) with all bids or offers on FTA-funded contracts, except those subject to a general waiver. Offers that are not accompanied by a completed Buy America certification must be rejected as nonresponsive. This requirement does not apply to lower tier subcontractors. Mark the applicable certifications below:

(1) **Certification requirement for procurement of steel, iron, or manufactured products:**

[✓] *Certificate of Compliance with 49 U.S.C. 5323(j)(1) and Pub .L .No. 117-58, §§70901-52*
The Bidder or Offeror hereby certifies that it will meet or meets the requirements of 49 U.S.C. 5323(j)(1) and the applicable regulations in 49 CFR Part 661.5 and Pub .L. No. 117-58, *§§70901-52*.

[ ] *Certificate of Non-Compliance with 49 U.S.C. 5323(j)(1)and Pub. L. No. 117-58, §§70901-52*
The Bidder or Offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j)(1), 49 C.F.R. 661.5 and Pub. L. No. 117-58, *§§70901-52*, but it may qualify for an exception pursuant to 49 U.S.C. 5323(j)(2)(A), 5323(j)(2)(B), or 5323(j)(2)(D), and 49 C.F.R. 661.7 and Pub. L. No. 117-58, *§70914(c)*.

(2) **Certification requirement for procurement of buses, other rolling stock and associated equipment:**

[✓] *Certificate of Compliance with 49 U.S.C. 5323(j)(2)(C)*
The Bidder or Offeror hereby certifies that it will comply with the requirements of 49 U.S.C. 5323(j)(2)(C) and the regulations at 49 C.F.R. Part 661.11.

[ ] *Certificate of Non-Compliance with 49 U.S.C. 5323(j)(2)(C)*
The Bidder or Offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j)(2)(C) and 49 C.F.R. 661.11, but may qualify for an exception pursuant to 49 U.S.C. 5323(j)(2)(A), 5323(j)(2)(B), or 5323(j)(2)(D), and 49 C.F.R. 661.7.

SIGNATURE BLOCK FOR ALL REPRESENTATIONS AND CERTIFICATIONS

Name of Proposer or Offeror: GILLIG LLC

Name and Title of Authorized Representative: WILLIAM F. FAY, JR., VICE PRESIDENT SALES

Print and Sign Name: William F. Fay

Title: VICE PRESIDENT SALES Date: MAY 1, 2024

THIS PAGE MUST BE COMPLETED AND RETURNED WITH YOUR PROPOSAL
DO NO ALTER FORMAT - COMPLETE IN FULL

Certification Regarding Lobbying Pursuant to 49 CFR Part 20 for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned Bidder certifies, to the best of his or her knowledge and belief that it complies with 31 USC §1352, as amended, 49 CFR Part 20, to the extent consistent with as necessary by 31 USC § 1352, as amended and all other applicable federal and state lobbying restrictions and specifically that:

(1) No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a state legislature, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any federal grant, the making of any federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any federal contract, grant, loan, or cooperative agreement.

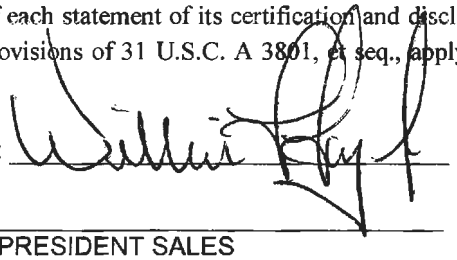
(2) If any funds other than federal appropriated funds have been paid or will be paid to any person for making lobbying contacts to an officer or employee of any agency, a state legislature, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form--LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. § 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

[Note: Pursuant to 31 U.S.C. § 1352(c)(1)-(2)(A), any person who makes a prohibited expenditure or fails to file or amend a required certification or disclosure form shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such expenditure or failure.]

The Bidder certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Bidder understands and agrees that the provisions of 31 U.S.C. A 3801, et seq., apply to this certification and disclosure, if any.

Signature of Bidder's/Subcontractor's Authorized Official: 

Printed Name of Bidder/Subcontractor: _____

Printed Name: WILLLIAM F. FAY, JR. Title: VICE PRESIDENT SALES

Date: MAY 1, 2024

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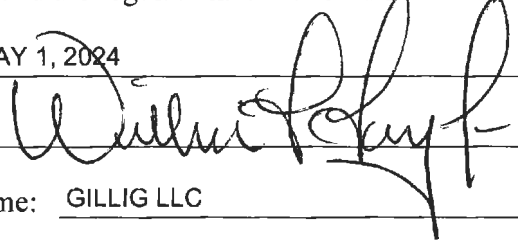
Pre-Award and Post Delivery Certification

BUY AMERICA CERTIFICATE OF COMPLIANCE WITH FTA REQUIREMENTS FOR BUSES, OTHER ROLLING STOCK, OR ASSOCIATED EQUIPMENT

Certificate of Compliance

The **Proposer** hereby certifies that it will comply with the requirements of 49 U.S.C. Section 5323(j)(2)(c), Section 165(b)(3) of the Surface Transportation Assistance Act of 1982, as amended, and the regulations of 49 C.F.R. 661.11.

Date: MAY 1, 2024

Signature: 

Company Name: GILLIG LLC

Title: WILLIAM F. FAY, JR., VICE PRESIDENT SALES

Certificate of Non-Compliance

The Proposer hereby certifies that it cannot comply with the requirements of 49 U.S.C. Section 5323(j)(2)(c)and Section 165(b)(3) of the Surface Transportation Assistance Act of 1982, as amended, but may qualify for an exception to the requirements consistent with 49 U.S.C. Sections 5323(j)(2)(B) or (j)(2)(D), Sections 165(b)(2) or (b)(4) of the Surface Transportation Assistance Act, as amended, and regulations in 49 C.F.R. 661.7.

Date: ------

Signature _____

Company Name _____

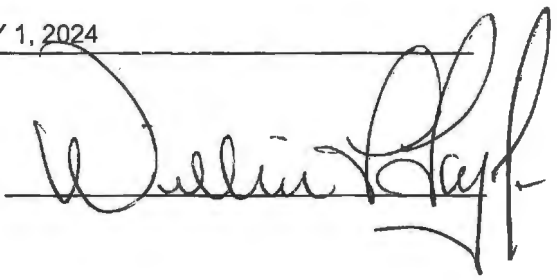
Title _____

CERTIFICATION OF COMPLINACE WITH FTA'S BUS TESTING REQUIREMENTS

The undersigned Proposer/Manufacturer certifies that the vehicle offered in this procurement complies with 49 U.S.C. A 5323(c) and FTA's implementing regulation at 49 CFR Part 665.

The undersigned understands that misrepresenting the testing status of a vehicle acquired with Federal financial assistance may subject the undersigned to civil penalties as outlined in the Department of Transportation's regulation on Program Fraud Civil Remedies, 49 CFR Part 31. In addition, the undersigned understands that FTA may suspend or debar a manufacturer under the procedures in 49 CFR Part 29.

Date: MAY 1, 2024

Signature: 

Company Name: GILLIG LLC

Title: WILLIAM F. FAY, JR., VICE PRESIDENT SALES

REFERENCE OUR ATTACHED CERTIFICATION.

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BUS TESTING PROGRAM

GILLIG LLC Here by certifies that the model of bus being offered in this proposal has met the requirements imposed by 49 CFR Part 665, Bus Testing, including the following two (2) conditions:

1) A model of the bus has been tested at the bus testing facility in Altoona, Pennsylvania; and

2) The proposal includes a copy of the Test Report prepared on the bus model being offered.

Authorized Signee: _____

Title: WILLIAM F. FAY, JR., VICE PRESIDENT SALES

Company: GILLIG LLC

REFERENCE OUR ATTACHED CERTIFICATION.

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GILLIG

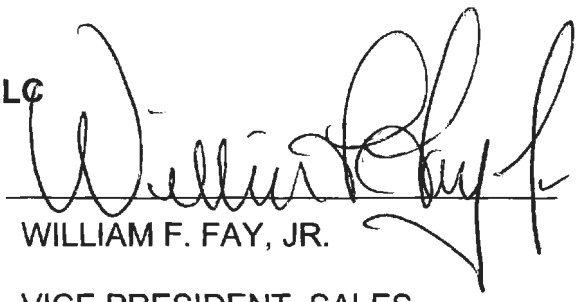
ALTOONA TEST CERTIFICATION

This is to certify that the bus model proposed for your procurement complies with the bus testing regulations required by the Surface Transportation and Uniform Relocation Assistance Act of 1987 as defined in the Interim Final Rulemaking (IFR) by the FTA in the Federal Register 49 CFR Part 665, dated July 28, 1992 and the Final Rule in the Federal Register 49 CFR part 665, dated August 1, 2016.

This statement means that the proposed vehicle complies with one or more of the clauses below, as required by the above IFR:

- was in mass transportation service prior to September 30, 1988, or
- is the same vehicle model that has been previously tested in PTI (Altoona), and that
- any new component(s) has (have) been tested at PTI (Altoona), or
- the installation of any new component(s) did not result in significant structural modification to the vehicle; or
- the installation of the component(s) did not result in a significant change in the data obtained from previous testing of the vehicle model.
- is a new bus model or a bus produced with a major change in components or configuration and shall provide a copy of the final test report to the recipient prior to the recipient's final acceptance of the first vehicle.

GILLIG LLC

By: 

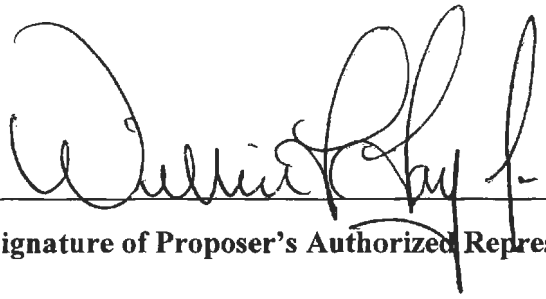
WILLIAM F. FAY, JR.

Title: VICE PRESIDENT, SALES

Date: MAY 1, 2024

Certification of Eligibility

GILLIG LLC hereby certifies that it is not included on the lists of persons or firms currently debarred for any reason, including but not limited to violations of various public contracts incorporating labor standards provisions, maintained by the United States Comptroller General, the United States Department of Transportation, the Florida Department of Transportation, the Jacksonville Transportation Authority, the City of Jacksonville, or any other transportation agency of any state.



Signature of Proposer's Authorized Representative

MAY 1, 2024

Date

WILLIAM F. FAY, JR.

Typed/Printed Name

VICE PRESIDENT SALES

Title

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JACKSONVILLE TRANSPORTATION AUTHORITY (JTA)

REQUEST FOR PROPOSAL (RFP) REQUIRED RESPONSE FORM

CERTIFICATION OF REDACTED COPY

CONFIDENTIAL, PROPRIETARY OR TRADE SECRET MATERIAL

Pursuant to Article 1, Section 24 of the Florida Constitution and under Chapter 119, Florida Statutes, if a Respondent considers any portion of the documents, data, or records submitted in response to this solicitation to be confidential, proprietary, trade secret, or otherwise not subject to disclosure pursuant to applicable State of Florida laws, the Respondent must provide JTA with a separate "REDACTED COPY" of its response. This redacted copy shall contain the JTA solicitation name, number, and the name of the Respondent on the cover, and shall be clearly titled "REDACTED COPY" at the same time Respondent submits its response to the solicitation. **An entire proposal or the proposed cost in a proposal cannot be identified as "CONFIDENTIAL", "PROPRIETARY" or "TRADE SECRET".**

The Respondent must provide a brief description of the grounds for claiming exemption from public records law, including the specific statutory citation for such exemption that allows the withholding below.

Page No	Paragraph	Reason for Redaction
		PLEASE SEE ATTACHED LISTING OF REDACTED INFORMATION.

Please use additional sheets if needed.

Respondent shall be responsible for defending its determination that the redacted portions of its response are confidential, proprietary, trade secret or otherwise not subject to disclosure. Further, Respondent shall protect, defend, and indemnify JTA for any and all claims arising from or relating to Respondents redacted portions of its response that Respondent claims are confidential, proprietary, trade secret or otherwise not subjected to disclosure.

If the Respondent fails to submit a redacted copy with its response, JTA is authorized to produce the entirety of documents, data or records submitted by Respondent in answer to a public records request for these records. Furthermore, if, in JTA's sole discretion, Respondent submits a redacted copy that is not compliant with Florida law, JTA is hereby authorized to release an unredacted copy of the response and Respondent hereby releases, discharges, acquits, indemnifies and holds harmless JTA from any and all claims, demands, actions, suits and causes of action that Respondent or any other person or entity has or hereinafter can, shall or may have against JTA because of its release of the unredacted response.

I have read and understand my responsibilities regarding any redactions I have made in this proposal.

Signed:	WILLIAM F. FAY, JR., VICE PRESIDENT SALES
On behalf of (company):	GILLIG LLC
Date:	MAY 1, 2024

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CERTIFICATION OF REDACTED COPY
CONFIDENTIAL, PROPRIETARY OR TRADE SECRET MATERIAL REDACTED FROM BID SUBMISSION

EVALUATION CRITERIA SUBMISSION

Page No	Paragraph	Reason for Redaction
3-5	Board Meeting Minutes entire document	Proprietary Company Information.
7-8	Bullet Points	Trade Secret information exclusive to GILLIG bus design.
10-17	Designs/Pictures/Drawings	Trade Secret designs, pictures &/or drawings exclusive to GILLIG manufacturing plant and/or bus design.
199-201	GILLIG Std Limited Warranty	Proprietary Company Information.
202-203	Staff Resume's	Proprietary Company Information.
206	Staff Contact Information	Proprietary Company Information.
207	Customer References	Proprietary Company Information.
207	Staff Parts Territories Map	Proprietary Company Information
209-211	GILLIG Std Limited Warranty entire document	Proprietary Company Information.
213-214	Designs/Pictures/Drawings	Trade Secret designs, pictures &/or drawings exclusive to GILLIG manufacturing plant and/or bus design.
216-222	Training Staff & Staff Resume's	Proprietary Company Information.

REQUIRED FORMS AND CERTIFICATIONS

7-22	Pre-Award Audit & Description and Cost of Final Assembly	Proprietary Company Information.
587-588	GILLIG Standard COI & Umbrella COI	Proprietary Company Information.

EXHIBITS – SUPPORTING DOCUMENTATION SUBMISSION

Page No	Paragraph	Reason for Redaction
6	Customer References	Proprietary Company Information.
31	Supplier References	Proprietary Company Information.
163-165	Designs/Pictures/Drawings	Trade Secret designs, pictures &/or drawings exclusive to GILLIG manufacturing plant and/or bus design.
195-200	GILLIG Paint Appearance Standard entire document	Trade Secret designs, pictures &/or drawings exclusive to GILLIG manufacturing plant and/or bus design
236-243	Customer Care Staff & Staff Resume's	Proprietary Company Information.
255-321	Quality Manual & Inspection Record sample	Trade Secret information exclusive to GILLIG bus design.

EQUAL OPPORTUNITY REPORT STATEMENT

AS REQUIRED AT 41-CFR-60-1.7(b)

The Proposer shall complete the following statement by checking the appropriate blanks. Failure to complete these blanks may be grounds for rejection of bid:

1. The Proposer has [✓] has not [ ] developed and has on file at each establishment a affirmative action program pursuant to 41-CFR-60-1.40 and 41-CFR-60-2.

2. The Proposer has [✓] has not [ ] participated in any previous contract or subcontract subject to the equal opportunity clause prescribed by Executive Order 11246, as amended.

3. The Proposer has [✓] has not [ ] filed with the Joint Reporting Committee the annual compliance report on Standard Form 100 (EEO-1 Report). (Ref. Page GP-80)

4. The Proposer does [✓] does not [ ] employ fifty (50) or more employees.

If the **Proposer** has participated in previous contracts subject to the equal opportunity clause and has not submitted compliance reports due under applicable filing requirements, the **Proposer** shall submit a compliance report on Standard Form 100 "Employee Information Report EEO-1" prior to the award of Contract.

The Proposer shall obtain an Equal Opportunity Report Statement from each subcontractor when the value of the subcontract exceeds $50,000.

By: _____

For: GILLIG LLC
(Proposer's Name)

WILLIAM F. FAY, JR., VICE PRESIDENT SALES
Printed Name & Title of Signing Official

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JACKSONVILLE TRANSPORTATION AUTHORITY

PAST EXPERIENCE/PERFORMANCE REFERENCE INFORMATION FORM

Instructions: **Provide a minimum of three (3) references. Provide information requested in sections 1 through 14. Form must be filled out completely and signed by the Proposer.**

1. Complete name of Government agency, commercial firm, or other organization CAPITAL DISTRICT TRANSPORTATION AUTHORITY	
2. Complete address 110 WATERVLIET AVENUE, ALBANY, NY 12206	
3. Contract number or other reference CDTA MAINT 162-3000	4. Date of contract JANUARY 26, 2022
5. Date work was begun JANUARY 26, 2022	6. Date work was completed JANUARY 25, 2027
7. Estimated contract price APPROXIMATELY $5.5MM AT A MINIMUM	8. Final amount invoiced or amount invoiced to date $23MM INVOICED TO DATE
9. Technical point of contact (name, title, address, telephone no. and email address) CARM BASILE, CHIEF EXECUTIVE OFFICER 110 WATERVLIET AVENUE, ALBANY, NY 12206 518-437-8310 CARM@CDTA.ORG	10. Location of work (country, state or province, county, city) GILLIG LLC 451 DISCOVERY DRIVE LIVERMORE, CA 94551
11. Description of contract work (Describe the nature and scope of the experience and provide an explanation of how the work is the same or similar to the work required by JTA). Attach an explanation of any performance problems or other conflicts with the customer. Use a continuation sheet, if necessary.) FORTY FOOT LOW FLOOR TRANSIT BUSES. PLEASE SEE OUR CUSTOMER REFERENCE LIST AND TESTIMONIAL LETTERS IN FOLLOWING SECTION EXHIBITS - SUPPORTING INFORMATION, ITEM # 1 GILLIG QUALIFICATIONS.	
12. Current status of contract: CURRENT CONTRACT EXPIRES JANUARY 25, 2027	
13. Signature of Proposer WILLIAM F. FAY, JR, VICE PRESIDENT SALES	Date MAY 1, 2024
14. Print Name of Proposer GILLIG LLC	

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JACKSONVILLE TRANSPORTATION AUTHORITY

PAST EXPERIENCE/PERFORMANCE REFERENCE INFORMATION FORM

Instructions: Provide a minimum of three (3) references. Provide information requested in sections 1 through 14. Form must be filled out completely and signed by the Proposer.

1. Complete name of Government agency, commercial firm, or other organization SOUTH CENTRAL TRANSIT AUTHORITY	
2. Complete address 45 ERICK ROAD, LANCASTER, PA 17601	
3. Contract number or other reference PA STATEWIDE BUS PROCUREMENT PROJECT #19-2020	4. Date of contract NOVEMBER 27, 2020
5. Date work was begun NOVEMBER 27, 2020	6. Date work was completed NOVEMBER 27, 2025
7. Estimated contract price APPROXIMATELY $30MM AT A MINIMUM	8. Final amount invoiced or amount invoiced to date $61MM INVOICED TO DATE
9. Technical point of contact (name, title, address, telephone no. and email address) GREG DOWNING, EXECUTIVE DIRECTOR 45 ERICK ROAD, LANCASTER, PA 17601 717-358-1925 GDOWNING@SCTAPA.COM	10. Location of work (country, state or province, county, city) GILLIG LLC 451 DISCOVERY DRIVE LIVERMORE, CA 94551

11. Description of contract work (Describe the nature and scope of the experience and provide an explanation of how the work is the same or similar to the work required by JTA). Attach an explanation of any performance problems or other conflicts with the customer. Use a continuation sheet, if necessary.)

PA STATEWIDE BUS PROCUREMENT OF 30', 35, 40' DIESEL, CNG AND HYBRID BUSES.

PLEASE SEE OUR CUSTOMER REFERENCE LIST AND TESTIMONIAL LETTERS IN FOLLOWING SECTION EXHIBITS - SUPPORTING INFORMATION, ITEM # 1 GILLIG QUALIFICATIONS.

12. Current status of contract:

CURRENT 5 YEAR CONTRACT EXPIRES NOVEMBER 27, 2025.

13. Signature of Proposer WILLIAM F. FAY, JR., VICE PRESIDENT SALES	Date MAY 1, 2024
14. Print Name of Proposer GILLIG LLC	

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JACKSONVILLE TRANSPORTATION AUTHORITY

PAST EXPERIENCE/PERFORMANCE REFERENCE INFORMATION FORM

Instructions: Provide a minimum of three (3) references. Provide information requested in sections 1 through 14. Form must be filled out completely and signed by the Proposer.

1. Complete name of Government agency, commercial firm, or other organization WHATCOM TRANSPORTATION AUTHORITY	
2. Complete address 4111 BAKERVIEW SPUR, BELLINGHAM, WA 98226	
3. Contract number or other reference STATE OF WASHINGTON CONTRACT NO. 06719-01	4. Date of contract APRIL 1, 2021
5. Date work was begun APRIL 1, 2021	6. Date work was completed MARCH 31, 2025
7. Estimated contract price PURCHASE OF UP TO 1,335 BUSES (29', 35', 40' DIESEL/HYBRID/CNG/BEB)	8. Final amount invoiced or amount invoiced to date $414MM INVOICED TO DATE
9. Technical point of contact (name, title, address, telephone no. and email address) ANDY BOWLER, DIRECTOR FLEET AND FACILITIES 4111 BAKERVIEW SPUR, BELLINGHAM, WA 98226 360-788-9351 ANDYB@RIDEWTA.COM	10. Location of work (country, state or province, county, city) GILLIG LLC 451 DISCOVERY DRIVE LIVERMORE, CA 94551

11. Description of contract work (Describe the nature and scope of the experience and provide an explanation of how the work is the same or similar to the work required by JTA). Attach an explanation of any performance problems or other conflicts with the customer. Use a continuation sheet, if necessary.)

WASHINGTON STATE TRANSIT BUS COOPERATIVE MASTER CONTRACT NO. 06719-01
30 FT DIESEL, 35 FT DIESEL, 40 FT DIESEL 35 FT HYBRID, 40 FT HYBRID, 30 FT CNG, 35 FT, CNG, 40 FT CNG, 35 FT ELECTRIC, 40 FT ELECTRIC CATEGORIES

PLEASE SEE OUR CUSTOMER REFERENCE LIST AND TESTIMONIAL LETTERS IN FOLLOWING SECTION EXHIBITS - SUPPORTING INFORMATION, ITEM # 1 GILLIG QUALIFICATIONS.

12. Current status of contract:

STATE CONTRACT INITIAL 2 YEAR TERM WITH 3 ONE YEAR EXTENSIONS.

13. Signature of Proposer WILLIAM F. FAY, JR., VICE PRESIDENT SALES	Date MAY 1, 2024
14. Print Name of Proposer GILLIG LLC	

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JACKSONVILLE TRANSPORTATATION AUTHORITY

INTENT TO CONTRACT AS A DBE SUBCONTRACTOR/SUBCONSULTANT

PROPOSAL/SOLICITATION NUMBER: P-23-030

Pursuant to DBE policy, businesses participating in the JTA's DBE Program must be certified by the Florida Uniform Certification Program (UCP) at the time of submittal of bid. The firm must be listed in the Florida UCP/DBE directory as a certified DBE firm. (http://www3b.dot.state.fl.us/EqualOpportunityOfficeBusinessDirectory/CustomSearch.aspx)

1. **Name of Prime Contractor/Consultant** GILLIG LLC
2. **Address, City, State and Zip** 451 DISCOVERY DRIVE, LIVERMORE, CA 94551
3. **FEIN Number of DBE Firm** ___ - _____
4. **The DBE subcontractor/subconsultant listed below is certified by which member agency within the Florida UCP?** NOT APPLICABLE
   □ JTA □ FDOT □ GOAA (Orlando Airport) □ Volusia County □ Miami/Dade County □ Broward County
   □ HCAA (Hillsborough County) □ City of Tallahassee □ Lee County Port □ Key West Airport
5. **The undersigned DBE firm is prepared to perform the following described work and/or supply the material listed in connection with the above project (where applicable specify "supply or "install" or both):**

NOT APPLICABLE - GILLIG DOES NOT SUB-CONTRACT THE MANUFACTURE OF OUR VEHICLES.

and at the following price $_____. With respect to the proposed subcontract described above, _____% of the dollar value of such subcontract will be sublet and/or awarded to the following DBE firm:

Name of DBE Firm	Address, City, State and Zip	Telephone

Signature of Owner, President or Authorized Agent of DBE Firm	Printed Name of Signer	Date
		___/___/___

DECLARATION OF PRIME CONTRACTOR/CONSULTANT

I HERBY DECALRE AND AFFIRM that I am the VICE PRESIDENT SALES
(Title Declarant)

and duly authorized representative of GILLIG LLC
(Name of Prime Contractor/Consultant)

to make this declaration and that I have personally reviewed the materials and facts set forth in this Intent to Perform form. To the best of my knowledge, information and belief, the facts and representations contained in this form are true, the owner or authorized agent of the DBE business signed this form in the place indicated, and no material facts have been omitted.

Except as authorized by the JTA Diversity & Equity Manager or his/her designee, the undersigned will enter into a formal agreement with the listed DBE business for work indicated by this form prior to the effective start date of the contract. The undersigned will, if requested, provide the JTA Diversity & Equity Manager or his/her designee a copy of that agreement.

The Prime Contractor/Consultant designated the following person as its DBE Liaison Officer:

MARLA LOAR, VICE PRESIDENT HUMAN RESOURCES	800-735-1500
Please Print Name	**Phone**

Pursuant to State Law, any person (entity) who makes a false of fraudulent statement in connection with the participation of a DBE in any locally funded project or otherwise violates applicable program requirements may be referred for prosecution.

WILLIAM F. FAY, JR., VICE PRESIDENT SALES
Name of Declarant

05 / 01 / 2024
Date

Signature

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GILLIG

DBE/MBE CERTIFICATION OF COMPLIANCE

DISADVANTAGED/MINORITY BUSINESS ENTERPRISE (DBE/MBE)

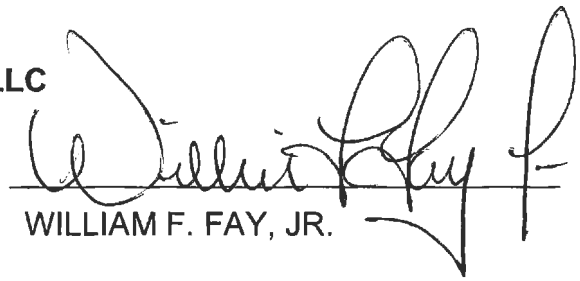
GILLIG LLC, 451 Discovery Drive, Livermore California 94551, hereby certifies that GILLIG LLC has complied with the requirements of 49 CFR Part 26 of the Transportation Assistance Act of 1982, and submitted the required documents to the Federal Transit Administration (FTA).

The FTA advised that GILLIG has obtained 49 C.F.R. Part 26.49 certification and we are eligible to bid on federally funded contracts in FY2024. Transit customers may call the FTA DBE Team for verification.

The list of eligible Transit Vehicle Manufacturers may be viewed at https://www.transit.dot.gov/regulations-and-guidance/civil-rights-ada/eligible-transit-vehicle-manufacturers

FEDERAL TRANSIT ADMINISTRATION
Office of Civil Rights
1200 New Jersey Avenue SE
Washington, DC 20590
Phone: 888-446-4511
E-mail: FTATVMSubmissions@dot.gov

GILLIG LLC

By: 

WILLIAM F. FAY, JR.

Title: VICE PRESIDENT, SALES

Date: MAY 1, 2024

Proposer's List

NAME OF PRIME CONTRACTR OR/CONTRACTOR: GILLIG LLC

The Contractor shall provide information on ALL prospective subcontractor(s)/supplier(s) who were contacted or submitted bids/quotations in support of this solicitation. **Attach additional copies of the form as necessary**.

NAME OF SUBCONTRACTOR/SUPPLIER(S)	SCOPE OF WORK TO BE PERFORMED	CERTIFIED DBE or LSBE FIRM? (Check all that apply)	PREVIOUS YEAR'S ANNUAL GROSS RECEIPTS		UTILIZING ON THIS CONTRACT? (Please circle
NAME: ADDRESS: NOT APPLICABLE - GILLIG DOES NOT SUB-CONTRACT THE MANUFACTURE OF OUR VEHICLES.	SCOPE OF WORK:	YES: DBE ☐ LSBE ☐	☐	Less than $500K	YES or NO
			☐	$500K - $3 mil	
			☐	$3 mil - $8 mil	
			☐	$8 mil.- $15 mil	
PHONE:		NO:	☐	$15 mil - $20 mil	
FAX:			☐	$20 mil - $30 mil	
CONTACT PERSON:	AGE OF FIRM:		☐	More than $30 mil	
NAME: ADDRESS:	SCOPE OF WORK:	YES: DBE ☐ LSBE ☐	☐	Less than $500K	YES or NO
			☐	$500K - $3 mil	
			☐	$3 mil - $8 mil	
			☐	$8 mil.- $15 mil	
PHONE:		NO:	☐	$15 mil - $20 mil	
FAX:			☐	$20 mil - $30 mil	
CONTACT PERSON:	AGE OF FIRM:		☐	More than $30 mil	
NAME: ADDRESS:	SCOPE OF WORK:	YES: DBE ☐ LSBE ☐	☐	Less than $500K	YES or NO
			☐	$500K - $3 mil	
			☐	$3 mil - $8 mil	
			☐	$8 mil.- $15 mil	
PHONE:		NO:	☐	$15 mil - $20 mil	
FAX:			☐	$20 mil - $30 mil	
CONTACT PERSON:	AGE OF FIRM:		☐	More than $30 mil	
NAME: ADDRESS:	SCOPE OF WORK:	YES: DBE ☐ LSBE ☐	☐	Less than $500K	YES or NO
			☐	$500K - $3 mil	
			☐	$3 mil - $8 mil	
			☐	$8 mil.- $15 mil	
PHONE:		NO:	☐	$15 mil - $20 mil	
FAX:			☐	$20 mil - $30 mil	
CONTACT PERSON:	AGE OF FIRM:		☐	More than $30 mil	

Name/Title of person completing this form: WILLIAM F. FAY, JR., VICE PRESIDENT SALES

Signature: [signature] Date: MAY 1, 2024

THIS PAGE MUST BE COMPLETED AND RETURNED WITH YOUR PROPOSAL
DO NO ALTER FORMAT - COMPLETE IN FULL

LITIGATION DISCLOSURE FORM

Provide information, including case name, case number, court in which the case was filed, and a short description of the case regarding any litigation in which your firm, company or any individual who holds equity or is involved in the project is or has been a party to and took a position adverse to the JTA.

CASE NAME	CASE NUMBER	COURT	DESCRITPTION
GILLIG LLC HEREBY CONFIRMS THAT IT HAS NOT BEEN INVOLVED IN ANY LITIGATION THAT WOULD PRECLUDE GILLIG LLC FROM PARTICIPATING IN OR BIDDING ON THIS SOLICITATION.			

By: _____

For: GILLIG LLC
(Company Name)

WILLIAM F. FAY, JR., VICE PRESIDENT SALES
Printed Name & Title of Signing Official

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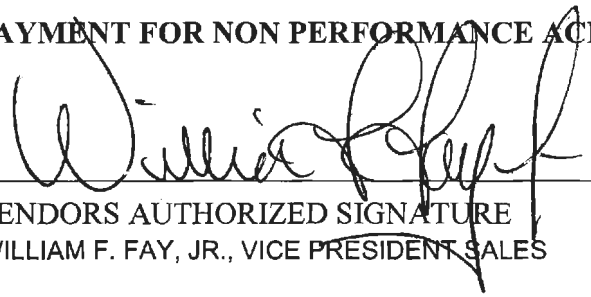
Non Performance Acknowledgement Form

The JTA will also maintain a record of any and all complaints received from private property owners. Vendors will be made aware of the complaints by e-mail affording them the opportunity to correct the problem. Continued complaints or an excessive number of complaints over a period of time or excessive frequency will be reason for cancellation of service contract. The decision of the JTA as to what constitutes excessive complaints or excessive frequency will be final. The JTA reserves the right to cancel this award without prior notification of this action. Effective date of cancellation may be immediate if in the opinion of the JTA that the situation so warrants. Decision of the JTA concerning the cancellation date will be final.

In the event of immediate award cancellation, the notifications of such cancellation may be verbal by way of a telephone call. At which time all work under this contract shall cease. Any verbal cancellations will be confirmed by way of a written letter of cancellation.

The Owner shall recover any costs associated with non-performance issues identified during regular and random inspections. Groups I, III, IV and V, within (24 hrs.) next business day of written or e-mail notice from the Owner; the Contractor must correct and report in writing the identified issue. Group II must be corrected before 10:00 AM and 3 PM. If the Contractor fails to respond or if the owner re-inspects after 24 hour notice has be given and has not been corrected, it will result in a reduction from the next monthly invoice the amount of the unit cost for the performance issues identified. The cost shall be treated separately from all assessments.

PAYMENT FOR NON PERFORMANCE ACKNOWLEDGEMENT:



MAY 1, 2024

VENDORS AUTHORIZED SIGNATURE
WILLIAM F. FAY, JR., VICE PRESIDENT SALES

DATE

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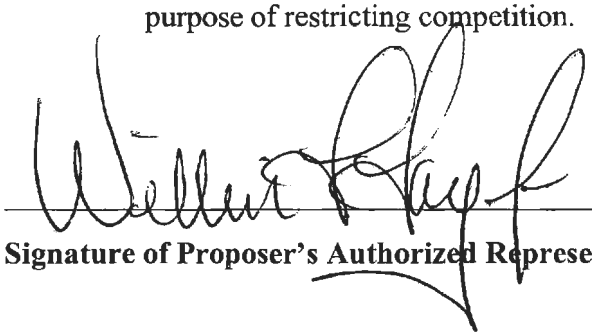
Non-Collusion Proposal Certification

By submission of this proposal, each Proposal and each person signing on behalf of any Proposer certifies, and in the case of a joint proposal, each party certifies as to its own organization, under penalty of perjury, that to the best of his/her knowledge and belief:

I. The prices in the Proposal have been arrived at independently without collusion, consultation, communication or agreement, with any other Proposer or with any other competitor for the purpose of restricting competition as to any other matter relating to such prices.

II. Unless otherwise required by law, the prices which have been noted in this Proposal have not been knowingly disclosed by the Proposer and will not knowingly be disclosed by Proposer prior to opening, directly or indirectly, to any other Proposer or to any competitor and,

III. No attempt has been made or will be made by the Proposer to induce any other person, partnership, or corporation to submit or not to submit a Proposal for the purpose of restricting competition.



Signature of Proposer's Authorized Representative

MAY 1, 2024

Date

WILLIAM F. FAY, JR.

Typed/Printed Name

VICE PRESIDENT SALES

Title

THIS PAGE MUST BE COMPLETED AND RETURNED WITH YOUR PROPOSAL
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CERTIFICATE OF LIABILITY INSURANCE

DATE(MM/DD/YYYY)
09/20/2023

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:	
Aon Risk Services Northeast, Inc. Cincinnati OH Office 8044 Montgomery Road Suite 405 Cincinnati OH 45236-2919 USA	PHONE (A/C. No. Ext): (866) 283-7122	FAX (A/C. No.): (800) 363-0105
	E-MAIL ADDRESS:	

INSURED	INSURER(S) AFFORDING COVERAGE	NAIC #
GILLIG LLC 451 Discovery Drive Livermore CA 94551 USA	INSURER A: Zurich American Ins Co	16535
	INSURER B:	
	INSURER C:	
	INSURER D:	
	INSURER E:	
	INSURER F:	

COVERAGES **CERTIFICATE NUMBER:** 570101590006 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS. **Limits shown are as requested**

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: X POLICY PRO-JECT LOC OTHER:			GL0819847400	10/01/2023	10/01/2024	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$1,000,000 $500,000 Excluded $1,000,000 $1,000,000 $1,000,000
A	AUTOMOBILE LIABILITY X ANY AUTO OWNED AUTOS ONLY HIRED AUTOS ONLY SCHEDULED AUTOS NON-OWNED AUTOS ONLY			BAP 8198475 00	10/01/2023	10/01/2024	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$3,000,000
	UMBRELLA LIAB OCCUR EXCESS LIAB CLAIMS-MADE DED RETENTION						EACH OCCURRENCE AGGREGATE	
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR / PARTNER / EXECUTIVE OFFICER/MEMBER EXCLUDED? Y/N: N (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	N/A		EWS819847200 Excess SIR applies per policy terms & conditions	10/01/2023	10/01/2024	X PER STATUTE OTH-ER E.L. EACH ACCIDENT E.L. DISEASE-EA EMPLOYEE E.L. DISEASE-POLICY LIMIT	 $1,000,000 $1,000,000 $1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

General Liability is excess of SIR. This Certificate is for Informational Purposes Only.

CERTIFICATE HOLDER

Gillig LLC
451 Discovery Drive
Livermore CA 94551 USA

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Aon Risk Services Northeast, Inc.

Holder Identifier :

Certificate No : 570101590006

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 10/1/2024 | 9/27/2023

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Lockton Companies 3280 Peachtree Road NE, Suite #1000 Atlanta GA 30305 (404) 460-3600	CONTACT NAME: PHONE (A/C, No, Ext): FAX (A/C, No): E-MAIL ADDRESS:
	INSURER(S) AFFORDING COVERAGE — NAIC #
	INSURER A : Underwriters at Lloyds of London — 10736
INSURED 1486569 Gillig LLC 451 Discovery Drive Livermore CA 94551	INSURER B : INSURER C : INSURER D : INSURER E : INSURER F :

COVERAGES **CERTIFICATE NUMBER:** 17324870 **REVISION NUMBER:** XXXXXXX

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
	COMMERCIAL GENERAL LIABILITY			NOT APPLICABLE			EACH OCCURRENCE	$ XXXXXXX
	☐ CLAIMS-MADE ☐ OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ XXXXXXX
							MED EXP (Any one person)	$ XXXXXXX
							PERSONAL & ADV INJURY	$ XXXXXXX
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$ XXXXXXX
	☐ POLICY ☐ PRO-JECT ☐ LOC						PRODUCTS - COMP/OP AGG	$ XXXXXXX
	OTHER:							$
	AUTOMOBILE LIABILITY			NOT APPLICABLE			COMBINED SINGLE LIMIT (Ea accident)	$ XXXXXXX
	☐ ANY AUTO						BODILY INJURY (Per person)	$ XXXXXXX
	☐ OWNED AUTOS ONLY ☐ SCHEDULED AUTOS						BODILY INJURY (Per accident)	$ XXXXXXX
	☐ HIRED AUTOS ONLY ☐ NON-OWNED AUTOS ONLY						PROPERTY DAMAGE (Per accident)	$ XXXXXXX
								$ XXXXXXX
A	X UMBRELLA LIAB X OCCUR	N	N	NAMCA2201256	10/1/2023	10/1/2024	EACH OCCURRENCE	$ 20,000,000
	EXCESS LIAB ☐ CLAIMS-MADE						AGGREGATE	$ 20,000,000
	DED X RETENTION $ 10,000							$ XXXXXXX
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY			NOT APPLICABLE			☐ PER STATUTE ☐ OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y / N ☐ (Mandatory in NH)	N / A					E.L. EACH ACCIDENT	$ XXXXXXX
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$ XXXXXXX
							E.L. DISEASE - POLICY LIMIT	$ XXXXXXX

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

Evidence of Coverage

CERTIFICATE HOLDER

17324870
Gillig LLC
451 Discovery Drive
Livermore CA 94551

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Proposer's Standard Assurances

Name of Proposer:

At this time, we understand all requirements and state that as a serious proposer we will comply with all the stipulations included in the proposal package.

The above-named proposer affirms and declares:

1. That the Proposer is of lawful age and that no other person, firm, or corporation has any interest in this Proposal.

2. That this Proposal is made without any understanding, agreement, or connection with any other person, firm, or corporation making a Proposal for the same project, and is in all respects fair and without collusion or fraud.

3. That the Proposer has carefully examined the site of the work and that from his/her investigations has been satisfied as to the nature and location of the work, the kind and extent of the equipment and other facilities needed for the performance of the work, the general and local conditions, all difficulties to be encountered, and all other items which in any way affect the work or its performance.

4. That the Proposer is in full compliance with all federal, state, and local laws and regulations and intends to fully comply with same during the entire term of the contract.

In witness thereof, this Proposal is hereby signed by the duly authorized representative of the Proposer and sealed as of the date indicated.

PROPOSER:

Signature

ATTEST:

Witness Signature

WILLIAM F. FAY, JR., VICE PRESIDENT SALES

Type Name and Title

MAY 1, 2024

Date

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Contractor Affidavit under Section 448.095 Florida Statutes

The undersigned contractor ("Contractor") executes this Affidavit to comply with Section 448.095 Florida Statutes related to any contract with the Jacksonville Transportation Authority to which Contractor is a party that is subject to Section 448.095 Florida Statutes and hereby verifies its compliance with Section 448.095 Florida Statutes, attesting as follows:

a) The Contractor has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify, https://e-verify.uscis.gov/emp , or any subsequent replacement program;

b) The Contractor will continue to use the federal work authorization program throughout the contract period, including any renewal or extension thereof;

c) The Contractor will notify the Jacksonville Transportation Authority in the event the Contractor ceases to utilize the federal work authorization program during the contract period, including renewals or extensions thereof;

d) The Contractor understands that ceasing to utilize the federal work authorization program constitutes a material breach of the contract;

e) The Contractor shall require all subcontractors performing work under this contract to use the E-Verify system will only contract for the performance of services in satisfaction of such contract with subcontractors who present an affidavit to the Contractor certifying compliance with Section 448.095 Florida Statutes;

f) The Contractor does not employ, contract with, or subcontract with any person who is an "unauthorized alien" as that term is defined in 8 U.S.C. 1324a(h)(3) and is otherwise in full compliance with Section 448.095 Florida Statutes.

g) The Contractor acknowledges and agrees that this Affidavit shall be incorporated into any contract(s) subject to the provisions of Section 448.095 Florida Statutes for the project listed below to which Contractor is a party after the date hereof without further action or consent by Contractor; and

h) Contractor acknowledges its responsibility to submit copies of any affidavits, drivers' licenses, and identification cards required pursuant to Section 448.095 Florida Statutes to the Jacksonville Transportation Authority within five (5) business days of receipt.

FEI/EIN #: 263085364 E-VERIFY COMPANY ID 347195	USING E-VERIFY AS OF 7/29/2010
Federal Work Authorization User Identification Number	Date of Authorization
GILLIG LLC	RFP P-23-030 STATE OF FLORIDA HEAVY DUTY TRANSIT BUS PROCUREMENT
Name of Contractor	Name of Project

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on MAY , 1 , 2023 in LIVERMORE (city), CA (state).

Signature of Authorized Officer or Agent

WILLIAM F. FAY, JR., VICE PRESIDENT SALES

Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME

ON THIS THE _____ DAY OF _____, 2023.

See attached

NOTARY PUBLIC

My Commission Expires:

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CALIFORNIA JURAT **GOVERNMENT CODE § 8202**

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California

County of ALAMEDA

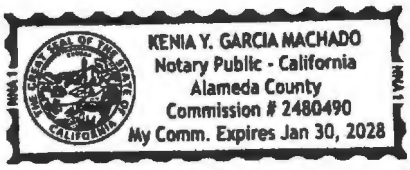
Subscribed and sworn to (or affirmed) before me on

this 25 (Date) day of APRIL (Month), 20 24 (Year), by

(1) WILLIAM FAY

(and (2) _____),
Name(s) of Signer(s)

proved to me on the basis of satisfactory evidence to be the person(s) who appeared before me.



Place Notary Seal and/or Stamp Above

Signature _____
Signature of Notary Public

OPTIONAL

Completing this information can deter alteration of the document or fraudulent reattachment of this form to an unintended document.

Description of Attached Document

Title or Type of Document: _____

Document Date: _____ Number of Pages: _____

Signer(s) Other Than Named Above: _____

Subcontractor Affidavit under Section 448.095, Florida Statutes

I hereby certify that _____ [insert subcontractor company name] does not employ, contract with, or subcontract with an unauthorized alien as that term is defined in 8 U.S.C. 1324a(h)(3), and is otherwise in full compliance with, Section 448.095, Florida Statutes.

All new employees working under this subcontract have had their work authorization status verified through the federal work authorization program commonly known as E-Verify, https://e-verify.uscis.gov/emp , or any subsequent replacement program.

A true and correct copy of _____ [insert subcontractor company name] proof of registration in the E-Verify system is attached to this Affidavit.

NOT APPLICABLE - GILLIG DOES NOT SUB-CONTRACT THE MANUFACTURE OF OUR VEHICLES.

_____ _____

Federal Work Authorization User Identification Number | Date of Authorization

_____ _____

Name of Subcontractor | Name of Project

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on , , 2023 in _____(city), _____(state).

_____

Signature of Authorized Officer or Agent

_____

Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME

ON THIS THE _____ DAY OF _____, 2023.

_____

NOTARY PUBLIC

My Commission Expires:

Exhibit 'F' – Buy America Compliance

(On the following pages)

STATE OF FLORIDA HEAVY DUTY BUSES
JACKSONVILLE, FL
PRE-AWARD BUY AMERICA CERTIFICATE
TWENTY-NINE FOOT LOW FLOOR TRANSIT BUSES (QTY: IDIQ, OPTION: TBD, BID/CONTRACT# STATE OF FLORIDA RFP P-23-030)
10-May-24

GILLIG IS ONE OF THE MOST "AMERICAN" BUS MANUFACTURERS IN THE WORLD. Gillig is 100% U.S. owned and operated. ALL OF OUR FACILITIES are located in the U.S.A. ALL OF OUR MANUFACTURING is done in the U.S.A. and we have a policy that stresses the use of products produced in the U.S.A.

We certify full compliance with the FTA's "Buy America" regulations (Section 49 CFR Part 663) and submit the following abbreviated listing as evidence of this compliance.

COMPONENT	MANUFACTURER	COUNTRY OF ORIGIN	PERCENT OF TOTAL COST
A/C TRANSITION DUCTS	THERMAL STRUCTURES, INC	U.S.A.	0.11%
AIR CONDITIONING SYSTEM	THERMO-KING CORPORATION	U.S.A.	6.26%
AIR DRYER ASSEMBLY	SKF USA, INC	U.S.A.	0.15%
BULKHEAD ASSEMBLY	ALVA-GWYN INC	U.S.A.	0.23%
CEILING PANELS	WILSONART INTERNATIONAL	U.S.A.	0.34%
COMPOSITE FLOORING	MILWAUKEE COMPOSITES	U.S.A.	0.61%
COOLANT PUMP	ENGINEERED MACHINE PRODUCTS	U.S.A.	0.12%
DESTINATION SIGNS	HANOVER DISPLAYS, INC	U.S.A.	2.20%
DOOR CONTROLS & PANELS - FRONT	VAPOR BUS INTERNATIONAL	U.S.A.	1.09%
DOOR CONTROLS & PANELS - REAR	VAPOR BUS INTERNATIONAL	U.S.A.	0.99%
DRIVER'S SEAT	UNITED SAFETY & SURVIVABILTY - DRIVER S	U.S.A.	0.95%
ELECTRICAL HARNESSES, CABLES & PANELS	COMPASS COMPONENTS, INC.	U.S.A.	2.44%
ELECTRICAL HARNESSES, CABLES & PANELS	RESQ MANUFACTURING	U.S.A.	2.59%
ENGINE & AFTERTREATMENT SYSTEM	CUMMINS, INC	U.S.A.	13.67%
EXTERIOR MIRRORS	SAFE FLEET	U.S.A.	0.35%
EXTRUSIONS	HYDRO EXTRUSION USA, LLC	U.S.A.	0.86%
FABRICATIONS	BAYFAB METALS INC	U.S.A.	0.50%
FABRICATIONS	DETENTION DEVICE SYSTEMS	U.S.A.	0.52%
FABRICATIONS	DIE & TOOL PRODUCTS, INC	U.S.A.	1.47%
FABRICATIONS	EAST BAY MACHINE	U.S.A.	0.77%
FABRICATIONS	G C M	U.S.A.	1.19%
FABRICATIONS	GOLDEN PLASTICS CORP	U.S.A.	0.40%
FABRICATIONS	HOGAN MFG. INC.	U.S.A.	0.86%
FABRICATIONS	IMPERIAL FABRICATORS	U.S.A.	6.34%
FABRICATIONS	MASTER METAL PRODUCTS CO.	U.S.A.	0.49%
FABRICATIONS	RON NUNES ENTERPRISES	U.S.A.	0.65%
FRONT AND REAR AXLE ASSEMBLIES	MERITOR AUTOMOTIVE	U.S.A.	3.97%
FRONT AND REAR BUMPER ASSEMBLIES	DYNATECT - RO-LAB	U.S.A.	0.72%
FRONT CAP	MC CLARIN PLASTICS LLC	U.S.A.	1.01%
HEATER ASSEMBLIES	MOBILE CLIMATE CONTROL	U.S.A.	0.47%
INTERIOR LIGHTING KIT	I/O CONTROLS - LIGHTS	U.S.A.	0.88%
MISCELLANEOUS-KD SPECIALTIES	KD SPECIALTIES	U.S.A.	0.44%
MISCELLANEOUS-I/O CONTROL	I/O CONTROLS - LIGHTS	U.S.A.	0.89%
PASSENGER SEAT ASSEMBLIES	UNITED SAFETY & SURVIVABILITY - PASS SE/	U.S.A.	5.15%
PIPING & TUBING	S.F. TUBE	U.S.A.	1.62%
RADIATOR PACKAGE	ENGINEERED MACHINED PRODUCTS, INC	U.S.A.	1.73%
REAR CAP ASSEMBLY	PERFORMANCE COMPOSTIES	U.S.A.	0.34%
REAR SUSPENSION	HENDRICKSON USA L.L.C.	U.S.A.	0.48%
ROOF HATCH	SPECIALTY MANUFACTURING INC	U.S.A.	0.13%
ROOF SKIN	CRANE COMPOSITES	U.S.A.	0.23%
TIRES	THE GOODYEAR TIRE & RUBBER COMPANY	U.S.A.	0.95%
VOLTAGE REGULATOR	VANNER, INC.	U.S.A.	0.14%
WHEELCHAIR RAMP	LIFT-U DIVISION OF HOGAN MFG.,INC	U.S.A.	2.27%
WHEELS	ADVANCED WHEELS SALES	U.S.A.	1.03%
WINDOW ASSEMBLIES	AROW GLOBAL	U.S.A.	2.79%
SPECIFICALLY IDENTIFIED U.S. COMPONENTS AS A % OF TOTAL MATERIALS			71.39% *
FINAL ASSEMBLY - ALL VEHICLE ASSEMBLY OPERATIONS, STARTING WITH THE UNDERSTRUCTURE THROUGH TO FINAL ROAD TEST ARE DONE IN LIVERMORE, CA	GILLIG	U.S.A.	100.00%

GILLIG

GILLIG LLC
LIVERMORE, CALIFORNIA

DESCRIPTION AND COST OF FINAL ASSEMBLY FOR 29' LOW FLOOR BUSES FY 2024

Gillig LLC certifies that final assembly of its buses occurs at its manufacturing plant in Livermore, California. The final assembly process consists of the assembly of the chassis; the installation and interconnection of the engine, transmission, axles, including the cooling and braking systems; the installation and interconnection of the heating and air conditioning equipment; the installation of pneumatic and electrical systems; mounting of the body structure to the chassis; installation of door systems; painting of the vehicle; installation of destination signs, windows, passenger seats, passenger grab rails, and wheelchair lifts; wheel alignment, dynamometer and road testing; final inspection, repairs and preparation of the vehicles for delivery.

The cost of the above mentioned activities for this order has been estimated to be $18,291.88 per bus.

STATE OF FLORIDA HEAVY DUTY BUSES
JACKSONVILLE, FL
PRE-AWARD BUY AMERICA CERTIFICATE
TWENTY-NINE FOOT LOW FLOOR (CNG) TRANSIT BUSES (QTY: IDIQ, OPTION: TBD, BID/CONTRACT# STATE OF FLORIDA RFP P-23-030)
10-May-24

GILLIG IS ONE OF THE MOST "AMERICAN" BUS MANUFACTURERS IN THE WORLD. Gillig is 100% U.S. owned and operated. ALL OF OUR FACILITIES are located in the U.S.A. ALL OF OUR MANUFACTURING is done in the U.S.A. and we have a policy that stresses the use of products produced in the U.S.A.

We certify full compliance with the FTA's "Buy America" regulations (Section 49 CFR Part 663) and submit the following abbreviated listing as evidence of this compliance.

COMPONENT	MANUFACTURER	COUNTRY OF ORIGIN	PERCENT OF TOTAL COST
A/C TRANSITION DUCTS	THERMAL STRUCTURES, INC	U.S.A.	0.10%
AIR CONDITIONING SYSTEM	THERMO-KING CORPORATION	U.S.A.	5.33%
AIR DRYER ASSEMBLY	SKF USA, INC	U.S.A.	0.15%
BULKHEAD ASSEMBLY	ALVA-GWYN INC	U.S.A.	0.15%
CEILING PANELS	WILSONART INTERNATIONAL	U.S.A.	0.33%
COMPOSITE FLOORING	MILWAUKEE COMPOSITES	U.S.A.	0.31%
DESTINATION SIGNS	HANOVER DISPLAYS, INC	U.S.A.	1.63%
DOOR CONTROLS & PANELS - FRONT	VAPOR BUS INTERNATIONAL	U.S.A.	0.72%
DOOR CONTROLS & PANELS - REAR	VAPOR BUS INTERNATIONAL	U.S.A.	0.62%
DRIVER'S SEAT	UNITED SAFETY & SURVIVABILTY - DRIVER S	U.S.A.	0.91%
ELECTRICAL HARNESSES, CABLES & PANELS	COMPASS COMPONENTS, INC.	U.S.A.	1.82%
ELECTRICAL HARNESSES, CABLES & PANELS	RESQ MANUFACTURING	U.S.A.	2.17%
ENGINE & AFTERTREATMENT SYSTEM	CUMMINS, INC	U.S.A.	15.21%
EXTERIOR MIRRORS	SAFE FLEET	U.S.A.	0.29%
EXTRUSIONS	HYDRO EXTRUSION USA, LLC	U.S.A.	0.83%
FABRICATIONS	BAYFAB METALS INC	U.S.A.	0.42%
FABRICATIONS	DETENTION DEVICE SYSTEMS	U.S.A.	0.25%
FABRICATIONS	DIE & TOOL PRODUCTS, INC	U.S.A.	1.13%
FABRICATIONS	EAST BAY MACHINE	U.S.A.	0.80%
FABRICATIONS	G C M	U.S.A.	1.41%
FABRICATIONS	GOLDEN PLASTICS CORP	U.S.A.	0.25%
FABRICATIONS	HOGAN MFG. INC.	U.S.A.	0.42%
FABRICATIONS	IMPERIAL FABRICATORS	U.S.A.	4.77%
FABRICATIONS	MASTER METAL PRODUCTS CO.	U.S.A.	0.34%
FABRICATIONS	RON NUNES ENTERPRISES	U.S.A.	0.45%
FRONT AND REAR AXLE ASSEMBLIES	MERITOR AUTOMOTIVE	U.S.A.	3.50%
FRONT AND REAR BUMPER ASSEMBLIES	DYNATECT - RO-LAB	U.S.A.	0.64%
FRONT CAP	MC CLARIN PLASTICS LLC	U.S.A.	0.56%
FUEL SYSTEM	AGILITY FUEL SYSTEMS	U.S.A.	10.26%
HEATER ASSEMBLIES	MOBILE CLIMATE CONTROL	U.S.A.	0.40%
INTERIOR LIGHTING KIT	I/O CONTROLS - LIGHTS	U.S.A.	0.85%
MISCELLANEOUS-KD SPECIALTIES	KD SPECIALTIES	U.S.A.	0.40%
MISCELLANEOUS-I/O CONTROL	I/O CONTROLS - LIGHTS	U.S.A.	0.22%
PASSENGER SEAT ASSEMBLIES	UNITED SAFETY & SURVIVABILITY - PASS SE/	U.S.A.	3.88%
PIPING & TUBING	S.F. TUBE	U.S.A.	1.22%
RADIATOR PACKAGE	ENGINEERED MACHINED PRODUCTS, INC	U.S.A.	2.34%
REAR CAP ASSEMBLY	PERFORMANCE COMPOSTIES	U.S.A.	0.20%
REAR SUSPENSION	HENDRICKSON USA L.L.C.	U.S.A.	0.46%
TIRES	THE GOODYEAR TIRE & RUBBER COMPANY	U.S.A.	0.98%
WHEELCHAIR RAMP	LIFT-U DIVISION OF HOGAN MFG.,INC	U.S.A.	1.95%
WHEELS	ADVANCED WHEELS SALES	U.S.A.	0.79%
WINDOW ASSEMBLIES	AROW GLOBAL	U.S.A.	1.95%
SPECIFICALLY IDENTIFIED U.S. COMPONENTS AS A % OF TOTAL MATERIALS			71.44% *
FINAL ASSEMBLY - ALL VEHICLE ASSEMBLY OPERATIONS, STARTING WITH THE UNDERSTRUCTURE THROUGH TO FINAL ROAD TEST ARE DONE IN LIVERMORE, CA	GILLIG	U.S.A.	100.00%

GILLIG

GILLIG LLC
LIVERMORE, CALIFORNIA

DESCRIPTION AND COST OF FINAL ASSEMBLY FOR 29' CNG BUSES FY 2024

Gillig LLC certifies that final assembly of its buses occurs at its manufacturing plant in Livermore, California. The final assembly process consists of the assembly of the chassis; the installation and interconnection of the engine, transmission, axles, including the cooling and braking systems; the installation and interconnection of the heating and air conditioning equipment; the installation of pneumatic and electrical systems; mounting of the body structure to the chassis; installation of door systems; painting of the vehicle; installation of destination signs, windows, passenger seats, passenger grab rails, and wheelchair lifts; wheel alignment, dynamometer and road testing; final inspection, repairs and preparation of the vehicles for delivery.

The cost of the above mentioned activities for this order has been estimated to be $19,194.98 per bus.

STATE OF FLORIDA HEAVY DUTY BUSES
JACKSONVILLE, FL
PRE-AWARD BUY AMERICA CERTIFICATE
THIRTY-FIVE FOOT LOW FLOOR TRANSIT BUSES (QTY: IDIQ, OPTION: TBD, BID/CONTRACT# STATE OF FLORIDA RFP P-23-030)
10-May-24

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We certify full compliance with the FTA's "Buy America" regulations (Section 49 CFR Part 663) and submit the following abbreviated listing as evidence of this compliance.

COMPONENT	MANUFACTURER	COUNTRY OF ORIGIN	PERCENT OF TOTAL COST
A/C TRANSITION DUCTS	THERMAL STRUCTURES, INC	U.S.A.	0.11%
AIR CONDITIONING SYSTEM	THERMO-KING CORPORATION	U.S.A.	6.48%
AIR DRYER ASSEMBLY	SKF USA, INC	U.S.A.	0.16%
BULKHEAD ASSEMBLY	ALVA-GWYN INC	U.S.A.	0.25%
CEILING PANELS	WILSONART INTERNATIONAL	U.S.A.	0.43%
COMPOSITE FLOORING	MILWAUKEE COMPOSITES	U.S.A.	0.43%
COOLANT PUMP	ENGINEERED MACHINE PRODUCTS	U.S.A.	0.12%
DESTINATION SIGNS	HANOVER DISPLAYS, INC	U.S.A.	1.14%
DOOR CONTROLS & PANELS - FRONT	VAPOR BUS INTERNATIONAL	U.S.A.	0.79%
DOOR CONTROLS & PANELS - REAR	VAPOR BUS INTERNATIONAL	U.S.A.	0.68%
DRIVER'S SEAT	UNITED SAFETY & SURVIVABILTY - DRIVER S	U.S.A.	1.00%
ELECTRICAL HARNESSES, CABLES & PANELS	COMPASS COMPONENTS, INC.	U.S.A.	2.00%
ELECTRICAL HARNESSES, CABLES & PANELS	RESQ MANUFACTURING	U.S.A.	3.73%
ENGINE & AFTERTREATMENT SYSTEM	CUMMINS, INC	U.S.A.	14.39%
EXTERIOR MIRRORS	SAFE FLEET	U.S.A.	0.34%
EXTRUSIONS	HYDRO EXTRUSION USA, LLC	U.S.A.	0.94%
FABRICATIONS	BAYFAB METALS INC	U.S.A.	0.20%
FABRICATIONS	DETENTION DEVICE SYSTEMS	U.S.A.	0.22%
FABRICATIONS	DIE & TOOL PRODUCTS, INC	U.S.A.	1.31%
FABRICATIONS	EAST BAY MACHINE	U.S.A.	0.81%
FABRICATIONS	G C M	U.S.A.	1.35%
FABRICATIONS	GOLDEN PLASTICS CORP	U.S.A.	0.25%
FABRICATIONS	HOGAN MFG. INC.	U.S.A.	0.35%
FABRICATIONS	IMPERIAL FABRICATORS	U.S.A.	6.00%
FABRICATIONS	MASTER METAL PRODUCTS CO.	U.S.A.	0.55%
FABRICATIONS	RON NUNES ENTERPRISES	U.S.A.	0.57%
FRONT AND REAR AXLE ASSEMBLIES	MERITOR AUTOMOTIVE	U.S.A.	4.71%
FRONT AND REAR BUMPER ASSEMBLIES	DYNATECT - RO-LAB	U.S.A.	0.80%
FRONT CAP	MC CLARIN PLASTICS LLC	U.S.A.	0.62%
HEATER ASSEMBLIES	MOBILE CLIMATE CONTROL	U.S.A.	0.57%
INTERIOR LIGHTING KIT	I/O CONTROLS - LIGHTS	U.S.A.	1.06%
MISCELLANEOUS-KD SPECIALTIES	KD SPECIALTIES	U.S.A.	0.46%
MISCELLANEOUS-I/O CONTROL	I/O CONTROLS - LIGHTS	U.S.A.	0.24%
PASSENGER SEAT ASSEMBLIES	UNITED SAFETY & SURVIVABILITY - PASS SE/	U.S.A.	6.44%
PIPING & TUBING	S.F. TUBE	U.S.A.	1.70%
RADIATOR PACKAGE	ENGINEERED MACHINED PRODUCTS, INC	U.S.A.	1.66%
REAR CAP ASSEMBLY	PERFORMANCE COMPOSTIES	U.S.A.	0.36%
REAR SUSPENSION	HENDRICKSON USA L.L.C.	U.S.A.	0.50%
ROOF HATCH	SPECIALTY MANUFACTURING INC	U.S.A.	0.13%
ROOF SKIN	CRANE COMPOSITES	U.S.A.	0.24%
TIRES	THE GOODYEAR TIRE & RUBBER COMPANY	U.S.A.	1.27%
VOLTAGE REGULATOR	VANNER, INC.	U.S.A.	0.14%
WHEELCHAIR RAMP	LIFT-U DIVISION OF HOGAN MFG.,INC	U.S.A.	2.14%
WHEELS	ADVANCED WHEELS SALES	U.S.A.	0.38%
WINDOW ASSEMBLIES	AROW GLOBAL	U.S.A.	3.07%
SPECIFICALLY IDENTIFIED U.S. COMPONENTS AS A % OF TOTAL MATERIALS			71.09% *
FINAL ASSEMBLY - ALL VEHICLE ASSEMBLY OPERATIONS, STARTING WITH THE UNDERSTRUCTURE THROUGH TO FINAL ROAD TEST ARE DONE IN LIVERMORE, CA	GILLIG	U.S.A.	100.00%

GILLIG

G I L L I G L L C
LIVERMORE, CALIFORNIA

DESCRIPTION AND COST OF FINAL ASSEMBLY FOR 35' & 40' LOW FLOOR BUSES FY 2024

Gillig LLC certifies that final assembly of its buses occurs at its manufacturing plant in Livermore, California. The final assembly process consists of the assembly of the chassis; the installation and interconnection of the engine, transmission, axles, including the cooling and braking systems; the installation and interconnection of the heating and air conditioning equipment; the installation of pneumatic and electrical systems; mounting of the body structure to the chassis; installation of door systems; painting of the vehicle; installation of destination signs, windows, passenger seats, passenger grab rails, and wheelchair lifts; wheel alignment, dynamometer and road testing; final inspection, repairs and preparation of the vehicles for delivery.

The cost of the above mentioned activities for this order has been estimated to be $19,215.51 per bus.

STATE OF FLORIDA HEAVY DUTY BUSES
JACKSONVILLE, FL
PRE-AWARD BUY AMERICA CERTIFICATE
THIRTY-FIVE FOOT (CNG)LOW FLOOR TRANSIT BUSES (QTY: IDIQ, OPTION: TBD, BID/CONTRACT# STATE OF FLORIDA RFP P-23-030)
10-May-24

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COMPONENT	MANUFACTURER	COUNTRY OF ORIGIN	PERCENT OF TOTAL COST
A/C TRANSITION DUCTS	THERMAL STRUCTURES, INC	U.S.A.	0.10%
AIR CONDITIONING SYSTEM	THERMO-KING CORPORATION	U.S.A.	5.98%
AIR DRYER ASSEMBLY	SKF USA, INC	U.S.A.	0.14%
BULKHEAD ASSEMBLY	ALVA-GWYN INC	U.S.A.	0.15%
CEILING PANELS	WILSONART INTERNATIONAL	U.S.A.	0.27%
COMPOSITE FLOORING	MILWAUKEE COMPOSITES	U.S.A.	0.38%
DESTINATION SIGNS	HANOVER DISPLAYS, INC	U.S.A.	1.58%
DOOR CONTROLS & PANELS - FRONT	VAPOR BUS INTERNATIONAL	U.S.A.	0.69%
DOOR CONTROLS & PANELS - REAR	VAPOR BUS INTERNATIONAL	U.S.A.	0.60%
DRIVER'S SEAT	UNITED SAFETY & SURVIVABILTY - DRIVER S	U.S.A.	0.88%
ELECTRICAL HARNESSES, CABLES & PANELS	COMPASS COMPONENTS, INC.	U.S.A.	1.64%
ELECTRICAL HARNESSES, CABLES & PANELS	RESQ MANUFACTURING	U.S.A.	2.14%
ENGINE & AFTERTREATMENT SYSTEM	CUMMINS, INC	U.S.A.	14.67%
EXTERIOR MIRRORS	SAFE FLEET	U.S.A.	0.31%
EXTRUSIONS	HYDRO EXTRUSION USA, LLC	U.S.A.	0.83%
FABRICATIONS	BAYFAB METALS INC	U.S.A.	0.24%
FABRICATIONS	DETENTION DEVICE SYSTEMS	U.S.A.	0.18%
FABRICATIONS	DIE & TOOL PRODUCTS, INC	U.S.A.	1.09%
FABRICATIONS	EAST BAY MACHINE	U.S.A.	0.79%
FABRICATIONS	G C M	U.S.A.	1.35%
FABRICATIONS	GOLDEN PLASTICS CORP	U.S.A.	0.23%
FABRICATIONS	HOGAN MFG. INC.	U.S.A.	0.33%
FABRICATIONS	IMPERIAL FABRICATORS	U.S.A.	4.63%
FABRICATIONS	MASTER METAL PRODUCTS CO.	U.S.A.	0.40%
FABRICATIONS	RON NUNES ENTERPRISES	U.S.A.	0.44%
FRONT AND REAR AXLE ASSEMBLIES	MERITOR AUTOMOTIVE	U.S.A.	3.89%
FRONT AND REAR BUMPER ASSEMBLIES	DYNATECT - RO-LAB	U.S.A.	0.70%
FRONT CAP	MC CLARIN PLASTICS LLC	U.S.A.	0.54%
FUEL SYSTEM	AGILITY FUEL SYSTEMS	U.S.A.	9.91%
HEATER ASSEMBLIES	MOBILE CLIMATE CONTROL	U.S.A.	0.30%
INTERIOR LIGHTING KIT	I/O CONTROLS - LIGHTS	U.S.A.	0.93%
MISCELLANEOUS-KD SPECIALTIES	KD SPECIALTIES	U.S.A.	0.32%
MISCELLANEOUS-I/O CONTROL	I/O CONTROLS - LIGHTS	U.S.A.	0.21%
PASSENGER SEAT ASSEMBLIES	UNITED SAFETY & SURVIVABILITY - PASS SE/	U.S.A.	5.66%
PIPING & TUBING	S.F. TUBE	U.S.A.	1.13%
RADIATOR PACKAGE	ENGINEERED MACHINED PRODUCTS, INC	U.S.A.	1.28%
REAR CAP ASSEMBLY	PERFORMANCE COMPOSTIES	U.S.A.	0.19%
REAR SUSPENSION	HENDRICKSON USA L.L.C.	U.S.A.	0.44%
TIRES	THE GOODYEAR TIRE & RUBBER COMPANY	U.S.A.	0.95%
WHEELCHAIR RAMP	LIFT-U DIVISION OF HOGAN MFG.,INC	U.S.A.	1.88%
WHEELS	ADVANCED WHEELS SALES	U.S.A.	0.54%
WINDOW ASSEMBLIES	AROW GLOBAL	U.S.A.	3.92%
SPECIFICALLY IDENTIFIED U.S. COMPONENTS AS A % OF TOTAL MATERIALS			72.83% *
FINAL ASSEMBLY - ALL VEHICLE ASSEMBLY OPERATIONS, STARTING WITH THE UNDERSTRUCTURE THROUGH TO FINAL ROAD TEST ARE DONE IN LIVERMORE, CA	GILLIG	U.S.A.	100.00%

GILLIG

GILLIG LLC
LIVERMORE, CALIFORNIA

DESCRIPTION AND COST OF FINAL ASSEMBLY FOR 35' & 40' CNG BUSES FY 2024

Gillig LLC certifies that final assembly of its buses occurs at its manufacturing plant in Livermore, California. The final assembly process consists of the assembly of the chassis; the installation and interconnection of the engine, transmission, axles, including the cooling and braking systems; the installation and interconnection of the heating and air conditioning equipment; the installation of pneumatic and electrical systems; mounting of the body structure to the chassis; installation of door systems; painting of the vehicle; installation of destination signs, windows, passenger seats, passenger grab rails, and wheelchair lifts; wheel alignment, dynamometer and road testing; final inspection, repairs and preparation of the vehicles for delivery.

The cost of the above mentioned activities for this order has been estimated to be $20,118.61 per bus.

STATE OF FLORIDA HEAVY DUTY BUSES
JACKSONVILLE, FL
PRE-AWARD BUY AMERICA CERTIFICATE
THIRTY-FIVE FOOT ALLISON HYBRID LOW FLOOR TRANSIT BUSES (QTY: IDIQ, OPTION: TBD, BID/CONTRACT# STATE OF FLORIDA RFP P-23-030)
10-May-24

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We certify full compliance with the FTA's "Buy America" regulations (Section 49 CFR Part 663) and submit the following abbreviated listing as evidence of this compliance.

COMPONENT	MANUFACTURER	COUNTRY OF ORIGIN	PERCENT OF TOTAL COST
A/C TRANSITION DUCTS	THERMAL STRUCTURES, INC	U.S.A.	0.06%
AIR CONDITIONING SYSTEM	THERMO-KING CORPORATION	U.S.A.	4.17%
CEILING PANELS	WILSONART INTERNATIONAL	U.S.A.	0.19%
COMPOSITE FLOORING	MILWAUKEE COMPOSITES	U.S.A.	0.29%
COOLANT PUMP	ENGINEERED MACHINE PRODUCTS	U.S.A.	0.07%
DESTINATION SIGNS	HANOVER DISPLAYS, INC	U.S.A.	0.66%
DOOR CONTROLS & PANELS - FRONT	VAPOR BUS INTERNATIONAL	U.S.A.	0.46%
DOOR CONTROLS & PANELS - REAR	VAPOR BUS INTERNATIONAL	U.S.A.	0.40%
DRIVER'S SEAT	UNITED SAFETY & SURVIVABILTY - DRIVER S	U.S.A.	0.58%
ELECTRIC DRIVE HYBIRD PROPULSION SYSTEM	ALLISON TRANSMISSION	U.S.A.	29.63%
ELECTRICAL HARNESSES, CABLES & PANELS	COMPASS COMPONENTS, INC.	U.S.A.	0.27%
ELECTRICAL HARNESSES, CABLES & PANELS	RESQ MANUFACTURING	U.S.A.	2.85%
ENGINE & AFTERTREATMENT SYSTEM	CUMMINS, INC	U.S.A.	5.10%
EXTERIOR MIRRORS	SAFE FLEET	U.S.A.	0.22%
EXTRUSIONS	HYDRO EXTRUSION USA, LLC	U.S.A.	0.56%
FABRICATIONS	BAYFAB METALS INC	U.S.A.	0.33%
FABRICATIONS	DETENTION DEVICE SYSTEMS	U.S.A.	0.30%
FABRICATIONS	DIE & TOOL PRODUCTS, INC	U.S.A.	0.80%
FABRICATIONS	EAST BAY MACHINE	U.S.A.	0.66%
FABRICATIONS	G C M	U.S.A.	0.91%
FABRICATIONS	GOLDEN PLASTICS CORP	U.S.A.	0.17%
FABRICATIONS	HOGAN MFG. INC.	U.S.A.	0.97%
FABRICATIONS	IMPERIAL FABRICATORS	U.S.A.	3.43%
FABRICATIONS	MASTER METAL PRODUCTS CO.	U.S.A.	0.57%
FABRICATIONS	RON NUNES ENTERPRISES	U.S.A.	0.55%
FRONT AND REAR AXLE ASSEMBLIES	MERITOR AUTOMOTIVE	U.S.A.	2.75%
FRONT AND REAR BUMPER ASSEMBLIES	DYNATECT - RO-LAB	U.S.A.	0.50%
FRONT CAP	MC CLARIN PLASTICS LLC	U.S.A.	0.62%
HEATER ASSEMBLIES	MOBILE CLIMATE CONTROL	U.S.A.	0.40%
INTERIOR LIGHTING KIT	I/O CONTROLS - LIGHTS	U.S.A.	0.64%
MISCELLANEOUS-KD SPECIALTIES	KD SPECIALTIES	U.S.A.	0.21%
PASSENGER SEAT ASSEMBLIES	UNITED SAFETY & SURVIVABILITY - PASS SE/	U.S.A.	3.75%
PIPING & TUBING	S.F. TUBE	U.S.A.	0.90%
RADIATOR PACKAGE	ENGINEERED MACHINED PRODUCTS, INC	U.S.A.	1.66%
REAR CAP ASSEMBLY	PERFORMANCE COMPOSTIES	U.S.A.	0.12%
REAR SUSPENSION	HENDRICKSON USA L.L.C.	U.S.A.	0.29%
TIRES	THE GOODYEAR TIRE & RUBBER COMPANY	U.S.A.	0.66%
TRANSMISSION	ALLISON TRANSMISSION	U.S.A.	2.99%
WHEELCHAIR RAMP	LIFT-U DIVISION OF HOGAN MFG.,INC	U.S.A.	1.24%
WHEELS	ADVANCED WHEELS SALES	U.S.A.	0.44%
WINDOW ASSEMBLIES	AROW GLOBAL	U.S.A.	1.25%
SPECIFICALLY IDENTIFIED U.S. COMPONENTS AS A % OF TOTAL MATERIALS			72.60% *
FINAL ASSEMBLY - ALL VEHICLE ASSEMBLY OPERATIONS, STARTING WITH THE UNDERSTRUCTURE THROUGH TO FINAL ROAD TEST ARE DONE IN LIVERMORE, CA	GILLIG	U.S.A.	100.00%

GILLIG

GILLIG LLC
LIVERMORE, CALIFORNIA

DESCRIPTION AND COST OF FINAL ASSEMBLY FOR 35' & 40' HYBRID BUSES FY 2024

Gillig LLC certifies that final assembly of its buses occurs at its manufacturing plant in Livermore, California. The final assembly process consists of the assembly of the chassis; the installation and interconnection of the engine, transmission, axles, including the cooling and braking systems; the installation and interconnection of the heating and air conditioning equipment; the installation of pneumatic and electrical systems; mounting of the body structure to the chassis; installation of door systems; painting of the vehicle; installation of destination signs, windows, passenger seats, passenger grab rails, and wheelchair lifts; wheel alignment, dynamometer and road testing; final inspection, repairs and preparation of the vehicles for delivery.

The cost of the above mentioned activities for this order has been estimated to be $19,872.31 per bus.

STATE OF FLORIDA HEAVY DUTY BUSES
JACKSONVILLE, FL
PRE-AWARD BUY AMERICA CERTIFICATE
FORTY FOOT LOW FLOOR TRANSIT BUSES (QTY: IDIQ, OPTION: TBD, BID/CONTRACT# STATE OF FLORIDA RFP P-23-030)
10-May-24

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We certify full compliance with the FTA's "Buy America" regulations (Section 49 CFR Part 663) and submit the following abbreviated listing as evidence of this compliance.

COMPONENT	MANUFACTURER	COUNTRY OF ORIGIN	PERCENT OF TOTAL COST
A/C TRANSITION DUCTS	THERMAL STRUCTURES, INC	U.S.A.	0.10%
AIR CONDITIONING SYSTEM	THERMO-KING CORPORATION	U.S.A.	6.44%
AIR DRYER ASSEMBLY	SKF USA, INC	U.S.A.	0.15%
BULKHEAD ASSEMBLY	ALVA-GWYN INC	U.S.A.	0.23%
CEILING PANELS	WILSONART INTERNATIONAL	U.S.A.	0.34%
COMPOSITE FLOORING	MILWAUKEE COMPOSITES	U.S.A.	0.41%
COOLANT PUMP	ENGINEERED MACHINE PRODUCTS	U.S.A.	0.12%
DESTINATION SIGNS	HANOVER DISPLAYS, INC	U.S.A.	1.61%
DOOR CONTROLS & PANELS - FRONT	VAPOR BUS INTERNATIONAL	U.S.A.	1.09%
DOOR CONTROLS & PANELS - REAR	VAPOR BUS INTERNATIONAL	U.S.A.	0.99%
DRIVER'S SEAT	UNITED SAFETY & SURVIVABILTY - DRIVER S	U.S.A.	0.95%
ELECTRICAL HARNESSES, CABLES & PANELS	COMPASS COMPONENTS, INC.	U.S.A.	0.89%
ELECTRICAL HARNESSES, CABLES & PANELS	RESQ MANUFACTURING	U.S.A.	3.80%
ENGINE & AFTERTREATMENT SYSTEM	CUMMINS, INC	U.S.A.	14.52%
EXTERIOR MIRRORS	SAFE FLEET	U.S.A.	0.26%
EXTRUSIONS	HYDRO EXTRUSION USA, LLC	U.S.A.	0.97%
FABRICATIONS	BAYFAB METALS INC	U.S.A.	0.21%
FABRICATIONS	DETENTION DEVICE SYSTEMS	U.S.A.	0.14%
FABRICATIONS	DIE & TOOL PRODUCTS, INC	U.S.A.	1.25%
FABRICATIONS	EAST BAY MACHINE	U.S.A.	0.73%
FABRICATIONS	G C M	U.S.A.	0.95%
FABRICATIONS	GOLDEN PLASTICS CORP	U.S.A.	0.30%
FABRICATIONS	HOGAN MFG. INC.	U.S.A.	2.00%
FABRICATIONS	IMPERIAL FABRICATORS	U.S.A.	4.29%
FABRICATIONS	MASTER METAL PRODUCTS CO.	U.S.A.	0.41%
FABRICATIONS	RON NUNES ENTERPRISES	U.S.A.	0.49%
FRONT AND REAR AXLE ASSEMBLIES	MERITOR AUTOMOTIVE	U.S.A.	4.50%
FRONT AND REAR BUMPER ASSEMBLIES	DYNATECT - RO-LAB	U.S.A.	0.76%
FRONT CAP	MC CLARIN PLASTICS LLC	U.S.A.	0.58%
HEATER ASSEMBLIES	MOBILE CLIMATE CONTROL	U.S.A.	0.53%
INTERIOR LIGHTING KIT	I/O CONTROLS - LIGHTS	U.S.A.	1.16%
MISCELLANEOUS-KD SPECIALTIES	KD SPECIALTIES	U.S.A.	0.22%
MISCELLANEOUS-I/O CONTROL	I/O CONTROLS - LIGHTS	U.S.A.	0.41%
PASSENGER SEAT ASSEMBLIES	UNITED SAFETY & SURVIVABILITY - PASS SE/	U.S.A.	7.37%
PIPING & TUBING	S.F. TUBE	U.S.A.	1.31%
RADIATOR PACKAGE	ENGINEERED MACHINED PRODUCTS, INC	U.S.A.	1.58%
REAR CAP ASSEMBLY	PERFORMANCE COMPOSTIES	U.S.A.	0.34%
REAR SUSPENSION	HENDRICKSON USA L.L.C.	U.S.A.	0.48%
ROOF HATCH	SPECIALTY MANUFACTURING INC	U.S.A.	0.13%
ROOF SKIN	CRANE COMPOSITES	U.S.A.	0.34%
TIRES	THE GOODYEAR TIRE & RUBBER COMPANY	U.S.A.	1.03%
VOLTAGE REGULATOR	VANNER, INC.	U.S.A.	0.13%
WHEELCHAIR RAMP	LIFT-U DIVISION OF HOGAN MFG.,INC	U.S.A.	2.27%
WHEELS	ADVANCED WHEELS SALES	U.S.A.	0.75%
WINDOW ASSEMBLIES	AROW GLOBAL	U.S.A.	3.81%
SPECIFICALLY IDENTIFIED U.S. COMPONENTS AS A % OF TOTAL MATERIALS			71.31% *
FINAL ASSEMBLY - ALL VEHICLE ASSEMBLY OPERATIONS, STARTING WITH THE UNDERSTRUCTURE THROUGH TO FINAL ROAD TEST ARE DONE IN LIVERMORE, CA	GILLIG	U.S.A.	100.00%

GILLIG

GILLIG LLC
LIVERMORE, CALIFORNIA

DESCRIPTION AND COST OF FINAL ASSEMBLY FOR 35' & 40' LOW FLOOR BUSES FY 2024

Gillig LLC certifies that final assembly of its buses occurs at its manufacturing plant in Livermore, California. The final assembly process consists of the assembly of the chassis; the installation and interconnection of the engine, transmission, axles, including the cooling and braking systems; the installation and interconnection of the heating and air conditioning equipment; the installation of pneumatic and electrical systems; mounting of the body structure to the chassis; installation of door systems; painting of the vehicle; installation of destination signs, windows, passenger seats, passenger grab rails, and wheelchair lifts; wheel alignment, dynamometer and road testing; final inspection, repairs and preparation of the vehicles for delivery.

The cost of the above mentioned activities for this order has been estimated to be $19,215.51 per bus.

STATE OF FLORIDA HEAVY DUTY BUSES
JACKSONVILLE, FL
PRE-AWARD BUY AMERICA CERTIFICATE
FORTY FOOT (CNG) LOW FLOOR TRANSIT BUSES (QTY: IDIQ, OPTION: TBD, BID/CONTRACT# STATE OF FLORIDA RFP P-23-030)
10-May-24

GILLIG IS ONE OF THE MOST "AMERICAN" BUS MANUFACTURERS IN THE WORLD. Gillig is 100% U.S. owned and operated. ALL OF OUR FACILITIES are located in the U.S.A. ALL OF OUR MANUFACTURING is done in the U.S.A. and we have a policy that stresses the use of products produced in the U.S.A.

We certify full compliance with the FTA's "Buy America" regulations (Section 49 CFR Part 663) and submit the following abbreviated listing as evidence of this compliance.

COMPONENT	MANUFACTURER	COUNTRY OF ORIGIN	PERCENT OF TOTAL COST
A/C TRANSITION DUCTS	THERMAL STRUCTURES, INC	U.S.A.	0.09%
AIR CONDITIONING SYSTEM	THERMO-KING CORPORATION	U.S.A.	5.58%
AIR DRYER ASSEMBLY	SKF USA, INC	U.S.A.	0.13%
BULKHEAD ASSEMBLY	ALVA-GWYN INC	U.S.A.	0.14%
CEILING PANELS	WILSONART INTERNATIONAL	U.S.A.	0.29%
COMPOSITE FLOORING	MILWAUKEE COMPOSITES	U.S.A.	0.36%
DESTINATION SIGNS	HANOVER DISPLAYS, INC	U.S.A.	1.39%
DOOR CONTROLS & PANELS - FRONT	VAPOR BUS INTERNATIONAL	U.S.A.	0.65%
DOOR CONTROLS & PANELS - REAR	VAPOR BUS INTERNATIONAL	U.S.A.	0.56%
DRIVER'S SEAT	UNITED SAFETY & SURVIVABILTY - DRIVER S	U.S.A.	0.82%
ELECTRICAL HARNESSES, CABLES & PANELS	COMPASS COMPONENTS, INC.	U.S.A.	0.81%
ELECTRICAL HARNESSES, CABLES & PANELS	RESQ MANUFACTURING	U.S.A.	3.39%
ENGINE & AFTERTREATMENT SYSTEM	CUMMINS, INC	U.S.A.	14.39%
EXTERIOR MIRRORS	SAFE FLEET	U.S.A.	0.22%
EXTRUSIONS	HYDRO EXTRUSION USA, LLC	U.S.A.	0.87%
FABRICATIONS	BAYFAB METALS INC	U.S.A.	0.21%
FABRICATIONS	DETENTION DEVICE SYSTEMS	U.S.A.	0.19%
FABRICATIONS	DIE & TOOL PRODUCTS, INC	U.S.A.	1.04%
FABRICATIONS	EAST BAY MACHINE	U.S.A.	0.76%
FABRICATIONS	G C M	U.S.A.	1.27%
FABRICATIONS	GOLDEN PLASTICS CORP	U.S.A.	0.23%
FABRICATIONS	HOGAN MFG. INC.	U.S.A.	1.74%
FABRICATIONS	IMPERIAL FABRICATORS	U.S.A.	3.26%
FABRICATIONS	MASTER METAL PRODUCTS CO.	U.S.A.	0.40%
FABRICATIONS	RON NUNES ENTERPRISES	U.S.A.	0.43%
FRONT AND REAR AXLE ASSEMBLIES	MERITOR AUTOMOTIVE	U.S.A.	3.90%
FRONT AND REAR BUMPER ASSEMBLIES	DYNATECT - RO-LAB	U.S.A.	0.65%
FRONT CAP	MC CLARIN PLASTICS LLC	U.S.A.	0.51%
FUEL SYSTEM	AGILITY FUEL SYSTEMS	U.S.A.	8.69%
HEATER ASSEMBLIES	MOBILE CLIMATE CONTROL	U.S.A.	0.39%
INTERIOR LIGHTING KIT	I/O CONTROLS - LIGHTS	U.S.A.	1.01%
MISCELLANEOUS-KD SPECIALTIES	KD SPECIALTIES	U.S.A.	0.19%
MISCELLANEOUS-I/O CONTROL	I/O CONTROLS - LIGHTS	U.S.A.	0.35%
PASSENGER SEAT ASSEMBLIES	UNITED SAFETY & SURVIVABILITY - PASS SE/	U.S.A.	6.39%
PIPING & TUBING	S.F. TUBE	U.S.A.	1.17%
RADIATOR PACKAGE	ENGINEERED MACHINED PRODUCTS, INC	U.S.A.	1.46%
REAR CAP ASSEMBLY	PERFORMANCE COMPOSTIES	U.S.A.	0.18%
REAR SUSPENSION	HENDRICKSON USA L.L.C.	U.S.A.	0.41%
TIRES	THE GOODYEAR TIRE & RUBBER COMPANY	U.S.A.	0.89%
WHEELCHAIR RAMP	LIFT-U DIVISION OF HOGAN MFG.,INC	U.S.A.	1.75%
WHEELS	ADVANCED WHEELS SALES	U.S.A.	0.65%
WINDOW ASSEMBLIES	AROW GLOBAL	U.S.A.	3.30%
SPECIFICALLY IDENTIFIED U.S. COMPONENTS AS A % OF TOTAL MATERIALS			71.11% *
FINAL ASSEMBLY - ALL VEHICLE ASSEMBLY OPERATIONS, STARTING WITH THE UNDERSTRUCTURE THROUGH TO FINAL ROAD TEST ARE DONE IN LIVERMORE, CA	GILLIG	U.S.A.	100.00%

GILLIG

GILLIG LLC
LIVERMORE, CALIFORNIA

DESCRIPTION AND COST OF FINAL ASSEMBLY FOR 35' & 40' CNG BUSES FY 2024

Gillig LLC certifies that final assembly of its buses occurs at its manufacturing plant in Livermore, California. The final assembly process consists of the assembly of the chassis; the installation and interconnection of the engine, transmission, axles, including the cooling and braking systems; the installation and interconnection of the heating and air conditioning equipment; the installation of pneumatic and electrical systems; mounting of the body structure to the chassis; installation of door systems; painting of the vehicle; installation of destination signs, windows, passenger seats, passenger grab rails, and wheelchair lifts; wheel alignment, dynamometer and road testing; final inspection, repairs and preparation of the vehicles for delivery.

The cost of the above mentioned activities for this order has been estimated to be $20,118.61 per bus.

STATE OF FLORIDA HEAVY DUTY BUSES
JACKSONVILLE, FL
PRE-AWARD BUY AMERICA CERTIFICATE
FORTY FOOT ALLISON HYBRID LOW FLOOR TRANSIT BUSES (QTY: IDIQ, OPTION: TBD, BID/CONTRACT# STATE OF FLORIDA RFP P-23-030)
10-May-24

GILLIG IS ONE OF THE MOST "AMERICAN" BUS MANUFACTURERS IN THE WORLD. Gillig is 100% U.S. owned and operated. ALL OF OUR FACILITIES are located in the U.S.A. ALL OF OUR MANUFACTURING is done in the U.S.A. and we have a policy that stresses the use of products produced in the U.S.A.

We certify full compliance with the FTA's "Buy America" regulations (Section 49 CFR Part 663) and submit the following abbreviated listing as evidence of this compliance.

COMPONENT	MANUFACTURER	COUNTRY OF ORIGIN	PERCENT OF TOTAL COST
A/C TRANSITION DUCTS	THERMAL STRUCTURES, INC	U.S.A.	0.07%
AIR CONDITIONING SYSTEM	THERMO-KING CORPORATION	U.S.A.	4.33%
CEILING PANELS	WILSONART INTERNATIONAL	U.S.A.	0.22%
COMPOSITE FLOORING	MILWAUKEE COMPOSITES	U.S.A.	0.29%
COOLANT PUMP	ENGINEERED MACHINE PRODUCTS	U.S.A.	0.08%
DESTINATION SIGNS	HANOVER DISPLAYS, INC	U.S.A.	1.04%
DOOR CONTROLS & PANELS - FRONT	VAPOR BUS INTERNATIONAL	U.S.A.	0.48%
DOOR CONTROLS & PANELS - REAR	VAPOR BUS INTERNATIONAL	U.S.A.	0.42%
DRIVER'S SEAT	UNITED SAFETY & SURVIVABILTY - DRIVER S	U.S.A.	0.61%
ELECTRIC DRIVE HYBIRD PROPULSION SYSTEM	ALLISON TRANSMISSION	U.S.A.	31.12%
ELECTRICAL HARNESSES, CABLES & PANELS	COMPASS COMPONENTS, INC.	U.S.A.	0.46%
ENGINE & AFTERTREATMENT SYSTEM	CUMMINS, INC	U.S.A.	5.82%
EXTRUSIONS	HYDRO EXTRUSION USA, LLC	U.S.A.	0.63%
FABRICATIONS	BAYFAB METALS INC	U.S.A.	0.31%
FABRICATIONS	DETENTION DEVICE SYSTEMS	U.S.A.	0.17%
FABRICATIONS	DIE & TOOL PRODUCTS, INC	U.S.A.	0.83%
FABRICATIONS	EAST BAY MACHINE	U.S.A.	0.65%
FABRICATIONS	G C M	U.S.A.	0.72%
FABRICATIONS	GOLDEN PLASTICS CORP	U.S.A.	0.17%
FABRICATIONS	HOGAN MFG. INC.	U.S.A.	2.01%
FABRICATIONS	IMPERIAL FABRICATORS	U.S.A.	2.65%
FABRICATIONS	MASTER METAL PRODUCTS CO.	U.S.A.	0.56%
FABRICATIONS	RON NUNES ENTERPRISES	U.S.A.	0.49%
FRONT AND REAR AXLE ASSEMBLIES	MERITOR AUTOMOTIVE	U.S.A.	2.90%
FRONT AND REAR BUMPER ASSEMBLIES	DYNATECT - RO-LAB	U.S.A.	0.49%
FRONT CAP	MC CLARIN PLASTICS LLC	U.S.A.	0.38%
INTERIOR LIGHTING KIT	I/O CONTROLS - LIGHTS	U.S.A.	0.78%
PASSENGER SEAT ASSEMBLIES	UNITED SAFETY & SURVIVABILITY - PASS SE/	U.S.A.	4.76%
PIPING & TUBING	S.F. TUBE	U.S.A.	0.83%
RADIATOR PACKAGE	ENGINEERED MACHINED PRODUCTS, INC	U.S.A.	1.19%
REAR CAP ASSEMBLY	PERFORMANCE COMPOSTIES	U.S.A.	0.13%
REAR SUSPENSION	HENDRICKSON USA L.L.C.	U.S.A.	0.31%
TIRES	THE GOODYEAR TIRE & RUBBER COMPANY	U.S.A.	0.67%
TRANSMISSION	ALLISON TRANSMISSION	U.S.A.	3.14%
WHEELCHAIR RAMP	LIFT-U DIVISION OF HOGAN MFG.,INC	U.S.A.	1.31%
WHEELS	ADVANCED WHEELS SALES	U.S.A.	0.48%
WINDOW ASSEMBLIES	AROW GLOBAL	U.S.A.	2.46%
SPECIFICALLY IDENTIFIED U.S. COMPONENTS AS A % OF TOTAL MATERIALS			73.94% *
FINAL ASSEMBLY - ALL VEHICLE ASSEMBLY OPERATIONS, STARTING WITH THE UNDERSTRUCTURE THROUGH TO FINAL ROAD TEST ARE DONE IN LIVERMORE, CA	GILLIG	U.S.A.	100.00%

GILLIG

GILLIG LLC
LIVERMORE, CALIFORNIA

DESCRIPTION AND COST OF FINAL ASSEMBLY FOR 35' & 40' HYBRID BUSES FY 2024

Gillig LLC certifies that final assembly of its buses occurs at its manufacturing plant in Livermore, California. The final assembly process consists of the assembly of the chassis; the installation and interconnection of the engine, transmission, axles, including the cooling and braking systems; the installation and interconnection of the heating and air conditioning equipment; the installation of pneumatic and electrical systems; mounting of the body structure to the chassis; installation of door systems; painting of the vehicle; installation of destination signs, windows, passenger seats, passenger grab rails, and wheelchair lifts; wheel alignment, dynamometer and road testing; final inspection, repairs and preparation of the vehicles for delivery.

The cost of the above mentioned activities for this order has been estimated to be $19,872.31 per bus.

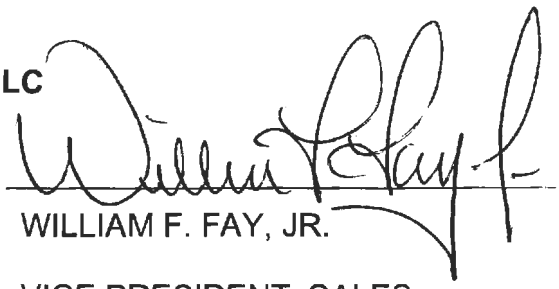
GILLIG

FMVSS CERTIFICATION

FEDERAL MOTOR VEHICLE SAFETY STANDARDS CERTIFICATION

GILLIG, LLC, 451 Discovery Drive, Livermore California 94551, hereby certifies that GILLIG, LLC has complied with all applicable requirements of the Federal Motor Vehicle Safety Standard (FMVSS) as required by the Federal Transit Administration (FTA) and the Department of Transportation (DOT), and described in Title 49 CFR Chapter V, part 571-FMVSS, last revised on October 1, 1998.

GILLIG LLC

By: 

WILLIAM F. FAY, JR.

Title: VICE PRESIDENT, SALES

Date: MAY 1, 2024

REVISIONS					
SYM	DWN	ZONE	DESCRIPTION	REL.	DATE
A	RAV		RELEASED FOR PRODUCTION	115460	10/04/16

MANUFACTURED BY GILLIG LLC

LIVERMORE, CALIFORNIA **DATE: _____**

GVWR: _____ kg _____ lb
GAWR: FRONT _____ kg _____ lb
WITH _____ TIRES,
_____ RIMS AT ____ kPa ____ psi COLD SINGLE
GAWR: REAR _____ kg _____ lb
WITH _____ TIRES,
_____ RIMS AT ____ kPa ____ psi COLD DUAL

THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S. FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VEHICLE I.D. NO.: _____ MODEL: _____
TYPE OF VEHICLE: BUS
ENGINE NUMBER: _____
UNLADEN WEIGHT: _____ lb

59-35132-007

NOTES:
1. ALL TEXT HEIGHT MUST BE GREATER THAN 3/32" TALL.
2. PRINT USING ZEBRA ZT410 LABEL PRINTER.
3. MINIMUM QUALITY SETTING OF 600DPI.
4. MEDIA TYPE IS THERMAL TRANSFER.
5. DARKNESS SETTING IS 28.
6. SPEED IS 2 INCHES PER SECOND.
7. DITHERING IS SMOOTH.

MAKE FROM: 59-52697-001		1
ITEM NO	DESCRIPTION	QTY
4 DAC	GILLIG LLC HAYWARD, CA	MARK PART W/PN PER GIL DB #370.002
		LH AS SHOWN, RH OPPOSITE NONE

REMOVE ALL BURRS, BREAK SHARP EDGES

DIMENSIONING AND TOLERANCING ARE PER ANSI Y14.5M-1994 UNLESS OTHERWISE SPECIFIED TOLERANCES ARE IN INCHES

DECIMALS .X ± .06, .XX ± .03, .XXX ± .010 ANGULAR ± .5° THIRD ANGLE

1ST S.O.

TITLE: DECAL-DATA PLATE GILLIG LLC, LIVERMORE LOCATION			
DWN: RAW	DATE: 10/04/16	MATER'L SPEC:	
CHKR'S INIT:	DATE:	MFG STD:	
APPR'S INIT:	DATE:	FMVSS COMPL:	STD NO 302
DRIG REL #: 115460	SIZE: A	DOCUMENT NO.	59-35132-007
CAD SCALE:			

GILLIG

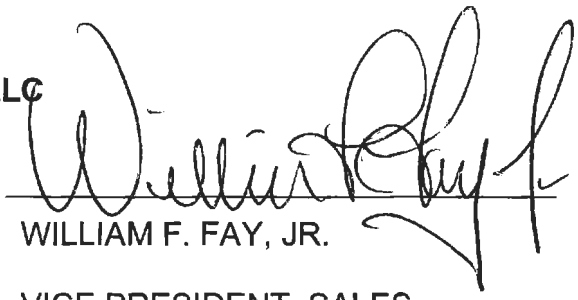
ALTOONA TEST CERTIFICATION

This is to certify that the bus model proposed for your procurement complies with the bus testing regulations required by the Surface Transportation and Uniform Relocation Assistance Act of 1987 as defined in the Interim Final Rulemaking (IFR) by the FTA in the Federal Register 49 CFR Part 665, dated July 28, 1992 and the Final Rule in the Federal Register 49 CFR part 665, dated August 1, 2016.

This statement means that the proposed vehicle complies with one or more of the clauses below, as required by the above IFR:

- was in mass transportation service prior to September 30, 1988, or
- is the same vehicle model that has been previously tested in PTI (Altoona), and that
- any new component(s) has (have) been tested at PTI (Altoona), or
- the installation of any new component(s) did not result in significant structural modification to the vehicle; or
- the installation of the component(s) did not result in a significant change in the data obtained from previous testing of the vehicle model.
- is a new bus model or a bus produced with a major change in components or configuration and shall provide a copy of the final test report to the recipient prior to the recipient's final acceptance of the first vehicle.

GILLIG LLC

By: 

WILLIAM F. FAY, JR.

Title: VICE PRESIDENT, SALES

Date: MAY 1, 2024

GILLIG

ALTOONA TESTING

GILLIG LLC hereby certifies that the bus model proposed for your procurement complies with the bus testing regulations required by the Surface Transportation and Uniform Relocation Assistance Act of 1987 as defined in the Interim Final Rulemaking (IFR) by the FTA in the Federal Register 49 CFR Part 665, dated July 28, 1992 and the Final Rule in the Federal Register 49 CFR part 665, dated August 1, 2016.

GILLIG is pleased to have completed full Altoona testing on all our Low Floor platform buses (diesel, Hybrid, CNG, Battery Electric).

1. PTI-BT-R9922-06-00: 29' Low Floor Diesel (June 2000)
2. PTI-BT-R0410: 35'/40' Low Floor Diesel (December 2004)
3. PTI-BT-R0405: 35'/40' Low Floor Hybrid (October 2004)
4. PTI-BT-R1109: 29' Low Floor CNG (January 2012)
5. PTI-BT-R1203-P: 35'/40' Low Floor BAE Hybrid (July 2012)
6. LTI-BT-R1911: 35'/40' Low Floor CNG (March 2020)
7. LTI-BT-R2020-05: 35'/40' Low Floor BEB (June 2021)
8. LTI-BT-R2022-06-P 35'/40' Low Floor eGen Flex Hybrid (August 2022)
9. LTI-BT-R2021-12: 35'/40' Low Floor BEB (December 2022)

A copy of the final test report(s) listed above can be provided upon request.

GILLIG

TESTING & DESIGN OPERATING PROFILE VALIDATION

Structural Analysis Validation - Completed

- Design Load Calculations
- Stress Calculations
- Finite Element Analysis
- Computer Simulations

Code and Regulation Compliance Validation

- Design Codes (interior lighting, driver's visibility, etc.)
- Design FMVSS Requirements

Component Application Analysis - Completed

- Component Selections
- Component Application Approvals
- Computer Simulations

Physical Validation Testing – Most Current Completion Date

- Optimization of Ride and Handling – 2011
- Vibration Tests – 2010
- Turning Radius Tests – 2011
- Turning Radius Test - 2020
- Engine Manufacturer Approvals
  - Cummins IQA Approvals 2007
  - Cummins IQA Approvals 2010
  - Cummins IQA Approvals 2013
  - Cummins IQA Approvals 2015 EMP Radiator only
  - Cummins IQA Approvals 2017 ISB BAE Hybrid
  - Cummins IQA Approval 2021 L9 Diesel
  - Cummins IQA Approval 2021 B67 Hybrid
  - Cummins IQA Approval 2021 40' Electric Bus
  - Cummins IQA Approval 2022 B67 Allision eGenFlex Hybrid
  - Cummins IQA includes engine/emission system installation approval, cooling system validation and compliance with electrical, AEB's.
- Strain Gauge Validation – 2005
- Loaded Road Dynamic Stress Test – 2006
- TRW Steering Geometry Test – 1998
- TRW Steering Geometry Test -2018
- TRW Steering Geometry Test - 2020
- Crashworthiness Test – 1998
- Crashworthiness Test -2018
- Crashworthiness Test - 2020
- Thermo King Performance Test T14 Unit– 2010
- Thermo King Performance Test T14 High Cooling Capacity -2015
- Thermo King Performance Test E Bus HVAC-2019
- Thermo King Performance Test E Bus HVAC -2020

GILLIG

TESTING & DESIGN OPERATING PROFILE VALIDATION

- Accelerated Durability Test Road simulation/shaker test 40' CNG 2012.
- Accelerated Durability Test Road simulation/shaker test 40' Electric Bus 2019
- Hot Weather on Road Testing (Death Valley) 40' Electric Gen 2.0 2019
- Hot Weather on Road Testing (Death Valley) 40' Electric Gen 2.5 2021
- Cold Weather Chamber and Cold Test Track Testing 40' Electric Bus 2020
- Cold Temperature Chamber testing 40' Electric bus 2021
- Vehicle Stability Testing 40' Electric Bus 2019
- Vehicle Stability Testing 40' Electric Bus 2020
- Vehicle ESC Testing 40' Electric 2019
- Vehicle Gradeability On Road Salt Lake City 40' Gen 2.0 Electric Bus 2019
- Vehicle Gradeability On Road Salt Lake City 40' Gen 2.5 Electric Bus 2021
- Altoona Style Durability Test Navistar Proving Grounds 40' Electric 2019
- Altoona Test 40' Diesel Bus Complete (ISM/Voith) – December 2004
- Altoona Test 40' Hybrid Bus Complete (ISB/EV40) – October 2004
- Altoona Test 29' Diesel Bus Complete (S40/B300) – June 2000
- Altoona Test 40' Hybrid Bus Complete (ISL/Voith Hybrid) – 2010
- Altoona Test 40' CNG Bus Complete (ISLG/B400R) – May 2011
- Altoona Test 29' CNG Bus Complete (ISLG/B400R) – January 2012
- Altoona Test 40' BAE Hybrid – July 2012
- Altoona Test 29' ISL – June 2010
- Altoona Test 40' CNG/Disc Brake – June 2013
- Altoona Test 40' Hybrid Bus (330 ISL/Allison Hybrid) - Feb 2019
- Altoona Test 40' Hybrid Bus (330L9/BAE Hybrid) – April 2018
- Altoona Test 29' Electric Bus – May 2018
- Altoona Test 40' Gen 2.0 Electric Bus - June 2021
- Altoona Test 40' CNG with Hendrickson Rear Suspension 2019
- Altoona Test 29' CNG with Hendrickson Rear Suspension 2021
- Altoona Test 40' Gen 2.5 Electric Bus - December 2022
- Altoona Test 40 ' Hybrid (B67/Allison Hybrid eGenFlex) – August 2022
- Altoona Test 40' Gen 3.0 Electric Bus – In Process

- FMVSS 121 Testing – Brakes
  - 2002 - 29 Ft. Low Floor Drum Brakes
  - 1999 - 29 Ft. Low Floor Drum Brake
  - 1998 - 40 Ft. Low Floor Drum Brake
  - 1997 - 40 Ft. Low Floor Drum Brake
  - 2011 - 40 Ft. Low Floor Drum Brake 27,000 Rear GAWR
  - 2013 - 40 Ft. Low Floor Meritor Disc Brakes
  - 2015 - 29' Low Floor Meritor Disc Brakes
  - 2016 - 29' Low Floor Drum Brake
  - 2019 - 40' Low Floor Meritor Disc Brakes Electric Bus @ 45,000 Lbs. GVWR
  - 2020 - 40' Low Floor Meritor Disc Brakes Electric Bus @ 47,180 Lbs. GVWR
  - 2022 - 40' Low Floor Meritor Disc Brakes Electric Bus @ 48,200 Lbs. GVWR

- Transmission Installation Approval & Cooling Tests
  - Allison 2007, 2010, 2013

  - Voith 2007, 2010, 2013, 2020
  - ZF 2007, 2010, 2013,2018
  - ZF 2021 Ecolife/L9
- Hybrid Drive
  - ISL 330 hp Allision - 2018
  - L9 330 hp BAE - 2018
- Amerex Fire Suppression Installation Approval 2013
- Amerex Fire Suppression Installation Approval 40' Electric Bus 2020
- Kidde Fire Suppression Installation Approval 2013
- Fogmaker Fire Suppression Installation Approval 2013
- Fire Trace Fire Suppression Installation Approval 2013
- Fire suppression installation approvals ongoing with new configurations

STURAA TEST

12 YEAR

500,000 MILE BUS

from

GILLIG CORPORATION

MODEL LOWFLOOR

DECEMBER 2004

PTI-BT-R0410

PENNSTATE

The Pennsylvania Transportation Institute

201 Research Office Building
The Pennsylvania State University
University Park, PA 16802

(814) 865-1891

Bus Testing and Research Center

2237 Old Rt 220 N.
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EXECUTIVE SUMMARY

The Gillig Corporation submitted a model Lowfloor, diesel-powered 36 seat (including the driver) 40-foot bus, for a 12 yr/500,000 mile STURAA test. The odometer reading at the time of delivery was 4,127 miles. Testing started on May 26, 2004 and was completed on December 3, 2004. The Check-In section of the report provides a description of the bus and specifies its major components.

The primary part of the test program is the Structural Durability Test, which also provides the information for the Maintainability and Reliability results. The Structural Durability Test was started on June 21, 2004 and was completed on November 5, 2004.

The interior of the bus is configured with seating for 36 passengers including the driver. Free floor space will accommodate 39 standing passengers resulting in a potential capacity of 75 persons. At 150 lbs per person, this load results in a measured gross vehicle weight of 37,950 lbs. The first segment of the Structural Durability Test was performed with the bus loaded to a GVW of 37,950 lbs. The middle segment was performed at a seated load weight of 32,540 lbs and the final segment was performed at a curb weight of 27,240 lbs. Durability driving resulted in unscheduled maintenance and failures that involved a variety of subsystems. A description of failures, and a complete and detailed listing of scheduled and unscheduled maintenance is provided in the Maintainability section of this report.

Accessibility, in general, was adequate. Components covered in Section 1.3 (Repair and/or Replacement of Selected Subsystems) along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

The Reliability section compiles failures that occurred during Structural Durability Testing. Breakdowns are classified according to subsystems. The data in this section are arranged so that those subsystems with more frequent problems are apparent. The problems are also listed by class as defined in Section 2. The test bus encountered no Class 1 or Class 2 failures. Of the 24 reported failures, nine were Class 3 and 15 were Class 4.

The Safety Test, (a double-lane change, obstacle avoidance test) was safely performed in both right-hand and left-hand directions up to a maximum test speed of 45 mph. The performance of the bus is illustrated by a speed vs. time plot. Acceleration and gradeability test data are provided in Section 4, Performance. The average time to obtain 50 mph was 30.82 seconds.

The Shakedown Test produced a maximum final loaded deflection of 0.183 inches with a permanent set ranging between 0.001 to 0.006 inches under a distributed static load of 28,125 lbs. The Distortion Test was completed with all subsystems, doors and escape mechanisms operating properly. No water leakage was observed throughout the test. All subsystems operated properly.

The Static Towing Test was performed using a target load (towing force) of 32,688 lbs. All four front pulls were completed to the full test load with no damage or deformation observed. The Dynamic Towing Test was performed by means of a front-lift tow. The towing interface was accomplished using a hydraulic under-lift wrecker. The bus was towed without incident and no damage resulted from the test. The manufacturer does not recommend towing the bus from the rear, therefore, a rear test was not performed. The Jacking and Hoisting Tests were also performed without incident. The bus was found to be stable on the jack stands, and the minimum jacking clearance observed with a tire deflated was 5.1 inches.

A Fuel Economy Test was run on simulated central business district, arterial, and commuter courses. The results were 3.50 mpg, 4.41 mpg, and 7.40 mpg respectively; with an overall average of 4.43 mpg.

A series of Interior and Exterior Noise Tests was performed. These data are listed in Section 7.1 and 7.2 respectively.

ABBREVIATIONS

ABTC - Altoona Bus Test Center
A/C - air conditioner
ADB - advance design bus
ATA-MC - The Maintenance Council of the American Trucking Association
CBD - central business district
CW - curb weight (bus weight including maximum fuel, oil, and coolant; but without passengers or driver)
dB(A) - decibels with reference to 0.0002 microbar as measured on the "A" scale
DIR - test director
DR - bus driver
EPA - Environmental Protection Agency
FFS - free floor space (floor area available to standees, excluding ingress/egress areas, area under seats, area occupied by feet of seated passengers, and the vestibule area)
GVL - gross vehicle load (150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space)
GVW - gross vehicle weight (curb weight plus gross vehicle load)
GVWR - gross vehicle weight rating
MECH - bus mechanic
mpg - miles per gallon
mph - miles per hour
PM - Preventive maintenance
PSBRTF - Penn State Bus Research and Testing Facility
PTI - Pennsylvania Transportation Institute
rpm - revolutions per minute
SAE - Society of Automotive Engineers
SCH - test scheduler
SEC - secretary
SLW - seated load weight (curb weight plus 150 lb for every designed passenger seating position and for the driver)
STURAA - Surface Transportation and Uniform Relocation Assistance Act
TD - test driver
TECH - test technician
TM - track manager
TP - test personnel

TEST BUS CHECK-IN

I. OBJECTIVE

The objective of this task is to log in the test bus, assign a bus number, complete the vehicle data form, and perform a safety check.

II. TEST DESCRIPTION

The test consists of assigning a bus test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer must certify that the bus meets all Federal regulations.

III. DISCUSSION

The check-in procedure is used to identify in detail the major components and configuration of the bus.

The test bus consists of a Gillig Corporation, model Lowfloor. The bus has a front door equipped with a Lift-U model LU6 03.-03 handicap ramp, located forward of the front axle and a rear door forward of the rear axle. Power is provided by a diesel-fueled, Cummins Motors model ISM 280 engine coupled to a Voith model A4VTOR2-8.5E transmission.

The measured curb weight is 8,300 lbs for the front axle and 18,940 lbs for the rear axle. These combined weights provide a total measured curb weight of 27,240 lbs. There are 36 seats including the driver and room for 39 standing passengers bringing the total passenger capacity to 75. Gross load is 150 lb x 75 = 11,250 lbs. At full capacity, the measured gross vehicle weight is 37,950 lbs.

VEHICLE DATA FORM

Bus Number: 0410	Arrival Date: 5-26-04
Bus Manufacturer: Gillig	Vehicle Identification Number (VIN): 15GGD211641076000
Model Number: Lowfloor	Date: 5-26-04
Personnel: T.S. & S.C.	

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	4,110	4,190	N/A	N/A	8,940	10,000
SLW	4,850	4,970	N/A	N/A	10,920	11,800
GVW	6,320	6,470	N/A	N/A	12,220	12,940

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	8,300	9,820	12,790	14,600
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	18,940	22,720	25,160	25,000
Total	27,240	32,540	37,950	GVWR: 39,600

Dimensions:

Length (ft/in)	40 / 10.0
Width (in)	101.0
Height (in)	121.0 (exhaust pipe)
Front Overhang (in)	89.5
Rear Overhang (in)	122.0
Wheel Base (in)	278.5
Wheel Track (in)	Front: 85.7
	Rear: 77.7

Bus Number: 0410	Date: 5-26-04

CLEARANCES:

Lowest Point Outside Front Axle	Location: Skid plate	Clearance(in): 9.0
Lowest Point Outside Rear Axle	Location: Transmission coolant pipe	Clearance(in): 10.4
Lowest Point between Axles	Location: Frame	Clearance(in): 12.8
Ground Clearance at the center (in)	12.8	
Front Approach Angle (deg)	8.1	
Rear Approach Angle (deg)	9.1	
Ramp Clearance Angle (deg)	5.3	
Aisle Width (in)	Front – 17.5 Rear – 23.0	
Inside Standing Height at Center Aisle (in)	Front – 94.6 Rear – 76.2	

BODY DETAILS:

Body Structural Type	Monocoque		
Frame Material	Steel		
Body Material	Aluminum & fiberglass		
Floor Material	Plywood		
Roof Material	Aluminum & fiberglass		
Windows Type	□ Fixed	■ Movable	
Window Mfg./Model No.	Excel / AS3 M14 G DOT 573		
Number of Doors	_1_ Front	_1_ Rear	
Mfr. / Model No.	Gillig / Vapor controllers		
Dimension of Each Door (in)	Front – 32.6 x 77.0	Rear – 29.8 x 77.7	
Passenger Seat Type	□ Cantilever	■ Pedestal	□ Other (explain)
Mfr. / Model No.	American Seating / Metropolitan		
Driver Seat Type	■ Air	□ Spring	□ Other (explain)
Mfr. / Model No.	Recaro / Ergo AM80/72		
Number of Seats (including Driver)	36 (2 w/c positions with 4 seats folded away)		

Bus Number: 0410	Date: 5/26/04

BODY DETAILS (Contd..)

Free Floor Space (ft^2)	58.8			
Height of Each Step at Normal Position (in)	Front 1. 15.2	2. N/A	3. N/A	4. N/A
	Middle 1. N/A	2. N/A	3. N/A	4. N/A
	Rear 1. 15.8	2. N/A	3. N/A	4. N/A
Step Elevation Change - Kneeling (in)	3.4			

ENGINE

Type	■ C.I.	□ Alternate Fuel	
	□ S.I.	□ Other (explain)	
Mfr. / Model No.	Cummins Motors / ISM 280		
Location	□ Front	■ Rear	□ Other (explain)
Fuel Type	□ Gasoline	□ CNG	□ Methanol
	■ Diesel	□ LNG	□ Other (explain)
Fuel Tank Capacity (indicate units)	120 gals		
Fuel Induction Type	■ Injected	□ Carburetion	
Fuel Injector Mfr. / Model No.	Cummins Motors / ISM 280		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	Cummins Motors / ISM 280		
Alternator (Generator) Mfr. / Model No.	C.E.Nichoff & Co.		
Maximum Rated Output (Volts / Amps)	26 / 300		
Air Compressor Mfr. / Model No.	Cummins / 18.7		
Maximum Capacity (ft^3 / min)	18.7		
Starter Type	■ Electrical	□ Pneumatic	□ Other (explain)
Starter Mfr. / Model No.	Delco-Remy / 10479130		

Bus Number: 0410	Date: 5-26-04

TRANSMISSION

Transmission Type	□ Manual	■ Automatic	
Mfr. / Model No.	Voith / A4VT0R2-8.5 E		
Control Type	□ Mechanical	■ Electrical	□ Other
Torque Convertor Mfr. / Model No.	Voith / A4VT0R2-8.5 E		
Integral Retarder Mfr. / Model No.	Voith / A4VT0R2-8.5 E		

SUSPENSION

Number of Axles	2		
Front Axle Type	□ Independent	■ Beam Axle	
Mfr. / Model No.	Meritor / FH946 RK		
Axle Ratio (if driven)	N/A		
Suspension Type	■ Air	□ Spring	□ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 902423		
Middle Axle Type	□ Independent	□ Beam Axle	
Mfr. / Model No.	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	□ Air	□ Spring	□ Other (explain)
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	□ Independent	■ Beam Axle	
Mfr. / Model No.	Meritor / 71163WX		
Axle Ratio (if driven)	5.38		
Suspension Type	■ Air	□ Spring	□ Other (explain)
No. of Shock Absorbers	4		
Mfr. / Model No.	Koni / 902626		

Bus Number: 0410	Date: 5-26-04

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Alcoa / 22.56 x 8.25
	Tire Mfr./ Model No.	Goodyear G159 / 12R 22.5
Rear	Wheel Mfr./ Model No.	Alcoa / 22.56 x 8.25
	Tire Mfr./ Model No.	Goodyear G159 / 12R 22.5

BRAKES

Front Axle Brakes Type	■ Cam	□ Disc	□ Other (explain)
Mfr. / Model No.	Meritor / 16.5x6 Cost plus		
Middle Axle Brakes Type	□ Cam	□ Disc	□ Other (explain)
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	■ Cam	□ Disc	□ Other (explain)
Mfr. / Model No.	Meritor / 14.5x10W		
Retarder Type	Integral hydraulic transmission		
Mfr. / Model No.	Voith / A4VT0R2-8.5 E		

HVAC

Heating System Type	□ Air	■ Water	□ Other
Capacity (Btu/hr)	94,000		
Mfr. / Model No.	Thermo King / T1		
Air Conditioner	■ Yes	□ No	
Location	Rear, above engine compartment		
Capacity (Btu/hr)	104,000		
A/C Compressor Mfr. / Model No.	Thermo King Corp. / X426		

STEERING

Steering Gear Box Type	Hydraulic gear
Mfr. / Model No.	TRW / Ross
Steering Wheel Diameter	20.0
Number of turns (lock to lock)	4.75

Bus Number: 0410	Date: 5-26-04

OTHERS

Wheel Chair Ramps	Location: Front door	Type: Hinged ramp
Wheel Chair Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	Lift-U / LU6 03-03	
Emergency Exit	Location: Windows Doors Roof hatch	Number: 6 2 2

CAPACITIES

Fuel Tank Capacity (units)	120 gals
Engine Crankcase Capacity (gallons)	8.675
Transmission Capacity (gallons)	Dry: 7.4 Refill: 6.6
Differential Capacity (gallons)	5.5
Cooling System Capacity (quarts)	50
Power Steering Fluid Capacity (gallons)	3.6

VEHICLE DATA FORM

Bus Number: 0410	Date: 5-26-04

List all spare parts, tools and manuals delivered with the bus.

Part Number	Description	Qty.
G159 12R 22.5	Goodyear tires	6
FA. Voith 59.3355.10	Transmission filter	3
Donaldson P151097	Engine air filter	1
5298	Airbags	4
LF9001	Engine oil filter	1
102011	Engine fuel filter	1
Koni 902423	Shock	1
WF2071	Coolant	1
Koni 902626	Shock	1
Na	Radius rod (front)	2
Na	Radius rod (rear)	2

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 0410	Date: 5-26-04

Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation	√	
Body and Sheet Metal	√	
Frame	√	
Steering	√	
Suspension	√	
Interior/Seating	√	
Axles	√	
Brakes	√	
Tires/Wheels	√	
Exhaust	√	
Fuel System	√	Diesel
Power Plant	√	
Accessories	√	
Lift System	√	Hinged ramp.
Interior Fasteners	√	
Batteries	√	

CHECK - IN

GILLIG CORPORATION'S
MODEL LOWFLOOR

1. MAINTAINABILITY

1.1 ACCESSIBILITY OF COMPONENTS AND SUBSYSTEMS

1.1-I. TEST OBJECTIVE

The objective of this test is to check the accessibility of components and subsystems.

1.1-II. TEST DESCRIPTION

Accessibility of components and subsystems is checked, and where accessibility is restricted the subsystem is noted along with the reason for the restriction.

1.1-III. DISCUSSION

Accessibility, in general, was adequate. Components covered in Section 1.3 (repair and/or replacement of selected subsystems), along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

ACCESSIBILITY DATA FORM

Bus Number: 0410	Date: 12-3-04

Component	Checked	Comments
ENGINE :	√	
Oil Dipstick	√	
Oil Filler Hole	√	
Oil Drain Plug	√	
Oil Filter	√	
Fuel Filter	√	
Air Filter	√	
Belts	√	
Coolant Level	√	
Coolant Filler Hole	√	
Coolant Drain	√	
Spark / Glow Plugs	√	
Alternator	√	
Diagnostic Interface Connector	√	
TRANSMISSION :		
Fluid Dip-Stick	√	
Filler Hole	√	
Drain Plug	√	
SUSPENSION :		
Bushings	√	
Shock Absorbers	√	
Air Springs	√	
Leveling Valves	√	
Grease Fittings	√	

ACCESSIBILITY DATA FORM

Bus Number: 0410	Date: 12-3-04

Component	Checked	Comments
HVAC :		
A/C Compressor	√	
Filters	√	
Fans	√	
ELECTRICAL SYSTEM :		
Fuses	√	
Batteries	√	
Voltage regulator	√	
Voltage Convertors	√	
Lighting	√	
MISCELLANEOUS :		
Brakes	√	
Handicap Lifts/Ramps	√	
Instruments	√	
Axles	√	
Exhaust	√	
Fuel System	√	
OTHERS :		

1.2 SERVICING, PREVENTIVE MAINTENANCE, AND REPAIR AND MAINTENANCE DURING TESTING

1.2-I. TEST OBJECTIVE

The objective of this test is to collect maintenance data about the servicing, preventive maintenance, and repair.

1.2.-II. TEST DESCRIPTION

The test will be conducted by operating the NBM and collecting the following data on work order forms and a driver log.

1. Unscheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Description of malfunction
    e. Location of malfunction (e.g., in service or undergoing inspection)
    f. Repair action and parts used
    g. Man-hours required

2. Scheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Engine running time (if available)
    e. Results of scheduled inspections
    f. Description of malfunction (if any)
    g. Repair action and parts used (if any)
    h. Man-hours required

The buses will be operated in accelerated durability service. While typical items are given below, the specific service schedule will be that specified by the manufacturer.

A. Service
    1. Fueling
    2. Consumable checks
    3. Interior cleaning

B. Preventive Maintenance
    4. Brake adjustments
    5. Lubrication
    6. 3,000 mi (or equivalent) inspection

7. Oil and filter change inspection
8. Major inspection
9. Tune-up

C. Periodic Repairs
1. Brake reline
2. Transmission change
3. Engine change
4. Windshield wiper motor change
5. Stoplight bulb change
6. Towing operations
7. Hoisting operations

1.2-III. DISCUSSION

Servicing and preventive maintenance were performed at manufacturer-specified intervals. The following Scheduled Maintenance Form lists the mileage, items serviced, the service interval, and amount of time required to perform the maintenance. Table 1 is a list of the lubricating products used in servicing. Finally, the Unscheduled Maintenance List along with Unscheduled Maintenance-related photographs is included in Section 5.7, Structural Durability. This list supplies information related to failures that occurred during the durability portion of testing. The Unscheduled Maintenance List includes the date and mileage at which the malfunction occurred, a description of the malfunction and repair, and the time required to perform the repair.

SCHEDULED MAINTENANCE

Gillig #0410

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
07-01-04	1,194	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
07-16-04	1,555	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
07-23-04	1,993	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08-04-04	2,585	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08-13-04	3,305	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08-19-04	3,759	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08-26-04	4,808	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
09-01-04	5,551	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
09-08-04	6,651	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00

SCHEDULED MAINTENANCE

Gillig #0410

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
09-15-04	7,822	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
09-21-04	8,929	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
09-28-04	9,852	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-04-04	10,767	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-18-04	12,743	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-27-04	13,816	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-01-04	14,567	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-08-04	15,000	P.M. / Inspection Fuel Economy Prep.	Linkage, tie rods, universals/u-joints all lubed. Oil changed. Oil, fuel, and air filters changed. Transmission oil and filter changed.	8.00	8.00

Table 1. STANDARD LUBRICANTS

The following is a list of Texaco lubricant products used in bus testing conducted by the Penn State University Altoona Bus Testing Center:

ITEM	PRODUCT CODE	TEXACO DESCRIPTION
Engine oil	#2112	URSA Super Plus SAE 30
Transmission oil	#1866	Automatic Trans Fluid Mercon/Dexron II Multipurpose
Gear oil	#2316	Multigear Lubricant EP SAE 80W90
Wheel bearing & Chassis grease	#1935	Starplex II

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

1.3-I. TEST OBJECTIVE

The objective of this test is to establish the time required to replace and/or repair selected subsystems.

1.3-II. TEST DESCRIPTION

The test will involve components that may be expected to fail or require replacement during the service life of the bus. In addition, any component that fails during the NBM testing is added to this list. Components to be included are:

1. Transmission
2. Alternator
3. Starter
4. Batteries
5. Windshield wiper motor

1.3-III. DISCUSSION

During the test, several additional components were removed for repair or replacement. Following is a list of components and total repair/replacement time.

	MAN HOURS
Left front bump stop.	0.50
Left front slack adjuster snap ring & spacers.	0.50
A/C Belt.	0.50
Right front bump stop.	0.50
Left rear, front axle air bag.	1.00
Left front shock.	1.00
Hydraulic fluid reservoir.	2.00
Right front shock.	0.25

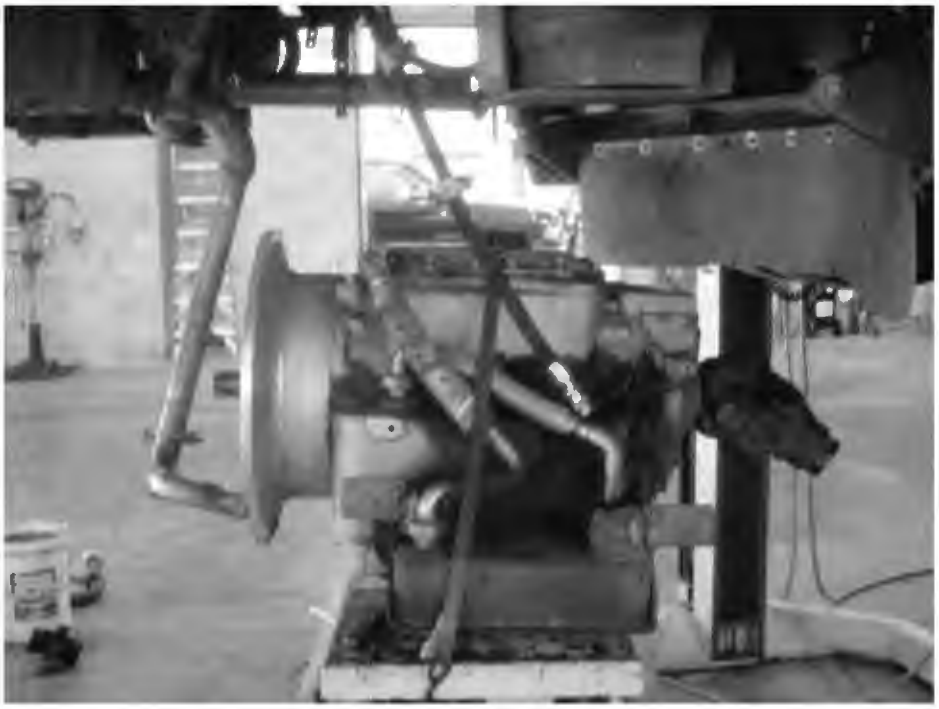
At the end of the test, the remaining items on the list were removed and replaced. The transmission assembly took 8.0 man-hours (two men 4.0 hrs) to remove and

replace. The time required for repair/replacement of the four remaining components is given on the following Repair and/or Replacement Form.

REPLACEMENT AND/OR REPAIR FORM

Subsystem	Replacement Time
Transmission	8.00 man hours
Wiper Motor	0.50 man hours
Starter	0.75 man hours
Alternator	0.75 man hours
Batteries	0.50 man hours

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

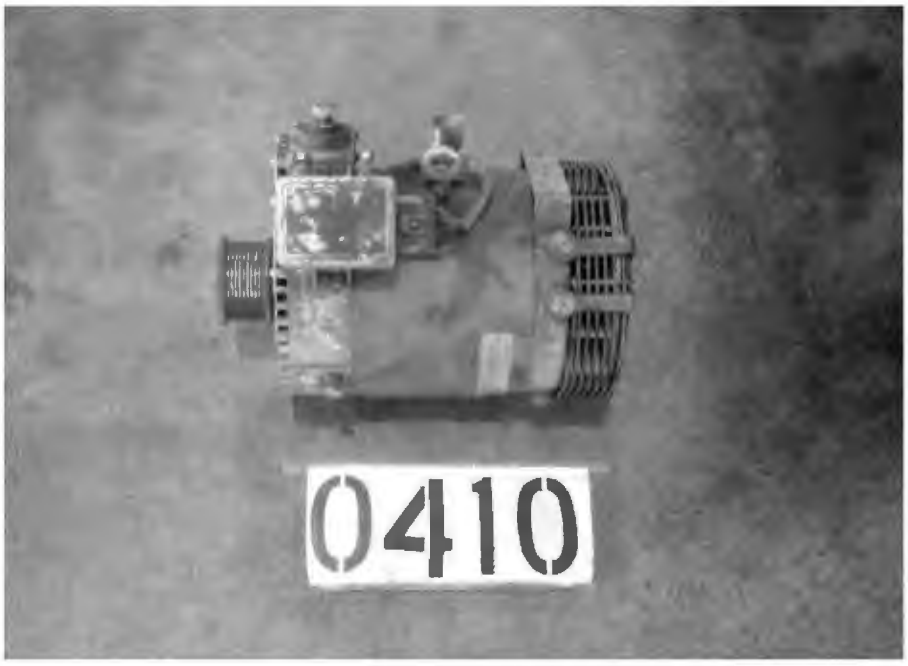


TRANSMISSION REMOVAL AND REPLACEMENT (8.00 MAN HOURS)

WIPER MOTOR REMOVAL AND REPLACEMENT (0.50 MAN HOURS)

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS CONT.

STARTER REMOVAL AND REPLACEMENT (0.75 MAN HOURS)



ALTERNATOR REMOVAL AND REPLACEMENT (0.75 MAN HOURS)

2. RELIABILITY - DOCUMENTATION OF BREAKDOWN AND REPAIR TIMES DURING TESTING

2-I. TEST OBJECTIVE

The objective of this test is to document unscheduled breakdowns, repairs, down time, and repair time that occur during testing.

2-II. TEST DESCRIPTION

Using the driver log and unscheduled work order forms, all significant breakdowns, repairs, man-hours to repair, and hours out of service are recorded on the Reliability Data Form.

CLASS OF FAILURES

Classes of failures are described below:

(a) Class 1: Physical Safety. A failure that could lead directly to passenger or driver injury and represents a severe crash situation.

(b) Class 2: Road Call. A failure resulting in an en route interruption of revenue service. Service is discontinued until the bus is replaced or repaired at the point of failure.

(c) Class 3: Bus Change. A failure that requires removal of the bus from service during its assignments. The bus is operable to a rendezvous point with a replacement bus.

(d) Class 4: Bad Order. A failure that does not require removal of the bus from service during its assignments but does degrade coach operation. The failure shall be reported by driver, inspector, or hostler.

2-III. DISCUSSION

A listing of breakdowns and unscheduled repairs is accumulated during the Structural Durability Test. The following Reliability Data Form lists all unscheduled repairs under classes as defined above. These classifications are somewhat subjective as the test is performed on a test track with careful inspections every two hours. However, even on the road, there is considerable latitude on deciding how to handle many failures.

The Unscheduled Repair List is also attached to provide a reference for the repairs that are included in the Reliability Data Forms.

The classification of repairs according to subsystem is intended to emphasize those systems which had persistent minor or more serious problems. There were no Class 1 or 2 failures. Of the nine Class 3 failures, seven involved the suspension system and one each to the brakes and engine/transmission. These, and the remaining 15 Class 4 failures are available for review in the Unscheduled Maintenance List, located in Section 5.7 Structural Durability.

RELIABILITY DATA FORMS

Bus Number: 0410	Date: 11/5/04
Personnel: Bob Reifsteck	

	Failure Type			
	Class 4 Bad Order	Class 3 Bus Change	Class 2 Road Call	Class 1 Physical Safety

Subsystems	Mileage	Mileage	Mileage	Mileage	Man Hours	Down Time
Suspension	1,346				0.50	24.00
	1,483				0.50	8.00
	2,464				0.50	8.00
		2,534			0.50	8.00
	2,534				0.50	0.50
	2,708				0.50	8.00
	3,147				0.50	8.00
	3,363				0.50	8.00
		3,419			1.00	1.00
	3,836				0.50	8.00
	5,201				0.50	8.00
		5,288			1.00	8.00
		7,307			1.00	8.00
		9,974			1.00	10.00
		12,743			0.25	3.00
		12,743			1.00	48.00
Seats/Compartment	2,095				0.50	8.00
	5,500				0.25	0.25
	5,500				0.25	0.25

RELIABILITY DATA FORMS

Bus Number: 0410	Date: 11/5/04
Personnel: Bob Reifsteck	

Failure Type			
Class 4 Bad Order	Class 3 Bus Change	Class 2 Road Call	Class 1 Physical Safety

Subsystems	Mileage	Mileage	Mileage	Mileage	Man Hours	Down Time
Air Conditioning	445				0.50	2.00
	729				1.00	4.00
Brakes		445			0.50	2.00
Engine/Transmission		12,487			2.00	2.00
Fuel System	729				0.50	8.00

3. SAFETY - A DOUBLE-LANE CHANGE (OBSTACLE AVOIDANCE)

3-I. TEST OBJECTIVE

The objective of this test is to determine handling and stability of the bus by measuring speed through a double lane change test.

3-II. TEST DESCRIPTION

The Safety Test is a vehicle handling and stability test. The bus will be operated at SLW on a smooth and level test track. The bus will be driven through a double lane change course at increasing speed until the test is considered unsafe or a speed of 45 mph is reached. The lane change course will be set up using pylons to mark off two 12 foot center to center lanes with two 100 foot lane change areas 100 feet apart. The bus will begin in one lane, change to the other lane in a 100 foot span, travel 100 feet, and return to the original lane in another 100 foot span. This procedure will be repeated, starting first in the right-hand and then in the left-hand lane.

3-III. DISCUSSION

The double-lane change was performed in both right-hand and left-hand directions. The bus was able to safely negotiate the test course in both the right-hand and left-hand directions up to the maximum test speed of 45 mph.

SAFETY DATA FORM

Bus Number: 0410	Date: 11-11-04
Personnel: R.C., T.S. & S.C.	

Temperature (°F): 56	Humidity (%): 45
Wind Direction: SW	Wind Speed (mph): 8
Barometric Pressure (in.Hg): 30.10	

SAFETY TEST: DOUBLE LANE CHANGE	
Maximum safe speed tested for double-lane change to left	45 mph
Maximum safe speed tested for double-lane change to right	45 mph
Comments of the position of the bus during the lane change: A safe profile was maintained through all portions of testing.	
Comments of the tire/ground contact patch: Tire/ground contact was maintained through all portions of testing.	

3. SAFETY

RIGHT - HAND APPROACH

LEFT - HAND APPROACH

4. PERFORMANCE - AN ACCELERATION, GRADEABILITY, AND TOP SPEED TEST

4-I. TEST OBJECTIVE

The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus.

4-II. TEST DESCRIPTION

In this test, the bus will be operated at SLW on the skid pad at the PSBRTF. The bus will be accelerated at full throttle from a standstill to a maximum "geared" or "safe" speed as determined by the test driver. The vehicle speed is measured using a Correvit non-contacting speed sensor. The times to reach speed between ten mile per hour increments are measured and recorded using a stopwatch with a lap timer. The time to speed data will be recorded on the Performance Data Form and later used to generate a speed vs time plot and gradeability calculations.

4-III. DISCUSSION

This test consists of three runs in both the clockwise and counterclockwise directions on the Test Track. Velocity versus time data is obtained for each run and results are averaged together to minimize any test variability which might be introduced by wind or other external factors. The test was performed up to a maximum speed of 50 mph. The fitted curve of velocity vs time is attached, followed by the calculated gradeability results. The average time to obtain 50 mph was 30.82 seconds.

PERFORMANCE DATA FORM

Bus Number: 0410	Date: 11-11-04
Personnel: R.C., T.S. & S.C.	

Temperature (°F): 56	Humidity (%): 45
Wind Direction: SW	Wind Speed (mph): 8
Barometric Pressure (in.Hg): 30.10	

Air Conditioning compressor-OFF	√_ Checked
Ventilation fans-ON HIGH	√_ Checked
Heater pump motor-Off	√_ Checked
Defroster-OFF	√_ Checked
Exterior and interior lights-ON	√_ Checked
Windows and doors-CLOSED	√_ Checked

ACCELERATION, GRADEABILITY, TOP SPEED

Counter Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	4.86	5.05	4.65
20 mph	8.24	8.42	8.15
30 mph	12.33	12.71	12.36
40 mph	20.39	20.36	19.83
Top Test Speed(mph) 50	33.00	32.37	32.03

Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	4.37	5.02	5.34
20 mph	7.71	8.34	8.62
30 mph	11.68	12.40	12.84
40 mph	18.27	18.99	19.81
Top Test Speed(mph) 50	28.35	29.02	30.16

0410.ACC

PERFORMANCE SUMMARY SHEET

BUS MANUFACTURER :Gillig
BUS MODEL :LowFloor
BUS NUMBER :0410
TEST DATE :11/11/04

TEST CONDITIONS :

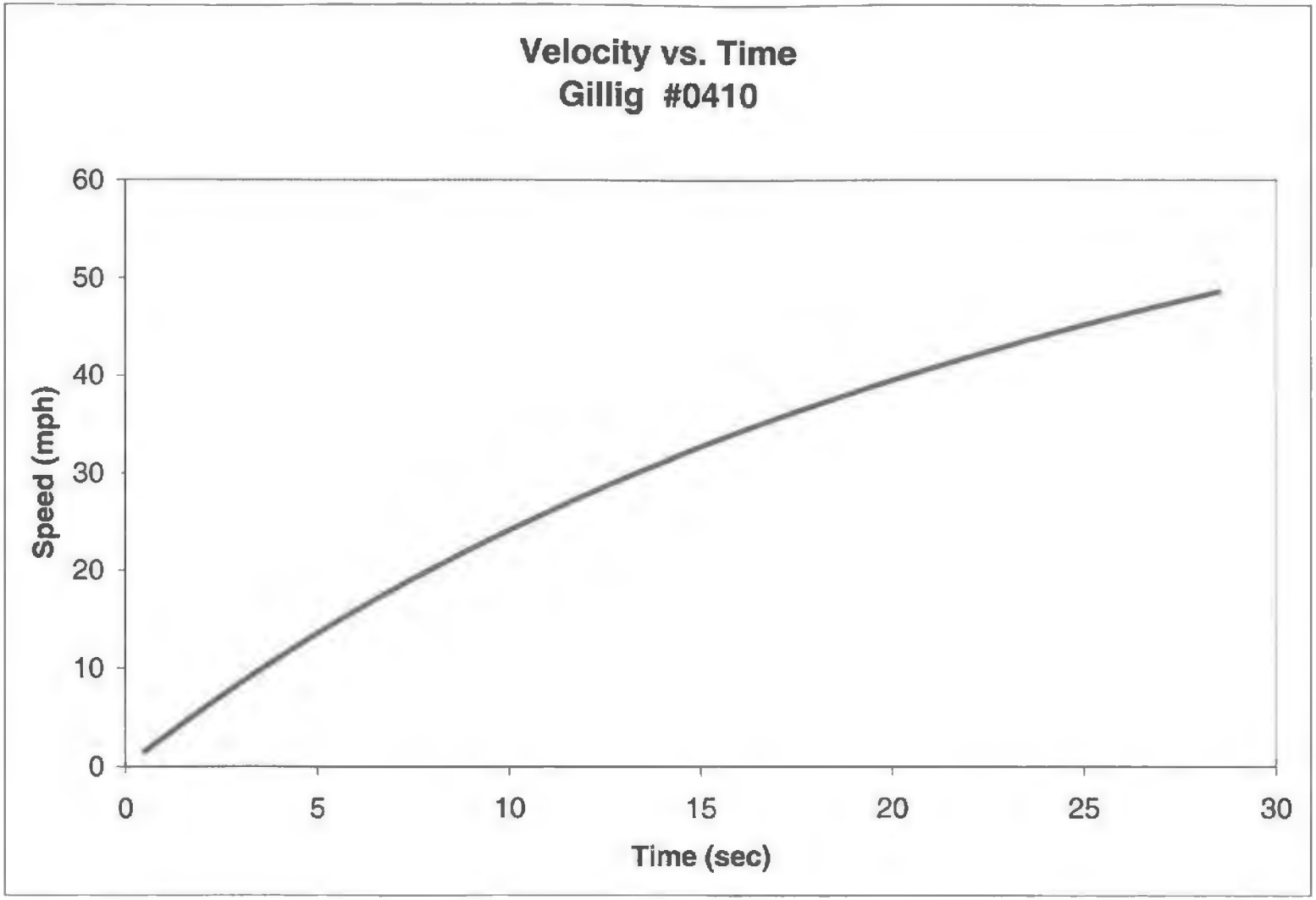
TEMPERATURE (DEG F) : 56.0
WIND DIRECTION : SW
WIND SPEED (MPH) : 8.0
HUMIDITY (%) : 45
BAROMETRIC PRESSURE (IN. HG) : 30.1

VEHICLE SPEED	AVERAGE TIME (SEC)		
(MPH)	CCW DIRECTION	CW DIRECTION	TOTAL
10.0	4.85	4.91	4.88
20.0	8.27	8.22	8.25
30.0	12.47	12.31	12.39
40.0	20.19	19.02	19.61
50.0	32.47	29.18	30.82

TEST SUMMARY :

VEHICLE SPEED (MPH)	TIME (SEC)	ACCELERATION (FT/SEC^2)	MAX. GRADE (%)
1.0	.33	4.4	13.7
5.0	1.71	4.1	12.8
10.0	3.59	3.7	11.7
15.0	5.65	3.4	10.6
20.0	7.93	3.0	9.5
25.0	10.49	2.7	8.4
30.0	13.38	2.4	7.4
35.0	16.66	2.1	6.5
40.0	20.45	1.8	5.6
45.0	24.87	1.5	4.8
50.0	30.12	1.3	4.0

NOTE : Gradeability results were calculated from performance test data. Actual sustained gradeability performance for vehicles equipped with auto transmission may be lower than the values indicated here.


Velocity vs. Time
Gillig #0410
Speed (mph)
60
50
40
30
20
10
0
0
5
10
15
20
25
30
Time (sec)

5. STRUCTURAL INTEGRITY

5.1 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL SHAKEDOWN TEST

5.1-I. DISCUSSION

The objective of this test is to determine certain static characteristics (e.g., bus floor deflection, permanent structural deformation, etc.) under static loading conditions.

5.1-II. TEST DESCRIPTION

In this test, the bus will be isolated from the suspension by blocking the vehicle under the suspension points. The bus will then be loaded and unloaded up to a maximum of three times with a distributed load equal to 2.5 times gross load. Gross load is 150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space. For a distributed load equal to 2.5 times gross load, place a 375-lb load on each seat and on every 1.5 sq ft of free floor space. The first loading and unloading sequence will "settle" the structure. Bus deflection will be measured at several locations during the loading sequences.

5.1-III. DISCUSSION

This test was performed based on a maximum passenger capacity of 75 people including the driver. The resulting test load is (75 x 375 lb) = 28,125 lb. The load is distributed evenly over the passenger space. Deflection data before and after each loading and unloading sequence is provided on the Structural Shakedown Data Form.

The unloaded height after each test becomes the original height for the next test. Some initial settling is expected due to undercoat compression, etc. After each loading cycle, the deflection of each reference point is determined. The bus is then unloaded and the residual (permanent) deflection is recorded. On the final test, the maximum loaded deflection was 0.183 inches at reference point 10. The maximum permanent deflection after the final loading sequence ranged from 0.001 inches at reference points 1, 6, and 7 to 0.006 inches at reference point 8.

STRUCTURAL SHAKEDOWN DATA FORM

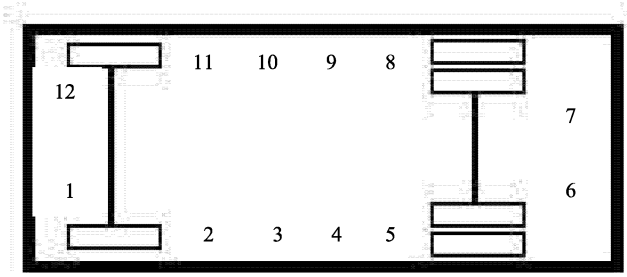
Bus Number: 0410	Date: 6-10-04
Personnel: D.L., M.H. T.S. & E.L.	Temperature (°F): 74
Loading Sequence: ■ 1 □ 2 □ 3 (check one) Test Load (lbs): 28,125	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus

Left



Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	0	.036	.036	.033	.033
2	0	.128	.128	.029	.029
3	0	.186	.186	.045	.045
4	0	.181	.181	.038	.038
5	0	.158	.158	.035	.035
6	0	.009	.009	.004	.004
7	0	.010	.010	.001	.001
8	0	.183	.183	.035	.035
9	0	.212	.212	.039	.039
10	0	.214	.214	.036	.036
11	0	.135	.135	.023	.023
12	0	.011	.011	.036	.036

STRUCTURAL SHAKEDOWN DATA FORM

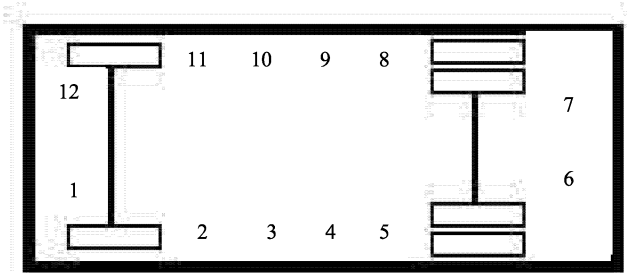
Bus Number: 0410	Date: 6-10-04
Personnel: D.L., M.H., T.S. & E.L.	Temperature (°F): 78
Loading Sequence: □ 1 ■ 2 □ 3 (check one) Test Load (lbs): 28,125	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus

Left



Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	.033	.045	.012	.034	.001
2	.029	.140	.111	.032	.003
3	.045	.204	.159	.050	.005
4	.038	.200	.162	.043	.005
5	.035	.175	.140	.040	.005
6	.004	.006	.002	.005	.001
7	.001	.000	-.001	.002	.001
8	.035	.185	.150	.041	.006
9	.039	.219	.180	.044	.005
10	.036	.219	.183	.041	.005
11	.023	.139	.116	.026	.003
12	.036	.012	-.024	.040	.004

5.1 STRUCTURAL SHAKEDOWN TEST

BUS LOADED TO 2.5 TIMES GVL
(28,125 LBS)

5.2 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL DISTORTION

5.2-I. TEST OBJECTIVE

The objective of this test is to observe the operation of the bus subsystems when the bus is placed in a longitudinal twist simulating operation over a curb or through a pothole.

5.2-II. TEST DESCRIPTION

With the bus loaded to GVWR, each wheel of the bus will be raised (one at a time) to simulate operation over a curb and the following will be inspected:

1. Body
2. Windows
3. Doors
4. Roof vents
5. Special seating
6. Undercarriage
7. Engine
8. Service doors
9. Escape hatches
10. Steering mechanism

Each wheel will then be lowered (one at a time) to simulate operation through a pothole and the same items inspected.

5.2-III. DISCUSSION

The test sequence was repeated ten times. The first and last test is with all wheels level. The other eight tests are with each wheel 6 inches higher and 6 inches lower than the other three wheels.

All doors, windows, escape mechanisms, engine, steering and handicapped devices operated normally throughout the test. The undercarriage and body indicated no deficiencies. No water leakage was observed during the test. The results of this test are indicated on the following data forms.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0410	Date: 6-17-04
Personnel: T.S., M.H., E.L. & E.D.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	■ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0410	Date: 6-17-04
Personnel: T.S., M.H., E.L. & E.D.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	■ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0410	Date: 6-17-04
Personnel: T.S., M.H., E.L. & E.D.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	■ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0410	Date: 6-17-04
Personnel: T.S., M.H., E.L. & E.D.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	■ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0410	Date: 6-17-04
Personnel: T.S., M.H., E.L. & E.D.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	■ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0410	Date: 6-17-04
Personnel: T.S., M.H., E.L. & E.D.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	■ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0410	Date: 6-17-04
Personnel: T.S., M.H., E.L. & E.D.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	■ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0410	Date: 6-17-04
Personnel: T.S., M.H., E.L. & E.D.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	■ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0410	Date: 6-17-04
Personnel: T.S., M.H., E.L. & E.D.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	■ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0410	Date: 6-17-04
Personnel: T.S., M.H., E.L. & E.D.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	□ before	■ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

5.2 STRUCTURAL DISTORTION TEST

RIGHT FRONT WHEEL SIX INCHES HIGHER

RIGHT REAR WHEEL SIX INCHES LOWER

5.3 STRUCTURAL STRENGTH AND DISTORTION TESTS - STATIC TOWING TEST

5.3-I. TEST OBJECTIVE

The objective of this test is to determine the characteristics of the bus towing mechanisms under static loading conditions.

5.3-II. TEST DESCRIPTION

Utilizing a load-distributing yoke, a hydraulic cylinder is used to apply a static tension load equal to 1.2 times the bus curb weight. The load will be applied to both the front and rear, if applicable, towing fixtures at an angle of 20 degrees with the longitudinal axis of the bus, first to one side then the other in the horizontal plane, and then upward and downward in the vertical plane. Any permanent deformation or damage to the tow eyes or adjoining structure will be recorded.

5.3-III. DISCUSSION

The load-distributing yoke was incorporated as the interface between the Static Tow apparatus and the test bus tow hook/eyes. The test was performed to the full target test weight of 32,688 lbs (1.2 x 27,240 lbs CW). All four front pulls were completed with no damage or deformation observed. The manufacturer does not recommend towing from the rear, therefore, no rear test was performed.

STATIC TOWING TEST DATA FORM

Bus Number: 0410	Date: 11-23-04
Personnel: R.C., T.S., M.H. & S.C.	Temperature (°F): 49

Inspect right front tow eye and adjoining structure.
Comments: No damage or deformation observed.
Check the torque/welds of all bolts attaching tow eye and surrounding structure.
Comments: Welds verified.
Inspect left tow eye and adjoining structure.
Comments: No damage or deformation observed.
Check the torque/welds of all bolts attaching tow eye and surrounding structure.
Comments: Welds verified.
Inspect right rear tow eye and adjoining structure.
Comments: N/A
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: N/A
Inspect left rear tow eye and adjoining structure.
Comments: N/A
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: N/A
General comments of any other structure deformation or failure: All four front pulls were completed to the full target test load of 32,688 lbs (1.2 x 27,240 lbs) with no damage or deformation observed. The manufacturer does not recommend rear towing, therefore, a rear test was not performed.

5.3 STATIC TOWING TEST

FRONT 20° UPWARD PULL

FRONT 20° DOWNWARD PULL

5.3 STATIC TOWING TEST CONT.

FRONT 20° LEFT PULL

FRONT 20° RIGHT PULL

5.4 STRUCTURAL STRENGTH AND DISTORTION TESTS - DYNAMIC TOWING TEST

5.4-I. TEST OBJECTIVE

The objective of this test is to verify the integrity of the towing fixtures and determine the feasibility of towing the bus under manufacturer specified procedures.

5.4-II. TEST DESCRIPTION

This test requires the bus be towed at curb weight using the specified equipment and instructions provided by the manufacturer and a heavy-duty wrecker. The bus will be towed for 5 miles at a speed of 20 mph for each recommended towing configuration. After releasing the bus from the wrecker, the bus will be visually inspected for any structural damage or permanent deformation. All doors, windows and passenger escape mechanisms will be inspected for proper operation.

5.4-III. DISCUSSION

The bus was towed using a heavy-duty wrecker. The towing interface was accomplished by incorporating a hydraulic under lift. A front lift tow was performed. Rear towing is not recommended. No problems, deformation, or damage was noted during testing.

DYNAMIC TOWING TEST DATA FORM

Bus Number: 0410	Date: 12-2-04
Personnel: S.C. & M.H.	

Temperature (°F): 41	Humidity (%): 60
Wind Direction: Calm	Wind Speed (mph): Calm
Barometric Pressure (in.Hg): 30.12	

Inspect tow equipment-bus interface.
Comments: A safe and adequate connection was made between the tow equipment and the bus.
Inspect tow equipment-wrecker interface.
Comments: A safe and adequate connection was made between the tow equipment and the wrecker.
Towing Comments: A front lift tow was performed incorporating a hydraulic under lift wrecker.
Description and location of any structural damage: None noted.
General Comments: The manufacturer does not recommend towing from the rear; therefore, a rear tow was not performed.

5.4 DYNAMIC TOWING TEST

TOWING INTERFACE

TEST BUS IN TOW

5.5 STRUCTURAL STRENGTH AND DISTORTION TESTS – JACKING TEST

5.5-I. TEST OBJECTIVE

The objective of this test is to inspect for damage due to the deflated tire, and determine the feasibility of jacking the bus with a portable hydraulic jack to a height sufficient to replace a deflated tire.

5.5-II. TEST DESCRIPTION

With the bus at curb weight, the tire(s) at one corner of the bus are replaced with deflated tire(s) of the appropriate type. A portable hydraulic floor jack is then positioned in a manner and location specified by the manufacturer and used to raise the bus to a height sufficient to provide 3-in clearance between the floor and an inflated tire. The deflated tire(s) are replaced with the original tire(s) and the hack is lowered. Any structural damage or permanent deformation is recorded on the test data sheet. This procedure is repeated for each corner of the bus.

5.5-III. DISCUSSION

The jack used for this test has a minimum height of 8.75 inches. During the deflated portion of the test, the jacking point clearances ranged from 5.1 inches to 24.0 inches. No deformation or damage was observed during testing. A complete listing of jacking point clearances is provided in the Jacking Test Data Form.

JACKING CLEARANCE SUMMARY

Condition	Frame Point Clearance
Front axle – one tire flat	8.2”
Rear axle – one tire flat	23.9”
Rear axle – two tires flat	21.7”

JACKING TEST DATA FORM

Bus Number: 0410	Date: 6-8-04
Personnel: S.C.	Temperature (°F): 70

Record any permanent deformation or damage to bus as well as any difficulty encountered during jacking procedure.

Deflated Tire	Jacking Pad Clearance Body/Frame (in)	Jacking Pad Clearance Axle/Suspension (in)	Comments
Right front	11.4 " I 8.2 " D	8.6 " I 5.3 " D	
Left front	11.3 " I 8.2 " D	8.6 " I 5.1 " D	
Right rear—outside	27.0 " I 24.0 " D	10.3 " I 9.5 " D	
Right rear—both	27.0 " I 21.8 " D	10.3 " I 8.1 " D	
Left rear—outside	26.8 " I 23.9 " D	10.3 " I 9.6 " D	
Left rear—both	26.8 " I 21.7 " D	10.3 " I 8.0 " D	
Right middle or tag—outside	NA	NA	
Right middle or tag—both	NA	NA	
Left middle or tag—outside	NA	NA	
Left middle or tag—both	NA	NA	

Additional comments of any deformation or difficulty during jacking:
none

5.6 STRUCTURAL STRENGTH AND DISTORTION TESTS - HOISTING TEST

5.6-I. TEST OBJECTIVE

The objective of this test is to determine possible damage or deformation caused by the jack/stands.

5.6-II. TEST DESCRIPTION

With the bus at curb weight, the front end of the bus is raised to a height sufficient to allow manufacturer-specified placement of jack stands under the axles or jacking pads independent of the hoist system. The bus will be checked for stability on the jack stands and for any damage to the jacking pads or bulkheads. The procedure is repeated for the rear end of the bus. The procedure is then repeated for the front and rear simultaneously.

5.6-III. DISCUSSION

The test was conducted using four posts of a six-post electric lift and standard 19 inch jack stands. The bus was hoisted from the front wheel, rear wheel, and then the front and rear wheels simultaneously and placed on jack stands.

The bus easily accommodated the placement of the vehicle lifts and jack stands and the procedure was performed without any instability noted.

HOISTING TEST DATA FORM

Bus Number: 0410	Date: 6-8-04
Personnel: S.C.	Temperature (°F): 75

Comments of any structural damage to the jacking pads or axles while both the front wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the rear wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the front and rear wheels are supported by the jack stands:
None noted.

5.7 STRUCTURAL DURABILITY TEST

5.7-I. TEST OBJECTIVE

The objective of this test is to perform an accelerated durability test that approximates up to 25 percent of the service life of the vehicle.

5.7-II. TEST DESCRIPTION

The test vehicle is driven a total of 15,000 miles; approximately 12,500 miles on the PSBRTF Durability Test Track and approximately 2,500 miscellaneous other miles. The test will be conducted with the bus operated under three different loading conditions. The first segment will consist of approximately 6,250 miles with the bus operated at GVW. The second segment will consist of approximately 2,500 miles with the bus operated at SLW. The remainder of the test, approximately 6,250 miles, will be conducted with the bus loaded to CW. If GVW exceeds the axle design weights, then the load will be adjusted to the axle design weights and the change will be recorded. All subsystems are run during these tests in their normal operating modes. All recommended manufacturers servicing is to be followed and noted on the vehicle maintainability log. Servicing items accelerated by the durability tests will be compressed by 10:1; all others will be done on a 1:1 mi/mi basis. Unscheduled breakdowns and repairs are recorded on the same log as are any unusual occurrences as noted by the driver. Once a week the test vehicle shall be washed down and thoroughly inspected for any signs of failure.

5.7-III. DISCUSSION

The Structural Durability Test was started on June 21, 2004 and was conducted until November 5, 2004. The first 6,250 miles were performed at a GVW of 37,950 lbs. and completed on September 8, 2004. The next 2,500 mile SLW segment was performed at 32,540 lbs and completed on September 22, 2004, and the final 6,250 mile segment was performed at a CW of 27,240 lbs and completed on November 5, 2004.

The following mileage summary presents the accumulation of miles during the Structural Durability Test. The driving schedule is included, showing the operating duty cycle. A detailed plan view of the Test Track Facility and Durability Test Track are attached for reference. Also, a durability element profile detail shows all the measurements of the different conditions. Finally, photographs illustrating some of the failures that were encountered during the Structural Durability Test are included.

GILLIG - TEST BUS #0410

MILEAGE DRIVEN/RECORDED FROM DRIVERS' LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
06/21/04 TO 06/27/04	511.00	75.00	586.00
06/28/04 TO 07/04/04	485.00	175.00	660.00
07/05/04 TO 07/11/04	95.00	5.00	100.00
07/12/04 TO 07/18/04	158.00	112.00	270.00
07/19/04 TO 07/25/04	358.00	121.00	479.00
07/26/04 TO 08/01/04	419.00	20.00	439.00
08/02/04 TO 08/08/04	184.00	109.00	293.00
08/09/04 TO 08/15/04	409.00	127.00	536.00
08/16/04 TO 08/22/04	504.00	127.00	631.00
08/23/04 TO 08/29/04	1155.00	52.00	1207.00
08/30/04 TO 09/05/04	790.00	130.00	920.00
09/06/04 TO 09/12/04	701.00	485.00	1186.00
09/13/04 TO 09/19/04	1118.00	51.00	1169.00
09/20/04 TO 09/26/04	920.00	187.00	1107.00
09/27/04 TO 10/03/04	994.00	49.00	1043.00
10/04/04 TO 10/10/04	1162.00	154.00	1316.00
10/11/04 TO 10/17/04	625.00	29.00	654.00

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
10/18/04 TO 10/24/04	403.00	123.00	526.00
10/25/04 TO 10/31/04	1196.00	156.00	1352.00
11/01/04 TO 11/07/04	304.00	222.00	526.00
TOTAL	12491.00	2509.00	15000.00

Table 4. Driving Schedule for Bus Operation on the Durability Test Track.

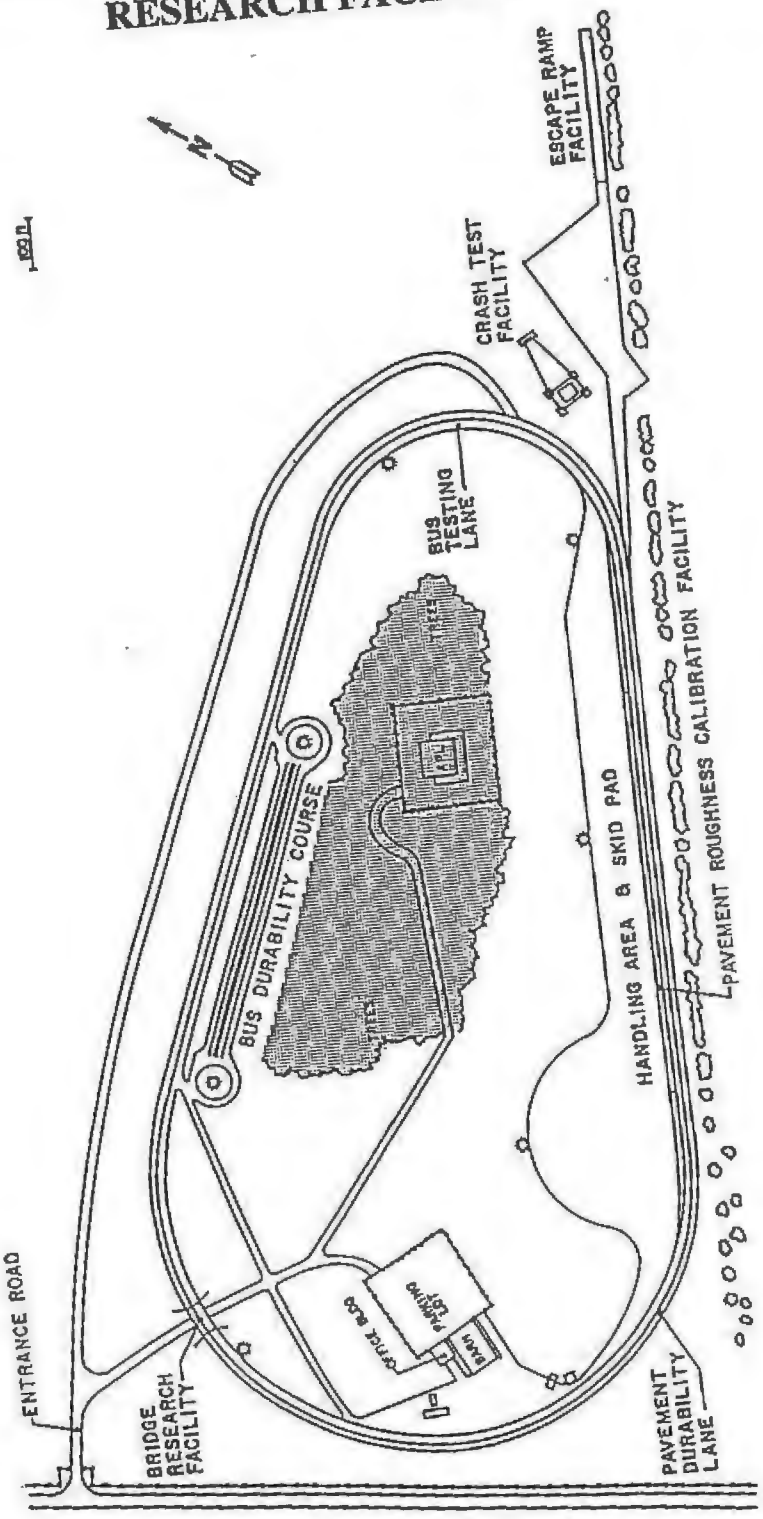
STANDARD OPERATING SCHEDULE

Monday through Friday

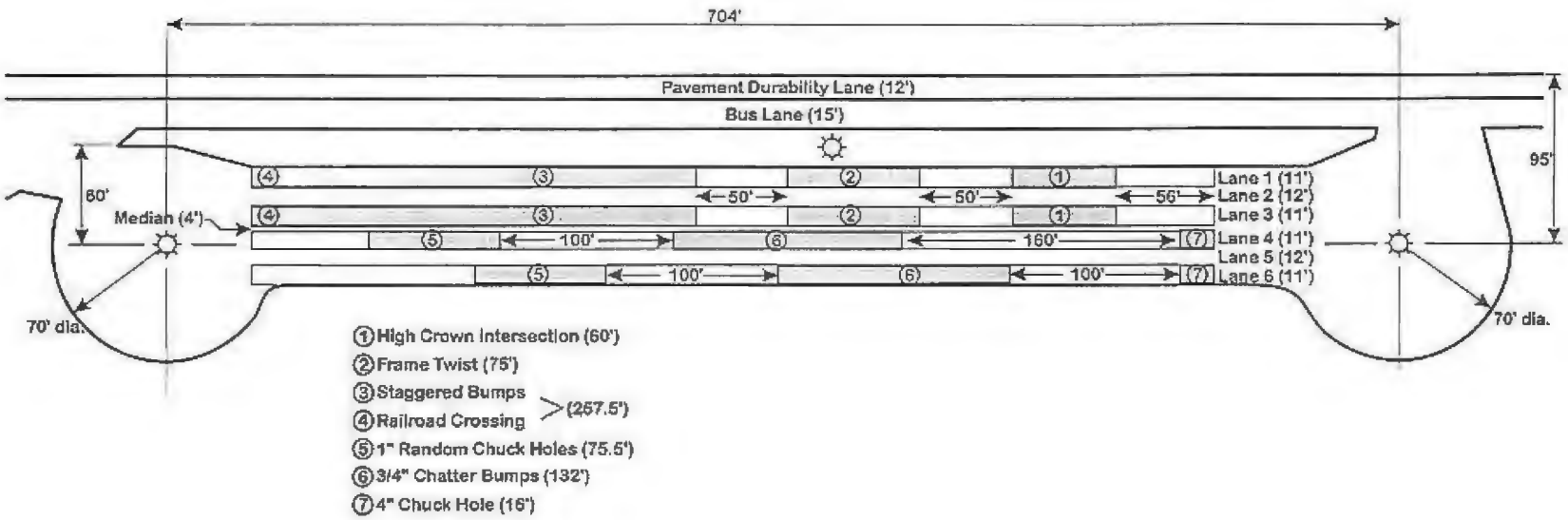
	HOUR	ACTION
Shift 1	midnight	D
	1:40 am	C
	1:50 am	B
	2:00 am	D
	3:35 am	C
	3:45 am	B
	4:05 am	D
	5:40 am	C
	5:50 am	B
	6:00 am	D
	7:40 am	C
	7:50 am	F
Shift 2	8:00 am	D
	9:40 am	C
	9:50 am	B
	10:00 am	D
	11:35 am	C
	11:45 am	B
	12:05 pm	D
	1:40 pm	C
	1:50 pm	B
	2:00 pm	D
	3:40 pm	C
	3:50 pm	F
Shift 3	4:00 pm	D
	5:40 pm	C
	5:50 pm	B
	6:00 pm	D
	7:40 pm	C
	7:50 pm	B
	8:05 pm	D
	9:40 pm	C
	9:50 pm	B
	10:00 pm	D
	11:40 pm	C
	11:50 pm	F

B—Break
C----Cycle all systems five times, visual inspection, driver's log entries
D—Drive bus as specified by procedure
F----Fuel bus, complete driver's log shift entries

"PLAN VIEW OF PENN STATE BUS TESTING AND RESEARCH FACILITY"



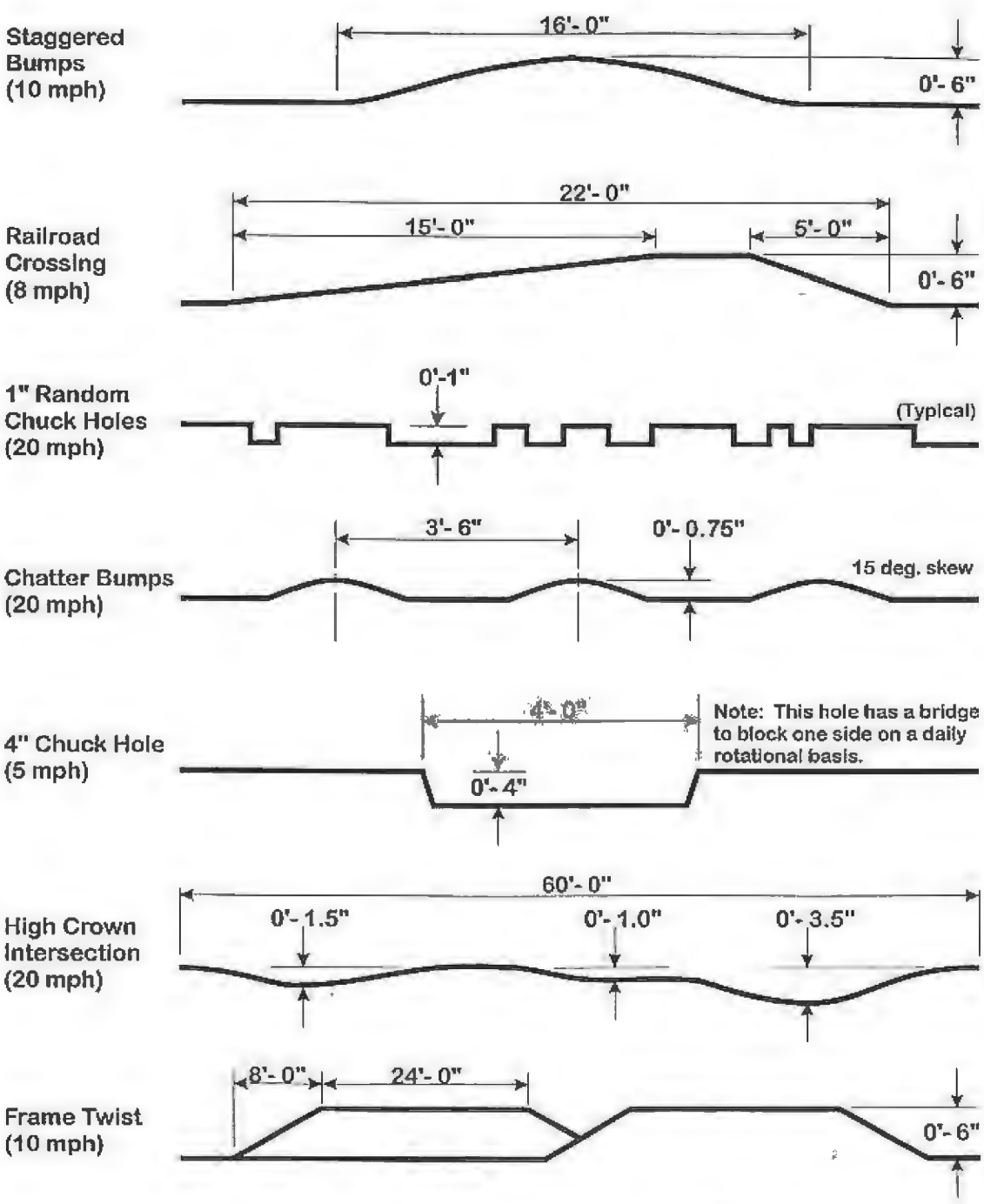
BUS TESTING AND RESEARCH TEST TRACK
UNIVERSITY PARK, PA



Plan View

Vehicle Durability Test Track

The Pennsylvania Transportation Institute
Penn State



Durability Element Profiles

The Pennsylvania Transportation Institute
Penn State

UNSCHEDULED MAINTENANCE

Gillig 0410

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
06/25/04	445	The snap ring and spacers are missing from the front left slack adjuster. Part found on the test track undamaged.	Snap ring and spacers installed in slack adjuster.	2.00	0.50
06/25/04	445	The A/C belt came off.	Undamaged A/C belt reinstalled.	2.00	0.50
06/29/04	729	Fuel is splashing out of the filler cap.	Hinged rubber cap replaced with a lock-on metal cap.	8.00	0.50
06/29/04	729	The A/C belt is riding half way off the pulleys.	A/C compressor repositioned and belt reinstalled.	4.00	1.00
07/13/04	1,346	The left front bump stop is broken.	Left front bump stop replaced.	24.00	0.50
07/15/04	1,483	The right front bump stop is broken.	Right front bump stop replaced.	8.00	0.50
07/26/04	2,095	The driver's seat will not hold air.	Leaking air supply line repaired.	8.00	0.50
07/28/04	2,464	The right front bump stop is broken.	Right front bump stop replaced.	8.00	0.50

UNSCHEDULED MAINTENANCE

Gillig 0410

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
07/30/04	2,534	The front leveling valve link is disconnected.	Front leveling valve link reconnected.	8.00	0.50
08/04/04	2,534	Both front bump stops are broken.	Both front bump stops replaced.	0.50	0.50
08/06/04	2,708	The right front bump stop is broken.	Right front bump stop replaced.	8.00	0.50
08/12/04	3,147	The right front bump stop is broken.	Right front bump stop replaced.	8.00	0.50
08/16/04	3,363	The right front bump stop is broken.	Right front bump stop replaced.	8.00	0.50
08/17/04	3,419	The left rear, front axle air bag has failed.	Air bag replaced.	1.00	1.00
08/20/04	3,836	The left front bump stop is broken.	Left front bump stop replaced.	8.00	0.50
08/30/04	5,201	The right front bump stop is broken.	Right front bump stop replaced.	8.00	0.50
08/31/04	5,288	The left front, front axle air bag is leaking air.	Air bag replaced.	8.00	1.00

UNSCHEDULED MAINTENANCE

Gillig 0410

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
09/01/04	5,500	The 3rd seat on the right side has a broken frame.	Seat removed.	0.25	0.25
09/01/04	5,500	The slide tracks on the battery tray are loose.	Screws tightened.	0.25	0.25
09/13/04	7,307	The “T” fitting for the left front, front axle air bag is leaking air.	“T” fitting replaced.	8.00	1.00
09/29/04	9,974	The left front shock is broken.	Left front shock replaced.	10.00	1.00
10/14/04	12,487	The hydraulic fluid reservoir is cracked at the inlet hose connection.	New reservoir installed.	2.00	2.00
10/20/04	12,743	The right front shock is worn and leaking oil.	Right front shock replaced.	3.00	0.25
10/20/04	12,743	The H-beam anchor point is cracked.	Crack welded/repaired.	48.00	1.00

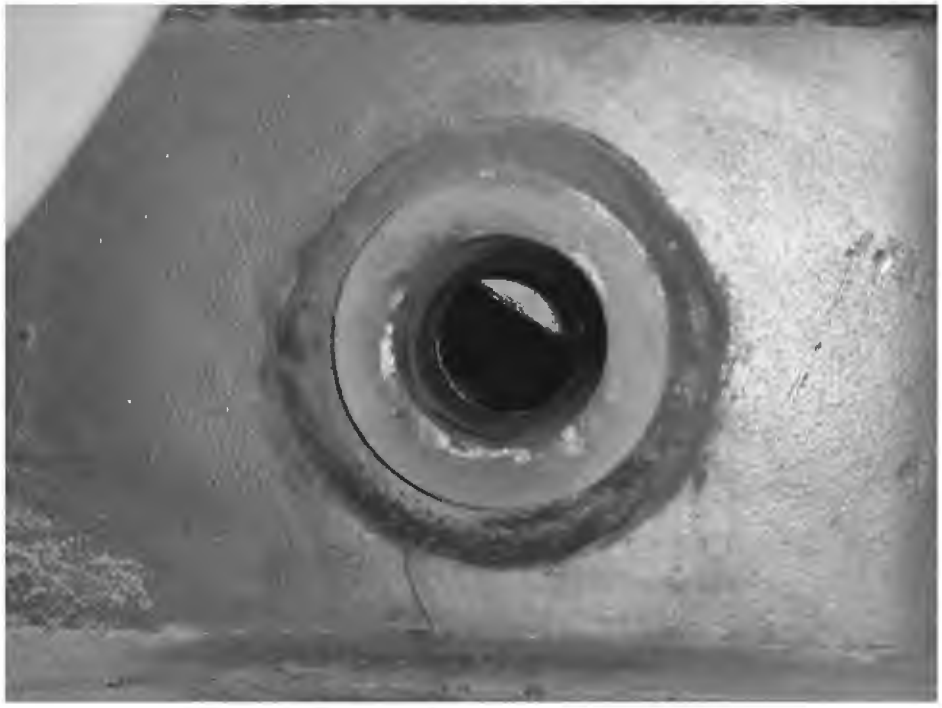
UNSCHEDULED MAINTENANCE

BROKEN SEAT FRAME
(5,500 TEST MILES)

BROKEN LEFT FRONT SHOCK
(9,974 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

CRACKED HYDRAULIC RESERVOIR
(12,487 TEST MILES)



CRACKED H-BEAM ANCHOR POINT
(12,743 TEST MILES)

6. FUEL ECONOMY TEST - A FUEL CONSUMPTION TEST USING AN APPROPRIATE OPERATING CYCLE

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable fuel consumption data on transit buses produced by different manufacturers. This fuel economy test bears no relation to the calculations done by the Environmental Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This fuel economy test, as designated here, is a measurement of the fuel expended by a vehicle traveling a specified test loop under specified operating conditions. The results of this test will not represent actual mileage but will provide data that can be used by recipients to compare buses tested by this procedure.

6-II. TEST DESCRIPTION

This test requires operation of the bus over a course based on the Transit Coach Operating Duty Cycle (ADB Cycle) at seated load weight using a procedure based on the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82. The procedure has been modified by elimination of the control vehicle and by modifications as described below. The inherent uncertainty and expense of utilizing a control vehicle over the operating life of the facility is impractical.

The fuel economy test will be performed as soon as possible (weather permitting) after the completion of the GVW portion of the structural durability test. It will be conducted on the bus test lane at the Penn State Test Facility. Signs are erected at carefully measured points which delineate the test course. A test run will comprise 3 CBD phases, 2 Arterial phases, and 1 Commuter phase. An electronic fuel measuring system will indicate the amount of fuel consumed during each phase of the test. The test runs will be repeated until there are at least two runs in both the clockwise and counterclockwise directions in which the fuel consumed for each run is within $\pm$ 4 percent of the average total fuel used over the 4 runs. A 20-minute idle consumption test is performed just prior to and immediately after the driven portion of the fuel economy test. The amount of fuel consumed while operating at normal/low idle is recorded on the Fuel Economy Data Form. This set of four valid runs along with idle consumption data comprise a valid test.

The test procedure is the ADB cycle with the following four modifications:

1. The ADB cycle is structured as a set number of miles in a fixed time in the following order: CBD, Arterial, CBD, Arterial, CBD, Commuter. A separate idle fuel consumption measurement is performed at the beginning and end of the fuel economy test. This phase sequence permits the reporting of fuel consumption for each of these phases separately, making the data more useful to bus manufacturers and transit properties.

2. The operating profile for testing purposes shall consist of simulated transit type service at seated load weight. The three test phases (figure 6-1) are: a central business district (CBD) phase of 2 miles with 7 stops per mile and a top speed of 20 mph; an arterial phase of 2 miles with 2 stops per mile and a top speed of 40 mph; and a commuter phase of 4 miles with 1 stop and a maximum speed of 40 mph. At each designated stop the bus will remain stationary for seven seconds. During this time, the passenger doors shall be opened and closed.

3. The individual ADB phases remain unaltered with the exception that 1 mile has been changed to 1 lap on the Penn State Test Track track. One lap is equal to 5,042 feet. This change is accommodated by adjusting the cruise distance and time.

4. The acceleration profile, for practical purposes and to achieve better repeatability, has been changed to "full throttle acceleration to cruise speed".

Several changes were made to the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82:

1. Sections 1.1, and 1.2 only apply to diesel, gasoline, methanol, and any other fuel in the liquid state (excluding cryogenic fuels).

1.1 SAE 1376 July 82 requires the use of at least a 16-gal fuel tank. Such a fuel tank when full would weigh approximately 160 lb. It is judged that a 12-gal tank weighing approximately 120 lb will be sufficient for this test and much easier for the technician and test personnel to handle.

1.2 SAE 1376 July 82 mentions the use of a mechanical scale or a flowmeter system. This test procedure uses a load cell readout combination that provides an accuracy of 0.5 percent in weight and permits on-board weighing of the gravimetric tanks at the end of each phase. This modification permits the determination of a fuel economy value for each phase as well as the overall cycle.

2. Section 2.1 applies to compressed natural gas (CNG), liquified natural gas (LNG), cryogenic fuels, and other fuels in the vapor state.

2.1 A laminar type flowmeter will be used to determine the fuel consumption. The pressure and temperature across the flow element will be monitored by the flow computer. The flow computer will use this data to calculate the gas flow rate. The flow computer will also display the flow rate (scfm) as well as the total fuel used (scf). The total fuel used (scf) for each phase will be recorded on the Fuel Economy Data Form.

3. Use both Sections 1 and 2 for dual fuel systems.

FUEL ECONOMY CALCULATION PROCEDURE

A. For diesel, gasoline, methanol and fuels in the liquid state.

The reported fuel economy is based on the following: measured test quantities--distance traveled (miles) and fuel consumed (pounds); standard reference values--density of water at 60°F (8.3373 lbs/gal) and volumetric heating value of standard fuel; and test fuel specific gravity (unitless) and volumetric heating value (BTU/gal). These combine to give a fuel economy in miles per gallon (mpg) which is corrected to a standard gallon of fuel referenced to water at 60°F. This eliminates fluctuations in fuel economy due to fluctuations in fuel quality. This calculation has been programmed into a computer and the data processing is performed automatically.

The fuel economy correction consists of three steps:

1.) Divide the number of miles of the phase by the number of pounds of fuel consumed

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$\mathbf{FEo_{mi/lb}} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{lb of fuel}}$$

2.) Convert the observed fuel economy to miles per gallon [mpg] by multiplying by the specific gravity of the test fuel Gs (referred to water) at 60°F and multiply by the density of water at 60°F

$$\mathbf{FEo_{mpg}} = \mathbf{FEc_{mi/lb}} \times Gs \times Gw$$

where **Gs** = Specific gravity of test fuel at 60°F (referred to water)
Gw = 8.3373 lb/gal

3.) Correct to a standard gallon of fuel by dividing by the volumetric heating value of the test fuel (H) and multiplying by the volumetric heating value of standard reference fuel (Q). Both heating values must have the same units.

$$\mathbf{FEc} = \mathbf{FEo_{mpg}} \times \frac{Q}{H}$$

where

H = Volumetric heating value of test fuel [BTU/gal]
Q = Volumetric heating value of standard reference fuel

Combining steps 1-3 yields

$$\Rightarrow FEc = \frac{miles}{lbs} \times (Gs \times Gw) \times \frac{Q}{H}$$

4.) Covert the fuel economy from mpg to an energy equivalent of miles per BTU. Since the number would be extremely small in magnitude, the energy equivalent will be represented as miles/BTUx10^6.

Eq = Energy equivalent of converting mpg to mile/BTUx10^6.

$$Eq = ((mpg)/(H))x10^6$$

B. CNG, LNG, cryogenic and other fuels in the vapor state.

The reported fuel economy is based on the following: measured test quantities--distance traveled (miles) and fuel consumed (scf); density of test fuel, and volumetric heating value (BTU/lb) of test fuel at standard conditions (P=14.73 psia and T=60 °F).

These combine to give a fuel economy in miles per lb. The energy equivalent (mile/BTUx10^6) will also be provided so that the results can be compared to buses that use other fuels.

1.) Divide the number of miles of the phase by the number of standard cubic feet (scf) of fuel consumed.

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$\mathbf{FEo_{mi/scf}} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{scf of fuel}}$$

2.) Convert the observed fuel economy to miles per lb by dividing FEo by the density of the test fuel at standard conditions (Lb/ft^3).

Note: The density of test fuel must be determined at standard conditions as described above. If the density is not defined at the above standard conditions, then a correction will be needed before the fuel economy can be calculated.

$$\mathbf{FEo_{mi/lb}} = FEo / Gm$$

where Gm = Density of test fuel at standard conditions

3.) Convert the observed fuel economy (FEomi/lb) to an energy equivalent of (miles/BTUx10^6) by dividing the observed fuel economy (FEomi/lb) by the heating value of the test fuel at standard conditions.

$$Eq = ((FEomi/lb)/H)x10^6$$

where

Eq = Energy equivalent of miles/lb to mile/BTUx10^6
H = Volumetric heating value of test fuel at standard conditions

6-III. DISCUSSION

This is a comparative test of fuel economy using diesel fuel with a heating value of 20,214.0 btu/lb. The driving cycle consists of Central Business District (CBD), Arterial (ART), and Commuter (COM) phases as described in 6-II. The fuel consumption for each driving cycle and for idle is measured separately. The results are corrected to a reference fuel with a volumetric heating value of 127,700.0 btu/gal.

An extensive pretest maintenance check is made including the replacement of all lubrication fluids. The details of the pretest maintenance are given in the first three Pretest Maintenance Forms. The fourth sheet shows the Pretest Inspection. The next sheet shows the correction calculation for the test fuel. The next four Fuel Economy Forms provide the data from the four test runs. Finally, the summary sheet provides the average fuel consumption. The overall average is based on total fuel and total mileage for each phase. The overall average fuel consumption values were; CBD – 3.50 mpg, ART – 4.41 mpg, and COM – 7.40 mpg. Average fuel consumption at idle was 7.88 lb/hr (1.26 gph).

FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 0410	Date: 11-4-04	SLW (lbs): 32,540
Personnel: E.D., E.L. & S.C.		

FUEL SYSTEM	OK	Date	Initials
Install fuel measurement system	√	11/4/04	S.C.
Replace fuel filter	√	11/4/04	S.C.
Check for fuel leaks	√	11/4/04	S.C.
Specify fuel type (refer to fuel analysis)	Diesel		
Remarks: none			
BRAKES/TIRES	**OK**	**Date**	**Initials**
Inspect hoses	√	11/4/04	E.D.
Inspect brakes	√	11/4/04	E.D.
Relube wheel bearings	√	11/4/04	E.D.
Check tire inflation pressures (mfg. specs.)	√	11/4/04	E.D.
Remarks: none			
COOLING SYSTEM	**OK**	**Date**	**Initials**
Check hoses and connections	√	11/4/04	T.S.
Check system for coolant leaks	√	11/4/04	T.S.
Remarks: none			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 2)

Bus Number: 0410	Date: 11-4-04
Personnel: E.D., T.S. & S.C.	

ELECTRICAL SYSTEMS	OK	Date	Initials
Check battery	√	11/4/04	S.C.
Inspect wiring	√	11/4/04	S.C.
Inspect terminals	√	11/4/04	S.C.
Check lighting	√	11/4/04	S.C.
Remarks: none			

DRIVE SYSTEM	OK	Date	Initials
Drain transmission fluid	√	11/4/04	T.S.
Replace filter/gasket	√	11/4/04	T.S.
Check hoses and connections	√	11/4/04	T.S.
Replace transmission fluid	√	11/4/04	T.S.
Check for fluid leaks	√	11/4/04	T.S.
Remarks: none			

LUBRICATION	OK	Date	Initials
Drain crankcase oil	√	11/4/04	E.D.
Replace filters	√	11/4/04	E.D.
Replace crankcase oil	√	11/4/04	E.D.
Check for oil leaks	√	11/4/04	E.D.
Check oil level	√	11/4/04	E.D.
Lube all chassis grease fittings	√	11/4/04	E.D.
Lube universal joints	√	11/4/04	E.D.
Replace differential lube including axles	√	11/4/04	E.D.
Remarks: none			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 3)

Bus Number: 0410	Date: 11-4-04
Personnel: E.D., T.S. & S.C.	

EXHAUST/EMISSION SYSTEM	OK	Date	Initials
Check for exhaust leaks	√	11/4/04	S.C.
Remarks: none			

ENGINE	OK	Date	Initials
Replace air filter	√	11/4/04	T.S.
Inspect air compressor and air system	√	11/4/04	T.S.
Inspect vacuum system, if applicable	√	11/4/04	T.S.
Check and adjust all drive belts	√	11/4/04	T.S.
Check cold start assist, if applicable	√	11/4/04	T.S.
Remarks: none			

STEERING SYSTEM	OK	Date	Initials
Check power steering hoses and connectors	√	11/4/04	S.C.
Service fluid level	√	11/4/04	S.C.
Check power steering operation	√	11/4/04	S.C.
Remarks: none			

	OK	Date	Initials
Ballast bus to seated load weight	√	11/4/04	S.C.

TEST DRIVE	OK	Date	Initials
Check brake operation	√	11/4/04	S.C.
Check transmission operation	√	11/4/04	S.C.
Remarks: none			

FUEL ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 0410	Date: 11-9-04
Personnel: S.C.	

PRE WARM-UP	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	S.C.
Cold tire pressure (psi): Front 120 Middle N/A Rear 120	S.C.
Tire wear:	S.C.
Engine oil level	S.C.
Engine coolant level	S.C.
Interior and exterior lights on, evaporator fan on	S.C.
Fuel economy instrumentation installed and working properly.	S.C.
Fuel line -- no leaks or kinks	S.C.
Speed measuring system installed on bus. Speed indicator installed in front of bus and accessible to TECH and Driver.	S.C.
Bus is loaded to SLW	S.C.
WARM-UP	**If OK, Initial**
Bus driven for at least one hour warm-up	S.C.
No extensive or black smoke from exhaust	S.C.
POST WARM-UP	**If OK, Initial**
Warm tire pressure (psi): Front 121 Middle N/A Rear 122	S.C.
Environmental conditions Average wind speed <12 mph and maximum gusts <15 mph Ambient temperature between 30°F(-1C°) and 90°F(32°C) Track surface is dry Track is free of extraneous material and clear of interfering traffic	S.C.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0410	Manufacturer: Gillig	Date: 11/8/04
Run Number: 1	Personnel: R.C., T.S. & S.C.	
Test Direction: □CW or ■CCW	Temperature (°F): 43	Humidity (%): 39
SLW (lbs): 32,540	Wind Speed (mph) & Direction: 10 / NW	Barometric Pressure (in.Hg): 30.18

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:51	8:51	37.0	87.85	84.10	3.75
ART #1	0	4:06	4:06	37.5	84.10	81.30	2.80
CBD #2	0	8:45	8:45	38.6	81.30	78.20	3.10
ART #2	0	4:05	4:05	39.8	78.20	75.80	2.40
CBD #3	0	8:49	8:49	42.0	75.80	72.50	3.30
COMMUTER	0	6:06	6:06	42.4	72.50	69.10	3.40
							Total Fuel = 18.75 lbs

20 minute idle : Total Fuel Used = 2.65 lbs
Heating Value = 20,214.0 BTU/LB
Comments: none

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0410	Manufacturer: Gillig	Date: 11-8-04
Run Number: 2	Personnel: R.C., T.S. & S.C.	
Test Direction: ■CW or □CCW	Temperature (°F): 43	Humidity (%): 39
SLW (lbs): 32,540	Wind Speed (mph) & Direction: 10 / W	Barometric Pressure (in.Hg): 30.21

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:47	8:47	42.8	65.75	62.45	3.30
ART #1	0	4:05	4:05	43.0	62.45	59.70	2.75
CBD #2	0	8:45	8:45	43.1	59.70	56.05	3.65
ART #2	0	4:03	4:03	43.1	56.05	53.15	2.90
CBD #3	0	8:48	8:48	43.4	53.15	49.95	3.20
COMMUTER	0	6:03	6:03	43.3	49.95	46.80	3.15
							Total Fuel = 18.95 lbs

20 minute idle : Total Fuel Used = N/A lbs
Heating Value = 20,214.0 BTU/LB
Comments: none

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0410	Manufacturer: Gillig	Date: 11-9-04
Run Number: 3	Personnel: R.C., T.S. & S.C.	
Test Direction: □CW or ■CCW	Temperature (°F): 360	Humidity (%): 55
SLW (lbs): 32,540	Wind Speed (mph) & Direction:10/NNW	Barometric Pressure (in.Hg): 30.45

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:57	8:57	35.3	89.35	85.90	3.45
ART #1	0	4:05	4:05	36.0	85.90	82.90	3.00
CBD #2	0	8:48	8:48	36.7	82.90	79.20	3.70
ART #2	0	4:03	4:03	37.5	79.20	76.70	2.50
CBD #3	0	8:51	8:51	39.2	76.70	73.10	3.60
COMMUTER	0	6:03	6:03	41.1	73.10	69.95	3.15
							Total Fuel = 19.40 lbs

20 minute idle : Total Fuel Used = N/A lbs

Heating Value = 20,214.0 BTU/LB

Comments: none

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0410	Manufacturer: Gillig	Date: 11-9-04
Run Number: 4	Personnel: R.C., T.S. & S.C.	
Test Direction: ■CW or □CCW	Temperature (°F): 38	Humidity (%): 55
SLW (lbs): 32,540	Wind Speed (mph) & Direction:10/NNW	Barometric Pressure (in.Hg): 30.45

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:48	8:48	41.5	69.95	66.50	3.45
ART #1	0	4:03	4:03	41.9	66.50	63.80	2.70
CBD #2	0	8:47	8:47	42.8	63.80	60.70	3.10
ART #2	0	4:03	4:03	42.8	60.70	58.00	2.70
CBD #3	0	8:47	8:47	42.9	58.00	54.55	3.45
COMMUTER	0	6:04	6:04	42.9	54.55	51.30	3.25
							Total Fuel = 18.65 lbs

20 minute idle : Total Fuel Used = 2.6 lbs

Heating Value = 20,214.0 BTU/LB

Comments: none

0410.FUL
FUEL ECONOMY SUMMARY SHEET

BUS MANUFACTURER :Gillig
BUS MODEL :LowFloor
BUS NUMBER :0410
TEST DATE :11/8/04

FUEL TYPE : DIESEL
SP. GRAVITY : .8095
HEATING VALUE : 20214.00 BTU/Lb
Standard Conditions : 60 deg F and 14.7 psi
Density of Water : 8.3373 lb/gallon at 60 deg F

CYCLE	TOTAL FUEL USED (Lb)	TOTAL MILES	FUEL ECONOMY M/Lb(Measured)	FUEL ECONOMY MPG(Corrected)
Run # :1, CCW				
CBD	10.15	5.73	.56	3.54
ART	5.20	3.82	.73	4.60
COM	3.40	3.82	1.12	7.04
TOTAL	18.75	13.37	.71	4.47
Run # :2, CW				
CBD	10.15	5.73	.56	3.54
ART	5.65	3.82	.68	4.24
COM	3.15	3.82	1.21	7.60
TOTAL	18.95	13.37	.71	4.42
Run # :3, CCW				
CBD	10.75	5.73	.53	3.34
ART	5.50	3.82	.69	4.35
COM	3.15	3.82	1.21	7.60
TOTAL	19.40	13.37	.69	4.32
Run # :4, CW				
CBD	10.00	5.73	.57	3.59
ART	5.40	3.82	.71	4.43
COM	3.25	3.82	1.18	7.37
TOTAL	18.65	13.37	.72	4.49

IDLE CONSUMPTION

First 20 Minutes Data : 2.65 Lb Last 20 Minutes Data : 2.60 Lb
Average Idle Consumption : 7.88 Lb/Hr

RUN CONSISTENCY: % Difference from overall average of total fuel used

Run 1 : 1.0 Run 2 : -.1 Run 3 : -2.4 Run 4 : 1.5

SUMMARY

Average Idle Consumption : 1.26 G/Hr
Average CBD Phase Consumption : 3.50 MPG
Average Arterial Phase Consumption : 4.41 MPG
Average Commuter Phase Consumption : 7.40 MPG
Overall Average Fuel Consumption : 4.43 MPG
Overall Average Fuel Consumption : 32.44 Miles/ Million BTU

7. NOISE

7.1 INTERIOR NOISE AND VIBRATION TESTS

7.1-I. TEST OBJECTIVE

The objective of these tests is to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level will be measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system shall provide a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories will be switched off and all openings including doors and windows will be closed. This test will be performed at the ABTC.

2. The bus accelerating at full throttle from a standing start to 35 mph on a level pavement. All openings will be closed and all accessories will be operating during the test. This test will be performed on the track at the Test Track Facility.

3. The bus will be operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles will be noted. This test will be performed on the test segment between the Test Track and the Bus Testing Center.

All tests will be performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions will be recorded in the test data.

7.1-III. DISCUSSION

This test is performed in three parts. The first part exposes the exterior of the vehicle to 80.0 dB(A) on the left side of the bus and the noise transmitted to the interior is measured. The overall average of the six measurements was 60.8 dB(A); ranging from 59.4 dB(A) at the rear passenger seats to 63.2 dB(A) at he driver's seat. The interior ambient noise level for this test was 41.9 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 72.5 dB(A) at the front passenger seats to 76.1 dB(A) at the rear passenger seats. The overall average was 74.2 dB(A). The interior ambient noise level for this test was 34.2 dB(A).

The third part of the test is to listen for resonant vibrations, rattles, and other noise sources while operating over the road. No vibrations or rattles were noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise

Bus Number: 0410	Date: 5-26-04
Personnel: T.S. & S.C.	
Temperature (°F): 73	Humidity (%): 86
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.14	
Initial Sound Level Meter Calibration: ■ checked by: S.C.	
Interior Ambient Noise Level dB(A): 41.9	Exterior Ambient Noise Level dB(A): 47.1
Microphone Height During Testing (in): 48.0	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	63.2
Front Passenger Seats	61.0
In Line with Front Speaker	60.9
In Line with Middle Speaker	60.7
In Line with Rear Speaker	59.5
Rear Passenger Seats	59.4

Final Sound Level Meter Calibration: ■ checked by: S.C.

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test

Bus Number: 0410	Date: 11-11-04
Personnel: T.S. & R.C.	
Temperature (°F): 56	Humidity (%): 45
Wind Speed (mph): 8	Wind Direction: SW
Barometric Pressure (in.Hg): 30.10	
Initial Sound Level Meter Calibration: ■ checked by: S.C.	
Interior Ambient Noise Level dB(A): 34.2	Exterior Ambient Noise Level dB(A): 40.3
Microphone Height During Testing (in): 48.0	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	75.3
Front Passenger Seats	72.5
Middle Passenger Seats	72.8
Rear Passenger Seats	76.1

Final Sound Level Meter Calibration: ■ checked by: S.C.

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test

Bus Number: 0410	Date: 11-11-04
Personnel: T.S. & R.C.	
Temperature (°F): 56	Humidity (%): 45
Wind Speed (mph): 8	Wind Direction: SW
Barometric Pressure (in.Hg): 30.10	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location
Engine and Accessories	None noted.
Windows and Doors	None noted.
Seats and Wheel Chair lifts	None noted.

Comment on any other vibration or noise source which may have occurred
that is not described above: none noted

7.1 INTERIOR NOISE TEST

TEST BUS SET-UP FOR 80 dB(A)
INTERIOR NOISE TEST

7.2 EXTERIOR NOISE TESTS

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus will be operated at a SLW in three different conditions using a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed at or below 35 mph and just prior to transmission up shift.
2. Accelerating at full throttle from standstill.
3. Stationary, with the engine at low idle, high idle, and wide open throttle.

In addition, the buses will be tested with and without the air conditioning and all accessories operating. The exterior noise levels will be recorded.

The test site is at the PSBRTF and the test procedures will be in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The test site is an open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus will measure the noise level.

During the test, special attention should be paid to:

1. The test site characteristics regarding parked vehicles, signboards, buildings, or other sound-reflecting surfaces
2. Proper usage of all test equipment including set-up and calibration
3. The ambient sound level

7.2-III. DISCUSSION

The Exterior Noise Test determines the noise level generated by the vehicle under different driving conditions and at stationary low and high idle, with and without air conditioning and accessories operating. The test site is a large, level, bituminous paved area with no reflecting surfaces nearby.

With an exterior ambient noise level of 41.8 dB(A), the average test result obtained while accelerating from a constant speed was 71.4 dB(A) on the right side and 72.6 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 42.5 dB(A), the average of the results obtained were 71.0 dB(A) on the right side and 71.6 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 62.6 dB(A) at low idle, 64.3 dB(A) at high idle, and 74.8 dB(A) at wide open throttle. With the accessories and air conditioning off, the readings averaged 0.9 dB(A) higher at low idle, 1.3 dB(A) higher at high idle, and 1.2 dB(A) higher at wide open throttle. The exterior ambient noise level measured during this test was 42.4 dB(A).

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 0410	Date: 11-11-04
Personnel: T.S. & R.C.	
Temperature (°F): 56	Humidity (%): 45
Wind Speed (mph): 8	Wind Direction: SW
Barometric Pressure (in.Hg): 30.10	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.C.	
Initial Sound Level Meter Calibration: ■ checked by: S.C.	
Exterior Ambient Noise Level dB(A): 41.8	

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	71.6	1	71.9
2	70.7	2	72.2
3	71.1	3	72.0
4	71.1	4	72.7
5	71.0	5	72.4
Average of two highest actual noise levels = 71.4 dB(A)		Average of two highest actual noise levels = 72.6 dB(A)	

Final Sound Level Meter Calibration Check: ■ checked by: S.C.
Comments: None

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 0410	Date: 11-11-04
Personnel: R.C. & T.S.	
Temperature (°F): 56	Humidity (%): 45
Wind Speed (mph): 8	Wind Direction: SW
Barometric Pressure (in.Hg): 30.10	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.C.	
Initial Sound Level Meter Calibration: ■ checked by: S.C.	
Exterior Ambient Noise Level dB(A): 42.5	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	71.2	1	71.8
2	70.3	2	70.5
3	70.6	3	71.3
4	70.8	4	70.9
5	70.8	5	70.4
Average of two highest actual noise levels = 71.0 dB(A)		Average of two highest actual noise levels = 71.6 dB(A)	

Final Sound Level Meter Calibration Check: ■ checked by: S.C.

Comments: None

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 0410	Date: 11-11-04
Personnel: T.S. & R.C.	
Temperature (°F): 56	Humidity (%): 45
Wind Speed (mph): 8	Wind Direction: SW
Barometric Pressure (in.Hg): 30.10	

Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.C.

Initial Sound Level Meter Calibration: ■ checked by: S.C.

Exterior Ambient Noise Level dB(A): 42.4

Accessories and Air Conditioning ON

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	700	62.3	62.0
High Idle	998	63.5	65.0
Wide Open Throttle	2,335	73.7	75.8

Accessories and Air Conditioning OFF

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	702	64.0.	62.9
High Idle	1,001	66.5	64.6
Wide Open Throttle	2,333	74.7	76.2

Final Sound Level Meter Calibration Check: ■ checked by: S.C.

Comments: None

7.2 EXTERIOR NOISE TEST

TEST BUS UNDERGOING EXTERIOR NOISE TESTING

FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration U.S. DOT
In accordance with 49 CFR, Part 665

Manufacturer: Gillig LLC
Model: Low Floor

Partial Test

August 2022

Report Number: LTI-BT-R2022-06-P

The Thomas D. Larson
Pennsylvania Transportation Institute
201 Transportation Research Building
The Pennsylvania State University
University Park, PA 16802
(814) 865-1891

Bus Testing and Research Center
2237 Plank Road
Duncansville, PA 16635
(814) 695-3404

PennState
College of Engineering

LTI BUS RESEARCH
AND TESTING CENTER

FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration, U.S. DOT
1200 New Jersey Avenue, SE
Washington, DC 20590

In accordance with 49 CFR Part, 665

Manufacturer: Gillig LLC
Manufacturer's address: 451 Discovery Drive Livermore, CA 94551

Model: Low Floor

Partial Test

Report Number: LTI-BT-R2022-06-P

ACCREDITED
Mechanical Testing Certificate 3172.01

David Klinikowski	Director, Bus Research and Testing Center	August 16th, 2022
Quality Authorization	*Title*	*Date*

TABLE OF CONTENTS

EXECUTIVE SUMMARY

TEST HIGHLIGHTS

The information in this report pertains only to this specific bus, as received from the manufacturer for testing.

The Check-In section of the report provides a description of the bus and specifies its major components. The following table gives the salient specifications.

Manufacturer	Gillig LLC
Model	Low Floor
Chassis Make/Model	Gillig / Low Floor
Chassis Modified	No
Length	41 feet / 9.9 inches
Fuel	Diesel – Electric Hybrid
Service Life	12 Year / 500,000 Miles - Partial
Number of Seats (including driver)	39 or 32 and 2 wheelchairs
Manufacturer-Designated Standing Passenger Capacity	34
Gross Vehicle Weight used for testing	42,380 lb.
Gross Vehicle Weight Rating	44,300 lb.
Mileage at Delivery	2,956 miles
Test Start Date	May 02, 2022
Test Completion Date	June 10, 2022
Report Issuance Date	August 16, 2022

The measured curb weight was 11,220 lb. for the front axle and 20,170 lb. for the rear axle. These combined weights provided a total measured curb weight of 31,390 lb. There are 39 seats including the driver (7 seats stow away for two wheelchair positions) and free floor space for 36 standing passengers bringing the potential total passenger capacity to 75. However, a placard shows the maximum number of standing passengers as 34, therefore, the gross load represents a total of 73 passengers. Gross load is calculated as 150 lb. x 73 = 10,950 lb. The wheelchair positions are not used for gross load because 34 standees can only be achieved when the wheelchair positions are not in use and utilizing the space for standees yields a higher gross load for testing. At full declared capacity, the measured gross vehicle weight was 42,380 lb. The heaviest seated load weight is achieved using the two wheelchair positions with 32 seated passengers, including the driver. Seated load is calculated as (32 x 150 lb.) + (2 x 600 lb.) = 6,000 lb. There is a potential to overload this bus with the available floor space for standing passengers.

The FTA determined that this bus be tested for check in, safety-braking, performance (EV and hybrid mode), fuel/energy economy (EV and hybrid mode), interior noise (EV and hybrid mode), exterior noise (EV and hybrid mode) and emissions (hybrid mode); the baseline full Bus Testing report for this test is PTI-BT-R0405.

During testing, it was noticed that the castle nut on the drag link, where it connects to the pitman arm, was on upside down. The pitman arm and drag link were replaced. In addition, the battery thermal management system (BTMS) control module was replaced as it was found defective, and a new auto breathing valve was installed on the cooling system.

ABBREVIATIONS AND ACRONYMS

ABS - anti-skid braking system
ABTC - Altoona Bus Test Center
A/C - air conditioner, or air conditioning
AC - alternating current
ADA - American Disability Act
Ah - Ampere hours
CDCTS - chassis dynamometer test control system
CVS - constant volume sampling
CW - curb weight (bus weight including maximum fuel, oil, and coolant; but without passengers or driver)
dB(A) - decibels with reference to 0.0002 microbar as measured on the "A" scale
DC - direct current
DIR - test director
DR - bus driver
EPA - Environmental Protection Agency
GAWR – gross axle weight rating
GVL - gross vehicle load (150 lb. for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space)
GVW - gross vehicle weight (curb weight plus gross vehicle load)
GVWR - gross vehicle weight rating
HD-UDDS – Heavy Duty-Urban Dynamometer Driving Schedule
LTI - Larson Transportation Institute
mpg - miles per gallon
mph - miles per hour
PM - Preventive maintenance
PSTT - Penn State Test Track
rpm - revolutions per minute
SAE - Society of Automotive Engineers
SCF - Standard cubic foot
SCH - test scheduler
SA - staff assistant
SLW - seated load weight (curb weight plus 150 lb. for every designed passenger seating position and for the driver)
TD - test driver
TECH - test technician
TM - track manager
TP - test personnel
Wh - Watt hour

TEST BUS CHECK-IN

I. OBJECTIVE

The objective of this task is to log in the test bus, assign a bus number, complete the vehicle data form, and perform a safety check.

II. TEST DESCRIPTION

The test consisted of assigning a bus test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer certified that the bus meets all Federal regulations.

III. DISCUSSION

The check-in procedure is used to identify in detail the major components and configuration of the bus.

The test bus consisted of a Gillig LLC, Low Floor model. The bus has a front passenger door forward of the front axle and a rear passenger door forward of the rear axle. The front passenger door is equipped with a Lift-U LU18-02-12 electric bi-fold ramp. This is a diesel electric hybrid bus. Power is provided by a diesel fueled, Cummins B6.7 280 hp engine coupled to an Allison / eGen Flex transmission and an Allison VCM TCM HGM 29566342 motor control system.

The measured curb weight was 11,220 lb. for the front axle and 20,170 lb. for the rear axle. These combined weights provided a total measured curb weight of 31,390 lb. There are 39 seats including the driver (7 seats stow away for two wheelchair positions) and free floor space for 36 standing passengers bringing the potential total passenger capacity to 75. However, a placard shows the maximum number of standing passengers as 34, therefore, the gross load represents a total of 73 passengers. Gross load is calculated as 150 lb. x 73 = 10,950 lb. The wheelchair positions are not used for gross load because 34 standees can only be achieved when the wheelchair positions are not in use and utilizing the space for standees yields a higher gross load for testing. At full declared capacity, the measured gross vehicle weight was 42,380 lb. The heaviest seated load weight is achieved using the two wheelchair positions with 32 seated passengers, including the driver. Seated load is calculated as (32 x 150 lb.) + (2 x 600 lb.) = 6,000 lb. There is a potential to overload this bus with the available floor space for standing passengers.

VEHICLE DATA FORM

Bus Number: 2022-06-P	Date of Check-In: 05/02/22 to 05/05/22
Bus Manufacturer: Gillig LLC	Vehicle Identification Number (VIN): 15GGD3013N3197144
Model Name: Low Floor	Chassis Mfr./Mod. #: Gillig / Low Floor
Personnel: S.R., E.D., F.T., T.G., J.M. & M.R.	Starting Odometer Reading: 2,956 miles

WEIGHT:

Individual Wheel Reactions:

Weights (lb.)	Front Axle		Middle Axle		Rear Axle	
	Curb	Street	Curb	Street	Curb	Street
CW	5,610	5,610	N/A	N/A	9,420	10,750
SLW	6,530	6,540	N/A	N/A	11,210	13,100
GVW	7,820	7,750	N/A	N/A	12,480	14,330

Total Weight Details:

Weight (lb.)	CW	SLW	GVW	GAWR
Front Axle	11,220	13,070	15,570	15,660
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	20,170	24,310	26,810	28,640
Total	31,390	37,380	42,380	GVWR: 44,300 (Declared by Manufacturer)

Dimensions:

Length (ft/in)	41 / 4.8
Length Over Bumpers (ft/in)	41 / 9.9
Overall Length with Add-ons (ft/in)	42 / 8 (with bike rack)
Width (in)	100.4 (without mirrors) 132.5 (with mirrors)
Height of bus (in)	110.1
Overall Height (in)	130.1
Front Overhang (in)	100.3
Rear Overhang (in)	122.1
Wheelbase (in)	279.5
Wheel Track (in)	Front: 85.5
	Middle: N/A
	Rear: 78.0

Bus Number: 2022-06-P	Date:05/02/22 to 05/05/22

CLEARANCES:

Lowest Point Outside Front Axle	Location: Framework beam	Clearance(in): 9.1
Lowest Point Outside Rear Axle	Location: Tube steel radiator guard on rear streetside	Clearance(in): 9.4
Lowest Point between Axles	Location: Bolt on coolant line clamp	Clearance(in): 12.3
Front Bumper Height (in)	14.8	
Rear Bumper Height (in)	20.2	
Ground Clearance at the center (in)	13.2	
Front Approach Angle (deg)*	8.4	
Rear Approach Angle (deg)*	8.3	
Ramp Clearance Angle (deg)	5.4	
Aisle Width (in)	23.9	
Inside Standing Height at Center Aisle (in)	95.2	

*measurements used to calculate approach and departure angles are taken from the centerline of the axles.

BODY DETAILS:

Body Structural Type	Semi-monocoque		
Frame Material	Stainless steel		
Body Material	Aluminum		
Floor Material	Plywood		
Roof Material	Composite		
Windows Type	■ Fixed	☐ Movable	
Window Mfg./Model No.	Ricon / 56725		
Number of Doors	_1_ Front (curbside)	_1_ Rear (curbside)	
Mfr. / Model No.	Front- Vapor Ameriview / 50940254-00 Rear- Vapor Ameriview / 50940254-01		
Dimension of Each Door (in)	Front- 32 x 75.1	Rear- 28.3 x 77.9	
Passenger Seat Type	■ Cantilever	■ Pedestal	☐ Other
Passenger Seat Mfg./ Model No.	USSC Gemini / SL81012-194690		
Driver Seat Type	■ Air	☐ Spring	☐ Other
Mfr. / Model No.	USSC / G2A		
Number of Seats (including Driver)	39 or 32 with two wheelchair positions		

Bus Number: 2022-06-P	Date: 05/02/22 to 05/05/22

BODY DETAILS (Contd.)

Free Floor Space (ft^2)	59.0 with seats 48.2 with wheelchairs
Height of Each Step at Normal Position (in)	Front 1. 16.1 2. N/A 3. N/A 4. N/A
	Rear 1. 15.4 2. N/A 3. N/A 4. N/A
Step Elevation Change - Kneeling (in)	Front: 3.6 Rear: 1.1

ENGINE

Type	■ C.I.	☐ Alternate Fuel	
	☐ S.I.	☐ Other (explain)	
Mfr. / Model No.	Cummins / B6.7 280hp		
Engine Power	280 hp @ 2400 rpm		
Engine Power	Max torque 910 ft. lb. @ 2300 rpm		
Location	☐ Front	■ Rear	☐ Other (explain)
Fuel Type	☐ Gasoline	☐ CNG	☐ Methanol
	■ Diesel	☐ LNG	☐ Other (explain)
Alternator (Generator) Mfr./Model No.	N/A*		
Maximum Rated Output (Volts / Amps)	N/A		
Air Compressor Mfr. / Model No.	Powerex-Iwata Air Technology, Inc. / SBBHS050020GG09		
Maximum Capacity (ft^3 / min)	12.5 cfm @ 145 PSIG		
Starter Type	☐ Electrical	☐ Pneumatic	■ Other *see below
Starter Mfr. / Model No.	Mopar / 428000-7202 / 04801839AD		

*Conventional alternator and starter have been replaced by the Allison eGEN FLEX hybrid transmission components. Hybrid drive generator is used to start engine.

TRANSMISSION

Transmission Type	☐ Manual	■ Automatic	☐ Load Sensing Adaptive
Mfr. / Model No.	Allison / eGEN Flex 40 Max		
Control Type	☐ Mechanical	■ Electrical	☐ Other
Integral Retarder Mfr. / Model No.	☐ Yes	■ No	

Bus Number: 2022-06-P	Date: 05/02/22 to 05/05/22

ELECTRIC DRIVE SYSTEM

Type	☐ Series Battery Electric	■ Parallel Electric Hybrid
Number of Traction Motors	1	
Mfr. / Model No.	Allison / eGEN Flex 40 Max, PN 29563868	
Location of Traction Motor(s)	Rear	
Type	Electric	
Motor Control System Mfr./Model No.	Allison VCM TCM HGM / 29566342	
Location	Rear electrical panel (with access door open)	
Max Rated Power Output (kW)	209	
Nominal Voltage (volts)	644	
Drive Battery Mfr./ Model No.	Allison / eGEN Flex Max 29564244	
Number of Battery Packs	1	
Location of Battery Packs	Rooftop / Middle Streetside	
Individual Battery Capacity (kWh)	26	
Total Nominal Battery Capacity (kWh)	26	
Total Usable Battery Capacity (kWh)	20	
Total Nominal Battery Capacity (Ah)	31	
Battery Type (Chemistry)	Lithium Titanate	
Low Voltage Battery	■ 12 Volt ☐ 24 Volt	
Low Voltage Battery Mfr./Model No.	Deka / DP31CS	

Bus Number: 2022-06-P	Date: 05/02/22 to 05/05/22

SUSPENSION

Number of Axles	2		
Front Axle Type	☐ Independent	■ Beam Axle	
Mfr. / Model No.	Meritor / FH946KX75		
GAWR (lb.)	15,660		
Axle Ratio (if driven)	N/A		
Suspension Type	■ Air	☐ Spring	☐ Other
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni (Holland) / 99B 3202SPI		
Sway Bar Equipped	Not sway bar equipped		
Middle Axle Type	☐ Independent	☐ Beam Axle	
Mfr. / Model No.	N/A		
GAWR (lb.)	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	☐ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	☐ Independent	■ Beam Axle	
Mfr. / Model No.	Meritor / 79163KX28-538		
GAWR (lb.)	28,640		
Axle Ratio (if driven)	5.38		
Suspension Type	■ Air	☐ Spring	☐ Other
No. of Shock Absorbers	4		
Mfr. / Model No.	Koni (Holland) / 1 73703000 / 99B 3203		

Bus Number: 2022-06-P	Date: 05/02/22 to 05/05/22

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Alcoa / Durabright EVO 22.5 x 8.25
	Wheel Weight Rating	8,050 lb.
	Tire Mfr./ Model No.	Michelin / XIncity 305/80R 22.5
	Tire Weight Rating	7,830 lb. (Single tire)
Rear	Wheel Mfr./ Model No.	Alcoa / Durabright EVO 22.5 x 8.25
	Wheel Weight Rating	8,050 lb.
	Tire Mfr./ Model No.	Michelin / XIncity 305/80R 22.5
	Tire Weight Rating	7,160 (Dual tire)

BRAKES

Front Axle Brakes Type	☐Cam	■ Disc	☐ Other (explain)
Mfr. / Model No.	Meritor / EX225H3		
Middle Axle Brakes Type	☐Cam	☐ Disc	☐ Other
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	☐Cam	■ Disc	☐Other (explain)
Mfr. / Model No.	Meritor / EX225H3		
External Parking Brake Mfr. / Model No.	N/A		

HVAC

Driver Heating System Type	■ Engine Coolant ☐ Electric
Capacity (Btu/hr)	62,000
Mfr./Model No.	Mobile Climate Control / 12-8530
Passenger Heating System Type	■ Engine Coolant ☐ Electric
Capacity (Btu/hr)	Under seat heaters 34,000 Front threshold 12,000
Mfr./Model No.	Mobile Climate Control / 12-11382 (under seat) Mobile Climate Control / 12-4482 (front threshold)
Auxiliary Heater	■Yes – Type: Diesel ☐ No
Mfr./Model No.	Proheat / PH9310/10-31K BTU
Driver Air Conditioner	■ Yes ☐ No
Location	Rear – Part of passenger air conditioning system
Capacity (Btu/hr)	Not available
A/C Compressor Mfr./Model Number	Part of passenger air conditioning system
Passenger Air Conditioner	■ Yes ☐ No

Bus Number: 2022-06-P	Date: 05/02/22 to 05/05/22

HVAC (cont.)

Passenger Air Conditioner	☐ Engine Driven	■ Electric	☐ Other
Location	Rear		
Capacity (Btu/hr)	62,000		
A/C Compressor Mfr./Model No.	Copeland Scroll Emerson / ZR48K3E-TF5-130		

STEERING

Steering Gear Box Type	Hydraulic		
Mfr. / Model No.	TRW / PBR110FAA		
Steering Wheel Diameter	20”		
Number of turns (lock to lock)	4 ¾		
Control Type	☐ Electric	■Hydraulic	☐Other (explain)

OTHERS

ADA Ramps	Location: Front Entry Door	Type: Bi-fold Electric
ADA Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	Lift-U / LU18-02-12	
Emergency Exit	Location: Window Door Roof Hatch	Number: 6 2 2
Type	N/A	
Fire Suppression System Type	Amerex 17K CTRL	
Mfr./Model No.	Amerex / V25 ABC (Located in rear top curbside)	

*Additional handheld fire extinguisher on top of front curbside wheel well

CAPACITIES

Fuel Tank Capacity (gallons)	120 usable (127)
Engine Crankcase Capacity (gallons)	6.5
Transmission Capacity (gallons)	2.12
Differential Capacity (quarts)	18.8 – 20.8
Engine Cooling System Capacity (gallons)	14
Battery Cooling System Capacity (gallons)	4 (BTMS)
Electronic Cooling System Capacity (gallons)	1.7 (Electronic Cooling Package- ECP)
Drive Motor Cooling System (gallons)	2.12 (Combined with Transmission)
Power Steering Fluid Capacity (gallons)	1.5

VEHICLE DATA FORM

Bus Number: 2022-06-P	Date: 05/02/22 to 05/05/22

List all spare parts, tools and manuals delivered with the bus.

Part Number	Description	Qty.
	DEF Fluid	2
	Interior intercom equipment	1

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 2022-06-P	Date: 05/04/22

Subsystem	Checked	Initials	Comments
Air Conditioning Heating and Ventilation	✓	E.D.	None noted.
Body and Sheet Metal	✓	E.D.	None noted.
Frame	✓	E.D.	None noted.
Steering	✓	E.D.	None noted.
Suspension	✓	E.D.	None noted.
Interior/Seating	✓	E.D.	None noted.
Axles	✓	E.D.	None noted.
Brakes	✓	E.D.	None noted.
Tires/Wheels	✓	E.D.	None noted.
Exhaust	✓	E.D.	None noted.
Fuel System	✓	E.D.	Hybrid Bus – Diesel & Electric
Transmission	✓	E.D.	None noted.
Drive Motor/Axle	✓	E.D.	Built into transmission
Engine	✓	E.D.	None noted.
Accessories	✓	E.D.	None noted.
ADA Accessible Lift System	N/A	E.D.	None noted.
ADA Accessible Ramp System	✓	E.D.	None noted.
Interior Fasteners	✓	E.D.	None noted.
Batteries	✓	E.D.	None noted.
Emergency Exits	✓	E.D.	None noted.
Fire Suppression System	✓	E.D.	None noted.

CHECK - IN

GILLIG LLC
LOW FLOOR

CHECK - IN CONT.

GILLIG LLC
LOW FLOOR

CHECK - IN CONT.

LIFT-U / LU18-02-12 ELECTRIC BI-FOLD RAMP

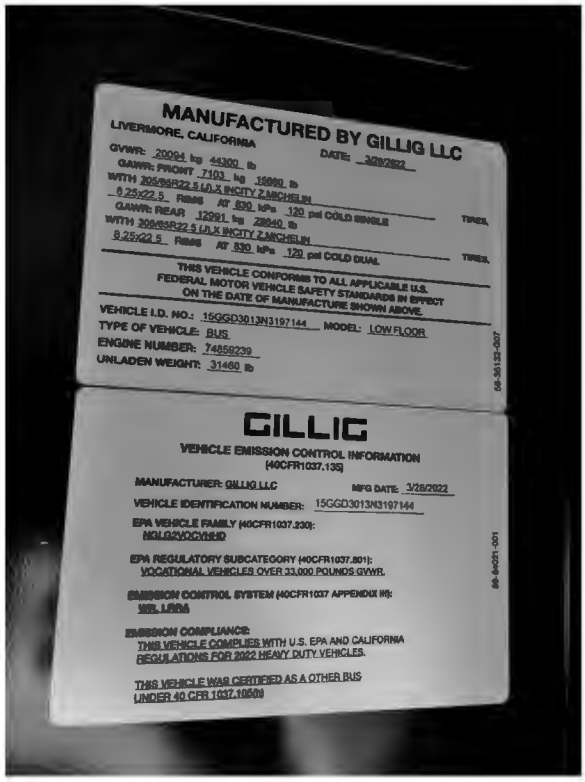
OPERATOR'S AREA

CHECK - IN CONT.

INTERIOR FROM FRONT

INTERIOR FROM REAR

CHECK - IN CONT.



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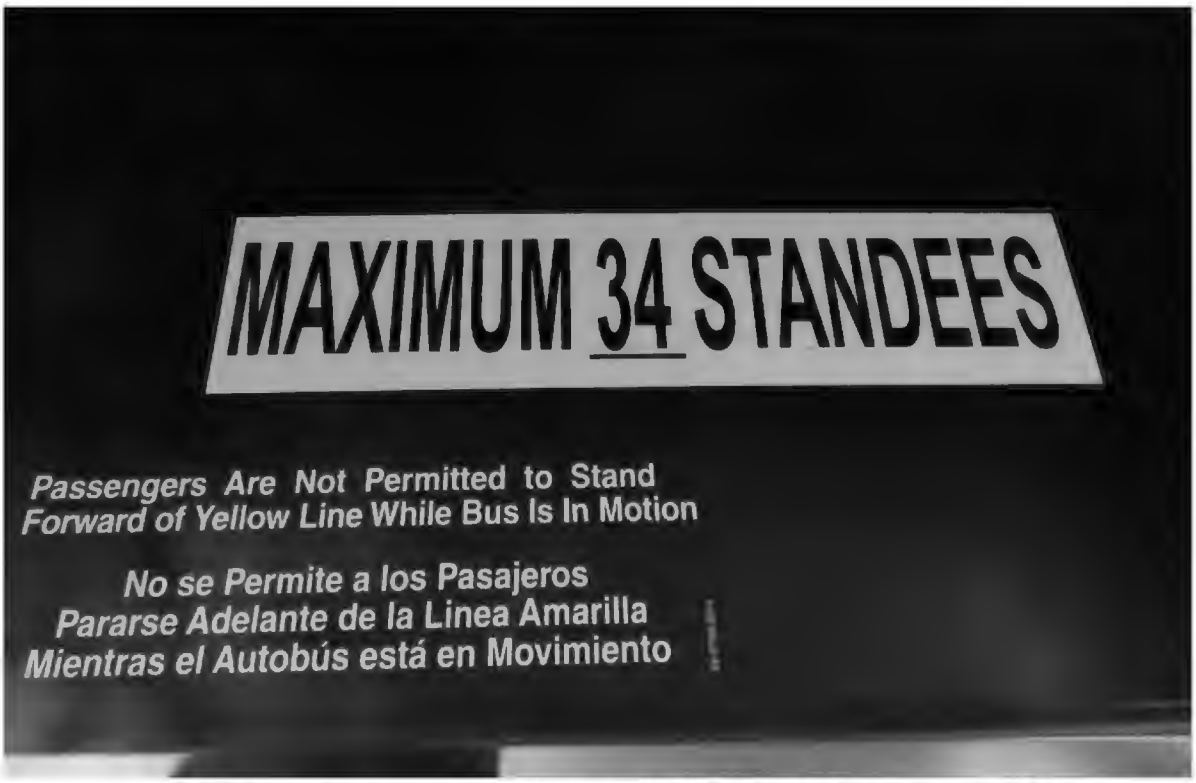
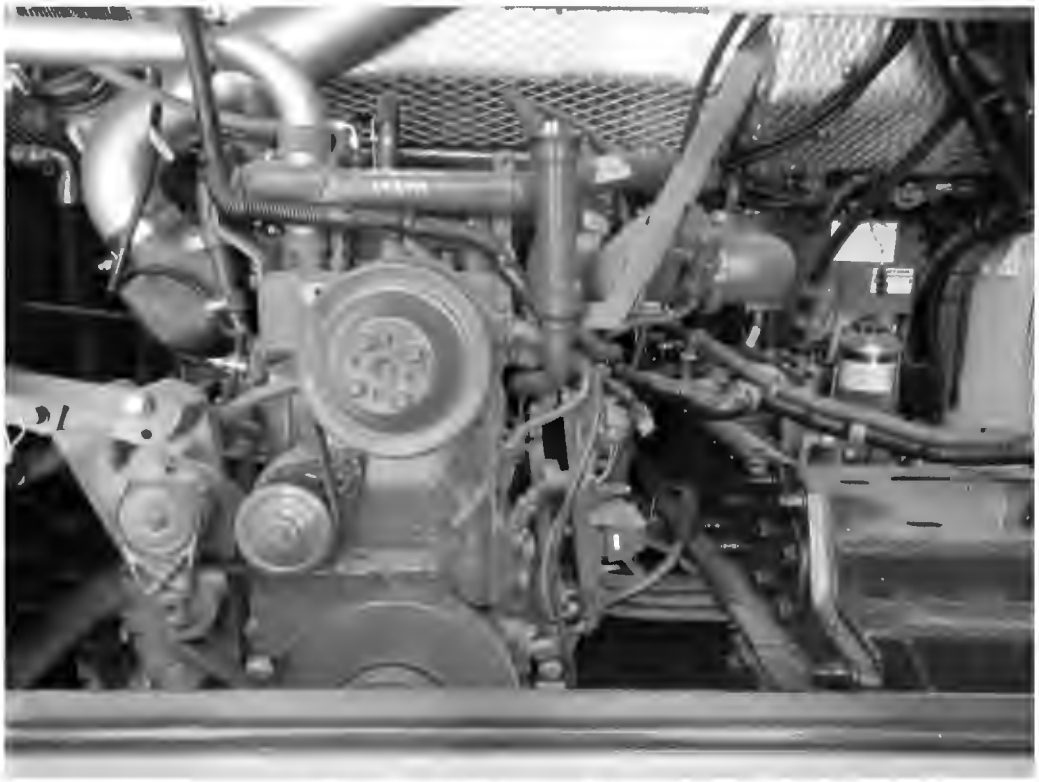
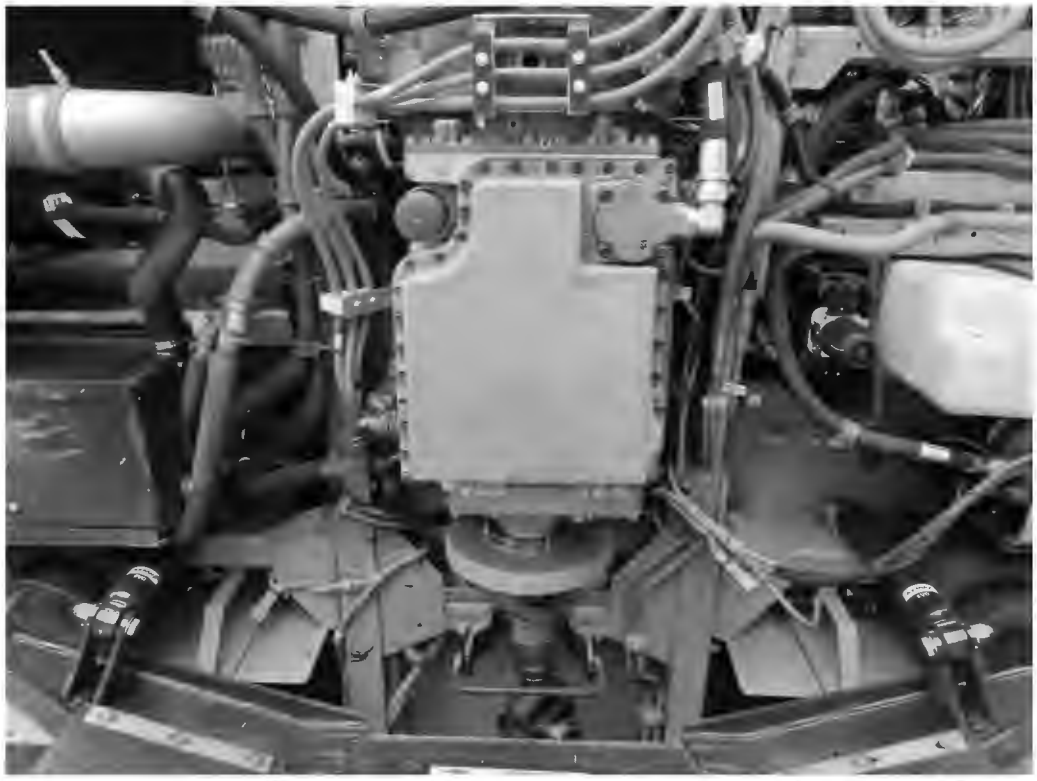


PLACARD SHOWING MAXIMUM STANDING PASSENGERS

CHECK - IN CONT.



REAR ENGINE COMPARTMENT



ALLISON E-GEN FLEX TRANSMISSION

CHECK - IN CONT.

UNDERSIDE OF BUS

3.2 Safety - Braking

3.2 I. TEST OBJECTIVE

The objective of this test is to provide, for comparison purposes, braking performance data on transit buses produced by different manufacturers.

3.2 II. TEST DESCRIPTION

The testing was conducted at the LTI Test Track skid pad area. Brake tests were conducted after completion of the GVW portion of the vehicle durability test. At this point in testing the brakes have been subjected to a large number of braking snubs and will be considered well burnished. For buses that have not completed Durability Testing, the brakes will be burnished according to the test procedure. Testing was performed when the bus was fully loaded at its GVW. All tires on each bus were representative of the tires on the production model vehicle and inflated to the bus manufacturer's specified pressures.

The brake testing procedure is comprised of three phases:

1. Stopping distance tests
    i. Dry surface (high-friction, Skid Number within the range of 70-76)
    ii. Wet surface (low-friction, Skid Number within the range of 30-36)
2. Stability tests
3. Parking brake test

3.2-III. DISCUSSION

The results of the Stopping Distance phase of the Brake Test are available in table 3.2-2. There was no deviation from the test lane during the performance of the Stopping Distance phase.

During the Stability phase of Brake Testing the test bus experienced no deviation from the test lane during both approaches to the Split Friction Road surface.

The Parking Brake phase was completed with the test bus maintaining the parked position for the full five-minute period with no slip or roll observed in both the uphill and downhill positions.

Table 3.2-1. Braking Test Data Forms

Bus Number: 2022-06-P	Date: 05/25/22
Personnel: F.T., S.R., T.G., M.R. & J.S.	
Amb. Temperature (ºF): 65	Wind Speed (mph): 8
Wind Direction: SE	Pavement Temp (°F) Start: 88 End:94

TIRE INFLATION PRESSURE (psi):

Tire Type: Front & Rear: Michelin XIncity 305 85R 22.5

	Left Tire(s)		Right Tire(s)	
Front	120		120	
	Inner	Outer	Inner	Outer
Middle	N/A	N/A	N/A	N/A
Rear	120	120	120	120

AXLE LOADS (lb.)

	Left	Right
Front	7,750	7,820
Middle	N/A	N/A
Rear	14,330	12,480

Table 3.2-2. Stopping Distance Test Results Form
(longest stopping distance in each test condition in bold)

Stopping Distance (ft)					
Vehicle Direction	CW	CW	CCW	CCW	
Speed (mph)	Stop 1	Stop 2	Stop 3	Stop 4	**Average**
20 (dry)	**28.63**	26.89	**28.63**	26.69	27.71
30 (dry)	50.90	**53.30**	51.72	52.05	51.99
40 (dry)	88.06	87.51	**91.64**	89.01	89.06
45 (dry)	109.02	112.76	111.55	**116.44**	112.44
20 (wet)	33.52	**34.11**	33.09	33.25	33.49

Table 3.2-3. Stability Test Results Form

Stability Test Results (Split Friction Road surface)			
Vehicle Direction	Attempt	Did test bus stay in 12' lane? (Yes/No)	Comments
Driver side on high friction	1	Yes	None noted.
	2	Yes	None noted.
Driver side on low friction	1	Yes	None noted.
	2	Yes	None noted.

Table 3.2-4. Parking Brake Test Form

PARKING BRAKE (Fully Loaded) – GRADE HOLDING						
Vehicle Direction	Attempt	Hold Time (min)	Slide (in)	Roll (in)	Did Hold	No Hold
Front up	1	5:00	0	0	✓	
	2	N/A	N/A	N/A	N/A	N/A
	3	N/A	N/A	N/A	N/A	N/A
Front down	1	5:00	0	0	✓	
	2	N/A	N/A	N/A	N/A	N/A
	3	N/A	N/A	N/A	N/A	N/A

Table 3.2-5. Record of All Braking System Faults/Repairs.

Date	Fault/Repair	Description
05/11/22	None noted.	None noted.

3.2 Safety - Bus Braking

PARKING BRAKE TEST
PARKING BRAKE HELD FOR 5 MINUTES IN
BOTH 20% UP AND 20% DOWN POSITIONS

4. PERFORMANCE - AN ACCELERATION, GRADEABILITY, AND TOP SPEED TEST

4-I. TEST OBJECTIVE

The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus.

4-II. TEST DESCRIPTION

In this test, the bus was operated at SLW on a chassis dynamometer. The procedure dictates that the test bus be accelerated to a maximum "power-limited"/"governed" or maximum "safe" speed not exceeding 80 mph. The maximum power-limited/governed speed, if applicable, is the top speed as limited by the engine control system. The maximum safe speed is defined as the maximum speed that the dynamometer, the tires or other bus components are limited to. The test vehicle speed was measured using a speed encoder built in the chassis dynamometer. The time intervals between 10 mph increments were recorded using a Data Acquisitions System. Time-speed data and the top speed attained were recorded on the Performance Data Form. The recorded data was used to generate a percent grade versus speed table and a speed versus time curve. All the above are available in the following pages.

4-III. DISCUSSION

This test consisted of three runs from standstill to full throttle on the chassis dynamometer. Speed versus time data was obtained for each run and results are averaged to minimize test variability.

In hybrid mode, the test was performed up to a maximum governed speed of 59.1 mph. The calculated gradeability results are attached. The average time to reach 30 mph was 14.3 seconds. The maximum gradeablity at 10 mph was 21.02% and at 40 mph was 4.29%.

In EV mode, the test was performed up to a maximum governed speed of 34.3 mph. The calculated gradeability results are attached. The average time to reach 30 mph was 17.1 seconds. The maximum gradeablity at 10 mph was 17.61%. The bus did not reach 40 mph in EV mode. Therefore, there are no gradeability results at 40 mph.

Although the bus did not meet passing requirements in EV mode, it did meet the passing requirements while in hybrid mode. The manufacturer represented that the bus did not meet passing requirements in EV mode due to the vehicle EV functionality governing vehicle speed.

PERFORMANCE DATA FORM

Bus Number: 2022-06-P – Hybrid Mode	Date: 06/02/22
Personnel: S.I. & D.B.	
Temperature (°F): 79.6	Humidity (%): 89.3
Barometric Pressure (inHg): 28.6	

		INITIALS:
Air Conditioning - OFF	✔Checked	D.B.
Heater pump motor - OFF	✔Checked	D.B.
Defroster - OFF	✔ Checked	D.B.
Exterior and interior lights - ON	✔ Checked	D.B.
Windows and doors - CLOSED	✔ Checked	D.B.

ACCELERATION, GRADEABILITY, TOP SPEED

Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.3	3.6	3.4
20 mph	7.3	7.6	7.5
30 mph	14.2	14.4	14.2
40 mph	22.8	22.9	22.7
50 mph	35.5	35.3	35.1
60 mph	N/A	N/A	N/A
70 mph	N/A	N/A	N/A

Maximum Speed (mph): 59.1 (maximum governed speed)

PERFORMANCE SUMMARY SHEET

Bus Number: 2022-06-P – Hybrid Mode	Date: 06/02/22
Personnel: S.I. & D.B.	

Test Conditions:

Temperature (°F): 79.6	Humidity (%): 89.3
Barometric Pressure (inHg): 28.6	

Test Results:

Vehicle Speed (MPH)	Time (SEC)	Acceleration (FT/SEC^2)	Max. Grade (%)
1.0	1.2	2.72	8.45
5.0	2.4	7.02	21.80
10.0	3.4	6.77	21.02
15.0	4.8	3.94	12.24
20.0	7.4	2.25	6.99
25.0	10.8	2.17	6.74
30.0	14.3	2.03	6.30
35.0	18.1	1.72	5.34
40.0	22.8	1.38	4.29
45.0	28.6	1.19	3.70
50.0	35.3	1.00	3.11
55.0	43.2	0.84	2.61
59.1	54.7	Maximum Speed	

PERFORMANCE DATA FORM

Bus Number: 2022-06-P – EV Mode	Date: 06/02/22
Personnel: S.I. & D.B.	
Temperature (°F): 88.4	Humidity (%): 78.2
Barometric Pressure (inHg): 28.6	

		INITIALS:
Air Conditioning - OFF	✔Checked	D.B.
Heater pump motor - OFF	✔Checked	D.B.
Defroster - OFF	✔ Checked	D.B.
Exterior and interior lights - ON	✔ Checked	D.B.
Windows and doors - CLOSED	✔ Checked	D.B.

ACCELERATION, GRADEABILITY, TOP SPEED

Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.9	3.9	4.2
20 mph	8.9	8.8	9.1
30 mph	17.0	17.0	17.2
40 mph	--	--	--
50 mph	--	--	--
60 mph	--	--	--
70 mph	--	--	--

Maximum Speed (mph): 34.3 (maximum governed speed)

PERFORMANCE SUMMARY SHEET

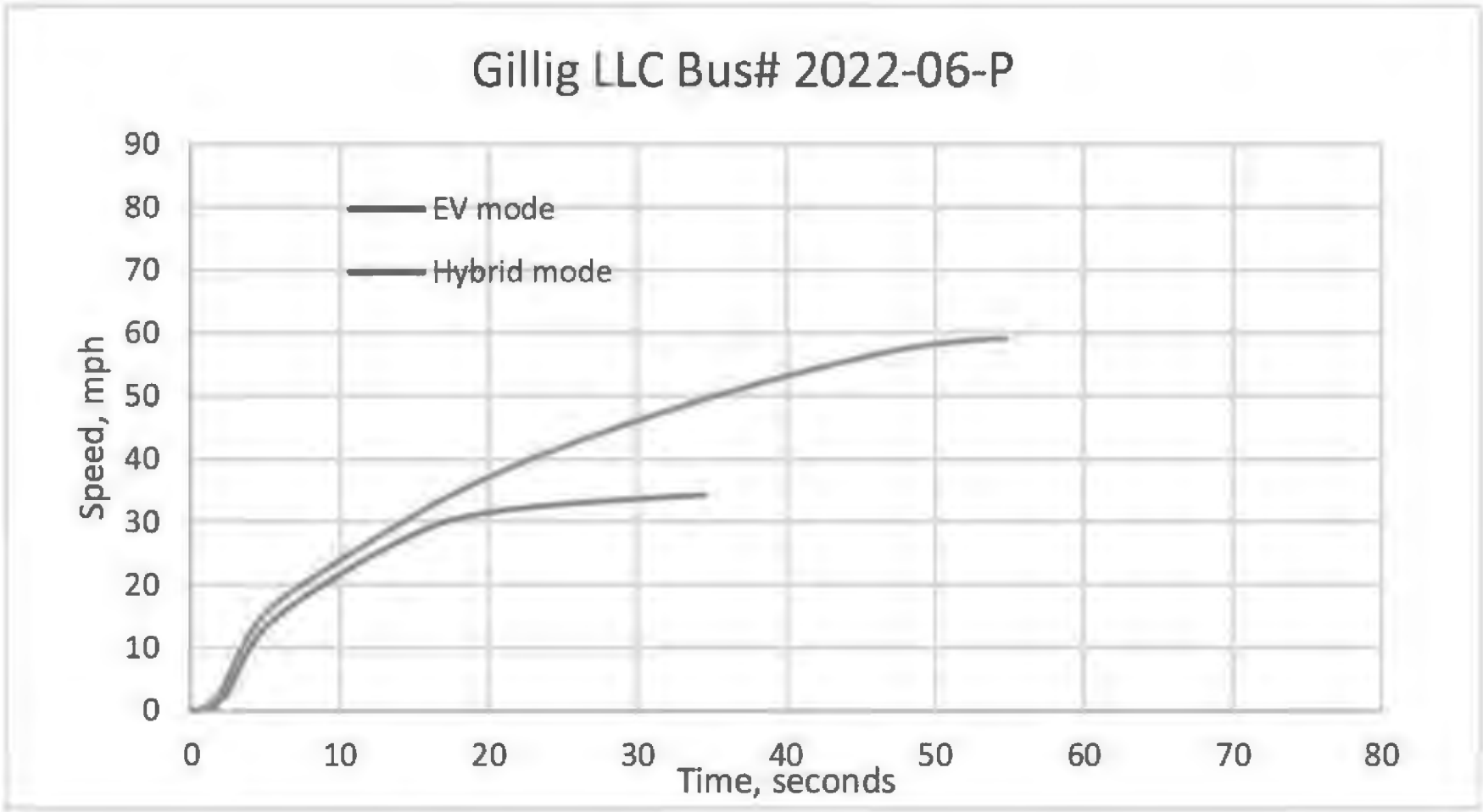
Bus Number: 2022-06 – EV Mode	Date: 06/02/22
Personnel: S.I. & D.B.	

Test Conditions:

Temperature (°F): 88.4	Humidity (%): 78.2
Barometric Pressure (inHg): 28.6	

Test Results:

Vehicle Speed (MPH)	Time (SEC)	Acceleration (FT/SEC^2)	Max. Grade (%)
1.0	1.7	2.79	8.66
5.0	2.9	6.87	21.34
10.0	4.0	5.67	17.61
15.0	5.8	2.84	8.82
20.0	8.9	2.22	6.89
25.0	12.4	1.89	5.87
30.0	17.1	1.05	3.26
34.3	34.5	Maximum Speed	


Gillig LLC Bus# 2022-06-P
Speed, mph
Time, seconds
EV mode
Hybrid mode
0
10
20
30
40
50
60
70
80
90
0
10
20
30
40
50
60
70
80

6. FUEL ECONOMY TEST - A FUEL CONSUMPTION TEST USING AN APPROPRIATE OPERATING CYCLE – HYBRID MODE

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable fuel consumption data on transit buses produced by different manufacturers. This fuel economy test bears no relation to the calculations done by the Environmental Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This fuel economy test, as designated here, is a measurement of the fuel expended by a vehicle traveling a specified test operating profile, under specified operating conditions that are typical of transit bus operation. The results of this test may not represent actual mileage in transit service but will provide data that can be used by FTA Grantees to compare the efficiency of buses tested using this procedure.

6-II. TEST DESCRIPTION

This test was performed in the emissions bay of the LTI Vehicle Testing Laboratory. The Laboratory is equipped with a Schenk Pegasus 300 HP, large-roll (72-inch diameter) chassis dynamometer suitable for heavy-vehicle emissions testing. The driving cycles are the Manhattan cycle, a low average speed, highly transient urban cycle (Figure 1), the Orange County Bus Cycle, a medium average speed transient urban cycle (Figure 2), and the EPA HD-UDDS Cycle, which consists of urban and highway driving segments (Figure 3). A fuel economy test was comprised of two runs for the three different driving cycles, and the average value was reported.

The test procedure for liquid-fueled buses such as this one uses a calibrated flowmeter system and/or a calibrated fuel weighing scale. The flowmeter system utilizes a precise four-piston positive displacement flow meter. The weighing scale system includes heat exchangers to maintain temperature in diesel and common-rail injection systems.

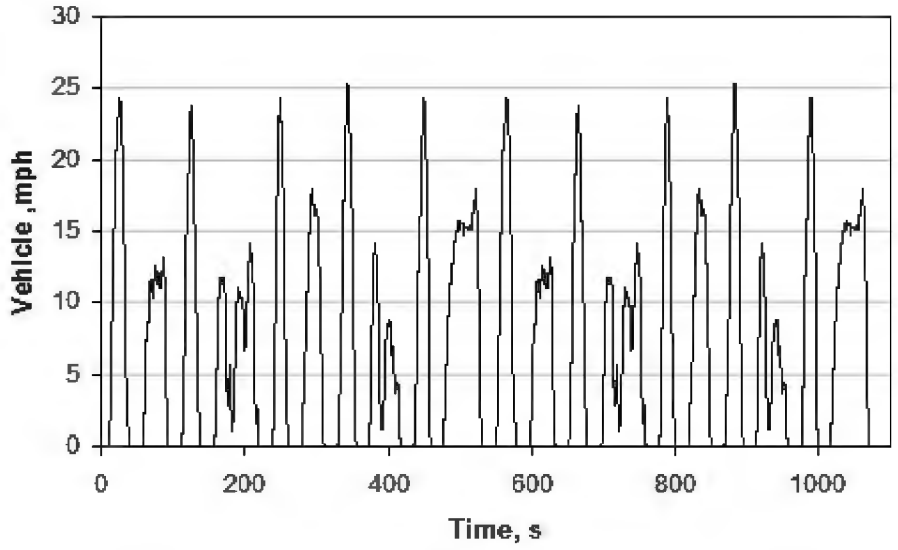


Figure 1. Manhattan Driving Cycle (duration 1089 sec, Maximum speed 25.4 mph, average speed 6.8 mph)

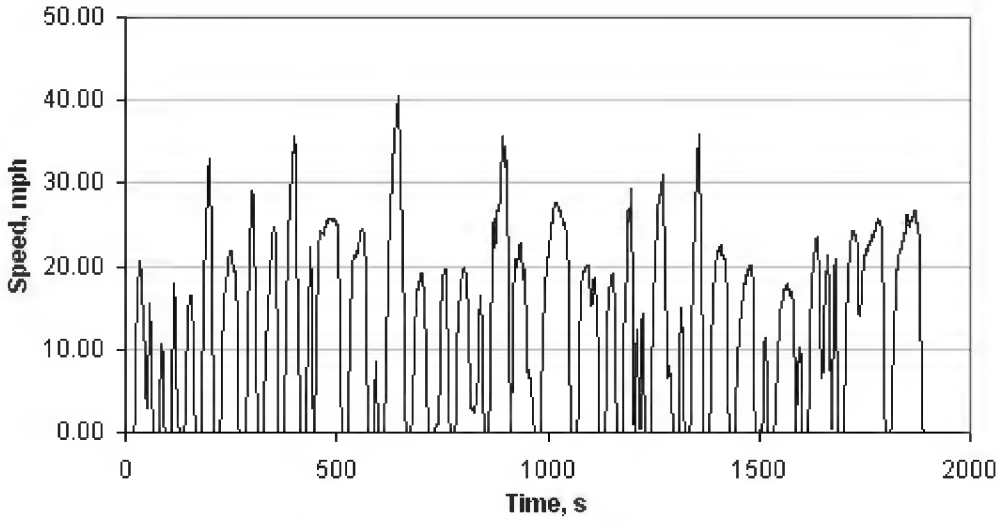


Figure 2. Orange County Bus Cycle (Duration 1909 Sec, Maximum Speed 41 mph, Average Speed 12 mph).

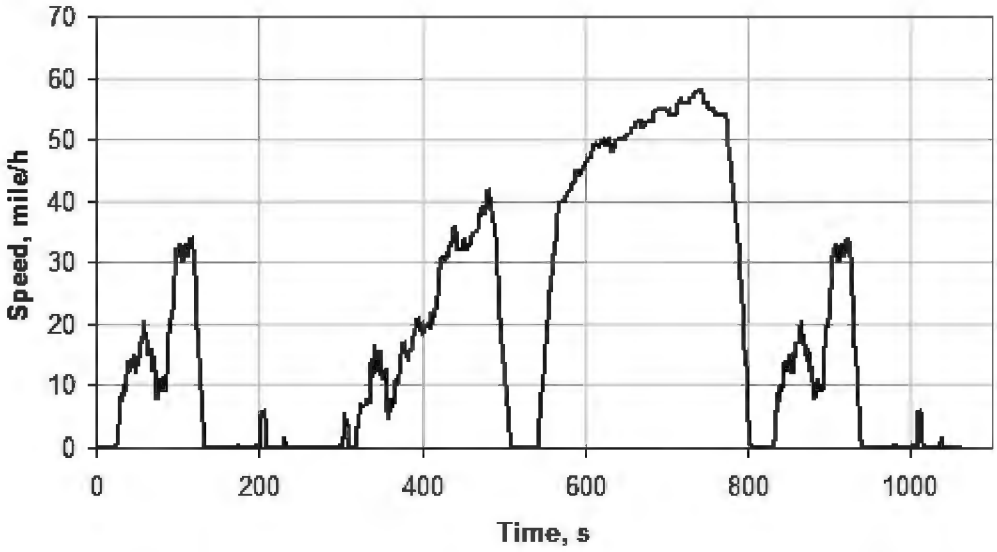


Figure 3. HD-UDDS Cycle (duration 1060 seconds, Maximum Speed 58 mph, Average Speed 18.86 mph).

6-III. DISCUSSION

The driving cycle consists of three simulated transit driving cycles: Manhattan, Orange County Bus Cycle and the HD-UDDS, as described in 6-II. The fuel consumption for each driving cycle and idle was measured.

An extensive pretest maintenance check was made including the replacement of all lubrication fluids. The details of the pretest maintenance are given in the first three Pretest Maintenance Forms. The fourth sheet shows the Pretest Inspection Form. Finally, the summary sheet provides the average fuel consumption for the three test cycles and for a 20-minute idle. **The average fuel consumption for the Manhattan, OCBC and the HD-UDDS were 4.32 mpg, 6.29 mpg and 6.43 mpg respectively. For idle, the fuel consumption was 0.52 gal/hr.**

FUEL ECONOMY/ENERGY ECONOMY
PRE-TEST MAINTENANCE FORM

Bus Number: 2022-06-P	Date: 05/31/22	SLW (lb.): 37,380
Personnel: R.M., S.R., F.T. & E.L.		

FUEL SYSTEM	OK
Install fuel measurement system	✓
Replace fuel filter	N/A
Check for fuel leaks	✓
Specify fuel type (Diesel)	✓
Remarks: None noted.	
BRAKES/TIRES	OK
Inspect hoses	✓
Inspect brakes	✓
Check tire inflation pressures (mfg. specs.)	✓
Check tire wear (less than 50%)	✓
Remarks: None noted.	
COOLING SYSTEM	OK
Check hoses and connections	✓
Check system for coolant leaks	✓
Remarks: None noted.	

FUEL ECONOMY/ENERGY ECONOMY
PRE-TEST MAINTENANCE FORM

Bus Number: 2022-06-P	Date: 05/31/22
Personnel: R.M., S.R., F.T. & E.L.	

ELECTRICAL SYSTEMS	OK
Check battery	✓
Inspect wiring	✓
Inspect terminals	✓
Check lighting	✓
Remarks: None noted.	

DRIVE SYSTEM	OK
Drain transmission fluid	N/A
Replace filter/gasket	N/A
Check hoses and connections	✓
Replace transmission fluid	N/A
Check for fluid leaks	✓
Remarks: Interval for transmission fluid change not reached.	

LUBRICATION	OK
Drain crankcase oil	N/A
Replace filters	N/A
Replace crankcase oil	N/A
Check for oil leaks	✓
Check oil level	✓
Lube all chassis grease fittings	✓
Lube universal joints	✓
Replace differential lube including axles	N/A
Remarks: Interval for oil/filter change not reached.	

FUEL ECONOMY/ENERGY ECONOMY
PRE-TEST MAINTENANCE FORM

Bus Number: 2022-06-P	Date: 05/31/22
Personnel: R.M., S.R., F.T. & E.L.	

EXHAUST/EMISSION SYSTEM	OK
Check for exhaust leaks	✓
Remarks: None noted.	
ENGINE	**OK**
Replace air filter	N/A
Inspect air compressor and air system	✓
Inspect vacuum system, if applicable	N/A
Check and adjust all drive belts	✓
Check cold start assist, if applicable	N/A
Remarks: None noted.	
STEERING SYSTEM	**OK**
Check power steering hoses and connectors	✓
Service fluid level	✓
Check power steering operation	✓
Remarks: None noted.	
	OK
Ballast bus to seated load weight	✓
TEST DRIVE	**OK**
Check brake operation	✓
Check transmission operation	✓
Remarks: None noted.	

FUEL ECONOMY/ENERGY ECONOMY
PRE-TEST INSPECTION FORM

Bus Number: 2022-06-P	Date: 05/31/22
Personnel: S.R, R.M. & F.T.	

PRE-WARM-UP	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	S.R./F.T.
Cold tire pressure (psi): Front 120 Middle N/A Rear 120	F.T./R.M.
Engine oil level	F.T./R.M.
Engine coolant level	F.T./R.M.
Fuel economy instrumentation installed and working properly.	R.M./F.T.
Fuel line -- no leaks or kinks	R.M.
Bus is loaded to SLW during coast down	F.T.
WARM-UP	**If OK, Initial**
Air conditioning off	D.B.
Interior and exterior lights on	D.B.
Defroster off	D.B.
Windows and doors closed	D.B.
Do not drive with left foot on brake	D.B.

FUEL ECONOMY DATA FORM
(Gaseous and Liquid fuels)

Bus Number: 2022-06-P	Manufacturer: Gillig	Date: 06/01/22
Fuel Type: Diesel	Personnel: S.I. & D.B.	
Temperature (°F): 93.5	Humidity (%): 76.8	Barometric Pressure (inHg): 28.6
SLW (lb.): 37,380		

Cycle	Manhattan	Orange County	HD-UDDS	Idle
Fuel Consumption (mpg)	4.32	6.29	6.43	0.52 G/hr

Comments: Hybrid mode.

6. ENERGY ECONOMY AND RANGE TEST – AN ENERGY CONSUMPTION AND RANGE TEST FOR BATTERY ELECTRIC BUSES USING APPROPRIATE OPERATING CYCLES – EV MODE

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable energy consumption data on battery electric transit buses produced by different manufacturers. This energy economy test bears no relation to the calculations done by the Environmental Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This energy economy test, as designated here, is a measurement of the energy consumed by a vehicle traveling a specified test operating profile, under specified operating conditions that are typical of transit bus operation. The results of this test will not represent actual energy usage but will provide data that can be used by FTA Grantees to compare buses tested using this procedure.

6-II. TEST DESCRIPTION

This test is performed in the emissions bay of the LTI Vehicle Testing Laboratory. The Laboratory is equipped with a Schenk Pegasus 300 HP, large-roll (72 inch diameter) chassis dynamometer suitable for heavy-vehicle emissions testing. The driving cycles are the Manhattan cycle, a low average speed, highly transient urban cycle (Figure 1), the Orange County Bus Cycle which consists of urban and highway driving segments (Figure 2), and the EPA HD-UDDS Cycle (Figure 3). This test is conducted at seated load weight.

This test is conducted generally as per the methods described in the SAE standard J 1634-2017. The light-duty test cycles specified in this standard are replaced by transit bus test cycles mentioned above.

The Multi-Cycle test (MCT) procedure is adopted for this bus. The end of test is determined when the bus cannot maintain 50 miles per hour or earlier, as recommended by the bus manufacturer. The battery system is recharged to full SOC at the end of the test, following procedures specified in SAE J 1634-2017. During the recharge, the DC energy (into the battery system) and the AC energy (into the charger) are recorded. From these data, the average AC energy consumption, the range (miles) and the charger efficiency for each test cycle are reported.

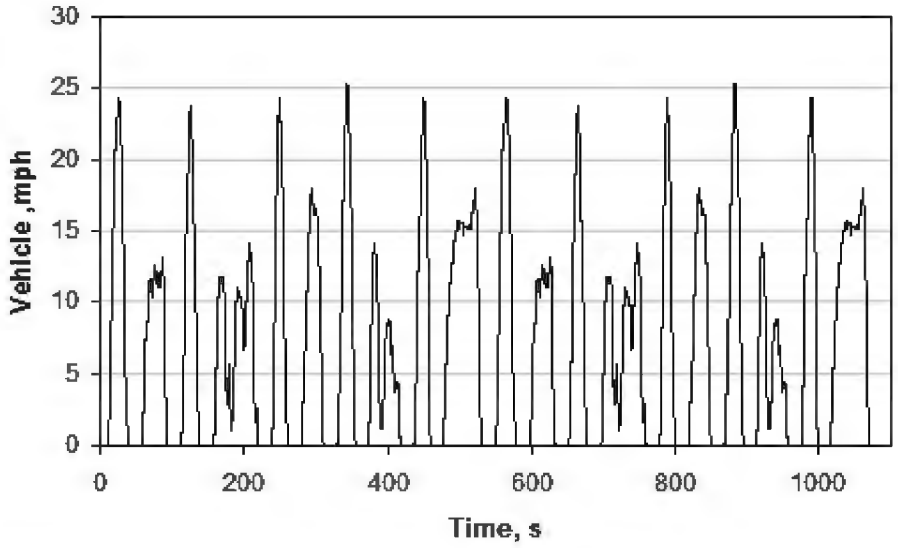


Figure 1. Manhattan Driving Cycle (duration 1089 sec, Maximum speed 25.4 mph, average speed 6.8 mph)

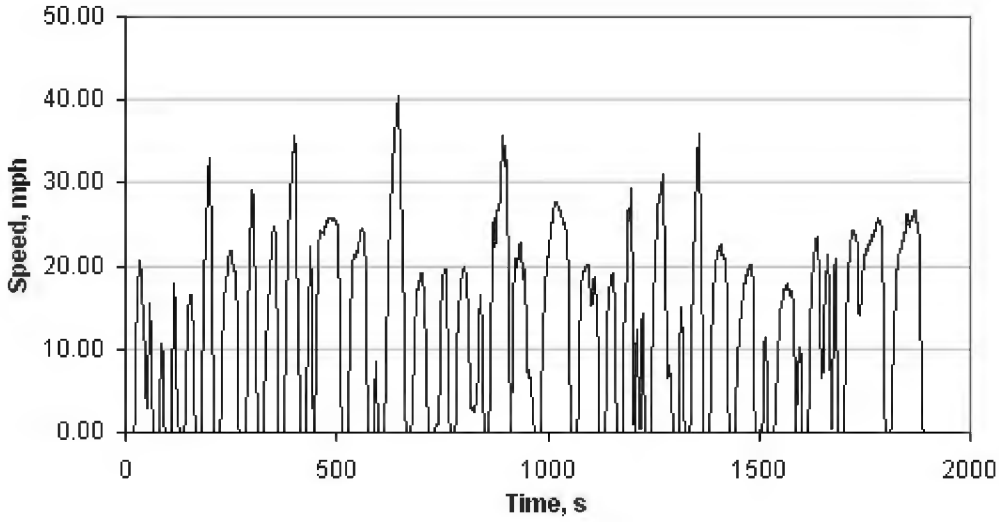


Figure 2. Orange County Bus Cycle (Duration 1909 Sec, Maximum Speed 41 mph, Average Speed 12 mph).

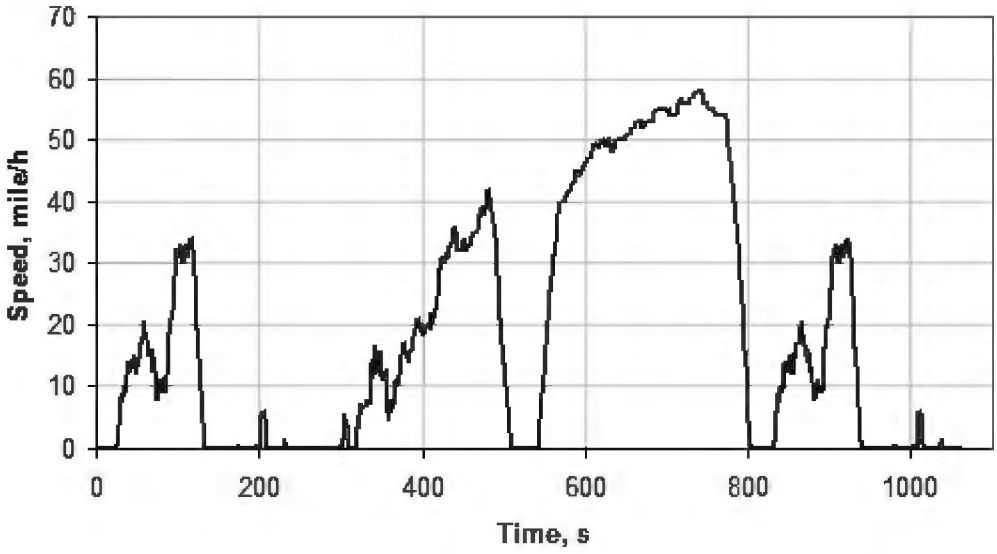


Figure 3. HD-UDDS Cycle (duration 1060 seconds, Maximum Speed 58 mph, Average Speed 18.86 mph).

6-III. DISCUSSION

The driving cycle consists of three simulated transit driving cycles: Manhattan, Orange County Bus Cycle and the HD-UDDS, as described in 6-II. The energy economy and range results for buses tested using these cycles are not directly comparable to buses tested under the earlier protocol that uses the CBD, Arterial and Commuter driving cycles.

An extensive pretest maintenance check is conducted including the replacement of all lubrication fluids, if applicable. The details of the pretest maintenance and inspection are given in the previous section – 6.0 Fuel economy – Hybrid Mode. The summary sheet provides the average energy consumption and range of bus for the three test cycles. The test was conducted at a seated load weight of 37,380 lbs. The average DC energy consumption for the Manhattan and OCBC were 3,675 Wh/mile and 2,807 Wh/mile. The range for those driving cycles were 2.49 miles and 3.27miles respectively. The maximum speed was 34.3 mph., therefore, the bus was not tested for the HD-UDDS cycle. This bus does not use an external (A/C) charger. The battery pack is internally charged by its diesel engine. Hence, AC energy measurements were not conducted.

ENERGY ECONOMY DATA FORM
(Battery Electric Buses)

Bus Number: 2022-06-P	Manufacturer: Gillig	Date: 06/02/22
Fuel Type: Electric	Personnel: S.I. & D.B.	
Temperature (°F): 83.9	Humidity (%): 91	Barometric Pressure (inHg): 28.5
SLW (lb.): 37,380	Charger: N/A (Bus operated on EV mode)	

	Manhattan	**Orange County**	**HD-UDDS**
DC Energy (Wh/mile)	3,675	2,807	N/A
AC Energy (Wh/mile)	N/A	N/A	N/A
Range (miles)	2.49	3.27	N/A

Comments: 1. The maximum speed of the bus in EV mode was 34.3 mph. The bus was not tested for the HD-UDDS cycle, as a significant part of the test cycle comprised of speeds above the capability of the bus in EV mode.

2. The bus does not use an external (AC) charger. The battery pack is internally charged by its diesel engine. Hence, AC measurements were not conducted.

7. NOISE

7.1 INTERIOR NOISE AND VIBRATION TESTS

7.1-I. TEST OBJECTIVE

The objective of these tests is to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level was measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system provided a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories were switched off and all openings including doors and windows were closed. This test was performed at the LTI Test Track Facility.

2. The bus was accelerated at full throttle from a standing start to 35 mph on a level pavement. All openings were closed and all accessories were operating during the test. This test was performed on the track at the LTI Test Track Facility.

3. The bus was operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles were noted. This test was performed on the test segment between the LTI Test Track and the Bus Testing Center.

All tests were performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions were recorded in the test data.

7.1-III. DISCUSSION

For the first part, with the bus in hybrid mode, the overall average of the six measurements was 51.0 dB(A); ranging from 50.4 dB(A) in line with the front speaker and at the rear passenger seats to 53.0 dB(A) at the driver's seat. With the bus in EV mode, the overall average of the six measurements was 50.0 dB(A); ranging from 49.5 dB(A) in line with the rear speaker and at the rear passenger seats to 51.6 dB(A) at the driver's seat. The interior ambient noise level for these tests was less than 30 dB(A).

For the second part, with the bus in hybrid mode, the interior noise level ranged from 75.5 dB(A) at the front passenger seats to 78.3 dB(A) at the rear passenger seats. The overall average was 76.8 dB(A). With the bus in EV mode, the interior noise level ranged from 66.6 dB(A) at the driver's seat to 67.7 dB(A) at the rear passenger seats. The overall average was 67.0 dB(A). The interior ambient noise level for these tests was less than 30 dB(A).

No vibrations or rattles were noted during the third part of this test in either hybrid mode or EV mode.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise – Hybrid Mode

Bus Number: 2022-06-P – Hybrid Mode	Date: 06/10/22
Personnel: F.T. & R.M.	
Temperature (°F): 58	Humidity (%): 81
Wind Speed (mph): 5	Wind Direction: WSW
Barometric Pressure (inHg): 29.92	
Interior Ambient Noise Level dB(A): less than 30	Exterior Ambient Noise Level dB(A): 35.2
Microphone Height During Testing (in): 46.2	

Reading Location	Measured Sound Level dB(A)
Driver's Seat	53.0
Front Passenger Seats	51.1
In Line with Front Speaker	50.4
In Line with Middle Speaker	50.8
In Line with Rear Speaker	50.5
Rear Passenger Seats	50.4

Comments: None noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test – Hybrid Mode

Bus Number: 2022-06-P – Hybrid Mode	Date: 06/06/22
Personnel: S.R., F.T. & T.G.	
Temperature (°F): 75	Humidity (%): 50
Wind Speed (mph): 10	Wind Direction: S
Barometric Pressure (inHg): 29.98	
Interior Ambient Noise Level dB(A): Less than 30	Exterior Ambient Noise Level dB(A): 40.0
Microphone Height During Testing (in): 46.2	

Reading Location	Measured Sound Level dB(A)
Driver's Seat	77.9
Front Passenger Seats	75.5
Middle Passenger Seats	75.6
Rear Passenger Seats	78.3

Comments: None noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test – Hybrid Mode

Bus Number: 2022-06-P – Hybrid Mode	Date: 05/26/22
Personnel: S.R., F.T., T.G. & G.C.	
Temperature (°F): 70	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location	Description of Noise
Engine and Accessories	N/A	N/A
Windows and Doors	N/A	N/A
Seats and Wheelchair lifts	N/A	N/A
Other	N/A	N/A

Comment on any other vibration or noise source which may have occurred
that is not described above: None noted.
Comments: None noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise – EV Mode

Bus Number: 2022-06-P – EV Mode	Date: 06/08/22
Personnel: F.T., E.L. & R.M.	
Temperature (°F): 63	Humidity (%): 76
Wind Speed (mph): 6	Wind Direction: N
Barometric Pressure (inHg): 29.97	
Interior Ambient Noise Level dB(A): less than 30	Exterior Ambient Noise Level dB(A): 34.8
Microphone Height During Testing (in): 46.2	

Reading Location	Measured Sound Level dB(A)
Driver's Seat	51.6
Front Passenger Seats	49.4
In Line with Front Speaker	49.7
In Line with Middle Speaker	50.3
In Line with Rear Speaker	49.5
Rear Passenger Seats	49.5

Comments: None noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test – EV Mode

Bus Number: 2022-06-P – EV Mode	Date: 06/07/22
Personnel: F.T. & E.L.	
Temperature (°F): 63	Humidity (%): 71
Wind Speed (mph): 9	Wind Direction: SSW
Barometric Pressure (inHg): 29.92	
Interior Ambient Noise Level dB(A): less than 30	Exterior Ambient Noise Level dB(A): 40.7
Microphone Height During Testing (in): 46.2	

Reading Location	Measured Sound Level dB(A)
Driver's Seat	66.6
Front Passenger Seats	66.8
Middle Passenger Seats	67.0
Rear Passenger Seats	67.7

Comments: Needed to regen on S mode, three times to complete test. Nothing Noted during test. Test was completed in electric mode.

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test – EV Mode

Bus Number: 2022-06-P – EV Mode	Date: 06/16/22
Personnel: F.T., R.M. & A.Z.	
Temperature (°F): 79	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location	Description of Noise
Engine and Accessories	N/A	None noted.
Windows and Doors	N/A	None noted.
Seats and Wheelchair lifts	N/A	None noted.
Other	N/A	None noted.

Comment on any other vibration or noise source which may have occurred
that is not described above: None noted.
Comments: In EV mode, but only reached 35 mph for a short distance before
switching back to hybrid mode. Odometer does not read mileage on EV Mode.

7.1 INTERIOR NOISE TEST

TEST BUS SET-UP FOR 80 dB(A)
INTERIOR NOISE TEST

7.2 EXTERIOR NOISE TESTS

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus was operated at a SLW in three different conditions using a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed starting from 35 mph.

2. Accelerating at full throttle from standstill.

3. Stationary, with the engine at low idle, high idle, and wide-open throttle, where applicable. In addition, the bus was tested with and without the air conditioning operating.

The test site is at the Larson Transportation Institute Test Track and the test procedures were performed in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The test site is an open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus was used to measure the noise level.

During the test, special attention was paid to:

1. The test site characteristics regarding parked vehicles, signboards, buildings, or other sound-reflecting surfaces
2. Proper usage of all test equipment including set-up and calibration
3. The ambient sound level

7.2-III. DISCUSSION

The Exterior Noise Test determines the noise level generated by the vehicle under different driving conditions and at stationary low and high idle, with and without air conditioning and accessories operating. The test site is a large, level, bituminous paved area with no reflecting surfaces nearby.

With an outside ambient noise level of 38.9 dB(A), the average of the two highest readings obtained while accelerating from a constant speed was 68.1 dB(A) on the right side and 72.1 dB(A) on the left side while operating in hybrid mode. While operating in EV mode, with an outside ambient noise level of 46.1 dB(A), the average of the two highest readings obtained while accelerating from a constant speed was 62.1 dB(A) on the right side and 63.5 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 39.9dB(A), the average of the two highest readings obtained were 68.2 dB(A) on the right side and 68.9 dB(A) on the left side while in hybrid mode. When in EV mode, with an exterior ambient noise level of 46.0 dB(A), the average of the two highest readings obtained were 63.2 dB(A) on the right side and 63.0 dB(A) on the left side.

While in hybrid mode, with the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 58.4 dB(A) at low idle, 61.1 dB(A) at high idle and 69.0 dB(A) at wide open throttle. With the accessories and air conditioning off, the readings averaged 57.4 dB(A) at low idle, 61.0 dB(A) at high idle and 68.9 dB(A) at wide open throttle. The exterior ambient noise level measured during this test was 39.6 dB(A). With the bus in EV mode, the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 48.4 dB(A). With the accessories and air conditioning off, the readings averaged 47.2 dB(A). There is no high idle or wide open throttle in EV mode. The exterior ambient noise level was 45.8 dB(A) while the bus was undergoing this test in EV mode.

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed - Hybrid Mode

Bus Number: 2022-06-P – Hybrid Mode	Date: 06/06/22
Personnel: S.R., F.T. & T.G.	
Temperature (°F): 70	Humidity (%): 50
Wind Speed (mph): 7	Wind Direction: S
Barometric Pressure (inHg): 30.00	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■	
Initial Sound Level Meter Calibration: 93.9 dB(A)	
Exterior Ambient Noise Level: 38.9 dB(A)	

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	66.5	1	68.5
2	67.7	2	69.7
3	68.4	3	71.8
4	N/A	4	72.3
5	N/A	5	71.8
6	N/A	6	N/A
7	N/A	7	N/A
8	N/A	8	N/A
9	N/A	9	N/A
10	N/A	10	N/A
Average of two highest actual noise levels = 68.1 dB(A)		Average of two highest actual noise levels = 72.1 dB(A)	

Final Sound Level Meter Calibration Check: 93.9 dB(A)
Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill – Hybrid Mode

Bus Number: 2022-06-P – Hybrid Mode	Date: 06/06/22
Personnel: S.R., F.T. & T.G.	
Temperature (°F): 72	Humidity (%): 51
Wind Speed (mph): 9	Wind Direction: S
Barometric Pressure (inHg): 30.00	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■	
Initial Sound Level Meter Calibration: 93.9 dB(A)	
Exterior Ambient Noise Level: 39.9 dB(A)	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	68.0	1	68.7
2	68.3	2	69.0
3	N/A	3	N/A
4	N/A	4	N/A
5	N/A	5	N/A
6	N/A	6	N/A
7	N/A	7	N/A
8	N/A	8	N/A
9	N/A	9	N/A
10	N/A	10	N/A
Average of two highest actual noise levels = 68.2 dB(A)		Average of two highest actual noise levels = 68.9 dB(A)	

Final Sound Level Meter Calibration Check: 93.9 dB(A)
Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Stationary – Hybrid Mode

Bus Number: 2022-06-P – Hybrid Mode	Date: 06/06/22
Personnel: S.R., F.T., T.G. & A.Z.	
Temperature (°F): 72	Humidity (%): 51
Wind Speed (mph): 9	Wind Direction: S
Barometric Pressure (inHg): 30.00	
Initial Sound Level Meter Calibration: 93.9 dB(A)	
Exterior Ambient Noise Level: 39.6 dB(A)	

Air Conditioning ON

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	720	58.0	58.8
High Idle	1000	60.3	61.8
Wide Open Throttle	2000	70.7	68.9

Air Conditioning OFF

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	720	59.0	55.7
High Idle	1000	64.1	57.8
Wide Open Throttle	2000	70.4	67.4

Final Sound Level Meter Calibration Check: 93.9 dB(A)

Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed - EV Mode

Bus Number: 2022-06-P – EV Mode	Date: 06/07/22
Personnel: F.T. & E.L.	
Temperature (°F): 64	Humidity (%): 62
Wind Speed (mph): 7	Wind Direction: SSW
Barometric Pressure (inHg): 29.93	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■	
Initial Sound Level Meter Calibration: 94.0 dB(A)	
Exterior Ambient Noise Level: 46.1 dB(A)	

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	61.5	1	62.4
2	61.4	2	63.7
3	62.7	3	63.3
4	N/A	4	N/A
5	N/A	5	N/A
6	N/A	6	N/A
7	N/A	7	N/A
8	N/A	8	N/A
9	N/A	9	N/A
10	N/A	10	N/A
Average of two highest actual noise levels = 62.1 dB(A)		Average of two highest actual noise levels = 63.5 dB(A)	

Final Sound Level Meter Calibration Check: 94.0 dB(A)
Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill – EV Mode

Bus Number: 2022-06-P – EV Mode	Date: 06/07/22
Personnel: F.T. & E.L.	
Temperature (°F): 64	Humidity (%): 65
Wind Speed (mph): 7	Wind Direction: SW
Barometric Pressure (inHg): 29.96	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■	
Initial Sound Level Meter Calibration: 94.0 dB(A)	
Exterior Ambient Noise Level: 46.0 dB(A)	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	63.0	1	62.8
2	63.4	2	63.2
3	N/A	3	N/A
4	N/A	4	N/A
5	N/A	5	N/A
6	N/A	6	N/A
7	N/A	7	N/A
8	N/A	8	N/A
9	N/A	9	N/A
10	N/A	10	N/A
Average of two highest actual noise levels = 63.2 dB(A)		Average of two highest actual noise levels = 63.5 dB(A)	

Final Sound Level Meter Calibration Check: 94.0 dB(A)
Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Stationary – EV Mode

Bus Number: 2022-06-P- EV Mode	Date: 06/07/22
Personnel: F.T. & E.L.	
Temperature (°F): 64	Humidity (%): 71
Wind Speed (mph): 9	Wind Direction: SSW
Barometric Pressure (inHg): 29.95	
Initial Sound Level Meter Calibration: 94.0dB(A)	
Exterior Ambient Noise Level: 45.8 dB(A)	

Air Conditioning ON

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	N/A	48.3	48.5
High Idle	N/A	N/A	N/A
Wide Open Throttle	N/A	N/A	N/A

Air Conditioning OFF

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	N/A	47.5	46.8
High Idle	N/A	N/A	N/A
Wide Open Throttle	N/A	N/A	N/A

Final Sound Level Meter Calibration Check: 94.0 dB(A)

Comments: Bus ran in electric mode only one reading due to no high idle and/or wide open throttle.

7.2 EXTERIOR NOISE TESTS

TEST BUS UNDERGOING EXTERIOR NOISE TESTING

8.0 EMISSIONS TEST – DYNAMOMETER-BASED EMISSIONS TEST USING TRANSIT DRIVING CYCLES

8-I. TEST OBJECTIVE

The objective of this test is to provide comparable emissions data on transit buses produced by different manufacturers. This chassis-based emissions test bears no relation to engine certification testing performed for compliance with the Environmental Protection Agency (EPA) regulation. EPA's certification tests are performed on an engine by itself on a dynamometer operating under the Federal Test Protocol.

The Bus Testing Center emissions test is a measurement of the gaseous engine emissions CO, CO2, NOx, HC and particulates (diesel vehicles) produced by a complete vehicle operating on a large-roll chassis dynamometer. The test is performed for three differed driving cycles intended to simulate a range of transit operating environments. The test is performed under laboratory conditions in compliance with EPA 1065 and SAE J2711. The results of this test may not represent actual in-service vehicle emissions but will provide data that can be used by recipients to compare the emissions of buses tested under a range of consistent operating conditions.

8-II. TEST DESCRIPTION

This test was performed in the emissions bay of the LTI Vehicle Testing Laboratory. The Laboratory is equipped with a Schenk Pegasus 300 HP, large-roll (72-inch diameter) chassis dynamometer suitable for heavy-vehicle emissions testing. The emissions laboratory provides capability for testing heavy-duty diesel, gasoline, and alternative-fueled buses for a variety of tailpipe emissions including particulate matter, oxides of nitrogen, carbon monoxide, carbon dioxide, and hydrocarbons. It is equipped with a Horiba full-scale dilution tunnel and a constant volume sampling (CVS) emissions measurement system. The system includes Horiba Mexa 7400 Series gas analyzers and a Horiba HF47 Particulate Sampling System. Test operation is automated using Horiba CDTCS software. The computer-controlled dynamometer is capable of simulating over-the-road operation for a variety of vehicles and driving cycles.

The driving cycles are the Manhattan cycle, a low average speed, highly transient urban cycle (Figure 1), the Orange County Bus Cycle, a medium average speed transient urban cycle (Figure 2), and the EPA HD-UDDS Cycle, which consists of urban and highway driving segments (Figure 3). An emissions test was comprised of two runs for each of the three different driving cycles, and the average values were reported. Test results reported include the average grams per mile value for each of the gaseous emissions of carbon dioxide, carbon monoxide, oxides of nitrogen, total hydrocarbons and non-methane hydrocarbons. In addition, emissions of particulate matter will also be reported for diesel fuel buses. Testing is performed in accordance with EPA CFR49, Part 1065 and SAE J2711 as practically determined by the FTA Emissions Testing Protocol developed by West Virginia University and Penn State University.

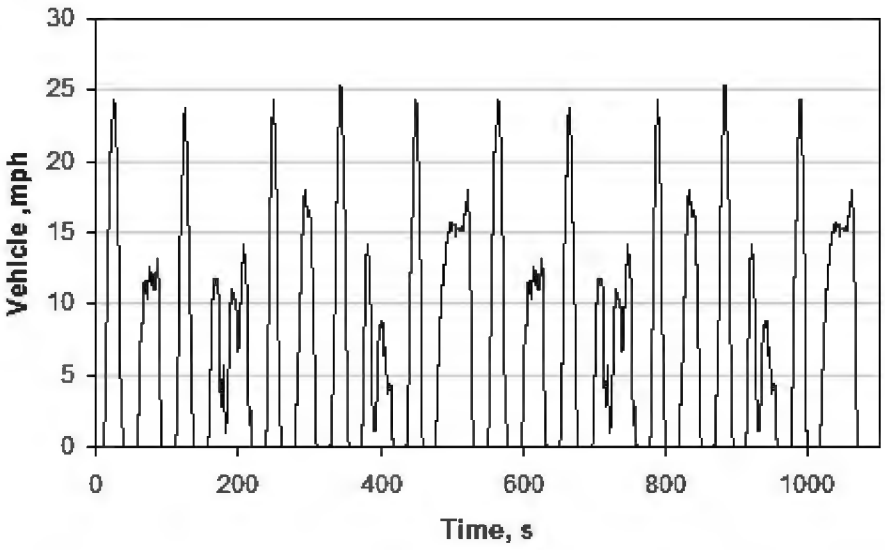


***Figure 8.1**. Manhattan Driving Cycle (Duration 1089 sec, Maximum Speed 25.4 mph, Average Speed 6.8 mph)*

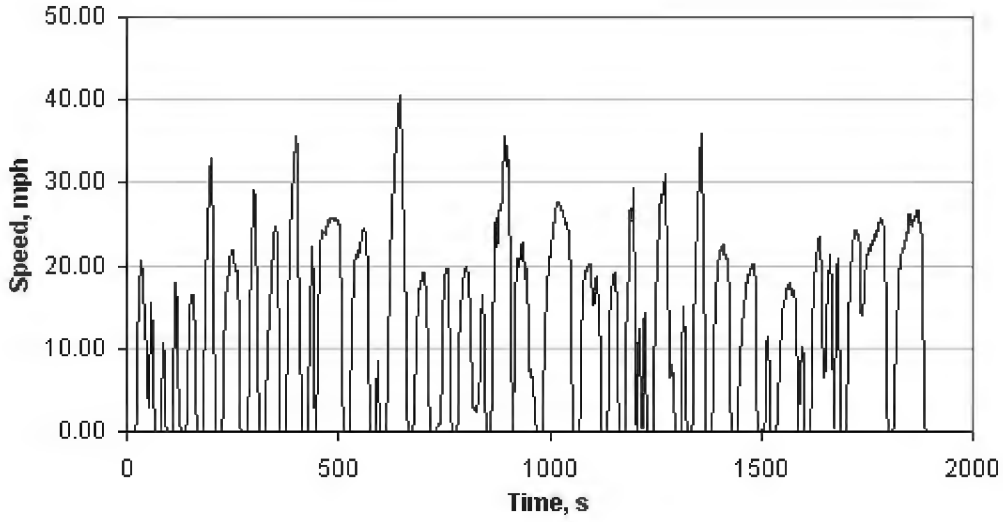


***Figure 8.2**. Orange County Bus Cycle (Duration 1909 Sec, Maximum Speed 41 mph, Average Speed 12 mph)*

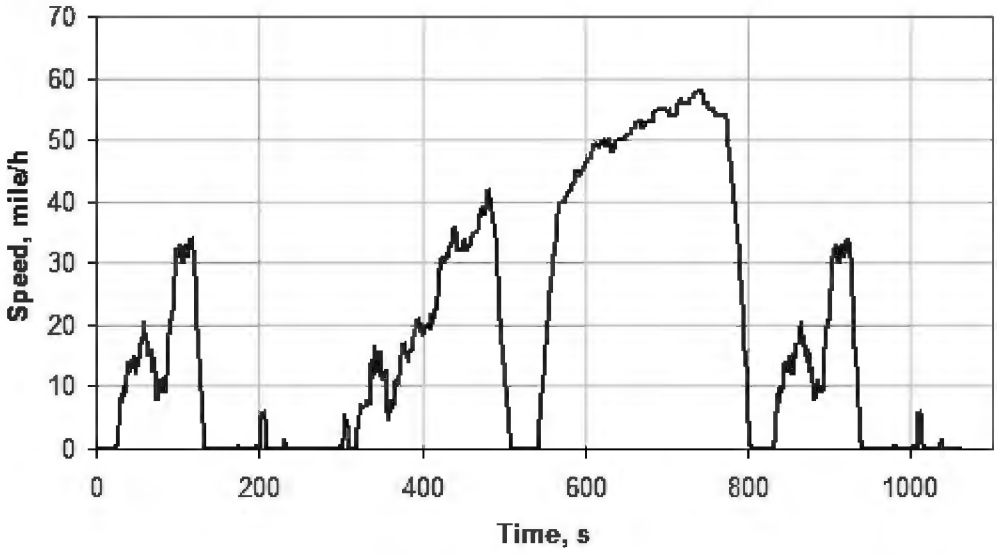


***Figure 8.3**. HD-UDDS Cycle (Duration 1060 seconds, Maximum Speed 58 mph, Average Speed 18.86 mph)*

8-III. TEST ARTICLE

The test article is a Gillig LLC Low Floor model transit bus equipped with a diesel fueled Cummins B6.7 280 hp engine. The bus was tested on June 1, 2022 with the odometer reading 3,286 miles.

8-IV. TEST EQUIPMENT

Testing was performed in the LTI Vehicle Testing Laboratory emissions testing bay. The test bay is equipped with a Schenk Pegasus 72-inch, large-roll chassis dynamometer. The dynamometer is electronically controlled to account for vehicle road-load characteristics and for simulating the inertia characteristics of the vehicle. Power to the roller is supplied and absorbed through an electronically controlled 3-phase ac motor. Absorbed power is returned to the electrical grid.

Vehicle exhaust is collected by a Horiba CVS, full-flow dilution tunnel. The system has separate tunnels for diesel and gasoline/natural gas fueled vehicles. In the case of diesel vehicles, particulate emissions are measured gravimetrically using 47mm Teflon filters. These filters are housed in a Horiba HF47 particulate sampler, per EPA 1065 test procedures. Heated gaseous emissions of hydrocarbons and NOx are sampled by Horiba heated oven analyzers.

Gaseous emissions for CO, CO2 and cold NOx are measured using a Horiba Mexa 7400 series gas analyzer. System operation, including the operation of the chassis dynamometer, and all calculations are controlled by a Dell workstation running Horiba CDCTS test control software. Particulate Filters are weighed in a glove box using a Sartorius microbalance accurate to 1 microgram.

8-V. TEST PREPARATION AND PROCEDURES

The test bus was prepared for emissions testing in accordance with the Fuel Economy Pre-Test Maintenance Form. (In the event that fuel economy test was performed immediately prior to emissions testing this step does not have to be repeated.) This is done to ensure that the bus is tested in optimum operating condition. The manufacturer-specified preventive maintenance shall be performed before this test. The ABS system is disabled for operation on the chassis dynamometer. Any manufacturer-recommended changes to the pre-test maintenance procedure must be noted on the revision sheet. The Fuel Economy Pre-Test Inspection Form will also be completed before performing the Emissions test. Both the Fuel Economy Pre-Test Maintenance Form and the Fuel Economy Pre-Test Inspection Form are found in section 6, Fuel Economy Test.

Prior to performing the emissions test, each bus is evaluated to determine its road-load characteristics using coast-down techniques in accordance with SAE J1263. This data is used to program the chassis dynamometer to accurately simulate over-the-road operation of the bus.

Warm-up consisted of driving the bus for 20 minutes at approximately 40 mph on the chassis dynamometer. During emissions testing, the test driver followed the prescribed driving cycle by watching the speed trace and instructions on the Horiba Drivers-Aid monitor which is placed in front of the windshield. The CDCTS computer monitored the test and collected data for calculation of emissions at the end of the test.

This bus was tested for emissions at seated load weight. The emissions data was obtained at the following conditions:

1. Air conditioning off
2. Heater off
3. Defroster off
4. Exterior and interior lights on
5. Windows and Doors closed
6. Seated load weight

The test tanks or the bus fuel tank(s) were filled prior to the fuel economy test with diesel fuel.

Table 8.1 provides the emissions testing results on a grams per mile basis for each of the exhaust constituents measured and for each driving cycle performed.

TABLE 8.1 Emissions Test Results

Test Completed at SLW: 37,380 lb.			
Driving Cycle	**Manhattan**	**Orange County Bus**	**UDDS**
CO_2, gm/mi	2,333	1,728	1,357
CO, gm/mi	0.19	0.10	0.06
THC, gm/mi	0.17	0.01	0.01
NMHC, gm/mi	0.06	0.01	0.01
NO_x, gm/mi	1.34	0.22	0.03
Particulates. gm/mi	0.02	0.03	0.03

8. EMISSIONS TEST

BUS TESTED ON CHASSIS DYNAMOMETER FOR PERFORMANCE, FUEL/ENERGY ECONOMY AND EMISSIONS

FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration U.S. DOT
In accordance with 49 CFR, Part 665

Manufacturer: GILLIG, LLC
Model: 40 FOOT LOW FLOOR L9N CNG

Tested in Service-Life Category
12 Year / 500,000 Miles

March 2020

Report Number: LTI-BT-R1911

The Thomas D. Larson
Pennsylvania Transportation Institute
201 Transportation Research Building
The Pennsylvania State University
University Park, PA 16802
(814) 865-1891

Bus Testing and Research Center
2237 Plank Road
Duncansville, PA 16635
(814) 695-3404

PennState
College of Engineering

LTI BUS RESEARCH
AND TESTING CENTER

FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration, U.S. DOT
1200 New Jersey Avenue, SE
Washington, DC 20590

In accordance with 49 CFR Part, 665

Manufacturer: GILLIG, LLC
Manufacturer's address: 451 DISCOVERY DRIVE LIVERMORE, CA 94551

Model: 40 Foot Low Floor L9N CNG

Tested in Service-Life Category
12 Year / 500,000 Miles

Report Number: LTI-BT-R1911

David Klinikowski	Director, Bus Research and Testing Center	02/11/2021
Quality Authorization	*Title*	*Date*

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EXECUTIVE SUMMARY

TEST HIGHLIGHTS

The information in this report pertains only to this specific bus, as received from the manufacturer for testing. Any modifications made by manufacturer during testing are recorded in this report.

The Check-In section of the report provides a description of the bus and specifies its major components. The following table gives the salient specifications.

Manufacturer	Gillig, LLC
Model	40 Foot Low Floor L9N
Chassis Make/Model	Gillig, LLC / L9N
Chassis Modified	No
Length	40 Foot 8 Inches
Fuel	CNG
Service Life	12-Year / 500,000 mile test
Number of Seats (including driver)	39 or 33 and 2 wheelchairs
Manufacturer-Designated Standing Passenger Capacity	33
Gross Vehicle Weight used for testing	41,500
Gross Vehicle Weight Rating	41,600
Mileage at Delivery	3,177
Test Start Date	June 27, 2019
Test Completion Date	December 10, 2019

The measured curb weight was 10,520 lb. for the front axle and 20,150 lb. for the rear axle. These combined weights provided a total measured curb weight of 30,670 lb. There are 39 seats including the driver and free floor space for 34 standing passengers bringing the potential total passenger capacity to 73. A placard shows the maximum number of standing passengers as 33. Six seats can fold away to accommodate 2 wheelchairs. Therefore, the gross load represents 39 seated passengers (including driver), and 33 standees, for a total of 72 passengers. Gross load is calculated as 72 x 150 = 10,800 lb. At full declared capacity, the measured gross vehicle weight was 41,500 lb.

BUS TESTING BACKGROUND

On August 1, 2016, FTA announced a final rule for bus testing for improving the process of ensuring the safety and reliability of new transit buses. The rule satisfies requirements in MAP-21 to establish minimum performance standards, a standardized scoring system, and a pass-fail threshold based on the score.

FTA's Bus Testing Program (often referred to as "Altoona Testing" due to the location of the main testing center) tests new transit bus models for:

- Maintainability
- Reliability

- Safety
- Performance (including Braking Performance)
- Structural Integrity (including Structural Durability)
- Fuel Economy (Energy Efficiency and Range, for electric buses)
- Noise
- Emissions

Bus models that fail to meet one or more minimum performance standards will "fail" their test and thus be ineligible for purchase with FTA funds until the failures are resolved and validated through further testing. FTA will use this authority to make sure defects are corrected before a bus model can be acquired with FTA funding.

In each application to FTA for the purchase or lease of any new bus model, or any bus model with a major change in configuration or components to be acquired or leased with funds obligated by the FTA, the recipient shall certify that it has received the appropriate full Bus Testing Report and any applicable partial testing report(s) before final acceptance of the first vehicle. In dealing with a bus manufacturer or dealer, the recipient shall be responsible for determining whether a vehicle to be acquired requires full testing or partial testing or has already satisfied the requirements of this part. A bus manufacturer or recipient may request guidance from FTA in making these determinations.

The purpose of the testing is intended set a "Pass/Fail" standard and grade the performance of the buses in order to provide performance information to the transit authorities that can be used in their purchase or lease decisions. The intent of this report is to provide the grantee a relative measure of the performance of a particular model of transit bus against a standard of performance. The passing of this test should ensure a vehicle has a high probability of meeting its service life in the category it was tested.

The data included in this test report and other applicable reports should be reviewed to choose the most suitable bus for a grantee's operation. A higher scoring bus is not necessarily the best bus for a given application. For example, a bus with a powerful engine may score well because of its performance and gradeability, but another bus with a smaller and more fuel-efficient engine could be a better choice for applications in mostly flat areas. It is the responsibility of the grantee to ensure the proper test report or applicable partial report is in their possession and has been thoroughly reviewed.

The score sheet for the subject vehicle of this test report is provided below. **This bus passed the Altoona test, with an aggregate score of 85.7.**

Gillig Bus# 1911									
Test category		Standard	Base Pts.	Bonus Pts.	Range	Range	Test Data	Score	FAIL
1. Maintainability	Unscheduled maint.	< 125 hours	2	14	0	125	9	14.99	
2. Reliability	# Class 2 failures	< 2 Uncorrected	2	6	0	2	0	8.00	
3. Safety	Hazards	No uncorrected Class 1	10	0	P	F	P	10.00	
	Stability	Lane change, 45 mph?	2.5	0	P	F	P	2.50	
	Braking	< 158 feet at 45mph	0.5	2	80	158	105.2	1.85	
		Holds Lane, Split coeffient	2.5	0	P	F	P	2.50	
		Parking brake, 20% grade	2.5	0	P	F	P	2.50	
4. Performance	Acceleration 0-30 mph	less than 30 sec	1.5	0	P	F	P	1.50	
	Gradeability 2.5%	more than 40 mph	1.5	0	P	F	P	1.50	
	Gradeability 10%	more than 10 mph	2	0	P	F	P	2.00	
5. Structural Integrity	Distortion	Exits are operational	1	0	P	F	P	1.00	
	Static Towing	No significant deformation	1	0	P	F	p	0.00	
	Dynamic Towing	Towable with std. wrecker	1	0	P	F	P	1.00	
	Jacking	Liftable with std. jack	1	0	P	F	P	1.00	
	Hoisting	Stable on jacks	1	0	P	F	P	1.00	
	Durability-Structural	No uncorrected failures	13	0	P	F	P	13.00	
	Durability-Powertrain	No uncorrected failures	12	0	P	F	P	12.00	
6. Fuel Economy	Liquid fuels	1-13mpg	1	6	1	13	NA	0.00	
	CNG	10-50 scf/mi			10	50	39.2	2.62	
	Hydrogen	15-98 cf/mi			15	98	NA	0.00	
	Electric	1-3 kWh/mi			1	3	NA	0.00	
7. Noise	Int. Noise (0-35 mph)	less than 80 db	0.5	3	30	80	76.8	0.69	
	Ext. Noise (0-35 mph)	less than 83 db	0.5	3	50	83	74.2	1.30	
8. Emissions	CO_2	0-4000 g/mi	1	4	0	4000	2104	2.90	
	CO	0-20 g/mi		0.4	0	20	4	0.32	
	Total hydrocarbon	0-3 g/mi		0.4	0	3	0.24	0.37	
	NMHC	0-3 g/mi		0.4	0	3	0.02	0.40	
	Nitrogen oxides	0-3 g/mi		0.4	0	2	0.03	0.39	
	Particulates	0-0.1 g/m		0.4	0	0.1	0	0.40	
Total			60	40				85.7	

Note: The use of the scoring system is not mandatory for procurement. It is only necessary that the bus being procured has received a passing score.

ABBREVIATIONS AND ACRONYMS

ABS - anti-skid braking system
ABTC - Altoona Bus Test Center
A/C - air conditioner, or air conditioning
AC - alternating current
ADA - American Disability Act
CDCTS - chassis dynamometer test control system
CVS - constant volume sampling
CW - curb weight (bus weight including maximum fuel, oil, and coolant; but without passengers or driver)
dB(A) - decibels with reference to 0.0002 microbar as measured on the "A" scale
DC - direct current
DIR - test director
DR - bus driver
EPA - Environmental Protection Agency
GAWR – gross axle weight rating
GVL - gross vehicle load (150 lb. for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space)
GVW - gross vehicle weight (curb weight plus gross vehicle load)
GVWR - gross vehicle weight rating
HD-UDDS – Heavy Duty-Urban Dynamometer Driving Schedule
LTI - Larson Transportation Institute
mpg - miles per gallon
mph - miles per hour
PM - Preventive maintenance
PSTT - Penn State Test Track
rpm - revolutions per minute
SAE - Society of Automotive Engineers
SCF - Standard cubic foot
SCH - test scheduler
SA - staff assistant
SLW - seated load weight (curb weight plus 150 lb. for every designed passenger seating position and for the driver)
TD - test driver
TECH - test technician
TM - track manager
TP - test personnel
Wh - Watt hour

TEST BUS CHECK-IN

I. OBJECTIVE

The objective of this task is to log in the test bus, assign a bus number, complete the vehicle data form, and perform a safety check.

II. TEST DESCRIPTION

The test consisted of assigning a bus test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer certified that the bus meets all Federal regulations.

III. DISCUSSION

The check-in procedure is used to identify in detail the major components and configuration of the bus.

The test bus consisted of a Gillig, LLC , model 40 Foot Low Floor L9N. The bus has a front passenger door forward of the front axle, and is equipped with an ADA accessible lift system, and a main passenger door forward of the rear axle. Power is provided by a CNG-fueled, Cummins / L9N 280 engine coupled to a Voith / D864.6 transmission.

The measured curb weight was 10,520 lb. for the front axle and 20,150 lb. for the rear axle. These combined weights provided a total measured curb weight of 30,670 lb. There are 39 seats including the driver and free floor space for 34 standing passengers bringing the potential total passenger capacity to 73. A placard shows the maximum number of standing passengers as 33. Six seats can fold away to accommodate 2 wheelchairs. Therefore, the gross load represents 39 seated passengers (including driver), and 33 standees, for a total of 72 passengers. Gross load is calculated as 72 x 150 = 10,800 lb. At full declared capacity, the measured gross vehicle weight was 41,500 lb

VEHICLE DATA FORM

Bus Number: 1911	Date of Check-In: 06/27/19
Bus Manufacturer: Gillig, LLC	Vehicle Identification Number (VIN): 15GGD3117K3190045
Model Number: L9N	Chassis Mfr./Mod.#: Gillig, LLC / L9N
Personnel: T.S.,S.R. & E.D.	Starting Odometer Reading: 3,177

WEIGHT:

Individual Wheel Reactions:

Weights (lb.)	Front Axle		Middle Axle		Rear Axle	
	Curb	Street	Curb	Street	Curb	Street
CW	5,250	5,270	N/A	N/A	9,500	10,650
SLW	6,230	6,230	N/A	N/A	11,410	12,960
GVW	7,270	7,250	N/A	N/A	12,720	14,260

Total Weight Details:

Weight (lb.)	CW	SLW	GVW	GAWR
Front Axle	10,520	12,460	14,520	14,600
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	20,150	24,370	26,980	27,000
Total	30,670	36,830	41,500	GVWR: 41,600 Specified by Manufacturer

Dimensions:

Length (ft/in)	40 / 8
Width (in)	100 ¾
Height (in)	124
Front Overhang (in)	88 ¼
Rear Overhang (in)	121 ¼
Wheel Base (in)	278 ½
Wheel Track (in)	Front: 85.2
	Middle: N/A
	Rear: 76.9

Bus Number: 1911	Date: 06/27/19

CLEARANCES:

Lowest Point Outside Front Axle	Location: Skid Plate Clearance(in): 8.5
Lowest Point Outside Rear Axle	Location: Coolant Pipe Clearance(in): 11.8
Lowest Point between Axles	Location: Frame Clearance(in): 13.8
Ground Clearance at the center (in)	13.8
Front Approach Angle (deg)*	8.0
Rear Approach Angle (deg)*	10.0
Ramp Clearance Angle (deg)	5.6
Aisle Width (in)	Front- 23 Rear- 22.6
Inside Standing Height at Center Aisle (in)	Front- 95.2 Rear-76.4

*measurements used to calculate approach and departure angles are taken from the center-line of the axles.

BODY DETAILS:

Body Structural Type	Semi-Monocoque		
Frame Material	Steel		
Body Material	Aluminum		
Floor Material	Plywood		
Roof Material	Composite		
Windows Type	■ Fixed- Bottom	■ Movable-Top	
Window Mfg./Model No.	Arow / AS3 M-3 DOT 1060		
Number of Doors	1 Front	1 Rear	
Mfr. / Model No.	Front - Vapor AmeriView / 51750578-00 Rear – Vapor Ameriview / 51750621-00		
Dimension of Each Door (in)	Front- 75.3 H x 31.9 W Rear- 78 H x 29.7 W		
Passenger Seat Type	■Cantilever-Front	■ Pedestal-Rear	☐ Other (explain)
Driver Seat Type	■ Air	☐ Spring	☐ Other (explain)
Mfr. / Model No.	USSC / 9000 CX Series		
Number of Seats (including Driver)	39 or 33 + 2 w/c		

Bus Number: 1911	Date: 06/27/19

BODY DETAILS (Contd.)

Free Floor Space (ft^2)	56.8
Height of Each Step at Normal Position (in)	Front 1. 15.4 2. N/A 3. N/A 4. N/A
	Middle 1. 16.6 2. N/A 3. N/A 4. N/A
	Rear 1. N/A 2. N/A 3. N/A 4. N/A
Step Elevation Change - Kneeling (in)	Front- 3.4 Middle-1.3

ENGINE

Type	☐ C.I.	☐ Alternate Fuel	
	■ S.I.	☐ Other (explain)	
Mfr. / Model No.	Cummins / L9N 280		
Location	☐ Front	■ Rear	☐ Other (explain)
Fuel Type	☐ Gasoline	■ CNG	☐ Methanol
	☐ Diesel	☐ LNG	☐ Other (explain)
Alternator (Generator) Mfr./Model No.	C.E. Niehoff & Co. / C803D		
Maximum Rated Output (Volts / Amps)	28 volts / 525 amps		
Air Compressor Mfr. / Model No.	Wabco / 4938827		
Maximum Capacity (ft^3 / min)	Minimum 179L/min @1000kPa, 30.4CFM		
Starter Type	■ Electrical	☐ Pneumatic	☐ Other (explain)
Starter Mfr. / Model No.	Delco Remy / 24V-42MT-450		

Bus Number: 1911	Date: 06/27/19

TRANSMISSION

Transmission Type	☐ Manual	■ Automatic	☐ Load Sensing Adaptive
Mfr. / Model No.	Voith / D864.6		
Control Type	☐ Mechanical	■ Electrical	☐ Other
Integral Retarder Mfr. / Model No.	☐ Yes	■ No	

SUSPENSION

Number of Axles	2		
Front Axle Type	☐ Independent	■ Beam Axle	
Mfr. / Model No.	Meritor / FH946KX46		
Axle Ratio (if driven)	N/A		
Suspension Type	■ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 99B 3202SP1Merit		
Middle Axle Type N/A	☐ Independent	☐ Beam Axle	
Mfr. / Model No.	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	☐ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	☐ Independent	■ Beam Axle	
Mfr. / Model No.	Meritor / 79163KX13-538		
Axle Ratio (if driven)	5.38		
Suspension Type	■ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	4		
Mfr. / Model No.	Koni / 1173703000		

Bus Number: 1911	Date: 06/27/19

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Accuride / 22.5 x 8.25
	Tire Mfr./ Model No.	Goodyear Metro Miler / B305 85R 22.5
Rear	Wheel Mfr./ Model No.	Accuride / 22.5 x 8.25
	Tire Mfr./ Model No.	Goodyear Metro Miler / B305 85R 22.5

BRAKES

Front Axle Brakes Type	☐ Cam	■ Disc	☐ Other (explain)
Mfr. / Model No.	Meritor / EX225H3 disc		
Middle Axle Brakes Type	☐ Cam	☐ Disc	■ N/A
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	☐ Cam	■ Disc	☐ Other (explain)
Mfr. / Model No.	Meritor / EX225H3 disc		

HVAC

Heating System Type	☐ Air	■Water	☐ Other
Capacity (Btu/hr)	98,000		
Mfr. / Model No.	ThermoKing / X426		
Air Conditioner	■ Yes	☐ No	
Location	Rear		
Capacity (Btu/hr)	86,000		
A/C Compressor Mfr. / Model No.	Thermo King / X426		

STEERING

Steering Gear Box Type	Hydraulic Gear		
Mfr. / Model No.	ZF/TRW TAS65 / TAS65171B		
Steering Wheel Diameter	20”		
Number of turns (lock to lock)	4 ½		
Control Type	☐ Electric	■ Hydraulic	☐ Other (explain)

Bus Number: 1911	Date: 06/27/19

OTHERS

Wheel Chair Ramps	Location: Front	Type: Fold-Out
Wheel Chair Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	Lift-U / LU18-02-09	
Emergency Exit	Location: Windows Doors Roof Hatch	Number: 5 2 1

CAPACITIES

Fuel Tank Capacity (gallons)	3600 psig @ 70˚ F (Liquid Capacity-2418 litres)
Engine Crankcase Capacity (quarts)	23
Transmission Capacity (quarts)	33 qrts initial fill / 25-26 quarts service
Differential Capacity (litres)	18.8-20.8
Cooling System Capacity (gallons)	15
Power Steering Fluid Capacity (quarts)	14

VEHICLE DATA FORM

Bus Number: 1911	Date: 06/27/19

List all spare parts, tools and manuals delivered with the bus.

Part Number	Description	Qty.
N/A	N/A	N/A

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 1911	Date: 06/27/19

Subsystem	Checked	Initials	Comments
Air Conditioning Heating and Ventilation	✓	E.D.	None noted
Body and Sheet Metal	✓	E.D.	None noted
Frame	✓	E.D.	None noted
Steering	✓	E.D.	None noted
Suspension	✓	E.D.	None noted
Interior/Seating	✓	E.D.	None noted
Axles	✓	E.D.	None noted
Brakes	✓	E.D.	None noted
Tires/Wheels	✓	E.D.	None noted
Exhaust	✓	E.D.	None noted
Fuel System	✓	E.D.	None noted
Power Plant	✓	E.D.	None noted
Accessories	✓	E.D.	None noted
ADA Accessible Lift System	N/A	E.D.	None noted
ADA Accessible Ramp System	✓	E.D.	None noted
Interior Fasteners	✓	E.D.	None noted
Batteries	✓	E.D.	None noted

CHECK - IN

GILLIG, LLC
40-FOOT LOW FLOOR LN9 CNG

CHECK - IN CONT.

ROOFTOP CNG TANKS

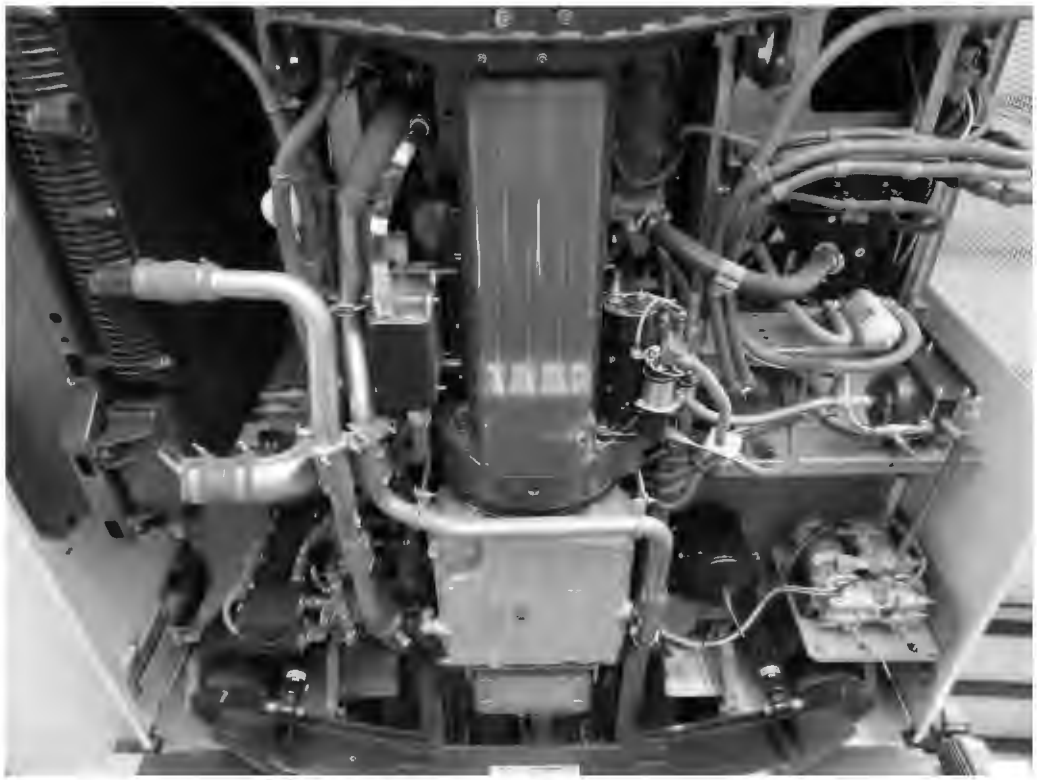
OPERATOR'S AREA

CHECK - IN CONT.

INTERIOR FROM FRONT

VIN TAG

PLACARD SHOWING MAXIMUM PASSENGERS



ENGINE COMPARTMENT

1. MAINTAINABILITY

1.1 ACCESSIBILITY OF COMPONENTS AND SUBSYSTEMS

1.1-I. TEST OBJECTIVE

The objective of this test is to check the accessibility of components and subsystems.

1.1-II. TEST DESCRIPTION

Accessibility of components and subsystems was checked, and where accessibility was restricted the subsystem was noted along with the reason for the restriction.

1.1-III. DISCUSSION

Accessibility, in general, was adequate. Components covered in Section 1.3 (repair and/or replacement of selected subsystems), along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

ACCESSIBILITY DATA FORM

Bus Number: 1911	Date: 12/10/19

Component	Checked	Comments
ENGINE :		
Oil Dipstick	✓	N/A
Oil Filler Hole	✓	N/A
Oil Drain Plug	✓	N/A
Oil Filter	✓	N/A
Fuel Filter	✓	N/A
Air Filter	✓	Difficult to change due to placement behind AC compressor & over hydraulic tank.
Belts	✓	N/A
Coolant Level	✓	N/A
Coolant Filler Hole	✓	N/A
Coolant Drain	✓	N/A
Spark / Glow Plugs	✓	N/A
Alternator	✓	N/A
Diagnostic Interface Connector	✓	N/A
TRANSMISSION :		
Fluid Dip-Stick	✓	N/A
Filler Hole	✓	N/A
Drain Plug	✓	N/A
SUSPENSION :		
Bushings	✓	N/A
Shock Absorbers	✓	N/A
Air Springs	✓	N/A
Leveling Valves	✓	N/A
Grease Fittings	✓	N/A

ACCESSIBILITY DATA FORM

Bus Number: 1911	Date: 12/10/19

Component	Checked	Comments
HVAC :		
A/C Compressor	✓	N/A
Filters	✓	N/A
Fans	✓	N/A
ELECTRICAL SYSTEM :		
Fuses	✓	N/A
Batteries	✓	N/A
Voltage regulator	✓	On alternator
Voltage Converters	✓	N/A
Lighting	✓	N/A
MISCELLANEOUS :		
Brakes	✓	N/A
ADA Accessible Lifts/Ramps	✓	N/A
Instruments	✓	N/A
Axles	✓	N/A
Exhaust	✓	N/A
Fuel System	✓	CNG tanks on the roof
OTHERS :		

1.2 SERVICING, PREVENTIVE MAINTENANCE, AND REPAIR AND MAINTENANCE DURING TESTING

1.2-I. TEST OBJECTIVE

The objective of this test is to collect maintenance data about the servicing, preventive maintenance, and repair.

1.2.-II. TEST DESCRIPTION

The test was conducted by operating the bus and collecting the following data on work order forms and a driver log.

1. Scheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Results of scheduled inspections
    e. Description of malfunction (if any)
    f. Repair action and parts used (if any)
    g. Man-hours required

2. Unscheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Description of malfunction
    e. Place and time of malfunction (e.g., in service or undergoing inspection)
    f. Repair action and parts used
    g. Man-hours required

The bus was operated in accelerated durability service. While typical items are given below, the specific service schedule was that specified by the manufacturer.

A. Service
    1. Fueling
    2. Consumable checks
    3. Interior cleaning

B. Preventive Maintenance
    1. Brake adjustments
    2. Lubrication
    3. 3,000 mi (or manufacturer recommended) inspection

4. Oil and filter change inspection
5. Major inspection
6. Tune-up

C. Periodic Repairs
1. Brake reline*
2. Transmission change
3. Engine change*
4. Windshield wiper motor change
5. Stoplight bulb change*
6. Towing operations
7. Hoisting operations

*These items are attended to if found necessary, while the others in the list are removed/replaced/tested for all buses undergoing a full test.

1.2-III. DISCUSSION

Servicing and preventive maintenance were performed at manufacturer-specified intervals. The following Scheduled Maintenance Form lists the mileage, items serviced, the service interval, and amount of time required to perform the maintenance.

The Unscheduled Maintenance List along with related photographs is included in Section 5.7, Structural Durability. This list supplies information related to failures that occurred during the durability portion of testing. The Unscheduled Maintenance List includes the date and mileage at which the malfunction was detected, a description of the malfunction and repair, and the time required to perform the repair.

(Page 1 of 2)
SCHEDULED MAINTENANCE
Gillig, LLC # 1911

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	LABOR HOURS
07/17/19	948	P.M./Inspection	Steering linkage lubed. Tie rods, universals/u-joints all checked. Inspected frame, body and suspension.	4.00	4.00
08/02/19	1851	P.M./Inspection	Steering linkage lubed. Tie rods, universals/u-joints all checked. Inspected frame, body and suspension.	4.00	4.00
08/12/19	2798	P.M./Inspection	Steering linkage lubed. Tie rods, universals/u-joints all checked. Inspected frame, body and suspension.	4.00	4.00
08/22/19	3796	P.M./Inspection	Steering linkage lubed. Tie rods, universals/u-joints all checked. Inspected frame, body and suspension.	4.00	4.00
09/05/19	5245	P.M./Inspection	Steering linkage lubed. Tie rods, universals/u-joints all checked. Inspected frame, body and suspension.	4.00	4.00
09/11/19	5940	P.M./Inspection	Steering linkage lubed. Tie rods, universals/u-joints all checked. Inspected frame, body and suspension.	4.00	4.00
09/25/19	7751	P.M./Inspection	Steering linkage lubed. Tie rods, universals/u-joints all checked. Inspected frame, body and suspension.	4.00	4.00

SCHEDULED MAINTENANCE

Gillig, LLC # 1911

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	LABOR HOURS
10/04/19	9558	P.M./Inspection	Steering linkage lubed. Tie rods, universals/u-joints all checked. Inspected frame, body and suspension.	4.00	4.00
10/15/19	10,583	P.M./Inspection	Steering linkage lubed. Tie rods, universals/u-joints all checked. Inspected frame, body and suspension.	4.00	4.00
10/22/19	11,491	P.M./Inspection	Steering linkage lubed. Tie rods, universals/u-joints all checked. Inspected frame, body and suspension.	4.00	4.00
11/05/19	12,904	P.M./Inspection	Steering linkage lubed. Tie rods, universals/u-joints all checked. Inspected frame, body and suspension.	4.00	4.00
11/20/19	14,985	P.M./Inspection Fuel Economy	Steering linkage lubed. Tie rods, universals/u-joints all checked. Inspected frame, body and suspension. Oil changed. Oil, fuel, and air filters changed. Transmission oil and filter changed.	8.00	8.00

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

1.3-I. TEST OBJECTIVE

The objective of this test is to establish the time required to replace and/or repair selected subsystems.

1.3-II. TEST DESCRIPTION

The test involved components that may be expected to fail or require replacement during the service life of the bus. In addition, any component that failed during testing of the bus was added to this list. Components to be included are:

1. Transmission
2. Alternator
3. Starter
4. Batteries
5. Windshield wiper motors

1.3-III. DISCUSSION

At the end of the test, the items on the list were removed and replaced. The transmission assembly took 6.00 labor-hours (3 persons @ 2.00 hrs) to remove and replace. The time required for repair/replacement of the other four components is given on the following Repair and/or Replacement Form.

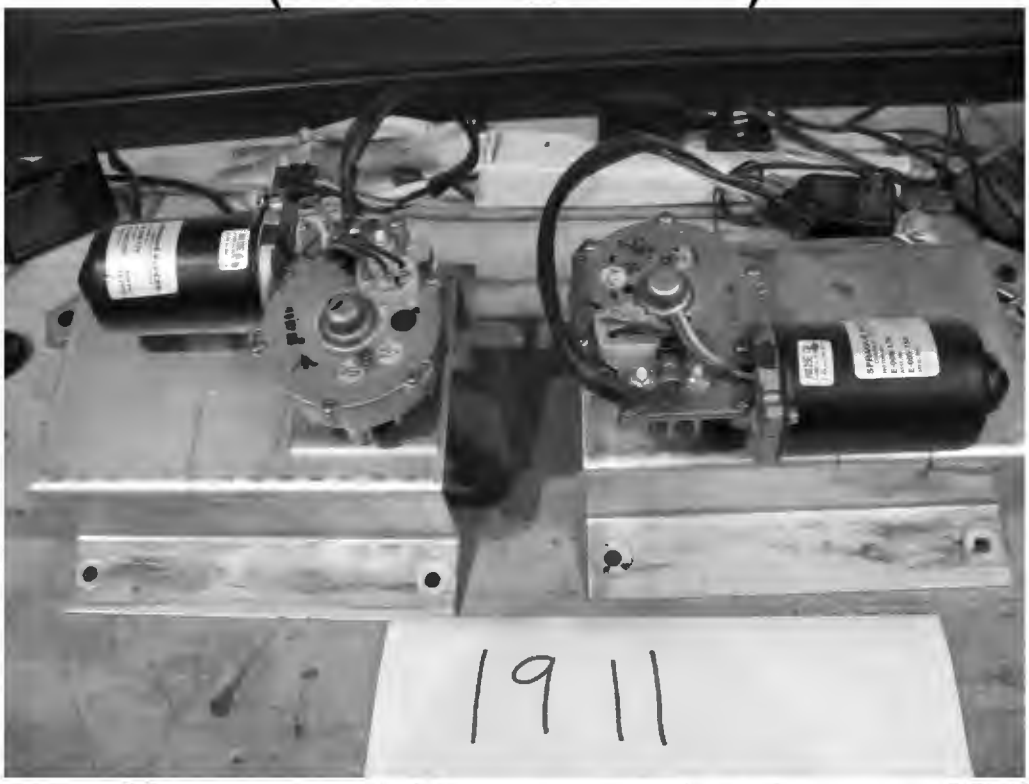
REPLACEMENT AND/OR REPAIR FORM

Subsystem	Replacement Time
Transmission	6.00 labor hours
(2) Wiper Motors	2.00 labor hours
Starter	1.00 labor hour
Alternator	2.00 labor hours
Batteries	1.00 labor hour

During the test, additional components were removed for repair or replacement and the details are available in Section 5.7 in Unscheduled Maintenance.

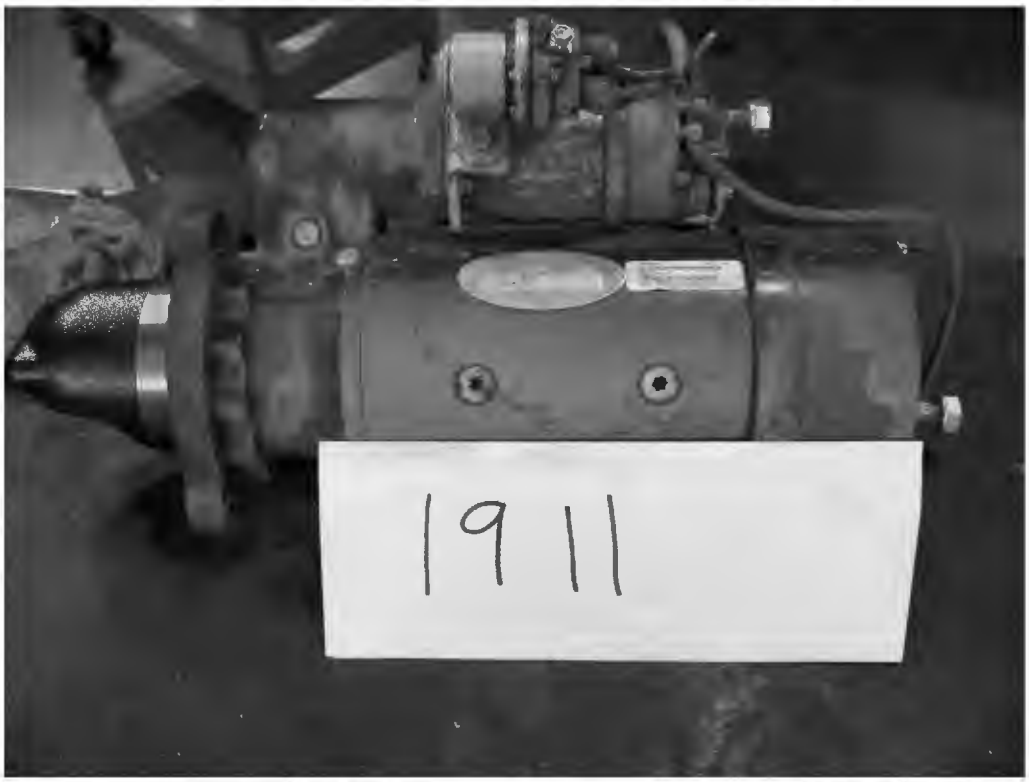
1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

TRANSMISSION REMOVAL AND REPLACEMENT (6.00 LABOR HOURS)



WIPER MOTORS REMOVAL AND REPLACEMENT (2.00 LABOR HOURS)

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS CONT.



STARTER REMOVAL AND REPLACEMENT (1.00 LABOR HOUR)

ALTERNATOR REMOVAL AND REPLACEMENT (2.00 LABOR HOURS)

2. RELIABILITY - DOCUMENTATION OF BREAKDOWN AND REPAIR TIMES DURING TESTING

2-I. TEST OBJECTIVE

The objective of this test is to document unscheduled breakdowns, repairs, down time, and repair time that occur during testing.

2-II. TEST DESCRIPTION

Using the driver log and unscheduled work order forms, all significant breakdowns, repairs, labor-hours to repair, and hours out of service were recorded on the Reliability Data Form.

CLASS OF FAILURES

Classes of failures are described below:

(a) Class 1: Physical Safety. A failure that could lead directly to Injury, a crash and/or significant physical damage.

(b) Class 2: Road Call. A failure resulting in an en-route interruption of revenue service. Service is discontinued until the bus is replaced or repaired at the point of failure.

(c) Class 3: Bus Change. A failure that requires removal of the bus from service during its assignments. The bus is operable to a rendezvous point with a replacement bus.

(d) Class 4: Bad Order. A failure that does not require removal of the bus from service during its assignments but does degrade coach operation. The failure shall be reported by driver, inspector, or hostler.

2-III. DISCUSSION

A listing of breakdowns and unscheduled repairs was accumulated during the Structural Durability Test. The following Reliability Data Form lists all unscheduled repairs under classes as defined above.

The classification of repairs according to subsystem is intended to emphasize those systems which had persistent minor or more serious problems. There was a total of 4 failures, 1 involved the HVAC system and the other 3 involved the suspension of the bus. All four of the failures were listed as Class 4. These failures are available for review in the Unscheduled Maintenance List, located in Section 5.7 Structural Durability.

This bus passed the Structural and Powertrain Durability sections of the test.

RELIABILITY DATA FORMS

Bus Number : 1911	Date: 01/15/2020
Personnel: S.I.	

Failure Type			
Class 4 Bad Order	Class 3 Bus Change	Class 2 Road Call	Class 1 Physical Safety

Subsystems	Mileage	Mileage	Mileage	Mileage	Labor Hours	Down Time
HVAC	9,558				2.00	2.00
Suspension	10,976				4.00	4.00
	11,491				1.00	1.00
	11,491				2.00	2.00

3.1 SAFETY - A DOUBLE-LANE CHANGE (OBSTACLE AVOIDANCE)

3.1-I. TEST OBJECTIVE

The objective of this test is to determine handling and stability of the bus by measuring speed through a double lane change test.

3.1-II. TEST DESCRIPTION

The Safety Test consisted of an obstacle avoidance maneuver to evaluate the handling and stability of the bus. The test was conducted at the LTI test track on the vehicle dynamics pad. The bus was driven through a double-lane change course at increasing speeds until the test was determined to be unsafe or a speed of 45 mph is reached. The test is determined unsafe if vehicle handling becomes unstable or if any of the tires lose contact with the pavement.

The layout of the test course was defined by placing pylons along painted guidelines that delineated the course. The guidelines marked off two 12 foot center-to-center lanes. Each lane had two 100 foot long gates with a spacing distance of 100 feet between them. The bus entered the test course in one lane, crossed over to the other lane within the 100 foot gate, traveled for 100 feet, and then returned back into the original lane within the next 100 foot gate. This maneuver was repeated from 20 mph with speed increasing in increments of 5 mph. The test was performed starting from both the right and left lanes.

A test run is considered valid if the bus is able to perform the maneuver at a constant speed without deviating from the test course or striking pylons. If the bus is not able to successfully complete the maneuver due to vehicle instability, the test will be terminated. The highest speed at which the maneuver can be successfully performed up to a maximum speed of 45 mph is recorded on the Safety Data Form.

3.1-III. DISCUSSION

The double-lane change was performed in both right-hand and left-hand directions. The bus was able to safely negotiate the test course in both the right-hand and left-hand directions up to the maximum test speed of 45 mph, and therefore, passed this portion of the test.

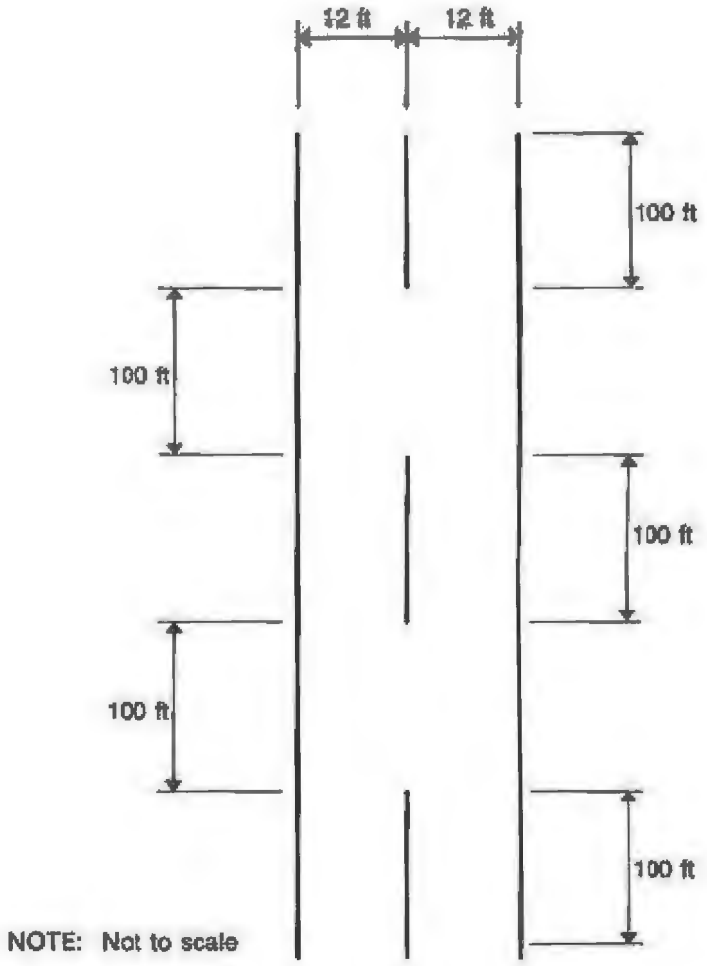


Figure 3.1. Double lane change test course

SAFETY DATA FORM

Bus Number: 1911	Date: 09-13-19
Personnel: T.S., S.R. & M.H.	

Temperature (°F): 63	Humidity (%): 69
Wind Direction: SE	Wind Speed (mph): 6
Barometric Pressure (in.Hg): 30.34	

SAFETY TEST: DOUBLE LANE CHANGE	
Maximum safe speed tested for double-lane change to left	45 mph
Maximum safe speed tested for double-lane change to right	45 mph
Comments of the position of the bus during the lane change:	
The bus maintained a safe position throughout the test.	
Comments of the tire/ground contact patch:	
The bus maintained contact with the ground throughout the test.	

RIGHT - HAND APPROACH

LEFT - HAND APPROACH

3.2 Safety - Braking

3.2 I. TEST OBJECTIVE

The objective of this test is to provide, for comparison purposes, braking performance data on transit buses produced by different manufacturers.

3.2 II. TEST DESCRIPTION

The testing was conducted at the LTI Test Track skid pad area. Brake tests were conducted after completion of the GVW portion of the vehicle durability test. At this point in testing the brakes have been subjected to a large number of braking snubs and will be considered well burnished. Testing was performed when the bus was fully loaded at its GVW. All tires on each bus were representative of the tires on the production model vehicle and inflated to the bus manufacturer's specified pressures.

The brake testing procedure is comprised of three phases:

1. Stopping distance tests

    i. Dry surface (high-friction, Skid Number within the range of 70-76)
    ii. Wet surface (low-friction, Skid Number within the range of 30-36)

2. Stability tests
3. Parking brake test

3.2-III. DISCUSSION

The results of the Stopping Distance phase of the Brake Test are available in table 3.2-2. There was no deviation from the test lane during the performance of the Stopping Distance phase. The bus passed this portion of the test.

During the Stability phase of Brake Testing the test bus experienced no deviation from the test lane during both approaches to the Split Friction Road surface.

The Parking Brake phase was completed with the test bus maintaining the parked position for the full five minute period with no slip or roll observed in both the uphill and downhill positions.

This bus passed all three phases of the Safety –Braking Test.

Table 3.2-1. Braking Test Data Forms

Bus Number: 1911	Date: 07-19-19
Personnel: S.R., E.D. & E.L.	
Amb. Temperature (ºF): 84	Wind Speed (mph): 9
Wind Direction: SW	Pavement Temp (°F) Start: 96 End: 98

TIRE INFLATION PRESSURE (psi):

Tire Type: Goodyear Metro Miler
Front: 305 / 85R / 22.5

Tire Type: Goodyear Metro Miler
Rear: 305 / 85R / 22.5

	Left Tire(s)		Right Tire(s)	
Front	110		110	
	Inner	Outer	Inner	Outer
Middle	N/A	N/A	N/A	N/A
Rear	110	110	110	110

AXLE LOADS (lb.)

	Left	Right
Front	7,600	7,620
Middle	N/A	N/A
Rear	13,910	12,370

Table 3.2-2. Stopping Distance Test Results Form
(longest stopping distance in each test condition in bold)

Stopping Distance (ft)					
Vehicle Direction	CW	CW	CCW	CCW	
Speed (mph)	Stop 1	Stop 2	Stop 3	Stop 4	**Average**
20 (dry)	28.73	22.20	26.24	**29.25**	26.60
30 (dry)	47.33	47.78	**52.34**	49.36	49.20
40 (dry)	78.45	71.37	**94.62**	71.79	79.05
45 (dry)	109.74	91.31	**113.25**	106.53	105.20
20 (wet)	**34.66**	31.98	29.61	31.19	31.86

Table 3.2-3. Stability Test Results Form

Stability Test Results (Split Friction Road surface)			
Vehicle Direction	Attempt	Did test bus stay in 12' lane? (Yes/No)	Comments
Driver side on high friction	1	Yes	None noted
	2	Yes	None noted
Driver side on low friction	1	Yes	None noted
	2	Yes	None noted

Table 3.2-4. Parking Brake Test Form

PARKING BRAKE (Fully Loaded) – GRADE HOLDING						
Vehicle Direction	Attempt	Hold Time (min)	Slide (in)	Roll (in)	Did Hold	No Hold
Front up	1	5:00	N/A	N/A	✓	
	2	N/A	N/A	N/A		
	3	N/A	N/A	N/A		
Front down	1	5:00	N/A	N/A	✓	
	2	N/A	N/A	N/A		
	3	N/A	N/A	N/A		

Table 3.2-5. Record of All Braking System Faults/Repairs.

Date	Fault/Repair	Description
07/19/2019	None Noted	N/A

3.2 Safety - Bus Braking

PARKING BRAKE TEST
PARKING BRAKE HELD FOR 5 MINUTES IN BOTH 20% UP AND 20% DOWN POSITIONS

4. PERFORMANCE - AN ACCELERATION, GRADEABILITY, AND TOP SPEED TEST

4-I. TEST OBJECTIVE

The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus.

4-II. TEST DESCRIPTION

In this test, the bus was operated at SLW on a chassis dynamometer. The procedure dictates that the test bus be accelerated to a maximum "power-limited"/"governed" or maximum "safe" speed not exceeding 80 mph. The maximum power-limited/governed speed, if applicable, is the top speed as limited by the engine control system. The maximum safe speed is defined as the maximum speed that the dynamometer, the tires or other bus components are limited to. The test vehicle speed was measured using a speed encoder built in the chassis dynamometer. The time intervals between 10 mph increments were recorded using a Data Acquisitions System. Time-speed data and the top speed attained were recorded on the Performance Data Form. The recorded data was used to generate a percent grade versus speed table and a speed versus time curve. All the above are available in the following pages.

4-III. DISCUSSION

This test consisted of three runs from standstill to full throttle on the chassis dynamometer. Speed versus time data was obtained for each run and results are averaged to minimize test variability. The test was performed up to a maximum safe speed of 55.9 mph. The calculated gradeability results are attached. The average time to reach 30 mph was 14.3 seconds. The maximum gradeablity at 10 mph was 27.95% and at 40 mph was 4.35%. This bus passed this section of the test.

PERFORMANCE DATA FORM

Bus Number: 1911	Date: 11/26/19
Personnel: S.I. / J.S.	
Temperature (°F): 74.3	Humidity (%): 32
Barometric Pressure (in.Hg): 28.5	

		INITIALS:
Air Conditioning - OFF	✔Checked	J.S.
Heater pump motor - OFF	✔Checked	J.S.
Defroster - OFF	✔ Checked	J.S.
Exterior and interior lights - ON	✔ Checked	J.S.
Windows and doors - CLOSED	✔ Checked	J.S.

ACCELERATION, GRADEABILITY, TOP SPEED

Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.7	3.5	3.4
20 mph	7.2	7.2	7.4
30 mph	14.2	14.2	14.5
40 mph	23.0	22.9	23.3
50 mph	35.7	35.7	36.2

Maximum Speed (mph): 55.9 (maximum safe dynamometer speed reached)

PERFORMANCE SUMMARY SHEET

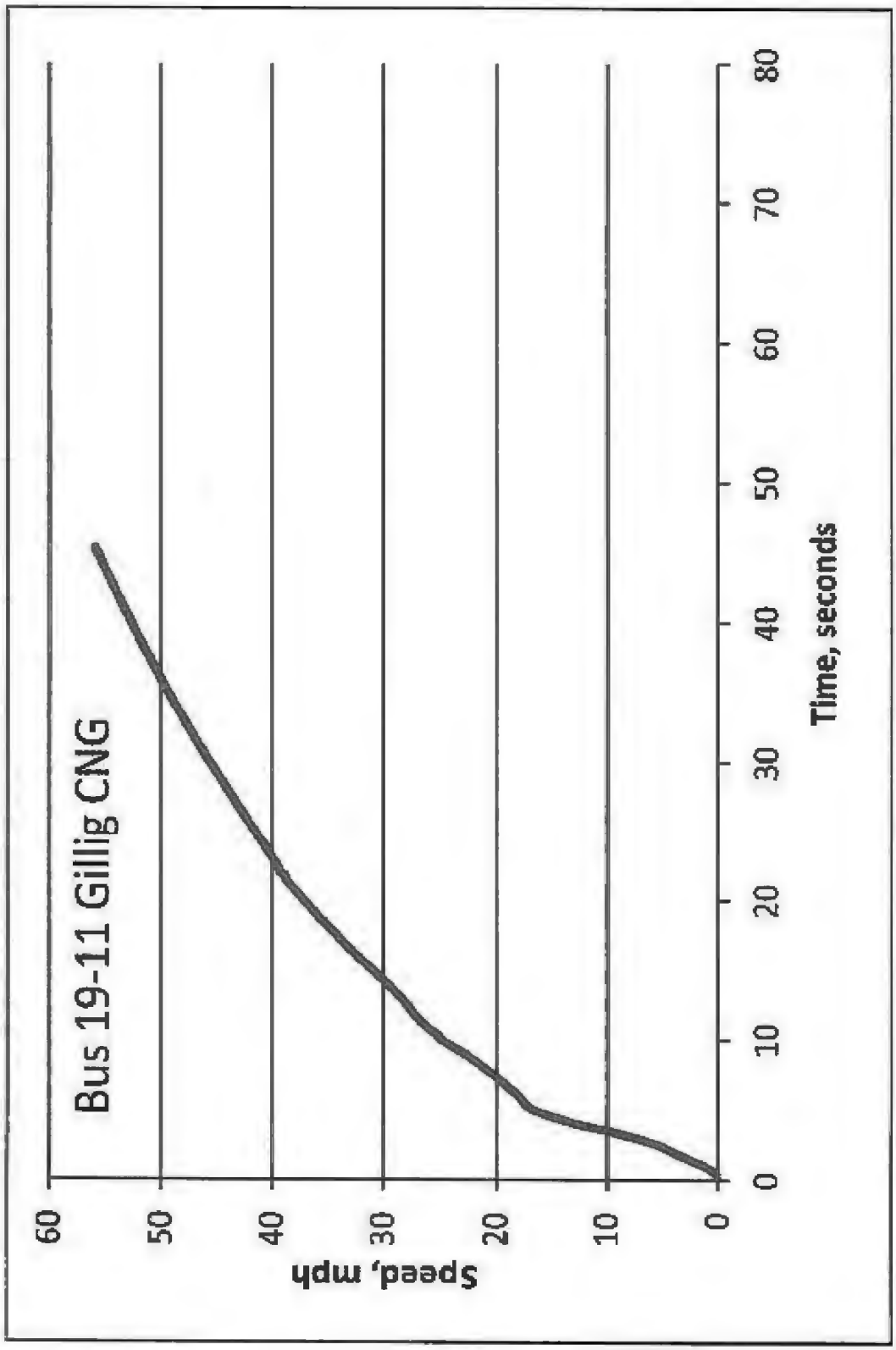
Bus Number: 1911	Date: 11/26/19
Personnel: S.I. & J.S.	

Test Conditions:

Temperature (°F): 74.3	Humidity (%): 32
Barometric Pressure (in.Hg): 28.5	

Test Results:

Vehicle Speed (MPH)	Time (SEC)	Acceleration (FT/SEC^2)	Max. Grade (%)
1.0	0.9	3.73	11.58
5.0	2.3	4.11	12.76
10.0	3.5	9.00	27.95
15.0	4.5	5.56	17.27
20.0	7.3	2.26	7.02
25.0	10.2	2.16	6.71
30.0	14.3	1.89	5.87
35.0	18.2	1.84	5.71
40.0	23.1	1.40	4.35
45.0	29.2	1.16	3.60
50.0	35.9	1.0	3.11
55.0	43.7	0.84	2.61
55.9	45.3	Maximum Speed	


Bus 19-11 Gillig CNG
Speed, mph
0
10
20
30
40
50
60
Time, seconds
0
10
20
30
40
50
60
70
80

5.2 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL DISTORTION

5.2-I. TEST OBJECTIVE

The objective of this test is to observe the operation of the bus subsystems when the bus is placed in a longitudinal twist simulating operation over a curb or through a pothole.

5.2-II. TEST DESCRIPTION

With the bus loaded to GVW, each wheel of the bus was raised (one at a time) to simulate operation over a curb and the following were inspected:

1. Body
2. Windows
3. Doors
4. Roof vents
5. Special seating
6. Undercarriage
7. Engine
8. Service doors
9. Escape hatches
10. Steering mechanism

Each wheel was then lowered (one at a time) to simulate operation through a pothole and the same items inspected.

5.2-III. DISCUSSION

The test sequence was repeated ten times. The first and last test is with all wheels level. The other eight tests are with each wheel 6 inches higher and 6 inches lower than the other three wheels.

All doors, windows, escape mechanisms, engine, steering and ADA accessible devices operated normally throughout the test. The undercarriage and body indicated no deficiencies. No water leakage was observed during the test. The results of this test are indicated on the following data forms. This bus passed this section of the test.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 1911	Date: 07/03/19
Personnel: E.D.,E.L.,P.D.,J.P.& T.G.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	■ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
Windows	No Deficiencies
Front Doors	No Deficiencies
Rear Doors	No Deficiencies
Escape Mechanisms/ Roof Vents	No Deficiencies
Engine	No Deficiencies
ADA Accessible/ Special Seating	No Deficiencies
Undercarriage	No Deficiencies
Service Doors	No Deficiencies
Body	No Deficiencies
Windows/ Body Leakage	No Deficiencies
Steering Mechanism	No Deficiencies

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 1911	Date: 07/03/19
Personnel: E.D.,E.L., P.D.,J.P. & T.G.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	■ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
Windows	No Deficiencies
Front Doors	No Deficiencies
Rear Doors	No Deficiencies
Escape Mechanisms/ Roof Vents	No Deficiencies
Engine	No Deficiencies
ADA Accessible/ Special Seating	No Deficiencies
Undercarriage	No Deficiencies
Service Doors	No Deficiencies
Body	No Deficiencies
Windows/ Body Leakage	No Deficiencies
Steering Mechanism	No Deficiencies

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 1911	Date: 07/03/19
Personnel: E.D.,E.L.,P.D., J.P. & T.G.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	■ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
Windows	No Deficiencies
Front Doors	No Deficiencies
Rear Doors	No Deficiencies
Escape Mechanisms/ Roof Vents	No Deficiencies
Engine	No Deficiencies
ADA Accessible/ Special Seating	No Deficiencies
Undercarriage	No Deficiencies
Service Doors	No Deficiencies
Body	No Deficiencies
Windows/ Body Leakage	No Deficiencies
Steering Mechanism	No Deficiencies

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 1911	Date: 07/03/19
Personnel: E.D.,E.L.,P.D., J.P. & T.G.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
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Windows/ Body Leakage	No Deficiencies
Steering Mechanism	No Deficiencies

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 1911	Date: 07/03/19
Personnel: E.D.,E.L.,P.D., J.P. & T.G.	Temperature(°F): 78

Wheel Position : (check one)		
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Front Doors	No Deficiencies
Rear Doors	No Deficiencies
Escape Mechanisms/ Roof Vents	No Deficiencies
Engine	No Deficiencies
ADA Accessible/ Special Seating	No Deficiencies
Undercarriage	No Deficiencies
Service Doors	No Deficiencies
Body	No Deficiencies
Windows/ Body Leakage	No Deficiencies
Steering Mechanism	No Deficiencies

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 1911	Date: 07/03/19
Personnel: E.D.,E.L.,P.D., J.P. & T.G.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	■ 6 in lower
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Undercarriage	No Deficiencies
Service Doors	No Deficiencies
Body	No Deficiencies
Windows/ Body Leakage	No Deficiencies
Steering Mechanism	No Deficiencies

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 1911	Date: 07/03/19
Personnel: E.D.,E.L.,P.D., J.P. & T.G.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
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Undercarriage	No Deficiencies
Service Doors	No Deficiencies
Body	No Deficiencies
Windows/ Body Leakage	No Deficiencies
Steering Mechanism	No Deficiencies

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 1911	Date: 07/03/19
Personnel: E.D.,E.L.,P.D., J.P. & T.G.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
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Right center	☐ 6 in higher	☐ 6 in lower
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	Comments
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Escape Mechanisms/ Roof Vents	No Deficiencies
Engine	No Deficiencies
ADA Accessible/ Special Seating	No Deficiencies
Undercarriage	No Deficiencies
Service Doors	No Deficiencies
Body	No Deficiencies
Windows/ Body Leakage	No Deficiencies
Steering Mechanism	No Deficiencies

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 1911	Date: 07/03/19
Personnel: E.D.,E.L.,P.D., J.P. & T.G.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
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Right center	☐ 6 in higher	☐ 6 in lower
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	Comments
Windows	No Deficiencies
Front Doors	No Deficiencies
Rear Doors	No Deficiencies
Escape Mechanisms/ Roof Vents	No Deficiencies
Engine	No Deficiencies
ADA Accessible/ Special Seating	No Deficiencies
Undercarriage	No Deficiencies
Service Doors	No Deficiencies
Body	No Deficiencies
Windows/ Body Leakage	No Deficiencies
Steering Mechanism	No Deficiencies

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 1911	Date: 07/03/19
Personnel: E.D.,E.L.,P.D., J.P. & T.G.	Temperature(°F): 78

Wheel Position : (check one)		
All wheels level	☐ before	■ after
Left front	☐ 6 in higher	☐ 6 in lower
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Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
Windows	No Deficiencies
Front Doors	No Deficiencies
Rear Doors	No Deficiencies
Escape Mechanisms/ Roof Vents	No Deficiencies
Engine	No Deficiencies
ADA Accessible/ Special Seating	No Deficiencies
Undercarriage	No Deficiencies
Service Doors	No Deficiencies
Body	No Deficiencies
Windows/ Body Leakage	No Deficiencies
Steering Mechanism	No Deficiencies

5.2 STRUCTURAL DISTORTION TEST

LEFT REAR WHEELS SIX INCHES LOWER

RIGHT REAR WHEELS SIX INCHES LOWER

5.3 STRUCTURAL STRENGTH AND DISTORTION TESTS - STATIC TOWING TEST

5.3-I. TEST OBJECTIVE

The objective of this test is to determine the characteristics of the bus towing mechanisms under static loading conditions.

5.3-II. TEST DESCRIPTION

Utilizing a load-distributing yoke, a hydraulic cylinder was used to apply a static tension load equal to 1.2 times the bus curb weight. The load was applied to both the front and rear, if applicable, towing fixtures at an angle of 20 degrees with the longitudinal axis of the bus, first to one side then the other in the horizontal plane, and then upward and downward in the vertical plane. Any permanent deformation or damage to the tow eyes or adjoining structure was recorded.

5.3-III. DISCUSSION

The test bus submitted for testing was not equipped with any type of tow eyes or tow hooks. Therefore, the static towing test was not performed. This bus is deemed to pass this section of the test, but no points were allotted for this section.

5.4 STRUCTURAL STRENGTH AND DISTORTION TESTS - DYNAMIC TOWING TEST

5.4-I. TEST OBJECTIVE

The objective of this test is to verify the integrity of the towing fixtures and determine the feasibility of towing the bus under manufacturer specified procedures.

5.4-II. TEST DESCRIPTION

This test required the bus to be towed at curb weight using the specified equipment and instructions provided by the manufacturer and a heavy-duty wrecker. The bus was towed for 5 miles at a speed of 20 mph for each recommended towing configuration. After releasing the bus from the wrecker, the bus was visually inspected for any structural damage or permanent deformation. All doors, windows and passenger escape mechanisms were inspected for proper operation.

5.4-III. DISCUSSION

The bus was towed using a heavy-duty wrecker. The towing interface was accomplished by incorporating a hydraulic under-lift. A front lift tow was performed. No problems, deformation, or damage was noted during testing. This bus passed this section of the test.

DYNAMIC TOWING TEST DATA FORM

Bus Number: 1911	Date: 10/03/19
Personnel: S.R.,E.D.&P.D.	

Temperature (°F): 56	
Wind Direction: NE	Wind Speed (mph): 5

Inspect tow equipment-bus interface.
Comments: An adequate connection between tow equipment and bus was made
Using a wheel lift.
Inspect tow equipment-wrecker interface.
Comments: An adequate connection between tow equipment and wrecker.

Towing Comments: Full tow test was done using a wheel lift.
Description and location of any structural damage: None noted
General Comments: None noted

5.4 DYNAMIC TOWING TEST

TOWING INTERFACE

TEST BUS IN TOW

5.5 STRUCTURAL STRENGTH AND DISTORTION TESTS – JACKING TEST

5.5-I. TEST OBJECTIVE

The objective of this test is to inspect for damage due to the deflated tire, and determine the feasibility of jacking the bus with a portable hydraulic jack to a height sufficient to replace a deflated tire.

5.5-II. TEST DESCRIPTION

With the bus at curb weight, the tire(s) at one corner of the bus were replaced with deflated tire(s) of the appropriate type. A portable hydraulic floor jack was then positioned in a manner and location specified by the manufacturer and used to raise the bus to a height sufficient to provide 3-in clearance between the floor and an inflated tire. The deflated tire(s) were replaced with the original tire(s) and the jack was lowered. Any structural damage or permanent deformation was recorded on the test data sheet. This procedure was repeated for each corner of the bus.

5.5-III. DISCUSSION

During the deflated portion of the test, the jacking point clearances ranged from 4.9 inches to 13.9 inches. No deformation or damage was observed during testing. A complete listing of jacking point clearances is provided in the Jacking Test Data Form. This bus passed this section of the test.

JACKING CLEARANCE SUMMARY

Condition	Frame Point Clearance
Front axle – one tire flat	10.1
Rear axle – one tire flat	13.4
Rear axle – two tires flat	9.9

JACKING TEST DATA FORM

Bus Number: 1911	Date: 07/02/19
Personnel: E.D.,S.R. & E.L.	Temperature (°F): 74

Record any permanent deformation or damage to bus as well as any difficulty encountered during jacking procedure.

I= Inflated D= Deflated

Deflated Tire	Jacking Pad Clearance Body/Frame (in)	Jacking Pad Clearance Axle/Suspension (in)	Comments
Right front	12.9 " I 10.1 " D	8.7 " I 6.0 " D	Body & Axle
Left front	12.1 " I 10.6 " D	8.6 " I 5.6 " D	Body & Axle
Right rear—outside	14.7 " I 13.9 " D	8.3 " I 7.6 " D	Body & Suspension
Right rear—both	14.7 " I 9.9 " D	8.3 " I 4.9 " D	Body & Suspension
Left rear—outside	14.4 " I 13.4 " D	8.1 " I 7.5 " D	Body & Suspension
Left rear—both	14.4 " I 10.9 " D	8.1 " I 5.5 " D	Body & Suspension
Right middle or tag—outside	N/A	N/A	N/A
Right middle or tag—both	N/A	N/A	N/A
Left middle or tag—outside	N/A	N/A	N/A
Left middle or tag—both	N/A	N/A	N/A

Additional comments of any deformation or difficulty during jacking:
None noted

5.5 JACKING TEST

JACK IN PLACE-FRONT

JACK IN PLACE-REAR

5.6 STRUCTURAL STRENGTH AND DISTORTION TESTS - HOISTING TEST

5.6-I. TEST OBJECTIVE

The objective of this test is to determine possible damage or deformation caused by the jack/stands.

5.6-II. TEST DESCRIPTION

With the bus at curb weight, the front end of the bus was raised to a height sufficient to allow manufacturer-specified placement of jack stands under the axles or jacking pads independent of the hoist system. The bus was checked for stability on the jack stands and for any damage to the jacking pads or bulkheads. The procedure was repeated for the tag/middle axles (if equipped), and rear end of the bus. The procedure was then repeated for the front, tag/middle (if equipped) axles, and rear simultaneously.

5.6-III. DISCUSSION

The test was conducted using four posts of a six-post electric lift and 19 inch jack stands. The bus was hoisted from the front wheels and then from the rear wheels, and then from the front and rear wheels simultaneously and placed on jack stands.

The bus accommodated the placement of the vehicle lifts and jack stands and the procedure was performed without any instability noted. This bus passed this section of the test.

HOISTING TEST DATA FORM

Bus Number: 1911	Date: 06/27/19
Personnel: S.R. & E.D.	Temperature (°F): 87

Comments of any structural damage to the jacking pads or axles while both the front wheels are supported by the jack stands:
None noted
Comments of any structural damage to the jacking pads or axles while both the rear wheels are supported by the jack stands:
None noted
Comments of any structural damage to the jacking pads or axles while both the tag axle wheels are supported by the jack stands:
N/A
Comments of any structural damage to the jacking pads or axles while the front, tag axle and rear wheels are supported by the jack stands:
None noted
Comments of any problems or interference placing wheel hoists under wheels:
None noted

5.6 HOISTING TEST

JACK STANDS IN PLACE-FRONT OF BUS

JACK STANDS IN PLACE-FRONT AND REAR OF BUS

5.7 STRUCTURAL DURABILITY TEST

5.7-I. TEST OBJECTIVE

The objective of this test is to perform an accelerated durability test that approximates 25 percent of the service life of the vehicle.

5.7-II. TEST DESCRIPTION

The test vehicle was driven a total of 15,000 miles; approximately 12,500 miles on the LTI Durability Test Track and approximately 2,500 miscellaneous other miles. The test was conducted with the bus operated under three different loading conditions. The first segment consisted of approximately 6,250 miles with the bus operated at GVW. The second segment consisted of approximately 2,500 miles with the bus operated at SLW. The remainder of the test, approximately 6,250 miles, was conducted with the bus loaded to CW. The loads on both axles and GVW were within their ratings with the bus loaded as specified by the manufacturer. All subsystems were running during these tests in their normal operating modes. All manufacturer-recommended servicing was followed and noted on the vehicle maintainability log. Servicing items accelerated by the durability tests were compressed by 10:1; all others were done on a 1:1 mi/mi basis. Unscheduled breakdowns and repairs were recorded on the same log as are any unusual occurrences as noted by the driver. Once a week the test vehicle was washed down and thoroughly inspected for any signs of failure.

5.7-III. DISCUSSION

The Structural Durability Test was started on July 3, 2019 and was conducted until December 2, 2019. The first 6,250 miles were performed at a GVW of 41,500 lb. and completed on September 13, 2019. The next 2,500-mile SLW segment was performed at 36,830 lb. and completed on September 30, 2019 and the final 6,250-mile segment was performed at a CW of 30,670 lb. and completed on December 2, 2019.

The following mileage summary presents the accumulation of miles during the Structural Durability Test. The driving schedule is included, showing the operating duty cycle. A detailed plan view of the LTI Test Track Facility and Durability Test Track are attached for reference. Also, a durability element profile detail shows all the measurements of the different conditions. Finally, photographs illustrating some of the failures that were encountered during the Structural Durability Test are included. This bus passed this section of the test, as there were no uncorrected Class 1 or Class 2 failures and the unscheduled maintenance of 9 hours was less than 125 hours.

Gillig, LLC Bus # 1911

MILEAGE DRIVEN/RECORDED FROM DRIVER'S LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
07/01/19 TO 07/07/19	61.00	53.00	114.00
07/08/19 TO 07/14/19	467.00	73.00	540.00
07/15/19 TO 07/21/19	325.00	104.00	429.00
07/22/19 TO 07/28/19	309.00	37.00	346.00
07/29/19 TO 08/04/19	416.00	61.00	477.00
08/05/19 TO 08/11/19	731.00	94.00	825.00
08/12/19 TO 08/18/19	567.00	93.00	660.00
08/19/19 TO 08/25/19	572.00	92.00	664.00
08/26/19 TO 09/01/19	719.00	94.00	813.00
09/02/19 TO 09/08/19	544.00	161.00	705.00
09/09/19 TO 09/15/19	655.00	110.00	765.00
09/16/19 TO 09/22/19	747.00	144.00	891.00
09/23/2019 TO 09/29/19	932.00	217.00	1149.00
09/30/19 TO 10/06/19	1008.00	154.00	1162.00
10/07/19 TO 10/13/19	528.00	112.00	640.00

Gillig, LLC Bus # 1911

MILEAGE DRIVEN/RECORDED FROM DRIVER'S LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
10/14/19 TO 10/20/19	1065.00	111.00	1176.00
10/21/19 TO 10/27/19	546.00	65.00	611.00
10/28/19 TO 11/03/19	683.00	49.00	732.00
11/04/19 TO 11/10/19	774.00	77.00	851.00
11/11/19 TO 11/17/19	851.00	523.00	1374.00
11/18/19 TO 11/24/19	0.00	0.00	0.00
11/25/19 TO 12/01/19	0.00	79.00	79.00
12/02/19 TO 12/08/19	0.00	48.00	48.00
TOTAL	12500.00	2551.00	15051.00

Driving Schedule for Bus Operation on the Durability Test Track.

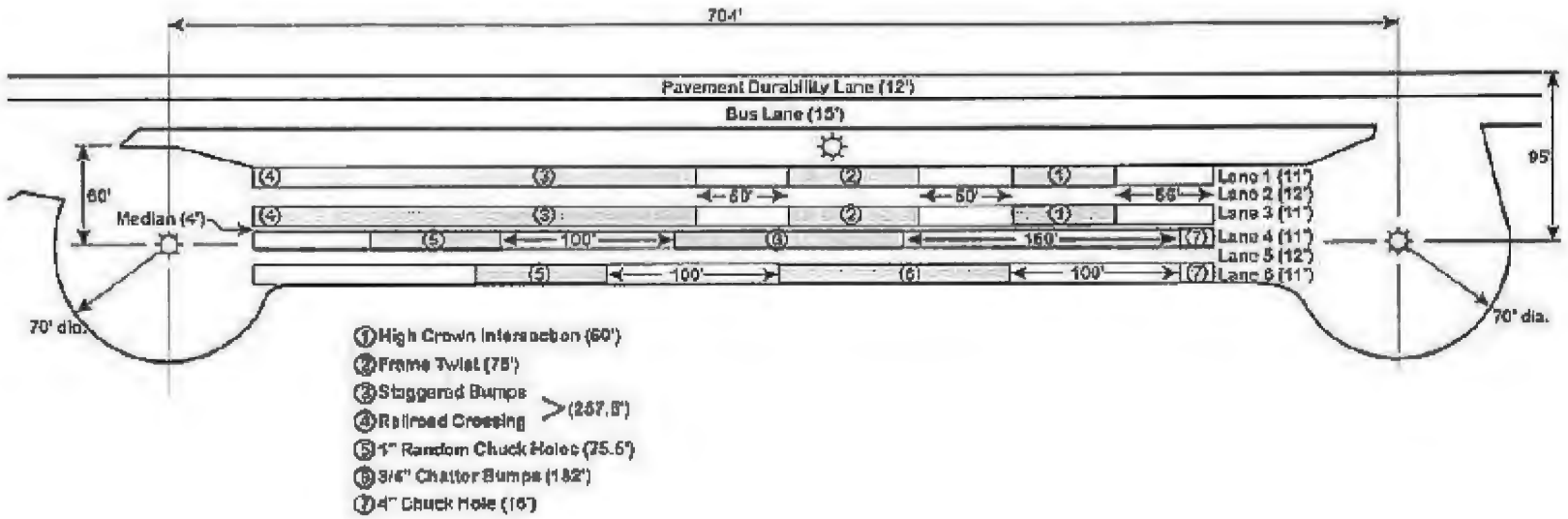
STANDARD OPERATING SCHEDULE

Monday through Friday

	HOUR	ACTION
Shift 1	midnight	D
	1:40 am	C
	1:50 am	B
	2:00 am	D
	3:35 am	C
	3:45 am	B
	4:05 am	D
	5:40 am	C
	5:50 am	B
	6:00 am	D
	7:40 am	C
	7:50 am	F
Shift 2	8:00 am	D
	9:40 am	C
	9:50 am	B
	10:00 am	D
	11:35 am	C
	11:45 am	B
	12:05 pm	D
	1:40 pm	C
	1:50 pm	B
	2:00 pm	D
	3:40 pm	C
	3:50 pm	F
Shift 3	4:00 pm	D
	5:40 pm	C
	5:50 pm	B
	6:00 pm	D
	7:40 pm	C
	7:50 pm	B
	8:05 pm	D
	9:40 pm	C
	9:50 pm	B
	10:00 pm	D
	11:40 pm	C
	11:50 pm	F

B—Break;
C—Cycle all systems five times, visual inspection, driver's log entries
D—Drive bus as specified by procedure
F—Fuel bus, complete driver's log shift entries


Brake Slope
Large Impact Pendulum
Crash Safety Research Facility
Modified Durability Course
1-Mile Oval
Vehicle Handling Area
Vehicle Durability Course
Vehicle Research and Testing Lab
Fueling
Office Building
Bridge Research Facility
Entrance Road
Full-Scale Research Facilities at
the Pennsylvania Transportation Institute



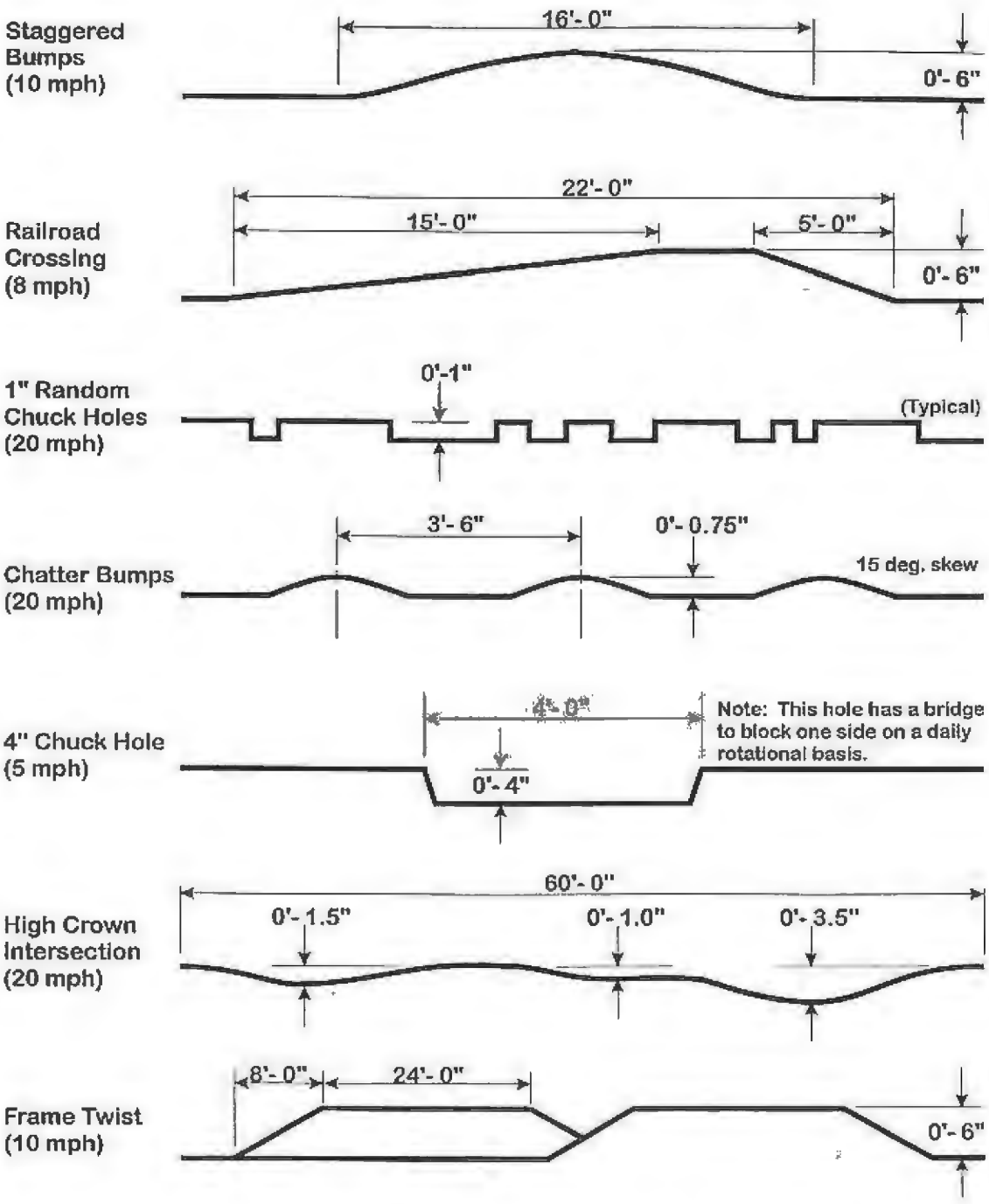
Plan View

Vehicle Durability Test Track

Track 1 (Track 2 has similar layout)

The Larson Transportation Institute

Penn State



Durability Element Profiles

The Pennsylvania Transportation Institute
Penn State

(Page 1 of 1)
UNSCHEDULED MAINTENANCE
Gillig, LLC Bus# 1911

DATE	TEST MILES	ISSUE	ACTION	LABOR HOURS	DOWN TIME
10/09/19	9,558	Air dryer bracket is cracked.	Removed and replaced air dryer bracket.	2.00	2.00
10/17/19	10,976	Driver's side front air bag is leaking.	Replaced driver's side front air bag.	4.00	4.00
10/21/19	11,491	Rubber is completely missing from front bump stops.	Found broken huck bolt on streetside rear suspension that bolts to main frame. New bump stops and 5/8" bolt were installed.	1.00	1.00
10/23/19	11,491	Front shocks are leaking and lower shock bushings are damaged.	Replaced both front shocks.	2.00	2.00

UNSCHEDULED MAINTENANCE

AIR DRYER BRACKET IS CRACKED
(9,558 TEST MILES)

DRIVER'S SIDE FRONT AIR BAG LEAKING
(10,976 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

BROKEN HUCK BOLT REPLACED
(11,491 TEST MILES)

FRONT SHOCK LEAKING
(11,491 TEST MILES)

6. FUEL ECONOMY TEST - A FUEL CONSUMPTION TEST USING AN APPROPRIATE OPERATING CYCLE

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable fuel consumption data on transit buses produced by different manufacturers. This fuel economy test bears no relation to the calculations done by the Environmental Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This fuel economy test, as designated here, is a measurement of the fuel expended by a vehicle traveling a specified test operating profile, under specified operating conditions that are typical of transit bus operation. The results of this test may not represent actual mileage in transit service, but will provide data that can be used by FTA Grantees to compare the efficiency of buses tested using this procedure.

6-II. TEST DESCRIPTION

This test was performed in the emissions bay of the LTI Vehicle Testing Laboratory. The Laboratory is equipped with a Schenk Pegasus 300 HP, large-roll (72 inch diameter) chassis dynamometer suitable for heavy-vehicle emissions testing. The driving cycles are the Manhattan cycle, a low average speed, highly transient urban cycle (Figure 1), the Orange County Bus Cycle, a medium average speed transient urban cycle (Figure 2), and the EPA HD-UDDS Cycle, which consists of urban and highway driving segments (Figure 3). A fuel economy test was comprised of two runs for the three different driving cycles, and the average value was reported.

For gaseous fuels, like compressed natural gas (CNG), liquefied natural gas (LNG), cryogenic fuels, and other fuels in the vapor state, a calibrated gaseous flowmeter will be used to determine the fuel consumption. The pressure and temperature across the flow element will be monitored by the flow computer. The flow computer will use this data to calculate the gas flow rate. The flow computer will also display the flow rate (scfm) as well as the total fuel used (scf). The total fuel used (scf) for each test will be recorded on the Fuel Economy Data Form.

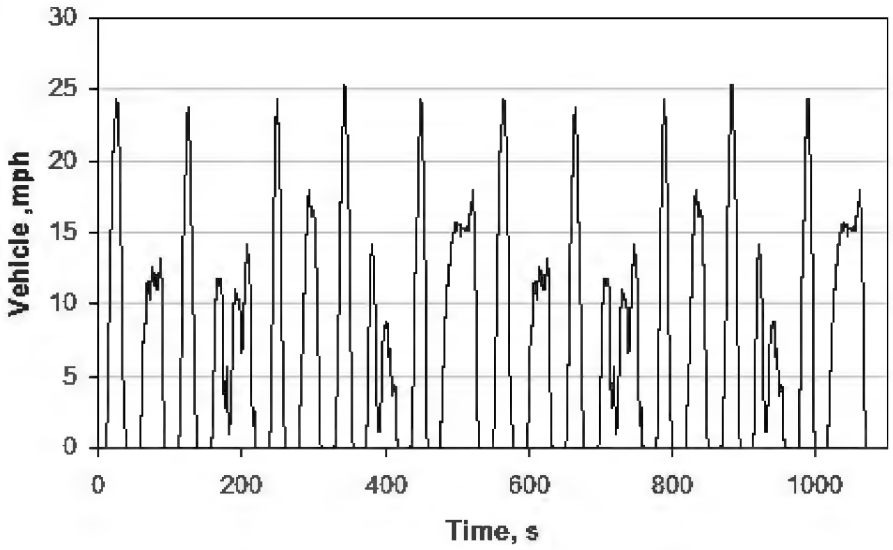


Figure 1. Manhattan Driving Cycle (duration 1089 sec, Maximum speed 25.4 mph, average speed 6.8 mph)

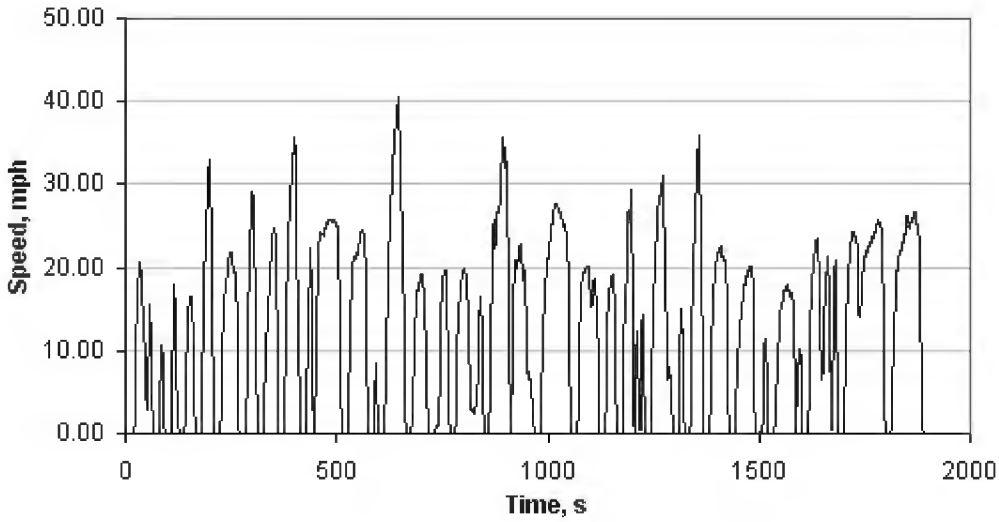


Figure 2. Orange County Bus Cycle (Duration 1909 Sec, Maximum Speed 41 mph, Average Speed 12 mph).

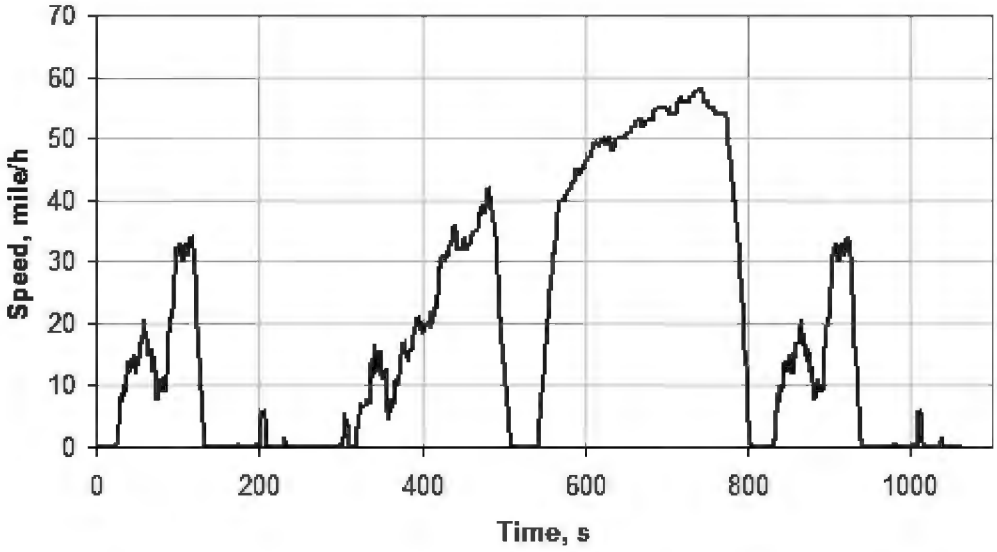


Figure 3. HD-UDDS Cycle (duration 1060 seconds, Maximum Speed 58 mph, Average Speed 18.86 mph).

6-III. DISCUSSION

The driving cycle consists of three simulated transit driving cycles: Manhattan, Orange County Bus Cycle and the HD-UDDS, as described in 6-II. The fuel consumption for each driving cycle and idle was measured.

An extensive pretest maintenance check was made including the replacement of all lubrication fluids. The details of the pretest maintenance are given in the first three Pretest Maintenance Forms. The fourth sheet shows the Pretest Inspection Form. Finally, the summary sheet provides the average fuel consumption for the three test cycles and for a 20 minute idle. **The average fuel consumption for the Manhattan, OCBC and the HD-UDDS were 53.9 mpg, 36.7 mpg and 27.1 mpg respectively. For idle, the fuel consumption was 110 scf/hr.**

FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 1911	Date: 11/19/19	SLW (lb.): 36,830
Personnel: T.S., E.D. & P.D.		

FUEL SYSTEM	OK
Install fuel measurement system	✓
Replace fuel filter	✓
Check for fuel leaks	✓
Specify fuel type (CNG)	✓
Remarks: None noted	
BRAKES/TIRES	OK
Inspect hoses	✓
Inspect brakes	✓
Check tire inflation pressures (mfg. specs.)	✓
Check tire wear (less than 50%)	✓
Remarks: None noted	
COOLING SYSTEM	OK
Check hoses and connections	✓
Check system for coolant leaks	✓
Remarks: None noted	

FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 1911	Date: 11/19/19
Personnel: T.S., E.D. & P.D.	

ELECTRICAL SYSTEMS	OK
Check battery	✓
Inspect wiring	✓
Inspect terminals	✓
Check lighting	✓
Remarks: None noted	

DRIVE SYSTEM	OK
Drain transmission fluid	N/A
Replace filter/gasket	N/A
Check hoses and connections	N/A
Replace transmission fluid	N/A
Check for fluid leaks	N/A
Remarks: Refer to manufacturer's maintenance manual for frequency of service.	

LUBRICATION	OK
Drain crankcase oil	✓
Replace filters	✓
Replace crankcase oil	✓
Check for oil leaks	✓
Check oil level	✓
Lube all chassis grease fittings	✓
Lube universal joints	✓
Replace differential lube including axles	N/A
Remarks: Refer to manufacturer's maintenance manual for service on differential.	

FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 1911	Date: 11/19/19
Personnel: T.S.,E.D.,P.D. & S.R.	

EXHAUST/EMISSION SYSTEM	OK
Check for exhaust leaks	✓
Remarks: None noted	
ENGINE	**OK**
Replace air filter	✓
Inspect air compressor and air system	✓
Inspect vacuum system, if applicable	N/A
Check and adjust all drive belts	✓
Check cold start assist, if applicable	N/A
Remarks: None noted	
STEERING SYSTEM	**OK**
Check power steering hoses and connectors	✓
Service fluid level	N/A
Check power steering operation	✓
Remarks: None noted	
	OK
Ballast bus to seated load weight	✓
TEST DRIVE	**OK**
Check brake operation	✓
Check transmission operation	✓
Remarks: None noted	

FUEL ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 1911	Date: 11/20/19
Personnel: T.S.	

PRE WARM-UP	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	T.S.
Cold tire pressure (psi): Front 110 Middle N/A Rear 110	T.S.
Engine oil level	T.S.
Engine coolant level	T.S.
Interior and exterior lights on, evaporator fan on	T.S.
Fuel economy instrumentation installed and working properly.	T.S.
Fuel line -- no leaks or kinks	T.S.
Bus is loaded to SLW during coast down	T.S.
WARM-UP	**If OK, Initial**
Bus driven for at least one hour warm-up	J.S.

FUEL ECONOMY DATA FORM
(Gaseous and Liquid fuels)

Bus Number: 1911	Manufacturer: Gillig	Date: 11/26/19
Fuel Type: CNG	Personnel: S.I. & J.S.	
Temperature (°F): 74.3	Humidity (%): 32	Barometric Pressure (in.Hg): 28.5
SLW (lb.):36,830		

Cycle	Manhattan	Orange County	HD-UDDS	Idle
Fuel Consumption scf/mile	53.9	36.7	27.1	110 scf/hr

Comments: Maximum speed limited to 55.9 mph. The bus could not keep up with thie speed
trace where it exceeded 55 mph during the UDDS test cycle.

7. NOISE

7.1 INTERIOR NOISE AND VIBRATION TESTS

7.1-I. TEST OBJECTIVE

The objective of these tests is to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level was measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system provided a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories were switched off and all openings including doors and windows were closed. This test was performed at the LTI Test Track Facility.

2. The bus was accelerated at full throttle from a standing start to 35 mph on a level pavement. All openings were closed and all accessories were operating during the test. This test was performed on the track at the LTI Test Track Facility.

3. The bus was operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles were noted. This test was performed on the test segment between the LTI Test Track and the Bus Testing Center.

All tests were performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions were recorded in the test data.

7.1-III. DISCUSSION

For the first part, the overall average of the six measurements was 46.3 dB(A); ranging from 44.7 dB(A) at the rear passenger seats to 47.7 dB(A) at the driver's seat. The interior ambient noise level for this test was less than 30 dB(A).

For the second part, the interior noise level ranged from 75.7 dB(A) at the front passenger seats to 77.5 dB(A) at the rear passenger seats. The overall average was 76.8 dB(A). The interior ambient noise level for this test was less than 30 dB(A).

No vibrations or rattles were noted during the third part of this test. This bus passed this section of the test.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise

Bus Number: 1911	Date: 10/01/19
Personnel: E.D.,S.R. & P.D.	
Temperature (°F): 68	Humidity (%): 94
Wind Speed (mph): 6	Wind Direction: SW
Barometric Pressure (in.Hg): 30.12	
Interior Ambient Noise Level dB(A): Less than 30	Exterior Ambient Noise Level dB(A): 39.2
Microphone Height During Testing (in): 45 ½	

Reading Location	Measured Sound Level dB(A)
Driver's Seat	47.7
Front Passenger Seats	46.1
In Line with Front Speaker	46.9
In Line with Middle Speaker	46.9
In Line with Rear Speaker	45.7
Rear Passenger Seats	44.7

Comments: None noted

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test

Bus Number: 1911	Date: 09/17/19
Personnel: T.S.,E.D.,S.R. & S.B.	
Temperature (°F): 65	Humidity (%): 62
Wind Speed (mph): 3	Wind Direction: NE
Barometric Pressure (in.Hg): 30.17	
Interior Ambient Noise Level dB(A): Less than 30	Exterior Ambient Noise Level dB(A): 42.4
Microphone Height During Testing (in): 45 ½	

Reading Location	Measured Sound Level dB(A)
Driver's Seat	77.4
Front Passenger Seats	75.7
Middle Passenger Seats	76.7
Rear Passenger Seats	77.5

Comments: None noted

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test

Bus Number: 1911	Date: 09/17/19
Personnel: T.S.,S.R.,E.D. & S.B.	
Temperature (°F): 78	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location	Description of Noise
Engine and Accessories	None noted	None noted
Windows and Doors	None noted	None noted
Seats and Wheel Chair lifts	None noted	None noted
Other	None noted	None noted

Comment on any other vibration or noise source which may have occurred
that is not described above: None noted
Comments: None noted

7.1 INTERIOR NOISE TEST

TEST BUS SET-UP FOR 80 dB(A)
INTERIOR NOISE TEST

7.2 EXTERIOR NOISE TESTS

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus was operated at a SLW in three different conditions using a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed starting from 35 mph.

2. Accelerating at full throttle from standstill.

3. Stationary, with the engine at low idle, high idle, and wide open throttle, where applicable. In addition, the bus was tested with and without the air conditioning operating.

The test site is at the Larson Transportation Institute Test Track and the test procedures were performed in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The test site is an open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus was used to measure the noise level.

During the test, special attention was paid to:

1. The test site characteristics regarding parked vehicles, signboards, buildings, or other sound-reflecting surfaces
2. Proper usage of all test equipment including set-up and calibration
3. The ambient sound level

7.2-III. DISCUSSION

The Exterior Noise Test determines the noise level generated by the vehicle under different driving conditions and at stationary low and high idle, with and without air conditioning and accessories operating. The test site is a large, level, bituminous paved area with no reflecting surfaces nearby.

With an outside ambient noise level of 44.3 dB(A), the average of the two highest readings obtained while accelerating from a constant speed was 71.3 dB(A) on the right side and 72.8 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 45.7 dB(A), the average of the two highest readings obtained were 74.2 dB(A) on the right side and 74.1 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 59.3 dB(A) at low idle, 62.7 dB(A) at high idle and 71.6 dB(A) at wide open throttle. With the accessories and air conditioning off, the readings averaged 56.3 dB(A) at low idle, 61.6 dB(A) at high idle and 71.3 dB(A) at wide open throttle. The exterior ambient noise level measured during this test was 41.7 dB(A). This bus passed this section of the test.

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 1911	Date: 09/16/19
Personnel: T.S., E.D. & S.B.	
Temperature (°F): 74	Humidity (%): 72
Wind Speed (mph): 0	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.04	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■	
Initial Sound Level Meter Calibration: 94.0 dB(A)	
Exterior Ambient Noise Level: 44.3 dB(A)	

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	71.3	1	71.9
2	70.3	2	73.0
3	70.8	3	72.4
4	71.0	4	72.6
5	71.3	5	71.9
6	N/A	6	N/A
7	N/A	7	N/A
8	N/A	8	N/A
9	N/A	9	N/A
10	N/A	10	N/A
Average of two highest actual noise levels = 71.3 dB(A)		Average of two highest actual noise levels = 72.8 dB(A)	

Final Sound Level Meter Calibration Check: 94.0 dB(A)
Comments: None noted

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 1911	Date: 09/16/19
Personnel: T.S.,E.D. & S.B.	
Temperature (°F): 74	Humidity (%): 70
Wind Speed (mph): 0	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.04	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■	
Initial Sound Level Meter Calibration: 93.9 dB(A)	
Exterior Ambient Noise Level: 45.7 dB(A)	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	74.2	1	73.9
2	74.1	2	74.1
3	74.2	3	73.7
4	74.0	4	73.9
5	74.2	5	74.1
6	N/A	6	N/A
7	N/A	7	N/A
8	N/A	8	N/A
9	N/A	9	N/A
10	N/A	10	N/A
Average of two highest actual noise levels = 74.2 dB(A)		Average of two highest actual noise levels = 74.1 dB(A)	

Final Sound Level Meter Calibration Check: 93.9 dB(A)
Comments: None noted

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 1911	Date: 09/16/19
Personnel: T.S.,E.D. & S.B.	
Temperature (°F): 75	Humidity (%): 67
Wind Speed (mph): 0	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.04	
Initial Sound Level Meter Calibration: 93.9 dB(A)	
Exterior Ambient Noise Level: 41.7 dB(A)	

Air Conditioning ON

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	701	60.4	58.1
High Idle	1002	62.5	62.9
Wide Open Throttle	1808	72.2	71.0

Air Conditioning OFF

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	703	56.2	56.4
High Idle	1001	61.5	61.7
Wide Open Throttle	1819	71.3	71.3

Final Sound Level Meter Calibration Check: 93.9 dB(A)

Comments: None noted

7.2 EXTERIOR NOISE TESTS

TEST BUS UNDERGOING EXTERIOR NOISE TESTING

8.0 EMISSIONS TEST – DYNAMOMETER-BASED EMISSIONS TEST USING TRANSIT DRIVING CYCLES

8-I. TEST OBJECTIVE

The objective of this test is to provide comparable emissions data on transit buses produced by different manufacturers. This chassis-based emissions test bears no relation to engine certification testing performed for compliance with the Environmental Protection Agency (EPA) regulation. EPA's certification tests are performed on an engine by itself on a dynamometer operating under the Federal Test Protocol.

The Bus Testing Center emissions test is a measurement of the gaseous engine emissions CO, CO2, NOx, HC and particulates (diesel vehicles) produced by a complete vehicle operating on a large-roll chassis dynamometer. The test is performed for three differed driving cycles intended to simulate a range of transit operating environments. The test is performed under laboratory conditions in compliance with EPA 1065 and SAE J2711. The results of this test may not represent actual in-service vehicle emissions but will provide data that can be used by recipients to compare the emissions of buses tested under a range of consistent operating conditions.

8-II. TEST DESCRIPTION

This test was performed in the emissions bay of the LTI Vehicle Testing Laboratory. The Laboratory is equipped with a Schenk Pegasus 300 HP, large-roll (72 inch diameter) chassis dynamometer suitable for heavy-vehicle emissions testing. The emissions laboratory provides capability for testing heavy-duty diesel, gasoline, and alternative-fueled buses for a variety of tailpipe emissions including particulate matter, oxides of nitrogen, carbon monoxide, carbon dioxide, and hydrocarbons. It is equipped with a Horiba full-scale dilution tunnel and a constant volume sampling (CVS) emissions measurement system. The system includes Horiba Mexa 7400 Series gas analyzers and a Horiba HF47 Particulate Sampling System. Test operation is automated using Horiba CDTCS software. The computer controlled dynamometer is capable of simulating over-the-road operation for a variety of vehicles and driving cycles.

The emissions test was performed as soon as practical after the completion of the GVW portion of the structural durability test. The driving cycles are the Manhattan cycle, a low average speed, highly transient urban cycle (Figure 1), the Orange County Bus Cycle, a medium average speed transient urban cycle (Figure 2), and the EPA HD-UDDS Cycle, which consists of urban and highway driving segments (Figure 3). An emissions test was comprised of two runs for each of the three different driving cycles, and the average values were reported.

Test results reported include the average grams per mile value for each of the gaseous emissions of carbon dioxide, carbon monoxide, oxides of nitrogen, total hydrocarbons and non-methane hydrocarbons. In addition, emissions of particulate matter will also be reported for diesel fuel buses. Testing is performed in accordance with EPA CFR49, Part 1065 and SAE J2711 as practically determined by the FTA Emissions Testing Protocol developed by West Virginia University and Penn State University.

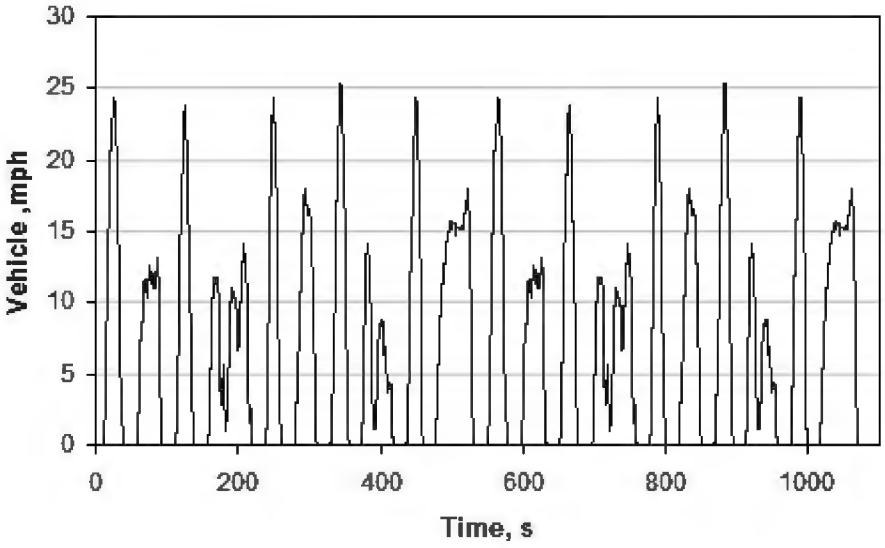


***Figure 8.1**. Manhattan Driving Cycle (Duration 1089 sec, Maximum Speed 25.4 mph, Average Speed 6.8 mph)*

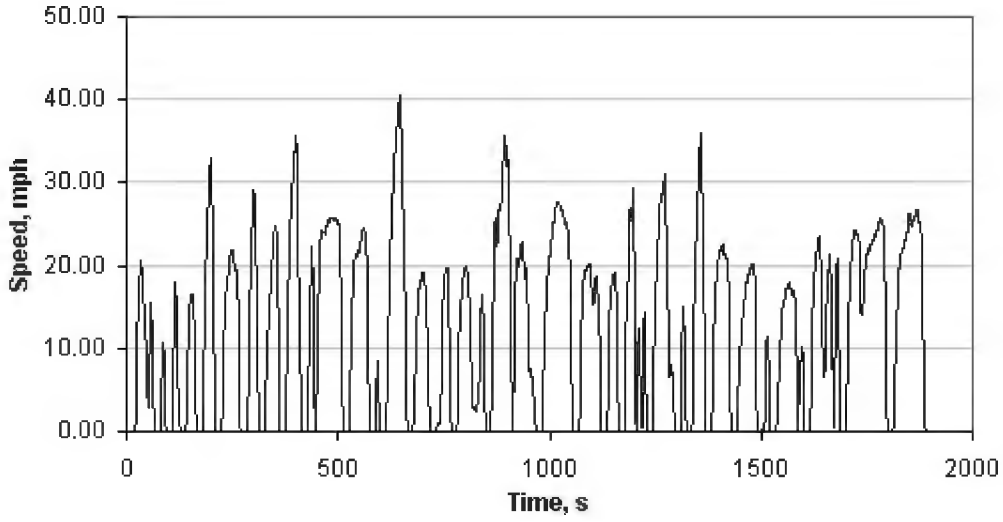


***Figure 8.2**. Orange County Bus Cycle (Duration 1909 Sec, Maximum Speed 41 mph, Average Speed 12 mph)*

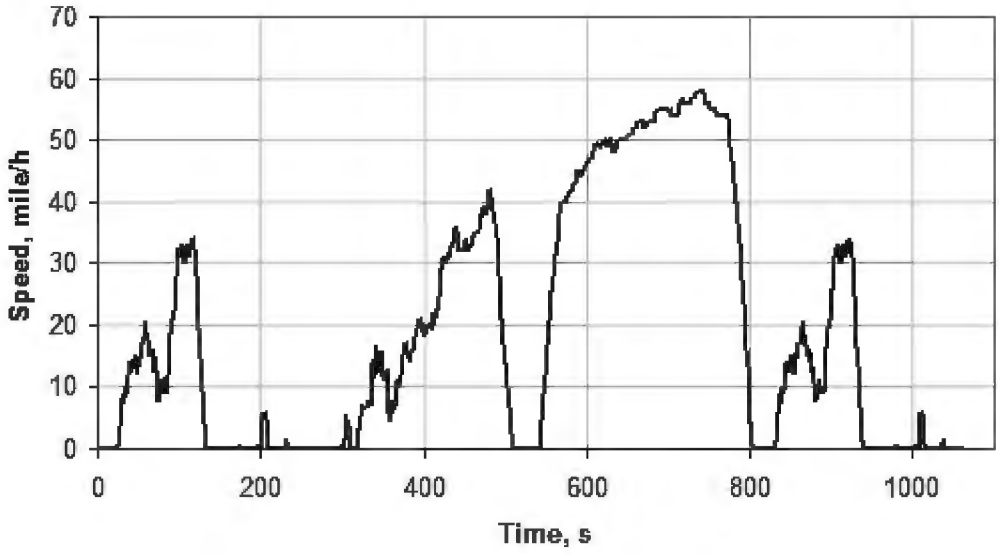


***Figure 8.3**. HD-UDDS Cycle (Duration 1060 seconds, Maximum Speed 58 mph, Average Speed 18.86 mph)*

8-III. TEST ARTICLE

The test article is a Gillig, LLC , 40 Foot Low Floor L9N model transit bus equipped with a CNG fueled Cummins / L9N 280 motor. The bus was tested on November 26, 2019 with the odometer reading 18,162 miles.

8-IV. TEST EQUIPMENT

Testing was performed in the LTI Vehicle Testing Laboratory emissions testing bay. The test bay is equipped with a Schenk Pegasus 72-inch, large-roll chassis dynamometer. The dynamometer is electronically controlled to account for vehicle road-load characteristics and for simulating the inertia characteristics of the vehicle. Power to the roller is supplied and absorbed through an electronically controlled 3-phase ac motor. Absorbed power is returned to the electrical grid.

Vehicle exhaust is collected by a Horiba CVS, full-flow dilution tunnel. The system has separate tunnels for diesel and gasoline/natural gas fueled vehicles. In the case of diesel vehicles, particulate emissions are measured gravimetrically using 47mm Teflon filters. These filters are housed in a Horiba HF47 particulate sampler, per EPA 1065 test procedures. Heated gaseous emissions of hydrocarbons and NOx are sampled by Horiba heated oven analyzers.

Gaseous emissions for CO, CO2 and cold NOx are measured using a Horiba Mexa 7400 series gas analyzer. System operation, including the operation of the chassis dynamometer, and all calculations are controlled by a Dell workstation running Horiba CDCTS test control software. Particulate Filters are weighed in a glove box using a Sartorius microbalance accurate to 1 microgram.

8-V. TEST PREPARATION AND PROCEDURES

The test bus was prepared for emissions testing in accordance with the Fuel Economy Pre-Test Maintenance Form. (In the event that fuel economy test was performed immediately prior to emissions testing this step does not have to be repeated) This is done to ensure that the bus is tested in optimum operating condition. The manufacturer-specified preventive maintenance shall be performed before this test. The ABS system is disabled for operation on the chassis dynamometer. Any manufacturer-recommended changes to the pre-test maintenance procedure must be noted on the revision sheet. The Fuel Economy Pre-Test Inspection Form will also be completed before performing the Emissions test. Both the Fuel Economy Pre-Test Maintenance Form and the Fuel Economy Pre-Test Inspection Form are found in section 6, Fuel Economy Test.

Prior to performing the emissions test, each bus is evaluated to determine its road-load characteristics using coast-down techniques in accordance with SAE J1263. This data is used to program the chassis dynamometer to accurately simulate over-the-road operation of the bus.

Warm-up consisted of driving the bus for 20 minutes at approximately 40 mph on the chassis dynamometer. During emissions testing, the test driver followed the prescribed driving cycle by watching the speed trace and instructions on the Horiba Drivers-Aid monitor which is placed in front of the windshield. The CDCTS computer monitored the test and collected data for calculation of emissions at the end of the test.

This bus was tested for emissions at seated load weight. The emissions data was obtained at the following conditions:

1. Air conditioning off
2. Heater off
3. Defroster off
4. Exterior and interior lights on
5. Windows and Doors closed
6. Seated load weight

The test tanks or the bus fuel tank(s) were filled prior to the fuel economy test with the CNG fuel.

8-VI DISCUSSION

Table 8.1 provides the emissions testing results on a grams per mile basis for each of the exhaust constituents measured and for each driving cycle performed.

TABLE 8.1 Emissions Test Results

Test Completed at SLW: 36,830 lb.			
Driving Cycle	**Manhattan**	**Orange County Bus**	**UDDS**
CO_2, gm/mi	2864	1975	1473
CO, gm/mi	5.8	3.6	2.6
THC, gm/mi	0.23	0.25	0.23
NMHC, gm/mi	0.02	0.02	0.01
NO_x, gm/mi	0.02	0.01	0.05

8. EMISSIONS TEST

BUS TESTED ON CHASSIS DYNAMOMETER FOR EMISSIONS AND FUEL ECONOMY

STURAA TEST

12 YEAR

500,000 MILE BUS

from

GILLIG CORPORATION

MODEL 29' LOW FLOOR

JUNE 2000

PTI-BT-R9922-06-00

PENNSTATE

1855

The Pennsylvania Transportation Institute

201 Research Office Building (814) 865-1891
The Pennsylvania State University
University Park, PA 16802

Bus Testing and Research Center

6th Avenue and 45th Street (814) 949-7944
Altoona, PA 16602

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EXECUTIVE SUMMARY

The Gillig Corporation submitted a model 29' Low Floor, diesel powered 28 seat/30-foot bus, for a 12 year/500,000 mile STURAA test. The odometer reading at the time of delivery was 32,867 miles. Testing started on November 1, 1999, and was completed on June 5, 2000. The Check-In section of the report provides a description of the bus and specifies its major components.

The primary part of the test program is the Structural Durability Test, which also provides the information for the Maintainability and Reliability results. The Structural Durability Test started on November 10, 1999 and was completed on May 10, 2000. The interior of the bus is configured with seating for 28 passengers including the driver. Additionally, free floor space will accommodate 12 standing passengers resulting in a potential load of 40 persons. At 150 lbs per person, this load results in a gross vehicle weight of 27,360 lbs. The SLW segment was performed at 25,590 lbs and the final segment of the test was performed at a CW of 21,460 lbs. Durability driving resulted in several failures that required unscheduled maintenance. A description of failures, and a complete and detailed listing of scheduled and unscheduled maintenance, is provided in the Maintainability section of this report.

The components covered in Section 1.3 (Repair and/or Replacement of Selected Subsystems) along with all other components encountered during testing were found to be readily accessible and no restrictions were noted.

The Reliability Section compiles failures that occurred during structural durability testing. Breakdowns are classified according to subsystems. The data in this section are arranged so that those subsystems with more frequent problems are apparent. The failures are also listed by class as defined in Section 2. The test bus encountered no Class 1 or Class 2 failures. Of the twenty-two reported failures, twenty were Class 3 and two were Class 4.

The Safety Test, a double-lane change maneuver was safely performed in both right-hand and left-hand directions up to a maximum test speed of 45 mph. The performance of the bus is illustrated by a speed vs. time plot. Acceleration and gradeability test data are provided in Section 4, Performance. The average time to obtain 50 mph was 26.06 seconds.

The Shakedown Test produced a maximum final loaded deflection of 0.120 inches under a distributed static load of 15,000 lbs. The test resulted in essentially no permanent deformation of the structure. The Distortion Test was completed with all subsystems, doors and escape mechanism operating properly. Water leakage observed during the test at both lower corners of the windshield. The Static Towing Test was performed using a target load (towing force) of 25,752 lbs. All four pulls were completed to the full target load with no damage or deformation observed. The Dynamic Towing Test was performed by means of a front lift tow. The towing interface was accomplished by chaining to the front axle using a 4x4 wooden beam at the cross member for protection. The bus was towed without incident and no damage resulted from the test. The manufacturer does not

recommend towing the bus from the rear, therefore a rear test was not performed. The Jacking and Hoisting Tests were performed without incident. The bus was found to be stable on the jack stands and the minimum jacking clearance, measured with a tire deflated, was 5.6 inches.

A Fuel Economy Test was run on simulated central business district, arterial, and commuter courses. The results were 3.18 mpg, 3.93 mpg, and 7.86 mpg respectively; with an overall average of 4.10 mpg.

A series of Interior and Exterior Noise Tests was performed. This data is listed in Section 7.1 and 7.2 respectively.

ABBREVIATIONS

ABTC	-	Altoona Bus Test Center
A/C	-	air conditioner
ADB	-	advance design bus
ATA-MC	-	The Maintenance Council of the American Trucking Association
CBD	-	central business district
CW	-	curb weight (bus weight including maximum fuel, oil, and coolant; but without passengers or driver)
dB(A)	-	decibels with reference to 0.0002 microbar as measured on the "A" scale
DIR	-	test director
DR	-	bus driver
EPA	-	Environmental Protection Agency
FFS	-	free floor space (floor area available to standees, excluding ingress/egress areas, area under seats, area occupied by feet of seated passengers, and the vestibule area)
GVL	-	gross vehicle load (150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space)
GVW	-	gross vehicle weight (curb weight plus gross vehicle load)
GVWR	-	gross vehicle weight rating
MECH	-	bus mechanic
mpg	-	miles per gallon
mph	-	miles per hour
PM	-	Preventive maintenance
PTI	-	Pennsylvania Transportation Institute
rpm	-	revolutions per minute
SAE	-	Society of Automotive Engineers
SCH	-	test scheduler
SEC	-	secretary
SLW	-	seated load weight (curb weight plus 150 lb for every designed passenger seating position and for the driver)
STURAA	-	Surface Transportation and Uniform Relocation Assistance Act
TD	-	test driver
TECH	-	test technician
TM	-	track manager
TP	-	test personnel

TEST BUS CHECK-IN

I. OBJECTIVE

The objective of this task is to log in the NBM, assign a NBM number, complete the vehicle data form, and perform a safety check.

II. TEST DESCRIPTION

The test consists of assigning a NBM test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer must certify that the bus meets all Federal regulations.

III. DISCUSSION

The check-in procedure is used to identify in detail the major components and configuration of the bus.

The test bus has a front door equipped with a Ricon fold over handicap ramp located forward of the front axle and a rear door located forward of the rear axle. The engine type is a diesel fueled DDC S40 267 hp. The transmission is an Allison B300.

The measured curb weight is 6,530 lb for the front axle and 14,930 lb for the rear axle. These combined weights provide a total measured curb weight of 21,460 lb. There are 28 seats including the driver and room for 12 standing passengers bringing the total passenger capacity to 40. Gross load is 150 lb x 40 = 6,000 lb. At full capacity, the measured gross vehicle weight is 27,360 lb. This value was used for all static tests.

VEHICLE DATA FORM

Bus Number: 9922	Arrival Date: 11-1-99
Bus Manufacturer: Gillig Corp.	Vehicle Identification Number (VIN): 15GGE2210XL090250
Model Number: 29" Low Floor	Date: 11-1-99
Personnel: B.L. & S.C.	

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	3,420	3,110	N/A	N/A	7,240	7,690
SLW	4,060	3,800	N/A	N/A	8,600	9,130
GVW	4,440	4,210	N/A	N/A	9,060	9,650

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	6,530	7,860	8,650	13,220
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	14,930	17,730	18,710	21,000
Total	21,460	25,590	27,360	GVWR: 34,220

Dimensions:

Length (ft/in)	30 / 8.75
Width (in)	102.00
Height (in)	117.00
Front Overhang (in)	89.00
Rear Overhang (in)	117.25
Wheel Base (in)	162.50
Wheel Track (in)	Front: 86.00
	Rear: 79.00

Bus Number: 9922	Date: 11-1-99

CLEARANCES:

Lowest Point Outside Front Axle	Location: W/C frame	Clearance(in): 10.2
Lowest Point Outside Rear Axle	Location: Transmission	Clearance(in): 10.5
Lowest Point between Axles	Location: frame	Clearance(in): 12.5
Ground Clearance at the center (in)	12.5	
Front Approach Angle (deg)	8.6	
Rear Approach Angle (deg)	8.2	
Ramp Clearance Angle (deg)	9.2	
Aisle Width (in)	Front: 35.5 Center: 39.3 Rear: 41.1	
Inside Standing Height at Center Aisle (ft)	Front: 94.5 Rear: 77.4	

BODY DETAILS:

Body Structural Type	Semi-monocoque		
Frame Material	Steel		
Body Material	Aluminum / Fiberglass		
Floor Material	Plywood		
Roof Material	Aluminum with fiberglass skin.		
Windows Type	☒ Fixed	☐ Movable	
Window Mfg./Model No.	Excel / with Guardian glazing / AS-3 66-M972 DOT-22		
Number of Doors	1 Front	1 Rear	
Mfr. / Model No.	Front - Vapor / Slide Glide Rear - Vapor / plug door		
Dimension of Each Door (in)	Front- 32.0 x 74.6	Rear- 23.5 x 77.6	
Passenger Seat Type	☐ Cantilever	☒ Pedestal	☐ Other
Mfr. / Model No.	American Seating / 6468		
Driver Seat Type	☒ Air	☐ Spring	☐ Other (explain)
Mfr. / Model No.	USSC Group Inc. / 9110-100002-066		
Number of Seats (including Driver)	28 + 2 wheelchair positions		

Bus Number: 9922	Date: 11-1-99

BODY DETAILS (Contd..)

Free Floor Space (ft^2)	18.1			
Height of Each Step at Normal Position (in)	Front	1. 15.0	2. N/A	3. N/A 4. N/A
	Middle	1. N/A	2. N/A	3. N/A 4. N/A
	Rear	1. 15.0	2. N/A	3. N/A 4. N/A
Step Elevation Change - Kneeling (in)	3.0			

ENGINE

Type	☒ C.I.	☐ Alternate Fuel	
	☐ S.I.	☐ Other (explain)	
Mfr. / Model No.	DDC / S40 267 hp		
Location	☐ Front	☒ Rear	☐ Other (explain)
Fuel Type	☐ Gasoline	☐ CNG	☐ Methanol
	☒ Diesel	☐ LNG	☐ Other (explain)
Fuel Tank Capacity (indicate units)	75 Gals.		
Fuel Induction Type	☒ Injected	☐ Carburetion	
Fuel Injector Mfr. / Model No.	DDC / S40 267 hp		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	DDC / S40 267 hp		
Alternator (Generator) Mfr. / Model No.	Delco-Remy / 1117863		
Maximum Rated Output (Volts / Amps)	24 / 270		
Air Compressor Mfr. / Model No.	Bendix / 5003834		
Maximum Capacity (ft^3 / min)	16.5 CFM @ 1250 rpm		
Starter Type	☒ Electrical	☐ Pneumatic	☐ Other (explain)
Starter Mfr. / Model No.	Delco_Remy / 10479213		

Bus Number: 9922	Date: 11-1-99

TRANSMISSION

Transmission Type	☐ Manual	☒ Automatic	
Mfr. / Model No.	Allison / B300		
Control Type	☐ Mechanical	☒ Electrical	☐ Other (explain)
Torque Convertor Mfr. / Model No.	Allison / B300		
Integral Retarder Mfr. / Model No.	Allison / B300		

SUSPENSION

Number of Axles	2		
Front Axle Type	☐ Independent	☒ Beam Axle	
Mfr. / Model No.	Dana / S46LF		
Axle Ratio (if driven)	N/A		
Suspension Type	☒ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 4298		
Middle Axle Type	☐ Independent	☐ Beam Axle	
Mfr. / Model No.	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	☐ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	☐ Independent	☒ Beam Axle	
Mfr. / Model No.	Rockwell / RS21145NFLF607		
Axle Ratio (if driven)	5:13		
Suspension Type	☒ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 88 1457 SPI		

Bus Number: 9922	Date: 11-1-99

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Alcoa 22.5 x 8.25 / 7,300 lb x 120PSI
	Tire Mfr./ Model No.	Michelin X / 275/70R22.5
Rear	Wheel Mfr./ Model No.	Alcoa 22.5 x 8.25 / 7,300 lb x 120PSI
	Tire Mfr./ Model No.	Michelin X / 275/70R22.5

BRAKES

Front Axle Brakes Type	☒ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	Spicer / 15x6 S-cam		
Middle Axle Brakes Type	☐ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	☒ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	Meritor / 16.5x7 Cast Plus S-cam		
Retarder Type	N/A		
Mfr. / Model No.	N/A		

HVAC

Heating System Type	☒ Air	☐ Water	☐ Other
Capacity (Btu/hr)	94,000		
Mfr. / Model No.	Thermo King / X426		
Air Conditioner	☒ Yes	☐ No	
Location	Rear		
Capacity (Btu/hr)	104,000 @ 95°F ambient		
A/C Compressor Mfr. / Model No.	Thermo King / X426		

STEERING

Steering Gear Box Type	Hydraulic gear
Mfr. / Model No.	TRW / TAS 65
Steering Wheel Diameter	20.0
Number of turns (lock to lock)	4.75

Bus Number: 9922	Date: 11-1-99

OTHERS

Wheel Chair Ramps	Location: Front door	Type: Fold over
Wheel Chair Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	Ricon / na	
Emergency Exit	Location: Windows Roof hatch Doors	Number: 6 2 2

CAPACITIES

Fuel Tank Capacity (gallons)	75 gals
Engine Crankcase Capacity (gallons)	7 gals
Transmission Capacity (gallons)	6.5 gals
Differential Capacity (gallons)	4.4 gals
Cooling System Capacity (gallons)	12 gals
Power Steering Fluid Capacity (gallons)	3 gals

VEHICLE DATA FORM

Bus Number: 9922	Date: 11-1-99

List all spare parts, tools and manuals delivered with the bus.

Part Number	Description	Qty.
82-14654	Oil filter	2
53-22412	Hydraulic filter	2
53-35688-000N	Rear suspension shock	2
80-37050-000N	Front shock	2
53-27363-001	Need release	1
1820479C1	Fuel filter	2
80-37209-000N	Front Air Spring	2
53-28088-001	Mount Center Bonded	8
53-21338-000	Mount Engine Rear Cushy Float	2
53-34748-000	Mount Lower Muffler Mtg.	4
04-36863-000	Valve Suspension Height Control	2
53-28088-000	Center bonded mount	2
56-07695-000	Radiator tie rod bushing	16
53-33621-002	Insulator	2
53-33621-001	Insulator	2
08-36629-000	Front suspension bump stop	4
53-21338-000	Mount Engine Rear Cushy Float	2

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 9922	Date: 11-1-99

Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation	✓	
Body and Sheet Metal	✓	
Frame	✓	
Steering	✓	
Suspension	✓	
Interior/Seating	✓	
Axles	✓	
Brakes	✓	
Tires/Wheels	✓	
Exhaust	✓	
Fuel System	✓	
Power Plant	✓	
Accessories	✓	
Lift System	✓	
Interior Fasteners	✓	
Batteries	✓	

CHECK - IN

GILLIG CORPORATION'S
MODEL 29' LOW FLOOR

1. MAINTAINABILITY

1.1 ACCESSIBILITY OF COMPONENTS AND SUBSYSTEMS

1.1-I. TEST OBJECTIVE

The objective of this test is to check the accessibility of components and subsystems.

1.1-II. TEST DESCRIPTION

Accessibility of components and subsystems is checked, and where accessibility is restricted the subsystem is noted along with the reason for the restriction.

1.1-III. DISCUSSION

The components covered in Section 1.3 (Repair and/or Replacement of Selected Subsystems) along with all other components were found to be readily accessible and no restrictions were noted.

ACCESSIBILITY DATA FORM

Bus Number: 9922	Date: 5-19-00

Component	Checked	Comments
ENGINE :		
Oil Dipstick	✓	
Oil Filler Hole	✓	
Oil Drain Plug	✓	
Oil Filter	✓	
Fuel Filter	✓	
Air Filter	✓	
Belts	✓	
Coolant Level	✓	
Coolant Filler Hole	✓	
Coolant Drain	✓	
Spark / Glow Plugs	✓	
Alternator	✓	
Diagnostic Interface Connector	✓	
TRANSMISSION :		
Fluid Dip-Stick	✓	
Filler Hole	✓	Fill through dip tube.
Drain Plug	✓	
SUSPENSION :		
Bushings	✓	
Shock Absorbers	✓	
Air Springs	✓	
Leveling Valves	✓	
Grease Fittings	✓	

ACCESSIBILITY DATA FORM

Bus Number: 9922	Date: 5-19-00

Component	Checked	Comments
HVAC :		
A/C Compressor	✓	
Filters	✓	
Fans	✓	
ELECTRICAL SYSTEM :		
Fuses	✓	
Batteries	✓	
Voltage regulator	✓	
Voltage Convertors	✓	
Lighting	✓	
MISCELLANEOUS :		
Brakes	✓	
Handicap Lifts/Ramps	✓	
Instruments	✓	
Axles	✓	
Exhaust	✓	
Fuel System	✓	
OTHERS :		

1.2 SERVICING, PREVENTIVE MAINTENANCE, AND REPAIR AND MAINTENANCE DURING TESTING

1.2-I. TEST OBJECTIVE

The objective of this test is to collect maintenance data about the servicing, preventive maintenance, and repair.

1.2.-II. TEST DESCRIPTION

The test will be conducted by operating the NBM and collecting the following data on work order forms and a driver log.

1. Unscheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Description of malfunction
    e. Location of malfunction (e.g., in service or undergoing inspection)
    f. Repair action and parts used
    g. Man-hours required

2. Scheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Engine running time (if available)
    e. Results of scheduled inspections
    f. Description of malfunction (if any)
    g. Repair action and parts used (if any)
    h. Man-hours required

The buses will be operated in accelerated durability service. While typical items are given below, the specific service schedule will be that specified by the manufacturer.

A. Service
    1. Fueling
    2. Consumable checks
    3. Interior cleaning

B. Preventive Maintenance
    4. Brake adjustments
    5. Lubrication
    6. 3,000 mi (or equivalent) inspection

7. Oil and filter change inspection
8. Major inspection
9. Tune-up

C. Periodic Repairs

1. Brake reline
2. Transmission change
3. Engine change
4. Windshield wiper motor change
5. Stoplight bulb change
6. Towing operations
7. Hoisting operations

1.2-III. DISCUSSION

Servicing and preventive maintenance were performed at manufacturer specified intervals. The following Scheduled Maintenance Form lists the mileage, items serviced, the service interval, and amount of time required to perform the maintenance. Table 1 is a list of the lubricating products used in servicing. Finally, the Unscheduled Maintenance List along with Unscheduled Maintenance related photographs is included in Section 5.7, Structural Durability. This list supplies information related to failures that occurred during the durability portion of testing. The Unscheduled Maintenance List includes the date and mileage at which the malfunction occurred, a description of the malfunction and repair, and the time required to perform the repair.

SCHEDULED MAINTENANCE

Gillig Corporation 9922

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
12-07-99	2,515	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-12-00	4,045	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-26-00	5,616	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
03-10-00	8,001	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
03-22-00	9,620	P.M. / Inspection Fuel Economy Prep.	Linkage, tie rods, universals/u-joints all lubed. Oil changed. Oil, fuel, and air filters changed. Transmission oil and filter changed.	8.00	8.00
04-03-00	10,756	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
04-10-00	11,790	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00

SCHEDULED MAINTENANCE

Gillig Corporation 9922

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
04-25-00	13,299	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
05-01-00	13,977	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00

Table 1. STANDARD LUBRICANTS

The following is a list of Texaco lubricant products used in bus testing conducted by the Penn State University Altoona Bus Testing Center:

ITEM	PRODUCT CODE	TEXACO DESCRIPTION
Engine oil	#2112	URSA Super Plus SAE 30
Transmission oil	#1866	Automatic Trans Fluid Mercon/Dexron II Multipurpose
Gear oil	#2316	Multigear Lubricant EP SAE 80W90
Wheel bearing & Chassis grease	#1935	Starplex II

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

1.3-I. TEST OBJECTIVE

The objective of this test is to establish the time required to replace and/or repair selected subsystems.

1.3-II. TEST DESCRIPTION

The test will involve components that may be expected to fail or require replacement during the service life of the bus. In addition, any component that fails during the NBM testing is added to this list. Components to be included are:

1. Transmission
2. Alternator
3. Starter
4. Batteries
5. Windshield wiper motor

1.3-III. DISCUSSION

During the test, several additional components were removed for repair or replacement. Following is a list of components and total repair/replacement time.

	MAN HOURS
Hydraulic line	1.0
Left rear ABS valve	1.0
Left rear suspension wear pad, rubber roller and hanger hardware	3.5
Two transmission cooler support brackets	2.0
Oil pan	2.5
Both front suspension stop blocks	2.0
Air governor	1.0
Both rear spring beams & leveling valves	4.5

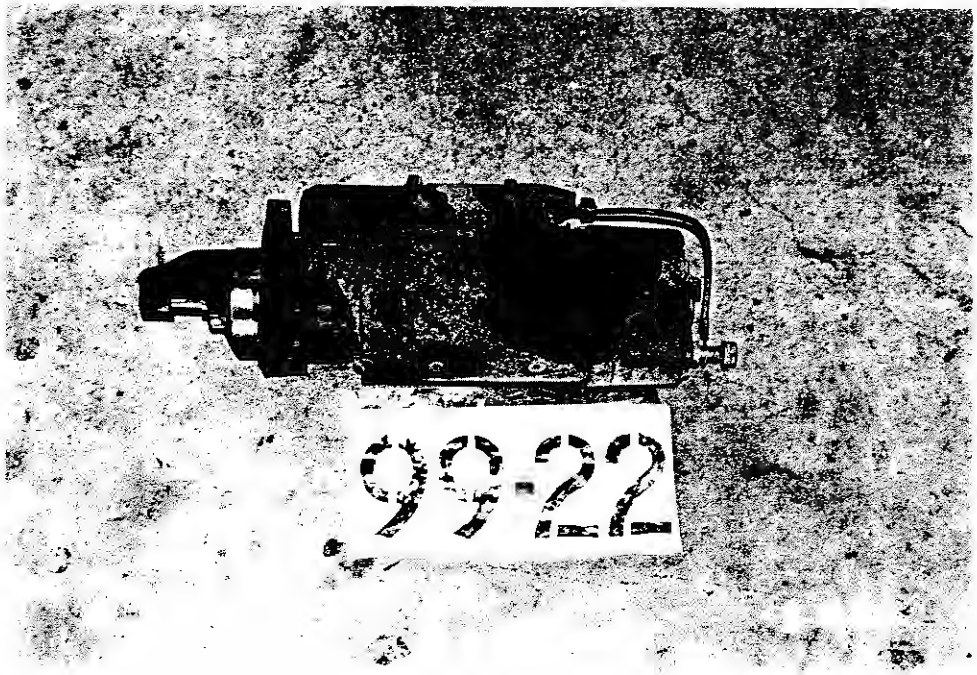
Right rear maxi brake	2.0
Right side low beam lamp	1.0
Both rear air bags	1.0

At the end of the test, the remaining items on the list were removed and replaced. The transmission/engine assembly took 19.0 man-hours (two men 9.5 hrs) to remove and replace. The time required for repair/replacement of the four remaining components is given on the following Repair and/or Replacement Form.

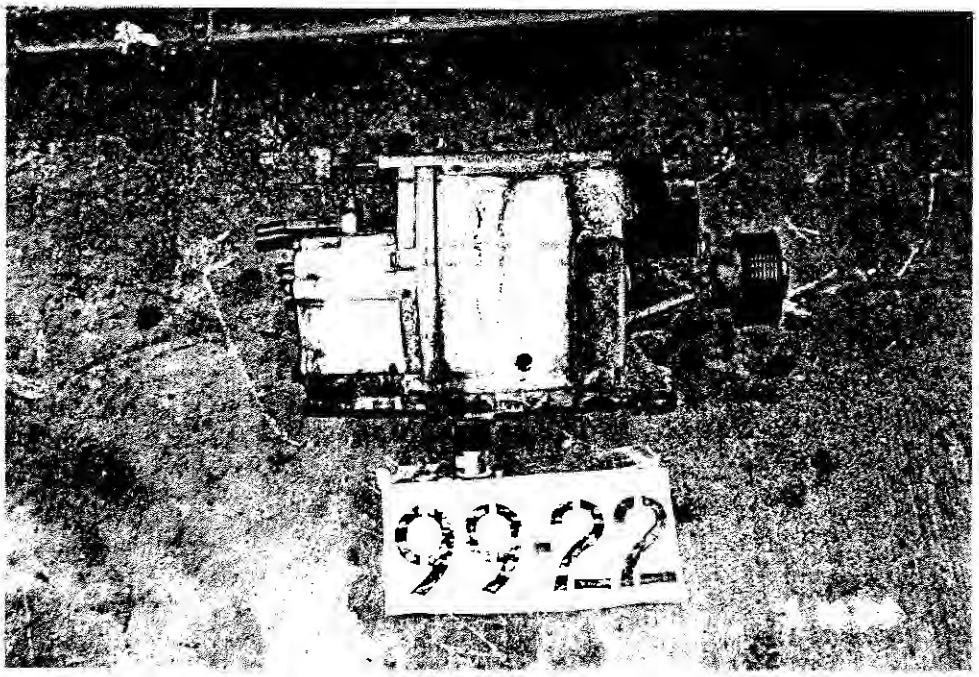
REPLACEMENT AND/OR REPAIR FORM

Subsystem	Replacement Time
Transmission	19.00 man hours
Wiper Motor	0.75 man hours
Starter	1.00 man hours
Alternator	2.00 man hours
Batteries	1.00 man hours

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

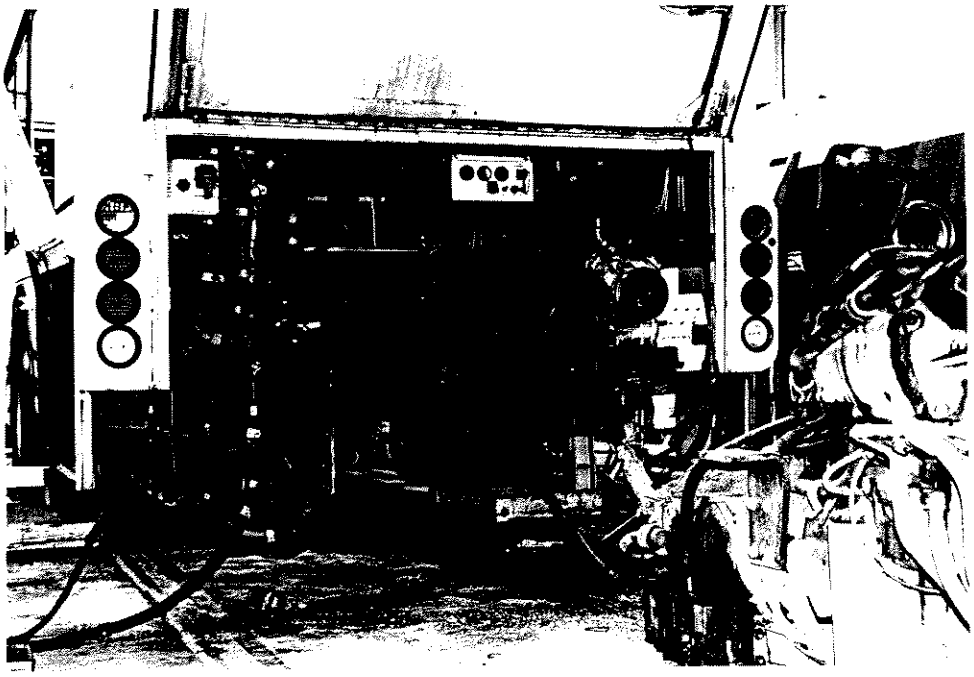


STARTER REMOVAL AND REPLACEMENT (1.00 MAN HOUR)

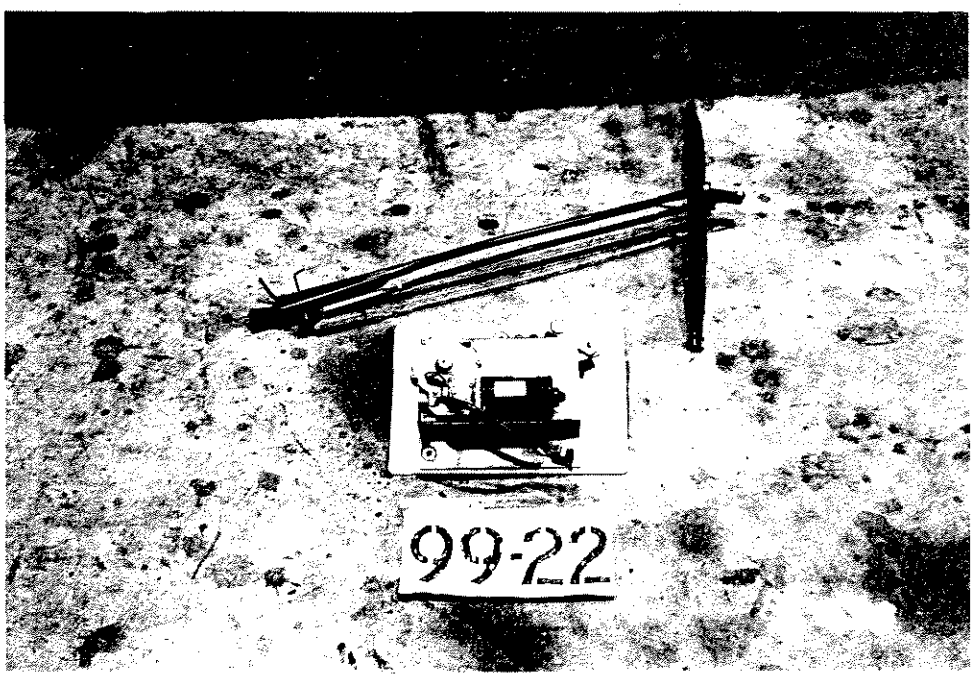


GENERATOR REMOVAL AND REPLACEMENT (2.00 MAN HOURS)

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS CONT.



ENGINE/TRANSMISSION REMOVAL AND REPLACEMENT (19.0 MAN HOURS)



WIPER MOTOR REMOVAL AND REPLACEMENT (0.75 MAN HOURS)

2. RELIABILITY - DOCUMENTATION OF BREAKDOWN AND REPAIR TIMES DURING TESTING

2-I. TEST OBJECTIVE

The objective of this test is to document unscheduled breakdowns, repairs, down time, and repair time that occur during testing.

2-II. TEST DESCRIPTION

Using the driver log and unscheduled work order forms, all significant breakdowns, repairs, man-hours to repair, and hours out of service are recorded on the Reliability Data Form.

CLASS OF FAILURES

Classes of failures are described below:

(a) Class 1: Physical Safety. A failure that could lead directly to passenger or driver injury and represents a severe crash situation.

(b) Class 2: Road Call. A failure resulting in an enroute interruption of revenue service. Service is discontinued until the bus is replaced or repaired at the point of failure.

© Class 3: Bus Change. A failure that requires removal of the bus from service during its assignments. The bus is operable to a rendezvous point with a replacement bus.

(d) Class 4: Bad Order. A failure that does not require removal of the bus from service during its assignments but does degrade coach operation. The failure shall be reported by driver, inspector, or hostler.

2-III. DISCUSSION

A listing of breakdowns and unscheduled repairs is accumulated during the Structural Durability Test. The following Reliability Data Form lists all unscheduled repairs under classes as defined above. These classifications are somewhat subjective as the test is performed on a test track with careful inspections every two hours. However, even on the road, there is considerable latitude on deciding how to handle many failures.

The Unscheduled Repair List is also attached to provide a reference for the repairs that are included in the Reliability Data Forms.

The classification of repairs according to subsystem is intended to emphasize those systems which had persistent minor or more serious problems. There were no Class 1 or 2 failures. Of the twenty Class 3 failures, nine occurred in the suspension system, seven to the engine/transmission, two with the brakes, and one each to the body and frame. These, and the remaining two Class 4 failures are available for review in the Unscheduled Maintenance List, located in Section 5.7 Structural Durability.

RELIABILITY DATA FORMS

Bus Number: 9922	Date: 05-04-00
Personnel: Bob Reifsteck	

	Failure Type			
	Class 4 Bad Order	Class 3 Bus Change	Class 2 Road Call	Class 1 Physical Safety

Subsystems	Mileage	Mileage	Mileage	Mileage	Man Hours	Down Time
Suspension		3,022			3.50	3.50
		5,616			2.00	2.00
		6,918			4.00	4.00
		7,183			4.50	4.50
		7,810			2.00	2.00
		13,299			0.50	0.50
		13,299			2.50	2.50
		13,299			0.50	0.50
		13,977			1.00	1.00
Engine/Transmission		000			1.00	1.00
		4,045			2.00	2.00
		5,169			2.50	2.50
		5,924			1.00	1.00
		5,924			1.50	1.50
	9,620				1.00	1.00
		12,992			0.50	0.50
		14,317			1.00	1.00
Brakes		566			1.00	1.00
		9,620			2.00	2.00
Body	817				1.00	1.00
		4,884			1.50	1.50
Frame		3,022			6.00	6.00

3. SAFETY - A DOUBLE-LANE CHANGE (OBSTACLE AVOIDANCE)

3-I. TEST OBJECTIVE

The objective of this test is to determine handling and stability of the bus by measuring speed through a double lane change test.

3-II. TEST DESCRIPTION

The Safety Test is a vehicle handling and stability test. The bus will be operated at SLW on a smooth and level test track. The bus will be driven through a double lane change course at increasing speed until the test is considered unsafe or a speed of 45 mph is reached. The lane change course will be set up using pylons to mark off two 12 foot center to center lanes with two 100 foot lane change areas 100 feet apart. The bus will begin in one lane, change to the other lane in a 100 foot span, travel 100 feet, and return to the original lane in another 100 foot span. This procedure will be repeated, starting first in the right-hand and then in the left-hand lane.

3-III. DISCUSSION

The double-lane change was performed in both right-hand and left-hand directions. The bus was able to safely negotiate the test course in both the right-hand and left-hand directions up to the maximum test speed of 45 mph.

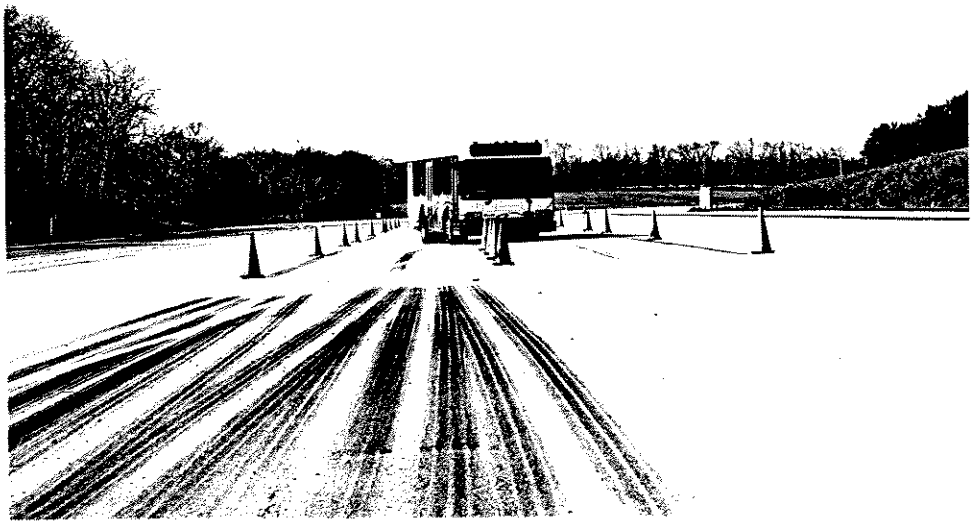
SAFETY DATA FORM

Bus Number: 9922	Date: 3-24-00
Personnel: S.C., E.D. & R.H.	

Temperature (°F): 43	Humidity (%): 68
Wind Direction: Calm	Wind Speed (mph): Calm
Barometric Pressure (in.Hg): 30.12	

SAFETY TEST: DOUBLE LANE CHANGE	
Maximum safe speed tested for double-lane change to left	45 mph
Maximum safe speed tested for double-lane change to right	45 mph
Comments of the position of the bus during the lane change:	
A safe profile was maintained through all portions of testing.	
Comments of the tire/ground contact patch:	
Tire/ground contact was maintained through all portions of testing.	

RIGHT - HAND APPROACH



LEFT - HAND APPROACH

4. PERFORMANCE - AN ACCELERATION, GRADEABILITY, AND TOP SPEED TEST

4-I. TEST OBJECTIVE

The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus.

4-II. TEST DESCRIPTION

In this test, the bus will be operated at SLW on the skid pad at the Test Track Facility. The bus will be accelerated at full throttle from a standstill to a maximum "geared" or "safe" speed as determined by the test driver. The vehicle speed is measured using a Correvit non-contacting speed sensor. The times to reach speed between ten mile per hour increments are measured and recorded using a stopwatch with a lap timer. The time to speed data will be recorded on the Performance Data Form and later used to generate a speed vs time plot and gradeability calculations.

4-III. DISCUSSION

This test consists of three runs in both the clockwise and counterclockwise directions on the Test Track. Velocity versus time data is obtained for each run and results are averaged together to minimize any test variability which might be introduced by wind or other external factors. The test was performed up to a maximum speed of 50 mph. The fitted curve of velocity vs time is attached, followed by the calculated gradeability results. The average time to obtain 50 mph was 26.06 seconds.

PERFORMANCE DATA FORM

Bus Number: 9922	Date: 3-24-00
Personnel: S.C., E.D. & R.H.	
Temperature (°F): 44	Humidity (%): 68
Wind Direction: Calm	Wind Speed (mph): Calm
Barometric Pressure (in.Hg): 30.12	
Air Conditioning compressor-OFF	✓ Checked
Ventilation fans-ON HIGH	✓ Checked
Heater pump motor-Off	✓ Checked
Defroster-OFF	✓ Checked
Exterior and interior lights-ON	✓ Checked
Windows and doors-CLOSED	✓ Checked

ACCELERATION, GRADEABILITY, TOP SPEED

Counter Clockwise Recorded Interval Times			
Speed	Run 1	Run 2	Run 3
10 mph	4.82	4.20	4.88
20 mph	8.16	7.16	8.17
30 mph	12.26	12.14	12.38
40 mph	18.73	18.64	19.38
Top Test Speed(mph) 50	27.26	27.38	27.92

Clockwise Recorded Interval Times			
Speed	Run 1	Run 2	Run 3
10 mph	4.39	4.57	4.32
20 mph	7.58	7.19	7.51
30 mph	11.58	11.85	11.38
40 mph	17.23	17.10	16.88
Top Test Speed(mph) 50	24.39	25.29	24.13

PERFORMANCE SUMMARY SHEET

BUS MANUFACTURER :Gillig Corporation
BUS MODEL :G22EL02E2
BUS NUMBER :9922
TEST DATE :03/24/00

TEST CONDITIONS :

TEMPERATURE (DEG F) : 44.0
WIND DIRECTION : 0
WIND SPEED (MPH) : .0
HUMIDITY (%) : 68
BAROMETRIC PRESSURE (IN. HG) : 30.1

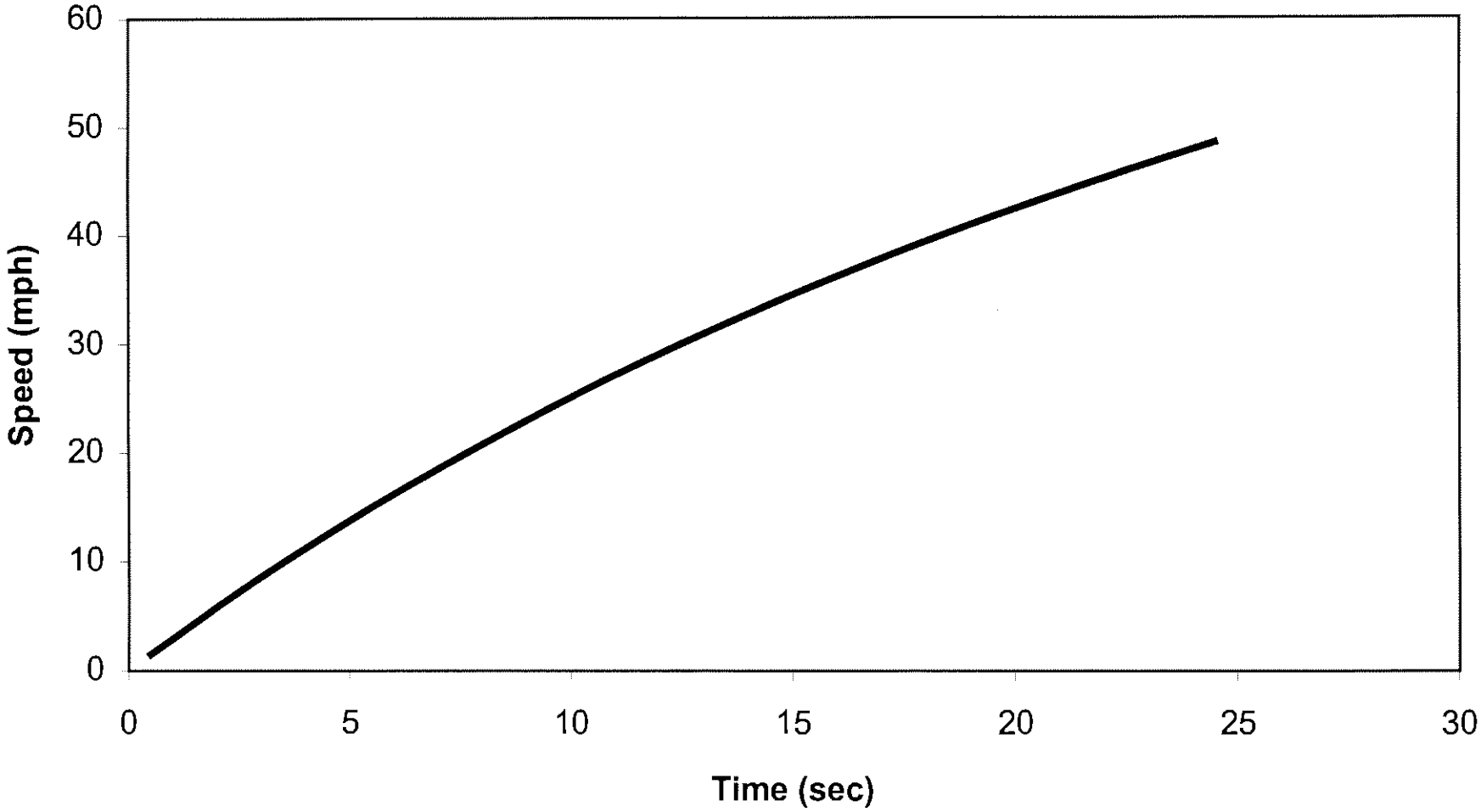
VEHICLE SPEED	AVERAGE TIME (SEC)		
(MPH)	CCW DIRECTION	CW DIRECTION	TOTAL
10.0	4.63	4.43	4.53
20.0	7.83	7.43	7.63
30.0	12.26	11.60	11.93
40.0	18.92	17.07	17.99
50.0	27.52	24.60	26.06

TEST SUMMARY :

VEHICLE SPEED (MPH)	TIME (SEC)	ACCELERATION (FT/SEC^2)	MAX. GRADE (%)
1.0	.33	4.4	13.7
5.0	1.71	4.2	13.0
10.0	3.54	3.9	12.1
15.0	5.51	3.6	11.2
20.0	7.64	3.3	10.3
25.0	9.97	3.0	9.4
30.0	12.51	2.8	8.6
35.0	15.30	2.5	7.8
40.0	18.38	2.3	7.0
45.0	21.82	2.0	6.3
50.0	25.68	1.8	5.6

NOTE : Gradeability results were calculated from performance test data. Actual sustained gradeability performance for vehicles equipped with auto transmission may be lower than the values indicated here.

Velocity vs. Time
Gillig #9922



5. STRUCTURAL INTEGRITY

5.1 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL SHAKEDOWN TEST

5.1-I. DISCUSSION

The objective of this test is to determine certain static characteristics (e.g., bus floor deflection, permanent structural deformation, etc.) under static loading conditions.

5.1-II. TEST DESCRIPTION

In this test, the bus will be isolated from the suspension by blocking the vehicle under the suspension points. The bus will then be loaded and unloaded up to a maximum of three times with a distributed load equal to 2.5 times gross load. Gross load is 150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space. For a distributed load equal to 2.5 times gross load, place a 375-lb load on each seat and on every 1.5 sq ft of free floor space. The first loading and unloading sequence will "settle" the structure. Bus deflection will be measured at several locations during the loading sequences.

5.1-III. DISCUSSION

This test was performed based on a maximum passenger capacity of 40 people including the driver. The resulting test load is (40 x 375 lb) = 15,000 lb. The load is distributed evenly over the passenger space. Deflection data before and after each loading and unloading sequence is provided on the Structural Shakedown Data Form.

The unloaded height after each test becomes the original height for the next test. Some initial settling is expected due to undercoat compression, etc. After each loading cycle, the deflection of each reference point is determined. The bus is then unloaded and the residual (permanent) deflection is recorded. On the final test, the maximum loaded deflection was 0.120 inches at reference point 9. The maximum permanent deflection after the final loading sequence ranged from 0.000 inches at reference points 1, 6, 7 and 12 to 0.003 inches at reference points 4, 5, and 10.

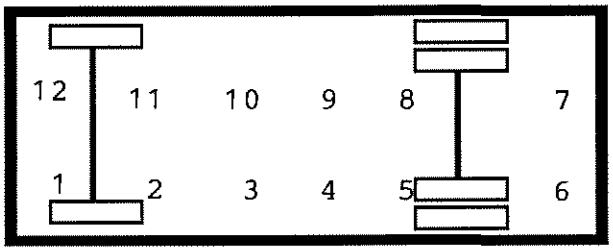
STRUCTURAL SHAKEDOWN DATA FORM

Bus Number: 9922	Date: 11-4-99
Personnel: S.C. & E.L.	Temperature (°F): 68
Loading Sequence: ☒ 1 ☐ 2 ☐ 3 (check one) Test Load (lbs): 15,000	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus



Left

Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	0	-.021	-.021	-.003	-.003
2	0	.070	.070	.012	.012
3	0	.099	.099	.015	.015
4	0	.121	.121	.018	.018
5	0	.113	.113	.020	.020
6	0	.045	.045	.004	.004
7	0	.034	.034	.000	.000
8	0	.104	.104	.016	.016
9	0	.125	.125	.008	.008
10	0	.104	.104	.016	.016
11	0	.075	.075	.014	.014
12	0	-.042	-.042	-.003	-.003

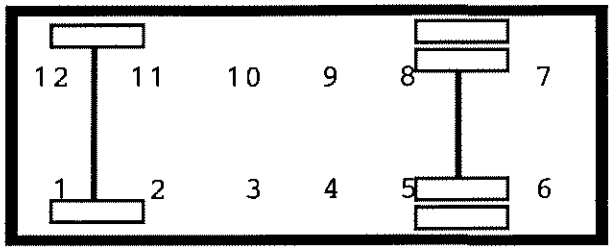
STRUCTURAL SHAKEDOWN DATA FORM

Bus Number: 9922	Date: 11-4-99
Personnel: S.C. & E.L.	Temperature (°F): 70
Loading Sequence: ☐ 1 ☒ 2 ☐ 3 (check one) Test Load (lbs): 15,000	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus

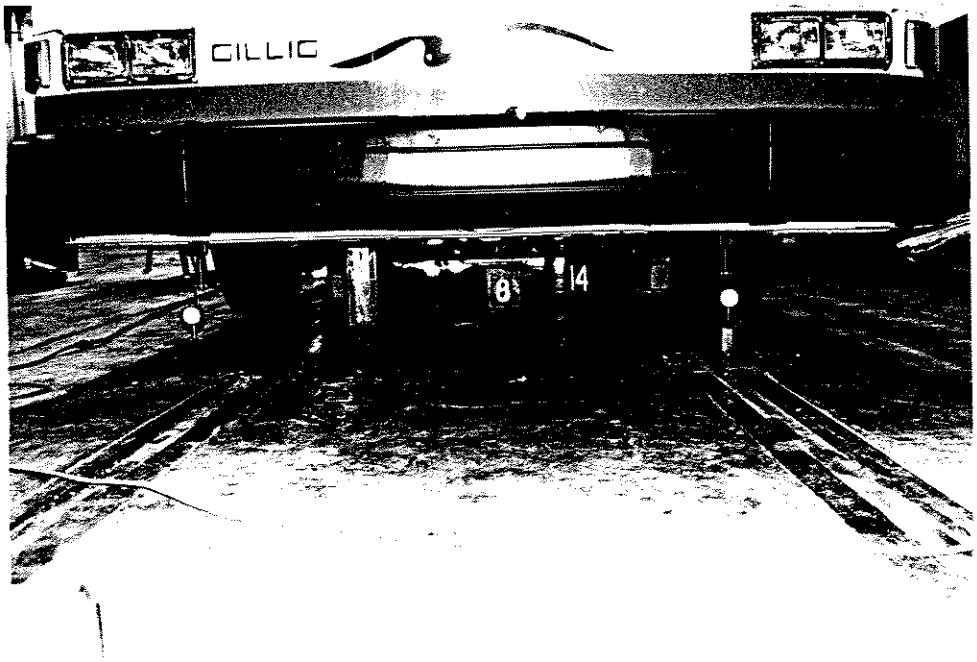


Left

Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	-.003	-.021	-.018	-.003	.000
2	.012	.069	.057	.014	.002
3	.015	.102	.087	.017	.002
4	.018	.125	.107	.021	.003
5	.020	.115	.095	.023	.003
6	.004	.044	.040	.004	.000
7	.000	.034	.034	.000	.000
8	.016	.106	.090	.018	.002
9	.008	.128	.120	.008	.000
10	.016	.106	.090	.019	.003
11	.014	.078	.064	.016	.002
12	-.003	-.041	-.038	-.003	.000

5.1 STRUCTURAL SHAKEDOWN TEST



DIAL INDICATORS IN POSITION

TEST BUS LOADED TO 2.5 TIMES GVL
(15,000 LBS.)

5.2 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL DISTORTION

5.2-I. TEST OBJECTIVE

The objective of this test is to observe the operation of the bus subsystems when the bus is placed in a longitudinal twist simulating operation over a curb or through a pothole.

5.2-II. TEST DESCRIPTION

With the bus loaded to GVWR, each wheel of the bus will be raised (one at a time) to simulate operation over a curb and the following will be inspected:

1. Body
2. Windows
3. Doors
4. Roof vents
5. Special seating
6. Undercarriage
7. Engine
8. Service doors
9. Escape hatches
10. Steering mechanism

Each wheel will then be lowered (one at a time) to simulate operation through a pothole and the same items inspected.

5.2-III. DISCUSSION

The test sequence was repeated ten times. The first and last test is with all wheels level. The other eight tests are with each wheel 6 inches higher and 6 inches lower than the other three wheels.

All doors, windows, escape mechanisms, engine, steering and handicapped devices operated normally throughout the test. The undercarriage and body indicated no deficiencies. Water leakage was observed during the test at both lower corners of the windshield. The results of this test are indicated on the following data forms.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9922	Date: 11-9-99
Personnel: K.D., J.P., S.C. & E.L.	Temperature(°F): 69

Wheel Position : (check one)		
All wheels level	☒ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9922	Date: 11-9-99
Personnel: K.D., J.P., S.C. & E.L.	Temperature(°F): 69

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	⊠ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
⊠ Windows	No deficiencies.
⊠ Front Doors	No deficiencies.
⊠ Rear Doors	No deficiencies.
⊠ Escape Mechanisms/ Roof Vents	No deficiencies.
⊠ Engine	No deficiencies.
⊠ Handicapped Device/ Special Seating	No deficiencies.
⊠ Undercarriage	No deficiencies.
⊠ Service Doors	No deficiencies.
⊠ Body	No deficiencies.
⊠ Windows/ Body Leakage	No deficiencies.
⊠ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9922	Date: 11-9-99
Personnel: K.D., J.P., S.C. & E.L.	Temperature(°F): 69

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	⊠ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
⊠ Windows	No deficiencies.
⊠ Front Doors	No deficiencies.
⊠ Rear Doors	No deficiencies.
⊠ Escape Mechanisms/ Roof Vents	No deficiencies.
⊠ Engine	No deficiencies.
⊠ Handicapped Device/ Special Seating	No deficiencies.
⊠ Undercarriage	No deficiencies.
⊠ Service Doors	No deficiencies.
⊠ Body	No deficiencies.
⊠ Windows/ Body Leakage	No deficiencies.
⊠ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9922	Date: 11-9-99
Personnel: K.D., J.P., S.C & E.L.	Temperature(°F): 69

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	⊠ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
⊠ Windows	No deficiencies.
⊠ Front Doors	No deficiencies.
⊠ Rear Doors	No deficiencies.
⊠ Escape Mechanisms/ Roof Vents	No deficiencies.
⊠ Engine	No deficiencies.
⊠ Handicapped Device/ Special Seating	No deficiencies.
⊠ Undercarriage	No deficiencies.
⊠ Service Doors	No deficiencies.
⊠ Body	No deficiencies.
⊠ Windows/ Body Leakage	Windshield leaks at both lower corners.
⊠ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9922	Date: 11-9-99
Personnel: K.D., J.P., S.C. & E.L.	Temperature(°F): 69

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	⊠ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
⊠ Windows	No deficiencies.
⊠ Front Doors	No deficiencies.
⊠ Rear Doors	No deficiencies.
⊠ Escape Mechanisms/ Roof Vents	No deficiencies.
⊠ Engine	No deficiencies.
⊠ Handicapped Device/ Special Seating	No deficiencies.
⊠ Undercarriage	No deficiencies.
⊠ Service Doors	No deficiencies.
⊠ Body	No deficiencies.
⊠ Windows/ Body Leakage	Windshield leak at both lower corners.
⊠ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9922	Date: 11-9-99
Personnel: K.D., J.P., S.C. & E.L.	Temperature(°F): 69

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	☒ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	Windshield leaks at both lower corners.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9922	Date: 11-9-99
Personnel: K.D., J.P., S.C. & E.L.	Temperature(°F): 69

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	☒ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	Windshield leaks at both lower corners.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9922	Date: 11-9-99
Personnel: K.D., J.P., S.C. & E.L.	Temperature(°F): 69

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	⊠ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
⊠ Windows	No deficiencies.
⊠ Front Doors	No deficiencies.
⊠ Rear Doors	No deficiencies.
⊠ Escape Mechanisms/ Roof Vents	No deficiencies.
⊠ Engine	No deficiencies.
⊠ Handicapped Device/ Special Seating	No deficiencies.
⊠ Undercarriage	No deficiencies.
⊠ Service Doors	No deficiencies.
⊠ Body	No deficiencies.
⊠ Windows/ Body Leakage	Windshield leaks at both lower corners.
⊠ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9922	Date: 11-9-99
Personnel: K.D., J.P., S.C. & E.L.	Temperature(°F): 69

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	⊠ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
⊠ Windows	No deficiencies.
⊠ Front Doors	No deficiencies.
⊠ Rear Doors	No deficiencies.
⊠ Escape Mechanisms/ Roof Vents	No deficiencies.
⊠ Engine	No deficiencies.
⊠ Handicapped Device/ Special Seating	No deficiencies.
⊠ Undercarriage	No deficiencies.
⊠ Service Doors	No deficiencies.
⊠ Body	No deficiencies.
⊠ Windows/ Body Leakage	Windshield leaks at both lower corners.
⊠ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9922	Date: 11-9-99
Personnel: K.D., J.P., S.C. & E.L.	Temperature(°F): 69

Wheel Position : (check one)		
All wheels level	☐ before	☒ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	Windshield leaks at both lower corners.
☒ Steering Mechanism	No deficiencies.

5.3 STRUCTURAL STRENGTH AND DISTORTION TESTS - STATIC TOWING TEST

5.3-I. TEST OBJECTIVE

The objective of this test is to determine the characteristics of the bus towing mechanisms under static loading conditions.

5.3-II. TEST DESCRIPTION

Utilizing a load-distributing yoke, a hydraulic cylinder is used to apply a static tension load equal to 1.2 times the bus curb weight. The load will be applied to both the front and rear, if applicable, towing fixtures at an angle of 20 degrees with the longitudinal axis of the bus, first to one side then the other in the horizontal plane, and then upward and downward in the vertical plane. Any permanent deformation or damage to the tow eyes or adjoining structure will be recorded.

5.3-III. DISCUSSION

The load-distributing yoke was incorporated as the towing interface between the Static Tow apparatus and the test bus tow eyes. The test was performed using a target load (towing force) of 25,752 lbs (1.2 x 21,460 lb CW). All four pulls were completed to the full target test load with no damage or deformation observed. No problems were encountered with the towing interface.

STATIC TOWING TEST DATA FORM

Bus Number: 9922	Date: 6-5-00
Personnel: S.C., E.D. & E.L.	Temperature (°F): 67

Inspect right front tow eye and adjoining structure.
Comments: No damage or deformation.
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: Lock pins showed no damage or deformation.
Inspect left tow eye and adjoining structure.
Comments: No damage or deformation.
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: Lock pins showed no damage or deformation.
Inspect right rear tow eye and adjoining structure.
Comments: N/A
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: N/A
Inspect left rear tow eye and adjoining structure.
Comments: N/A
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: N/A
General comments of any other structure deformation or failure:
All four pulls were completed to the full test load of 25,752 lbs.

5.4 STRUCTURAL STRENGTH AND DISTORTION TESTS - DYNAMIC TOWING TEST

5.4-I. TEST OBJECTIVE

The objective of this test is to verify the integrity of the towing fixtures and determine the feasibility of towing the bus under manufacturer specified procedures.

5.4-II. TEST DESCRIPTION

This test requires the bus be towed at curb weight using the specified equipment and instructions provided by the manufacturer and a heavy-duty wrecker. The bus will be towed for 5 miles at a speed of 20 mph for each recommended towing configuration. After releasing the bus from the wrecker, the bus will be visually inspected for any structural damage or permanent deformation. All doors, windows and passenger escape mechanisms will be inspected for proper operation.

5.4-III. DISCUSSION

The bus was towed using a heavy-duty wrecker. The towing interface was accomplished by chaining to the front axle using a 4x4 wooden beam at the cross member for protection. A front lift tow was performed with no problems with the towing interface, and no damage or deformation observed. Rear towing is not recommended by the manufacturer.

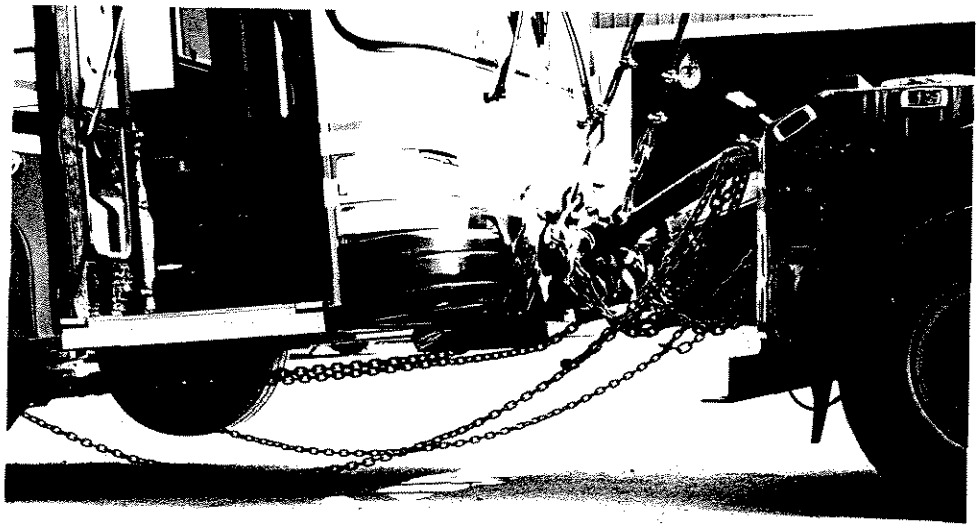
DYNAMIC TOWING TEST DATA FORM

Bus Number: 9922	Date: 5-15-00
Personnel: S.C., R.H. & E.D.	

Temperature (°F): 63	Humidity (%): 38
Wind Direction: N.W.	Wind Speed (mph): 3 - 5
Barometric Pressure (in.Hg): 29.75	

Inspect tow equipment-bus interface.
Comments: No damage or deformation noted.
Inspect tow equipment-wrecker interface.
Comments: No damage or deformation noted.
Towing Comments: Towing interface was accomplished by chaining to the front
axle. A 4x4 wooden beam was placed between the chains and cross member for
protection.
Description and location of any structural damage: None noted.
General Comments: A front lift tow was performed.

5.4 DYNAMIC TOWING TEST



TOWING INTERFACE

TEST BUS IN TOW

5.5 STRUCTURAL STRENGTH AND DISTORTION TESTS - JACKING TEST

5.5-I. TEST OBJECTIVE

The objective of this test is to inspect for damage due to the deflated tire, and determine the feasibility of jacking the bus with a portable hydraulic jack to a height sufficient to replace a deflated tire.

5.5-II. TEST DESCRIPTION

With the bus at curb weight, the tire(s) at one corner of the bus are replaced with deflated tire(s) of the appropriate type. A portable hydraulic floor jack is then positioned in a manner and location specified by the manufacturer and used to raise the bus to a height sufficient to provide 3-in clearance between the floor and an inflated tire. The deflated tire(s) are replaced with the original tire(s) and the jack is lowered. Any structural damage or permanent deformation is recorded on the test data sheet. This procedure is repeated for each corner of the bus.

5.5-III. DISCUSSION

The jack used for this test has a minimum height of 8.75 inches. During the deflated portion of the test, the jacking point clearances ranged from 5.6 inches to 14.9 inches. No deformation or damage was observed during testing. A complete listing of jacking point clearances is provided in the Jacking Test Data Form.

JACKING CLEARANCE SUMMARY

Condition	Frame Point Clearance
Front axle - one tire flat	8.6"
Rear axle - one tire flat	12.6"
Rear axle - two tires flat	11.3"

JACKING TEST DATA FORM

Bus Number: 9922	Date: 11-3-99
Personnel: B.L & E.L.	Temperature: 69

Record any permanent deformation or damage to bus as well as any difficulty encountered during jacking procedure.

Deflated Tire	Jacking Pad Clearance Body/Frame (in)	Jacking Pad Clearance Axle/Suspension (in)	Comments
Right front	9.7" I 8.6" D	8.2" I 5.6" D	
Left front	9.7" I 8.7" D	8.3" I 5.7" D	
Right rear--outside	13.0" I 12.7" D	15.2" I 14.8" D	
Right rear--both	13.0" I 11.3" D	15.2" I 12.7" D	
Left rear--outside	13.0" I 12.6" D	15.2" I 14.9" D	
Left rear--both	13.0" I 11.3" D	15.2" I 12.7" D	
Right middle or tag--outside	NA	NA	
Right middle or tag--both	NA	NA	
Left middle or tag--outside	NA	NA	
Left middle or tag--both	NA	NA	

Additional comments of any deformation or difficulty during jacking:
No damage, deformation or problems were observed.

5.6 STRUCTURAL STRENGTH AND DISTORTION TESTS - HOISTING TEST

5.6-I. TEST OBJECTIVE

The objective of this test is to determine possible damage or deformation caused by the jack/stands.

5.6-II. TEST DESCRIPTION

With the bus at curb weight, the front end of the bus is raised to a height sufficient to allow manufacturer-specified placement of jack stands under the axles or jacking pads independent of the hoist system. The bus will be checked for stability on the jack stands and for any damage to the jacking pads or bulkheads. The procedure is repeated for the rear end of the bus. The procedure is then repeated for the front and rear simultaneously.

5.6-III. DISCUSSION

The test was conducted using four posts of a six-post electric lift and standard 19 inch jack stands. The bus was hoisted from the front wheel, rear wheel, and then the front and rear wheels simultaneously and placed on jack stands.

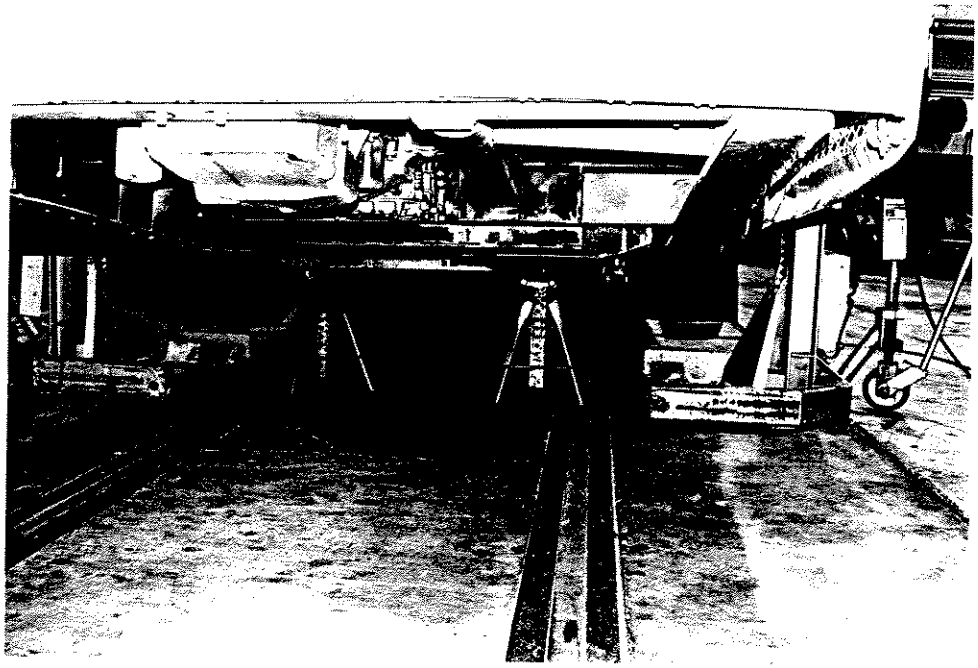
The bus easily accommodated the placement of the vehicle lifts and jack stands and the procedure was performed without any instability noted.

HOISTING TEST DATA FORM

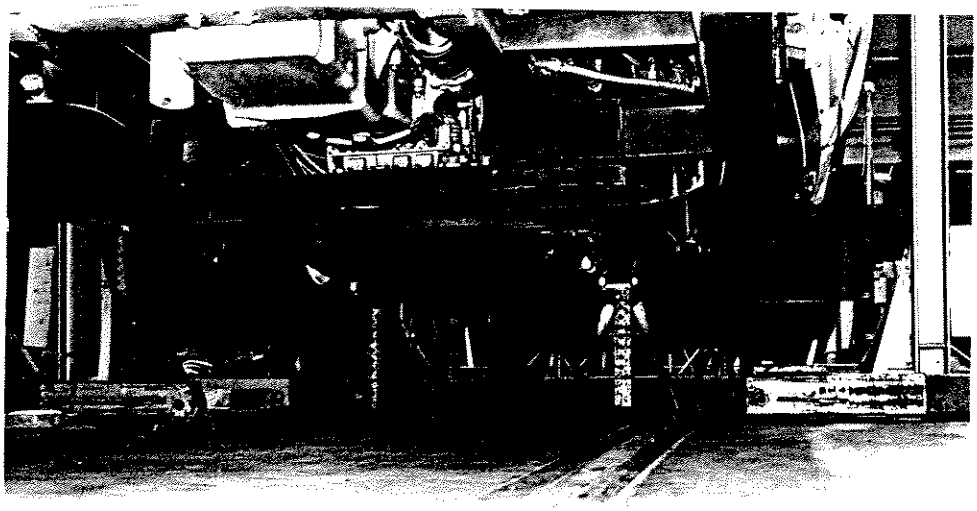
Bus Number: 9922	Date: 11-3-99
Personnel: B.L. & E.L.	Temperature (°F): 69

Comments of any structural damage to the jacking pads or axles while both the front wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the rear wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the front and rear wheels are supported by the jack stands:
None noted.

5.6 HOISTING TEST



TEST BUS STABLE ON JACK STANDS



5.7 STRUCTURAL DURABILITY TEST

5.7-I. TEST OBJECTIVE

The objective of this test is to perform an accelerated durability test that approximates up to 25 percent of the service life of the vehicle.

5.7-II. TEST DESCRIPTION

The test vehicle is driven a total of 15,000 miles; approximately 12,500 miles on the Durability Test Track and approximately 2,500 miscellaneous other miles. The test will be conducted with the bus operated under three different loading conditions. The first segment will consist of approximately 6,250 miles with the bus operated at GVW. The second segment will consist of approximately 2,500 miles with the bus operated at SLW. The remainder of the test, approximately 6,250 miles, will be conducted with the bus loaded to CW. If GVW exceeds the axle design weights, then the load will be adjusted to the axle design weights and the change will be recorded. All subsystems are run during these tests in their normal operating modes. All recommended manufacturers servicing is to be followed and noted on the vehicle maintainability log. Servicing items accelerated by the durability tests will be compressed by 10:1; all others will be done on a 1:1 mi/mi basis. Unscheduled breakdowns and repairs are recorded on the same log as are any unusual occurrences as noted by the driver. Once a week the test vehicle shall be washed down and thoroughly inspected for any signs of failure.

5.7-III. DISCUSSION

The Structural Durability Test was started on November 10, 1999 and was conducted until May 20, 2000. The first 6,250 miles were performed at a GVW of 27,360 lb. and was completed on March 10, 2000. The next 2,500 mile SLW segment was performed at 25,590 lb and completed on March 20, 2000 and the final 6,250 mile segment was performed at a CW of 21,460 lb and completed on May 10, 2000.

The mileage summary presents the accumulation of miles during the Structural Durability Test. The driving schedule is included, showing the operating duty cycle. A detailed plan view of the Test Track Facility and Durability Test Track are attached for reference. The amplitude and profile for each element of the durability test track is also included. Finally, a list of unscheduled maintenance is included describing the failures that were encountered along with related photographs during the Structural Durability Test.

GILLIG - TEST BUS #9922
MILEAGE DRIVEN/RECORDED FROM DRIVERS' LOGS

DATE	TOTAL OTHER MILES	TOTAL DURABILITY TRACK	TOTAL
11/10/99 TO 11/16/99	126.00	440.00	566.00
11/17/99 TO 11/23/99	0.00	0.00	0.00
11/24/99 TO 11/30/99	93.00	236.00	329.00
12/01/99 TO 12/07/99	251.00	759.00	1010.00
12/08./99 TO 12/14/99	53.00	915.00	968.00
12/15/99 TO 12/21/99	57.00	92.00	149.00
12/22/99 TO 12/28/99	0.00	0.00	0.00
12/29/99 TO 01/04/00	0.00	0.00	0.00
01/05/00 TO 01/11/00	98.00	748.00	846.00
01/12/00 TO 01/18/00	357.00	731.00	1088.00
01/19/00 TO 01/25/00	123.00	362.00	485.00
01/26/00 TO 02/01/00	170.00	313.00	483.00
02/02/00 TO 02/08/00	0.00	0.00	0.00
02/09/00 TO 02/15/00	164.00	156.00	320.00
02/16/00 TO 02/22/00	137.00	609.00	746.00
02/23/00 TO 02/29/00	10.00	183.00	193.00
03/01/00 TO 03/0700	30.00	394.00	424.00

DATE	TOTAL OTHER MILES	TOTAL DURABILITY TRACK	TOTAL
03/08/00 TO 03/14/00	144.00	751.00	895.00
03/15/00 TO 03/21/00	305.00	765.00	1070.00
03/22/00 TO 03/28/00	175.00	411.00	586.00
03/29/00 TO 04/04/00	148.00	792.00	940.00
04/05/00 TO 04/11/00	65.00	904.00	969.00
04/12/00 TO 04/18/00	0.00	865.00	865.00
04/19/00 TO 04/25/00	0.00	426.00	426.00
04/26/00 TO 05/02/00	0.00	766.00	766.00
05/03/00 TO 05/09/00	0.00	830.00	830.00
05/10/00 TO 05/16/00	0.00	60.00	60.00
TOTAL	2506.00	12508.00	15014.00

Table 4. Driving Schedule for Bus Operation on the Durability Test Track.

STANDARD OPERATING SCHEDULE

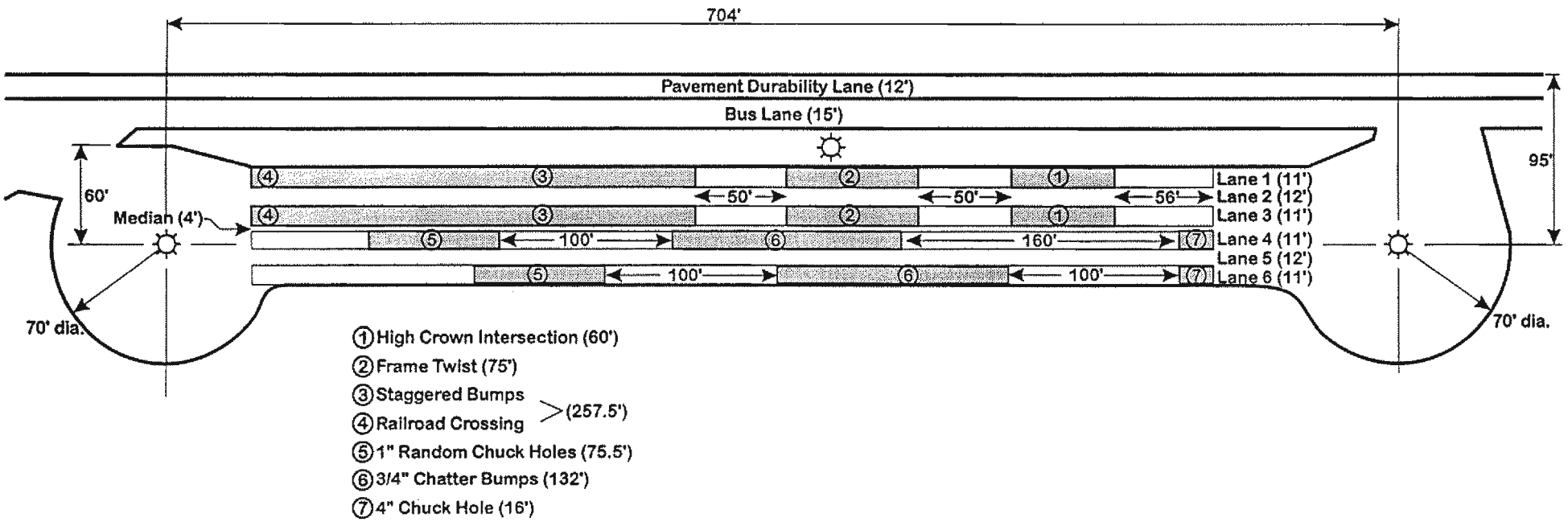
Monday through Friday

	HOUR	ACTION
Shift 1	midnight	D
	1:40 am	C
	1:50 am	B
	2:00 am	D
	3:35 am	C
	3:45 am	B
	4:05 am	D
	5:40 am	C
	5:50 am	B
	6:00 am	D
	7:40 am	C
	7:50 am	F
Shift 2	8:00 am	D
	9:40 am	C
	9:50 am	B
	10:00 am	D
	11:35 am	C
	11:45 am	B
	12:05 pm	D
	1:40 pm	C
	1:50 pm	B
	2:00 pm	D
	3:40 pm	C
	3:50 pm	F
Shift 3	4:00 pm	D
	5:40 pm	C
	5:50 pm	B
	6:00 pm	D
	7:40 pm	C
	7:50 pm	B
	8:05 pm	D
	9:40 pm	C
	9:50 pm	B
	10:00 pm	D
	11:40 pm	C
	11:50 pm	F

B---Break
C---Cycle all systems five times, visual inspection, driver's log entries
D---Drive bus as specified by procedure
F---Fuel bus, complete driver's log shift entries

BUS TESTING AND RESEARCH TEST TRACK
UNIVERSITY PARK, PA

"PLAN VIEW OF PENN STATE BUS TESTING AND RESEARCH FACILITY"

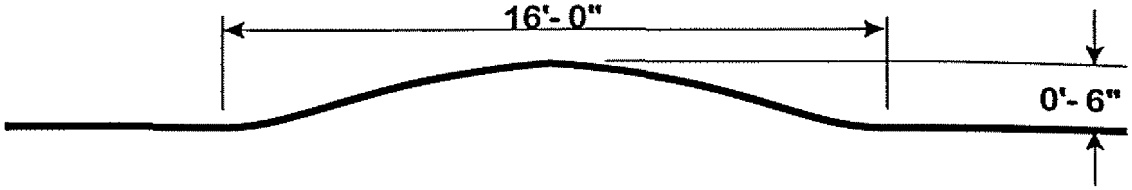


Plan View

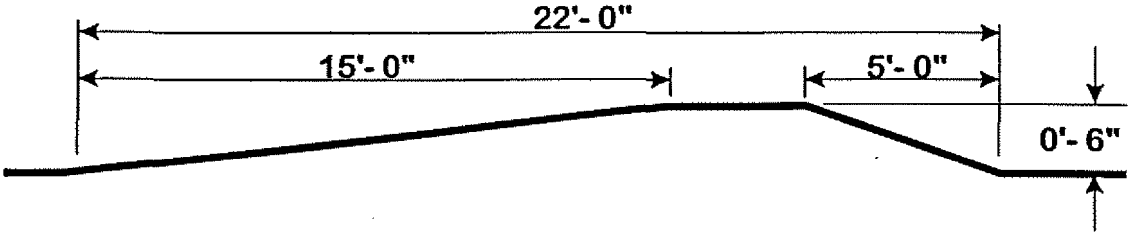
Vehicle Durability Test Track

The Pennsylvania Transportation Institute
Penn State

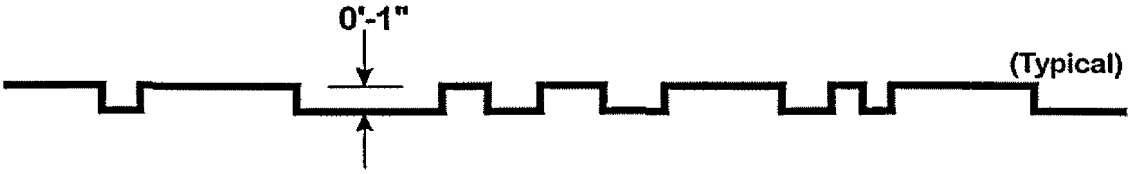
Staggered Bumps (10 mph)



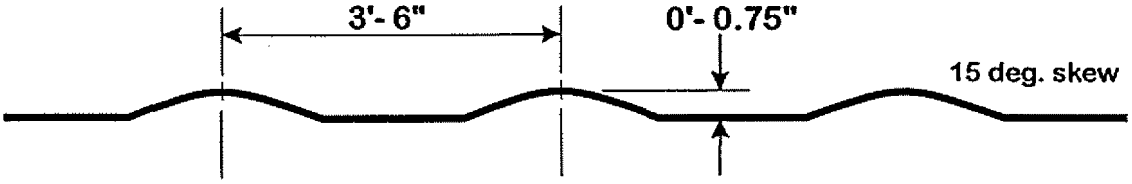
Railroad Crossing (8 mph)



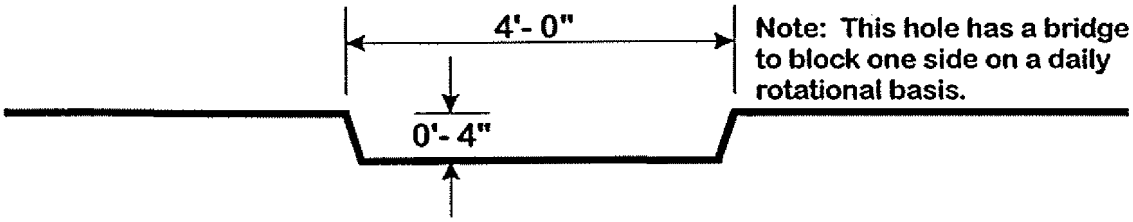
1" Random Chuck Holes (20 mph)



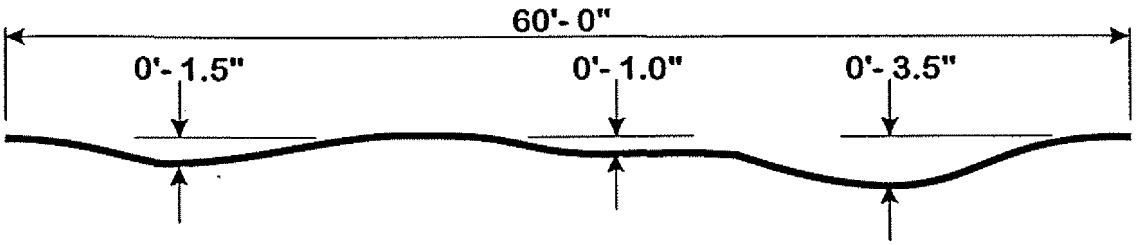
Chatter Bumps (20 mph)



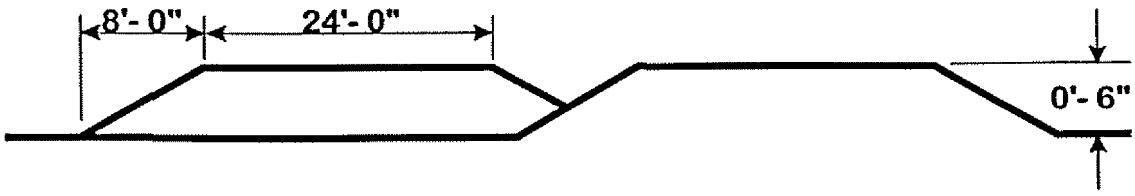
4" Chuck Hole (5 mph)



High Crown Intersection (20 mph)



Frame Twist (10 mph)



Durability Element Profiles

The Pennsylvania Transportation Institute
Penn State

UNSCHEDULED MAINTENANCE

Gillig Corporation 9922

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
11-10-99	0	The hydraulic line between the pup and fan has chaffed through on the frame.	Hydraulic line replaced between the pump and fan has chaffed through on the frame.	1.00	1.00
11-26-99	566	ABS warning light is on.	Diagnostic code showed left rear "ABS valve is open or wire broken." Left rear ABS valve replaced and codes cleared.	1.00	1.00
11-30-99	817	Height adjustment for the driver's seat will not function.	Trouble shooting found the air valve dirty. Cleaned air valve and reassembled.	1.00	1.00
12-17-99	3,022	The left rear suspension wear pad is worn and broken.	Wear pad, rubber roller and hanger hardware replaced.	3.50	3.50
01-04-00	3,022	The right frame rail is cracked at the rear axle track bar mount.	Rear axle removed for repairs. Crack welded/repaired. Eight ½" bolt holes drilled and frame liner installed. Axle reinstalled.	6.00	6.00
01-12-00	4,045	Two supports above the transmission cooler are broken.	Two new brackets installed.	2.00	2.00
01-18-00	4,884	The bottom hinge on the forward passenger door is cracked.	Hinge welded/repaired and 1/16" x 2" x 3" piece of steel added for reinforcement.	1.50	1.50
01-24-00	5,169	Oil pan broke while bottoming out on the durability track.	Oil pan replaced.	2.50	2.50

UNSCHEDULED MAINTENANCE

Gillig Corporation 9922

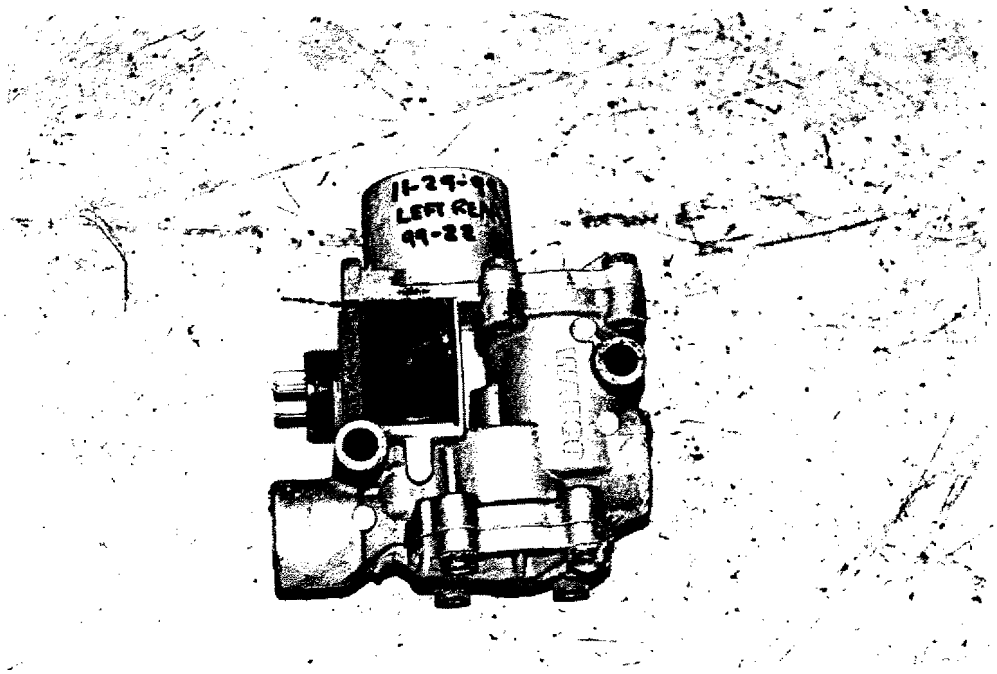
DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
01-26-00	5,616	Both front stop blocks located between the air bags are damaged.	New stop blocks installed with 1/4" spacers added.	2.00	2.00
02-02-00	5,924	Air pressure recovery is slow.	Air governor replaced and set to 120-125 psi.	1.00	1.00
02-02-00	5,924	Oil pan is damaged and leaking oil.	Oil pan welded/repaired.	1.50	1.50
02-22-00	6,918	Left rear suspension–wear pad is broken and the front attaching bolts are broken off in the hanger.	Rear axle removed for repair. Broken bolts drilled out. Both rear wear pads replaced and new bolts installed.	4.00	4.00
03-02-00	7,183	Left rear spring beam is broken at the forward u-bolt.	Both rear spring beams and both rear leveling valves replaced.	4.50	4.50
03-09-00	7,810	Left rear spring beam has shifted outward and the top plate on the right rear spring beam has shifted to the rear.	Spring beam properly aligned and new u-bolts and nuts installed.	2.00	2.00
03-22-00	9,620	Right rear maxi brake failed.	Right rear maxi brake replaced.	2.00	2.00
04-19-00	12,992	Transmission oil cooler bracket fasteners have fallen off.	Bracket reinstalled.	.50	.50
04-25-00	13,299	Right rear rubber spring beam roller is damaged.	Roller replaced.	0.50	0.50

UNSCHEDULED MAINTENANCE

Gillig Corporation 9922

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
04-25-00	13,299	Wear pad on left rear spring beam is smashed and the two front mounting bolts are broken.	Spring hanger removed. Broken bolts drilled out. Pad and bolts replaced.	2.50	2.50
04-25-00	13,299	Liner between the beam and the top plate on the left rear spring beam has shifted to the rear approximately one inch.	Plate aligned and fasteners retorqued.	.50	.50
05-01-00	13,977	Both rear air bags are cracking at the base.	Both rear air bags replaced.	1.00	1.00
05-04-00	14,317	Low voltage lights are on, intermittent loss of transmission display and air conditioning shuts down.	Broken terminal lug on the +24 volt post at the right rear side compartment replaced.	1.00	1.00

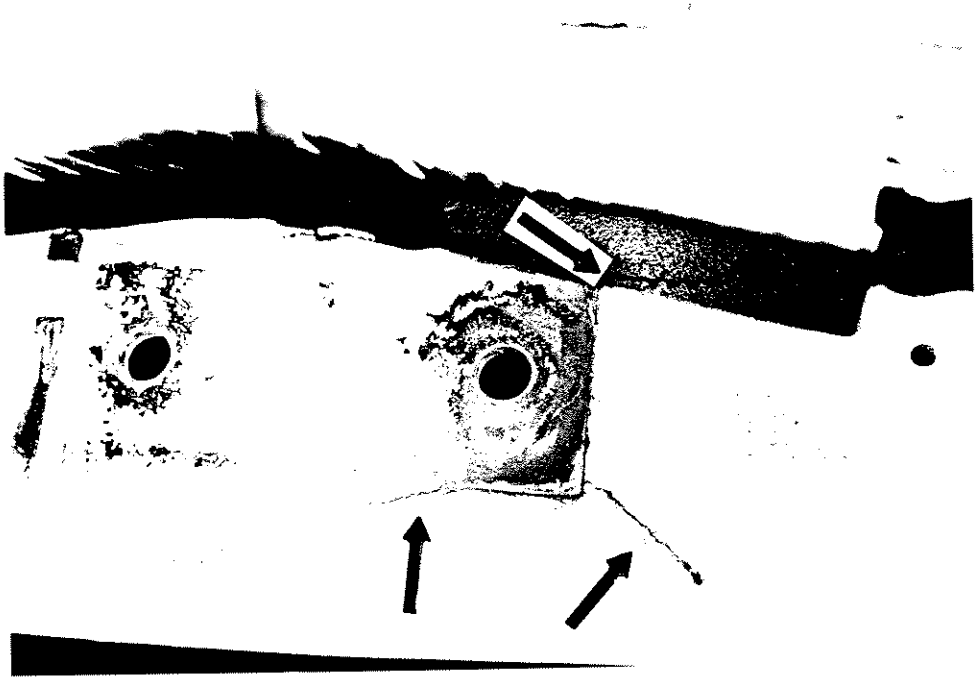
UNSCHEDULED MAINTENANCE



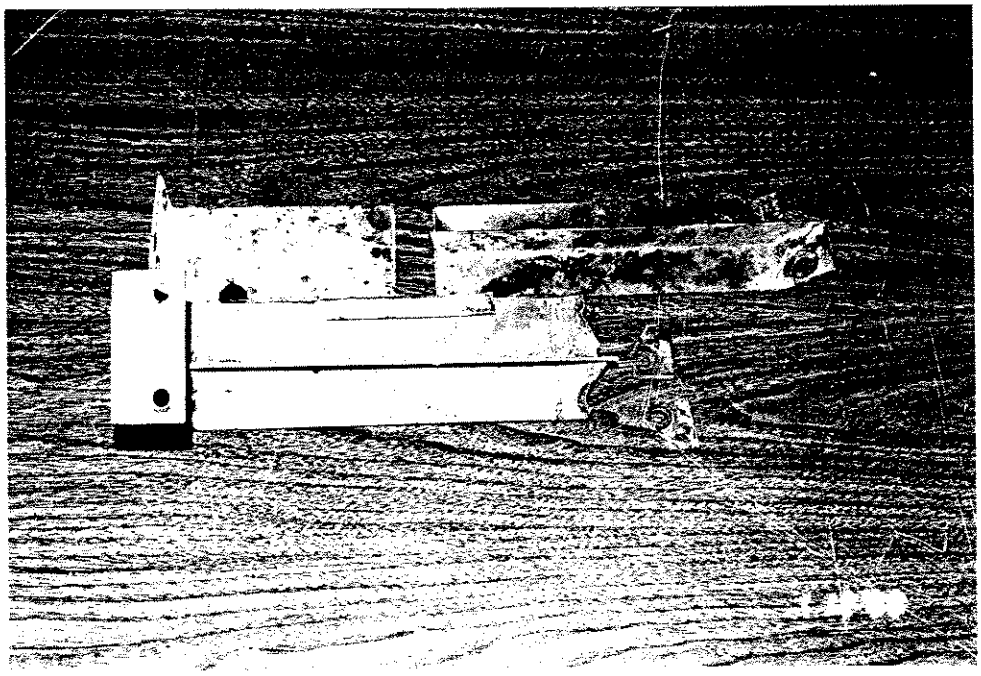
FAILED LEFT REAR ABS VALVE
(566 TEST MILES)

WORN LEFT REAR SUSPENSION PAD
(3,022 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

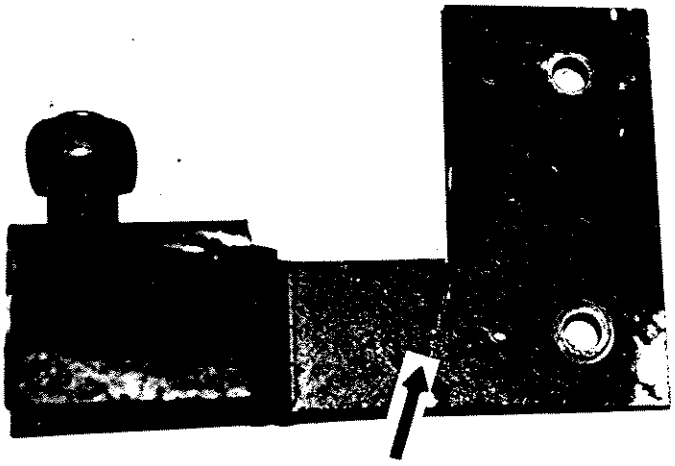


CRACKED RIGHT FRAME RAIL
(3,022 TEST MILES)

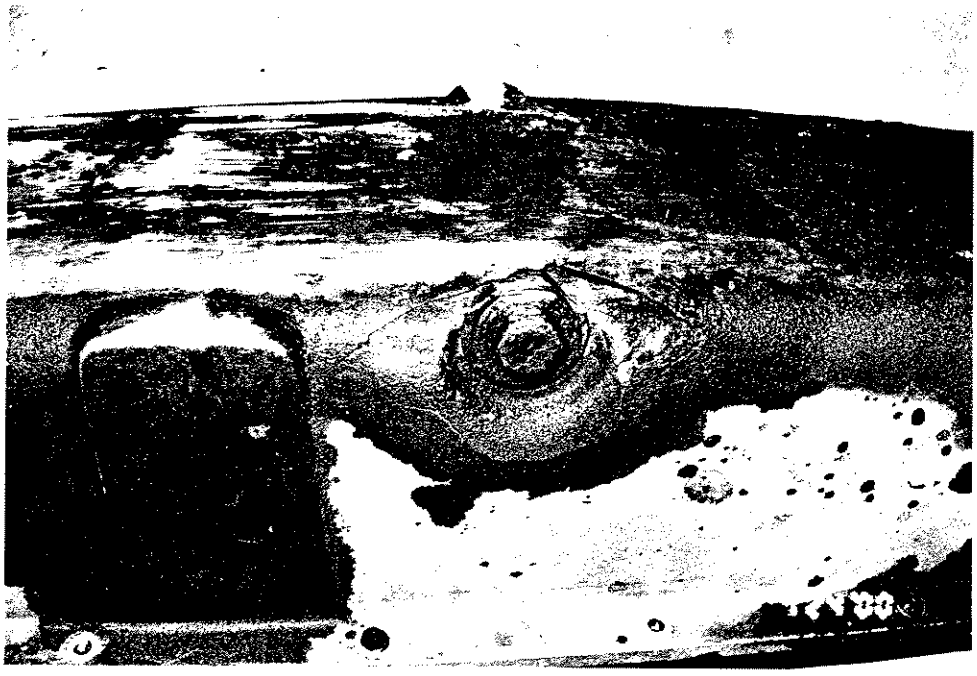


BROKEN TRANSMISSION COOLER BRACKETS
(4,045 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

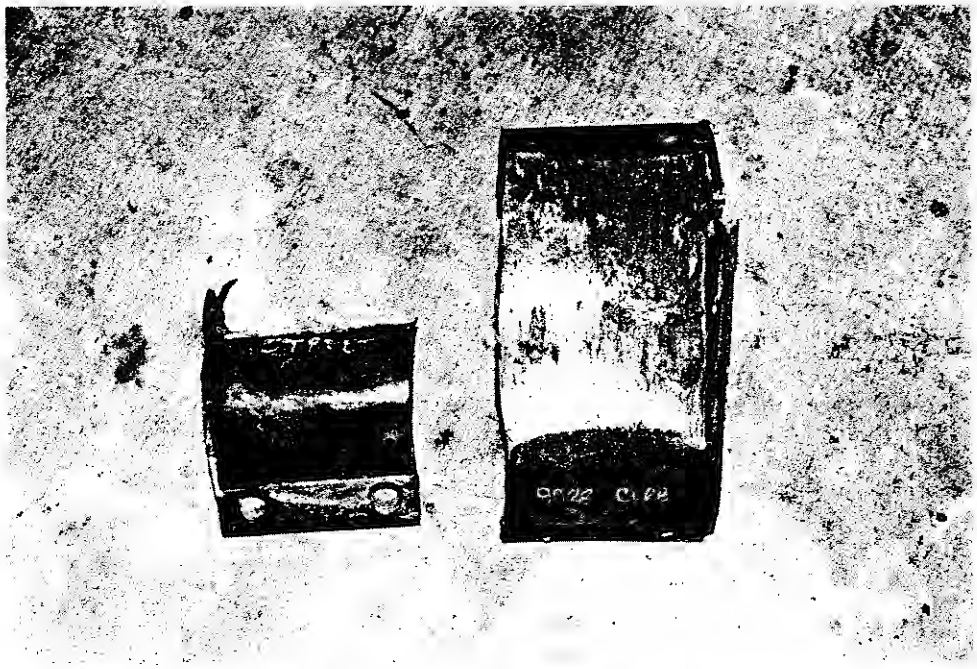


BROKEN DOOR HINGE
(4,884 TEST MILES)

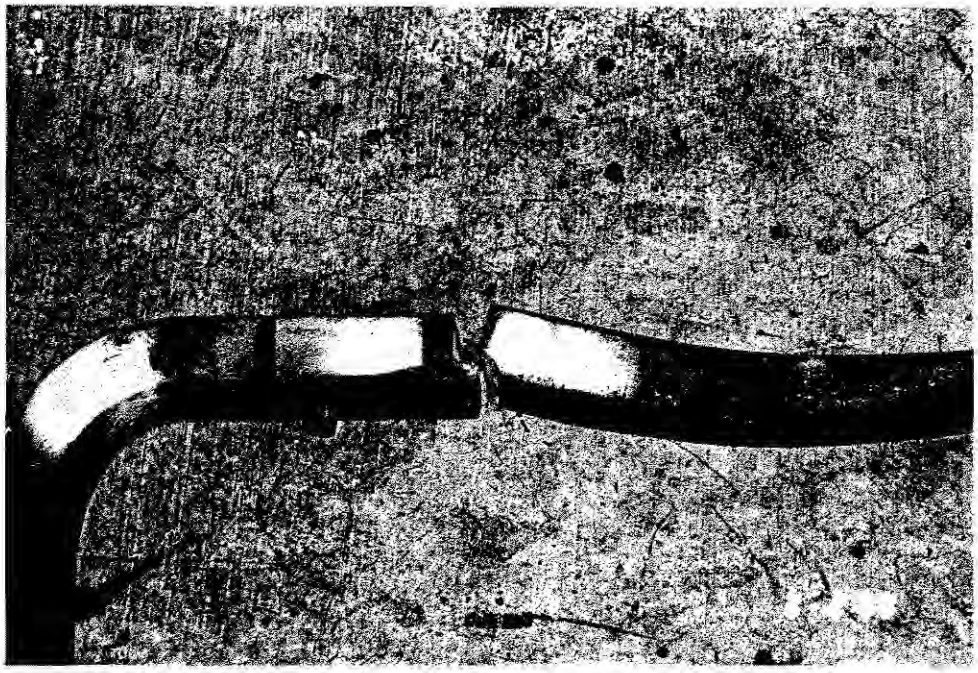


CRACKED OIL PAN
(5,169 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

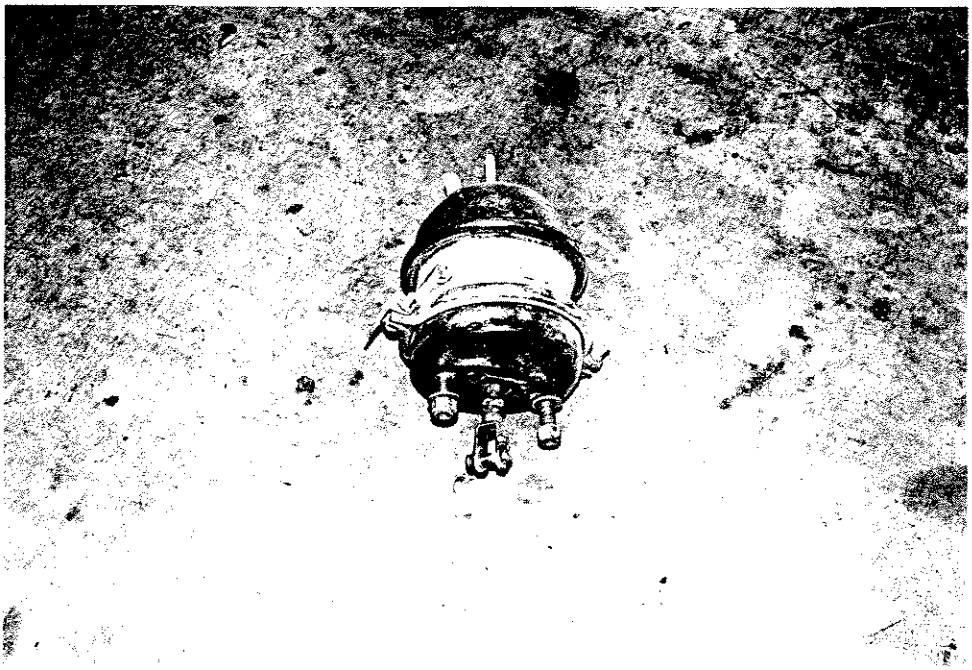


WORN WEAR PADS, REAR SUSPENSION
(6,918 TEST MILES)

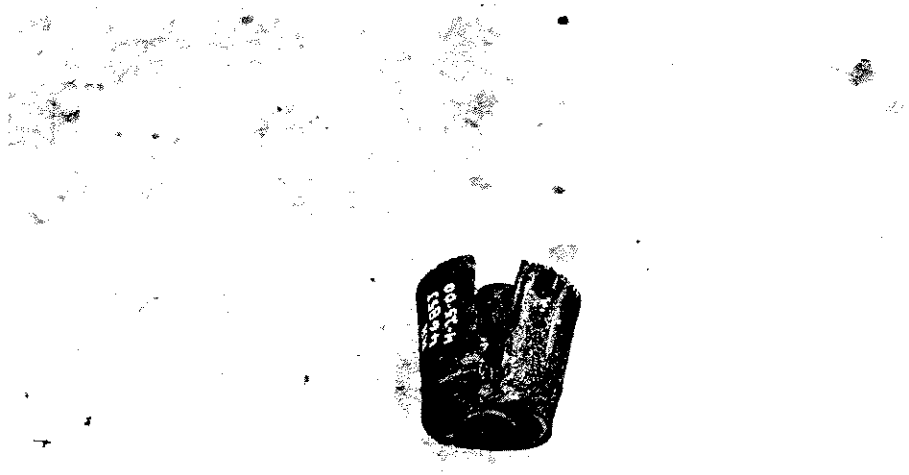


BROKEN LEFT REAR SPRING BEAM
(7,183 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



FAILED RIGHT REAR MAXI BRAKE
(9,620 TEST MILES)



DAMAGED RIGHT REAR SPRING BEAM ROLLER
(13,299 TEST MILES)

6. FUEL ECONOMY TEST - A FUEL CONSUMPTION TEST USING AN APPROPRIATE OPERATING CYCLE

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable fuel consumption data on transit buses produced by different manufacturers. This fuel economy test bears no relation to the calculations done by the Environmental Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This fuel economy test, as designated here, is a measurement of the fuel expended by a vehicle traveling a specified test loop under specified operating conditions. The results of this test will not represent actual mileage but will provide data that can be used by recipients to compare buses tested by this procedure.

6-II. TEST DESCRIPTION

This test requires operation of the bus over a course based on the Transit Coach Operating Duty Cycle (ADB Cycle) at seated load weight using a procedure based on the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82. The procedure has been modified by elimination of the control vehicle and by modifications as described below. The inherent uncertainty and expense of utilizing a control vehicle over the operating life of the facility is impractical.

The fuel economy test will be performed as soon as possible (weather permitting) after the completion of the GVW portion of the structural durability test. It will be conducted on the bus test lane at the PSBRTF. Signs are erected at carefully measured points which delineate the test course. A test run will comprise 3 CBD phases, 2 Arterial phases, and 1 Commuter phase. An electronic fuel measuring system will indicate the amount of fuel consumed during each phase of the test. The test runs will be repeated until there are at least two runs in both the clockwise and counterclockwise directions in which the fuel consumed for each run is within ± 4 percent of the average total fuel used over the 4 runs. A 20-minute idle consumption test is performed just prior to and immediately after the driven portion of the fuel economy test. The amount of fuel consumed while operating at normal/low idle is recorded on the Fuel Economy Data Form. This set of four valid runs along with idle consumption data comprise a valid test.

The test procedure is the ADB cycle with the following four modifications:

1. The ADB cycle is structured as a set number of miles in a fixed time in the following order: CBD, Arterial, CBD, Arterial, CBD, Commuter. A separate idle fuel consumption measurement is performed at the beginning and end of the fuel economy test. This phase sequence permits the reporting of fuel consumption for each of these phases separately, making the data more useful to bus manufacturers and transit properties.

2. The operating profile for testing purposes shall consist of simulated transit type service at seated load weight. The three test phases (figure 6-1) are: a central business district (CBD) phase of 2 miles with 7 stops per mile and a top speed of 20 mph; an arterial phase of 2 miles with 2 stops per mile and a top speed of 40 mph; and a commuter phase of 4 miles with 1 stop and a maximum speed of 40 mph. At each designated stop the bus will remain stationary for seven seconds. During this time, the passenger doors shall be opened and closed.

3. The individual ADB phases remain unaltered with the exception that 1 mile has been changed to 1 lap on the PSBRTF track. One lap is equal to 5,042 feet. This change is accommodated by adjusting the cruise distance and time.

4. The acceleration profile, for practical purposes and to achieve better repeatability, has been changed to "full throttle acceleration to cruise speed".

Several changes were made to the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82:

1. Sections 1.1, and 1.2 only apply to diesel, gasoline, methanol, and any other fuel in the liquid state (excluding cryogenic fuels).

1.1 SAE 1376 July 82 requires the use of at least a 16-gal fuel tank. Such a fuel tank when full would weigh approximately 160 lb. It is judged that a 12-gal tank weighing approximately 120 lb will be sufficient for this test and much easier for the technician and test personnel to handle.

1.2 SAE 1376 July 82 mentions the use of a mechanical scale or a flowmeter system. This test procedure uses a load cell readout combination that provides an accuracy of 0.5 percent in weight and permits on-board weighing of the gravimetric tanks at the end of each phase. This modification permits the determination of a fuel economy value for each phase as well as the overall cycle.

2. Section 2.1 applies to compressed natural gas (CNG), liquified natural gas (LNG), cryogenic fuels, and other fuels in the vapor state.

2.1 A laminar type flowmeter will be used to determine the fuel consumption. The pressure and temperature across the flow element will be monitored by the flow computer. The flow computer will use this data to calculate the gas flow rate. The flow computer will also display the flow rate (scfm) as well as the total fuel used (scf). The total fuel used (scf) for each phase will be recorded on the Fuel Economy Data Form.

3. Use both sections 1 and 2 for dual fuel systems.

FUEL ECONOMY CALCULATION PROCEDURE

A. For diesel, gasoline, methanol and fuels in the liquid state.

The reported fuel economy is based on the following: measured test quantities--distance traveled (miles) and fuel consumed (pounds); standard reference values--density of water at 60°F (8.3373 lbs/gal) and volumetric heating value of standard fuel; and test fuel specific gravity (unitless) and volumetric heating value (BTU/gal). These combine to give a fuel economy in miles per gallon (mpg) which is corrected to a standard gallon of fuel referenced to water at 60°F. This eliminates fluctuations in fuel economy due to fluctuations in fuel quality. This calculation has been programmed into a computer and the data processing is performed automatically.

The fuel economy correction consists of three steps:

1.) Divide the number of miles of the phase by the number of pounds of fuel consumed

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$FEo_{mi/lb}$ = Observed fuel economy = $\frac{\text{miles}}{\text{lb of fuel}}$

2.) Convert the observed fuel economy to miles per gallon [mpg] by multiplying by the specific gravity of the test fuel Gs (referred to water) at 60°F and multiply by the density of water at 60°F

$$\mathbf{FEo_{mpg}} = \mathbf{FEc_{mi/lb}} \times Gs \times Gw$$

where **Gs** = Specific gravity of test fuel at 60°F (referred to water)
Gw = 8.3373 lb/gal

3.) Correct to a standard gallon of fuel by dividing by the volumetric heating value of the test fuel (H) and multiplying by the volumetric heating value of standard reference fuel (Q). Both heating values must have the same units.

$$\mathbf{FEc} = \mathbf{FEo_{mpg}} \times \frac{Q}{H}$$

where

H = Volumetric heating value of test fuel [BTU/gal]
Q = Volumetric heating value of standard reference fuel

Combining steps 1-3 yields

$$\Rightarrow FEc = \frac{miles}{lbs} \times (Gs \times Gw) \times \frac{Q}{H}$$

4.) Covert the fuel economy from mpg to an energy equivalent of miles per BTU. Since the number would be extremely small in magnitude, the energy equivalent will be represented as miles/BTUx10^6.

Eq = Energy equivalent of converting mpg to mile/BTUx10^6.

$Eq = ((mpg)/(H))x10^6$

B. CNG, LNG, cryogenic and other fuels in the vapor state.

The reported fuel economy is based on the following: measured test quantities--distance traveled (miles) and fuel consumed (scf); density of test fuel, and volumetric heating value (BTU/lb) of test fuel at standard conditions (P=14.73 psia and T=60 °F). These combine to give a fuel economy in miles per lb. The energy equivalent (mile/BTUx10^6) will also be provided so that the results can be compared to buses that use other fuels.

1.) Divide the number of miles of the phase by the number of standard cubic feet (scf) of fuel consumed.

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$\mathbf{FEo_{mi/scf}} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{scf of fuel}}$$

2.) Convert the observed fuel economy to miles per lb by dividing FEo by the density of the test fuel at standard conditions (Lb/ft^3).

Note: The density of test fuel must be determined at standard conditions as described above. If the density is not defined at the above standard conditions, then a correction will be needed before the fuel economy can be calculated.

$$\mathbf{FEo_{mi/lb}} = FEo / Gm$$

where Gm = Density of test fuel at standard conditions

3.) Convert the observed fuel economy (FEomi/lb) to an energy equivalent of (miles/BTUx10^6) by dividing the observed fuel economy (FEomi/lb) by the heating value of the test fuel at standard conditions.

$$Eq = ((FEomi/lb)/H)x10^6$$

where

Eq = Energy equivalent of miles/lb to mile/BTUx10^6
H = Volumetric heating value of test fuel at standard conditions

6-III. DISCUSSION

This is a comparative test of fuel economy using number one diesel fuel with a heating value of 20,214.0 btu/lb. The driving cycle consists of Central Business District (CBD), Arterial (ART), and Commuter (COM) phases as described in 6-II. The fuel consumption for each driving cycle and for idle is measured separately. The results are corrected to a reference fuel with a volumetric heating value of 127,700 btu/gal.

An extensive pretest maintenance check is made including the replacement of all lubrication fluids. The details of the pretest maintenance are given in the first three Pretest Maintenance Forms. The fourth sheet shows the Pretest Inspection. The next sheet shows the correction calculation for the test fuel. The next four Fuel Economy Forms provide the data from the four test runs. Finally, the summary sheet provides the average fuel consumption. The overall average is based on total fuel and total mileage for each phase. The overall average fuel consumption values were; CBD - 3.18 mpg, ART - 3.93 mpg, and COM - 7.86 mpg. Average fuel consumption at idle was 4.71 lb/hr (0.75 gph).

FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 9922	Date: 3-22-00	SLW (lbs): 25,590
Personnel: S.C., E.L. & E.D.		

FUEL SYSTEM	OK	Date	Initials
Install fuel measurement system	✓	3-22-00	S.C.
Replace fuel filter	✓	3-22-00	S.C.
Check for fuel leaks	✓	3-22-00	S.C.
Specify fuel type (refer to fuel analysis)			
Remarks:			
BRAKES/TIRES	**OK**	**Date**	**Initials**
Inspect hoses	✓	3-22-00	S.C.
Inspect brakes	✓	3-22-00	S.C.
Relube wheel bearings	✓	3-22-00	S.C.
Check tire inflation pressures (mfg. specs.)	✓	3-22-00	S.C.
Remarks:			
COOLING SYSTEM	**OK**	**Date**	**Initials**
Check hoses and connections	✓	3-22-00	S.C.
Check system for coolant leaks	✓	3-22-00	S.C.
Remarks:			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 2)

Bus Number: 9922	Date: 3-22-00
Personnel: S.C., E.L. & E.D.	

ELECTRICAL SYSTEMS	OK	Date	Initials
Check battery	✓	3-22-00	S.C.
Inspect wiring	✓	3-22-00	S.C.
Inspect terminals	✓	3-22-00	S.C.
Check lighting	✓	3-22-00	S.C.
Remarks:			

DRIVE SYSTEM	OK	Date	Initials
Drain transmission fluid	✓	3-22-00	S.C.
Replace filter/gasket	✓	3-22-00	S.C.
Check hoses and connections	✓	3-22-00	S.C.
Replace transmission fluid	✓	3-22-00	S.C.
Check for fluid leaks	✓	3-22-00	S.C.
Remarks:			

LUBRICATION	OK	Date	Initials
Drain crankcase oil	✓	3-22-00	S.C.
Replace filters	✓	3-22-00	S.C.
Replace crankcase oil	✓	3-22-00	S.C.
Check for oil leaks	✓	3-22-00	S.C.
Check oil level	✓	3-22-00	S.C.
Lube all chassis grease fittings	✓	3-22-00	S.C.
Lube universal joints	✓	3-22-00	S.C.
Replace differential lube including axles	✓	3-22-00	S.C.
Remarks:			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 3)

Bus Number: 9922	Date: 3-22-00
Personnel: S.C.	

EXHAUST/EMISSION SYSTEM	OK	Date	Initials
Check for exhaust leaks	✓	3-22-00	S.C.
Remarks:			

ENGINE	OK	Date	Initials
Replace air filter	✓	3-22-00	S.C.
Inspect air compressor and air system	✓	3-22-00	S.C.
Inspect vacuum system, if applicable	✓	3-22-00	S.C.
Check and adjust all drive belts	✓	3-22-00	S.C.
Check cold start assist, if applicable	✓	3-22-00	S.C.
Remarks:			

STEERING SYSTEM	OK	Date	Initials
Check power steering hoses and connectors	✓	3-22-00	S.C.
Service fluid level	✓	3-22-00	S.C.
Check power steering operation	✓	3-22-00	S.C.
Remarks:			

	OK	Date	Initials
Ballast bus to seated load weight	✓	3-22-00	S.C.

TEST DRIVE	OK	Date	Initials
Check brake operation	✓	3-22-00	S.C.
Check transmission operation	✓	3-22-00	S.C.
Remarks:			

FUEL ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 9922	Date: 3-23-00
Personnel: S.C. & E.D.	

PRE WARM-UP	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	S.C.
Cold tire pressure (psi): Front 115 Middle N/A Rear 115	S.C.
Tire wear:	S.C.
Engine oil level	S.C.
Engine coolant level	S.C.
Interior and exterior lights on, evaporator fan on	S.C.
Fuel economy instrumentation installed and working properly.	S.C.
Fuel line -- no leaks or kinks	S.C.
Speed measuring system installed on bus. Speed indicator installed in front of bus and accessible to TECH and Driver.	S.C.
Bus is loaded to SLW	S.C.
WARM-UP	**If OK, Initial**
Bus driven for at least one hour warm-up	S.C.
No extensive or black smoke from exhaust	S.C.
POST WARM-UP	**If OK, Initial**
Warm tire pressure (psi): Front 120 Middle N/A Rear 120	S.C.
Environmental conditions Average wind speed <12 mph and maximum gusts <15 mph Ambient temperature between 30°(-1°) and 90°F(32°C) Track surface is dry Track is free of extraneous material and clear of interfering traffic	S.C.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9922	Manufacturer: Gillig	Date: 3-23-00
Run Number: 1	Personnel: S.C., E.D. & R.H.	
Test Direction: □CW or ⊠CCW	Temperature (°F): 45	Humidity (%): 87
SLW (lbs): 25,590	Wind Speed (mph) & Direction: Calm	Barometric Pressure (in.Hg): 30.10

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	9:15	9:15	24.2	112.20	107.80	4.40
ART #1	0	4:11	4:11	25.6	107.80	104.75	3.05
CBD #2	0	9:14	9:14	26.6	104.75	100.35	4.40
ART #2	0	4:06	4:06	27.5	100.35	97.20	3.15
CBD #3	0	8:55	8:55	28.7	97.20	93.55	3.65
COMMUTER	0	5:59	5:59	28.9	93.55	90.45	3.10
						Total Fuel =	21.75 lbs

20 minute idle : Total Fuel Used = 1.85 lbs

Heating Value = 20,214.0 BTU/LB

Comments:

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9922	Manufacturer: Gillig	Date: 3-23-00
Run Number: 2	Personnel: S.C., E.D. & R.H.	
Test Direction: ⊠CW or □CCW	Temperature (°F): 47	Humidity (%): 87
SLW (lbs): 25,590	Wind Speed (mph) & Direction: Calm	Barometric Pressure (in.Hg): 30.10

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:57	8:57	29.1	90.45	86.85	3.60
ART #1	0	4:09	4:09	31.5	86.85	83.85	3.00
CBD #2	0	9:09	9:09	32.0	83.85	80.35	3.50
ART #2	0	4:07	4:07	32.2	80.35	77.30	3.05
CBD #3	0	9:08	9:08	32.6	77.30	73.80	3.50
COMMUTER	0	6:00	6:00	33.0	73.80	70.55	3.25
						Total Fuel =	19.90 lbs

20 minute idle: Total Fuel Used = N/A

Heating Value = 20,214.0 BTU/LB

Comments:

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9922	Manufacturer: Gillig	Date: 3-23-00
Run Number: 3	Personnel: S.C., E.D. & R.H.	
Test Direction: □CW or ⊠CCW	Temperature (°F): 52	Humidity (%): 66
SLW (lbs): 25,590	Wind Speed (mph) & Direction: Calm	Barometric Pressure (in.Hg): 30.10

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:55	8:55	28.3	90.55	86.90	3.65
ART #1	0	4:07	4:07	29.2	86.90	83.90	3.00
CBD #2	0	8:57	8:57	30.1	83.90	80.25	3.65
ART #2	0	4:12	4:12	31.9	80.25	77.25	3.00
CBD #3	0	8:54	8:54	33.1	77.25	73.35	3.90
COMMUTER	0	6:00	6:00	33.4	73.35	70.65	2.70
							Total Fuel = 19.90 lbs

20 minute idle: Total Fuel Used = N/A
Heating Value = 20,214.0 BTU/LB
Comments:

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9922	Manufacturer: Gillig	Date: 3-23-00
Run Number: 4	Personnel: S.C., E.D. & R.H.	
Test Direction: ☒CW or ☐CCW	Temperature (°F): 54	Humidity (%): 66
SLW (lbs): 25,590	Wind Speed (mph) & Direction: Calm	Barometric Pressure (in.Hg): 30.10

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	9:01	9:01	34.7	70.65	66.95	3.70
ART #1	0	4:11	4:11	35.3	66.95	63.85	3.10
CBD #2	0	9:01	9:01	36.1	63.85	60.25	3.60
ART #2	0	4:10	4:10	36.9	60.25	57.20	3.05
CBD #3	0	9:03	9:03	37.2	57.20	53.45	3.75
COMMUTER	0	6:01	6:01	37.7	53.45	50.25	3.20
						Total Fuel =	20.40 lbs

20 minute idle : Total Fuel Used = 1.29 lbs
Heating Value = 20,214.0 BTU/LB
Comments:

FUEL ECONOMY SUMMARY SHEET

BUS MANUFACTURER :Gillig Corporation BUS NUMBER :Bus 9
BUS MODEL :G22EL02E2 TEST DATE :03/23/00

FUEL TYPE : DIESEL
SP. GRAVITY : .8095
HEATING VALUE : 20214.00 BTU/Lb
Standard Conditions : 60 deg F and 14.7 psi
Density of Water : 8.3373 lb/gallon at 60 deg F

CYCLE	TOTAL FUEL USED (Lb)	TOTAL MILES	FUEL ECONOMY M/Lb(Measured)	FUEL ECONOMY MPG(Corrected)
Run # :1, CCW				
CBD	12.45	5.73	.46	2.88
ART	6.20	3.82	.62	3.86
COM	3.10	3.82	1.23	7.72
TOTAL	21.75	13.37	.61	3.85
Run # :2, CW				
CBD	10.60	5.73	.54	3.39
ART	6.05	3.82	.63	3.96
COM	3.25	3.82	1.18	7.37
TOTAL	19.90	13.37	.67	4.21
Run # :3, CCW				
CBD	11.20	5.73	.51	3.21
ART	6.00	3.82	.64	3.99
COM	2.70	3.82	1.41	8.87
TOTAL	19.90	13.37	.67	4.21
Run # :4, CW				
CBD	11.05	5.73	.52	3.25
ART	6.15	3.82	.62	3.89
COM	3.20	3.82	1.19	7.48
TOTAL	20.40	13.37	.66	4.11

IDLE CONSUMPTION

First 20 Minutes Data : 1.85 Lb Last 20 Minutes Data : 1.29 Lb
Average Idle Consumption : 4.71 Lb/Hr

RUN CONSISTENCY: % Difference from overall average of total fuel used

Run 1 : -6.2 Run 2 : 2.9 Run 3 : 2.9 Run 4 : .4

SUMMARY

Average Idle Consumption : .75 G/Hr
Average CBD Phase Consumption : 3.18 MPG
Average Arterial Phase Consumption : 3.93 MPG
Average Commuter Phase Consumption : 7.86 MPG
Overall Average Fuel Consumption : 4.10 MPG
Overall Average Fuel Consumption : 30.02 Miles/ Million BTU

7. NOISE

7.1 INTERIOR NOISE AND VIBRATION TESTS

7.1-I. TEST OBJECTIVE

The objective of these tests is to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level will be measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system shall provide a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories will be switched off and all openings including doors and windows will be closed. This test will be performed at the ABTC.

2. The bus accelerating at full throttle from a standing start to 35 mph on a level pavement. All openings will be closed and all accessories will be operating during the test. This test will be performed on the track at the PSBRTF.

3. The bus will be operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles will be noted. This test will be performed on the test segment between the PSBRTF and the ABTC.

All tests will be performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions will be recorded in the test data.

7.1-III. DISCUSSION

This test is performed in three parts. The first part exposes the exterior of the vehicle to 80 dB(A) on the left side of the bus and the noise transmitted to the interior is measured. The overall average of the six measurements was 53.6 dB(A); ranging from 48.3 dB(A) at the rear passenger seats to 58.0 dB(A) at the driver's seat and in line with the front speaker. The interior ambient noise level for this test was 36.1 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 74.1 dB(A) at the driver's passenger seat and front speaker to 77.1 dB(A) at the rear passenger seats. The overall average was 75.2 dB(A). The interior ambient noise level for this test was 37.5 dB(A).

The third part of the test is to listen for resonant vibrations, rattles, and other noise sources while operating over the road. No vibrations or rattles were noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise

Bus Number: 9922	Date: 11-1-99
Personnel: B.L., S.C.& C.S.	
Temperature (°F): 72	Humidity (%): 51
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.14	
Initial Sound Level Meter Calibration: ☒ checked by B.L.	
Interior Ambient Noise Level dB(A): 36.1	Exterior Ambient Noise Level dB(A): 52.6
Microphone Height During Testing (in): 45	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	58.0
Front Passenger Seats	55.2
In Line with Front Speaker	58.0
In Line with Middle Speaker	53.5
In Line with Rear Speaker	48.5
Rear Passenger Seats	48.3

Final Sound Level Meter Calibration: ☒ checked by B.L.

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test

Bus Number: 9922	Date: 3-24-00
Personnel: S.C., E.D. & R.H.	
Temperature (°F): 44	Humidity (%): 68
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.12	
Initial Sound Level Meter Calibration: ⊠ checked by B.L.	
Interior Ambient Noise Level dB(A): 37.5	Exterior Ambient Noise Level dB(A): 45.5
Microphone Height During Testing (in): 45	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	74.1
Front Passenger Seats	74.1
Middle Passenger Seats	75.5
Rear Passenger Seats	77.1

Final Sound Level Meter Calibration: ⊠ checked by B.L.

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test

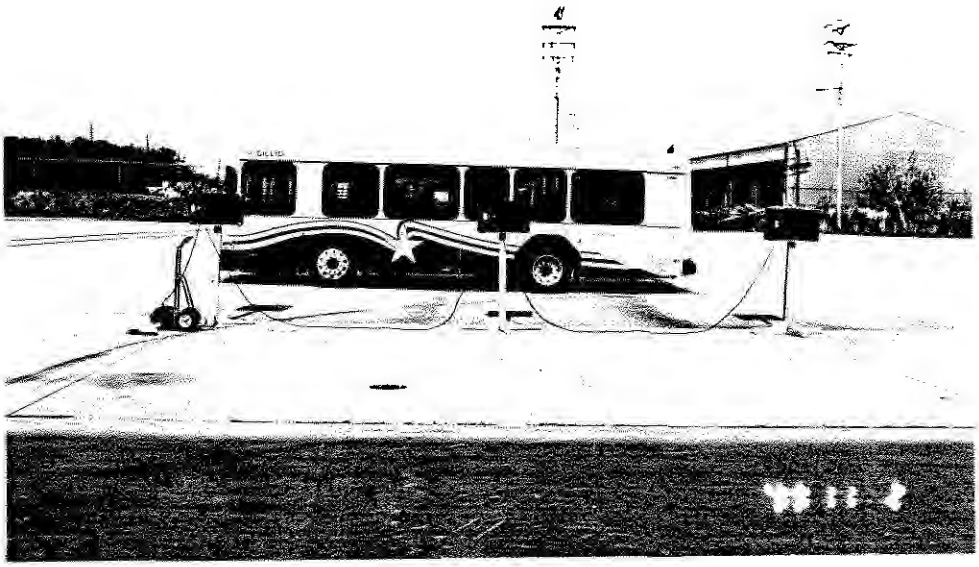
Bus Number: 9922	Date: 3-24-00
Personnel: S.C., E.D. & R.H.	
Temperature (°F): 44	Humidity (%): 68
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.12	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location
Engine and Accessories	None noted.
Windows and Doors	None noted.
Seats and Wheel Chair lifts	None noted.

Comment on any other vibration or noise source which may have occurred that is not described above: None noted.

7.1 INTERIOR NOISE TEST



TEST BUS SET-UP FOR INTERIOR NOISE TEST

7.2 EXTERIOR NOISE TESTS

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus will be operated at a SLW in three different conditions using a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed at or below 35 mph and just prior to transmission upshift.
2. Accelerating at full throttle from standstill.
3. Stationary, with the engine at low idle, high idle, and wide open throttle.

In addition, the buses will be tested with and without the air conditioning and all accessories operating. The exterior noise levels will be recorded.

The test site is at the Test Track Facility and the test procedures will be in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The test site is an open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus will measure the noise level.

During the test, special attention should be paid to:

1. The test site characteristics regarding parked vehicles, signboards, buildings, or other sound-reflecting surfaces
2. Proper usage of all test equipment including set-up and calibration
3. The ambient sound level

7.2-III. DISCUSSION

The Exterior Noise Test determines the noise level generated by the vehicle under different driving conditions and at stationary low and high idle, with and without air conditioning and accessories operating. The test site is a large, level, bituminous paved area with no reflecting surfaces nearby.

With an exterior ambient noise level of 46.5 dB(A), the average test result obtained while accelerating from a constant speed was 72.7 dB(A) on the right side and 73.0 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 43.4 dB(A), the average of the results obtained were 72.6 dB(A) on the right side and 73.4 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 61.9 dB(A) at low idle, 62.8 dB(A) at high idle and 74.1 dB(A) at wide open throttle. With the accessories and air conditioning off, the readings averaged 0.7 dB(A) lower at low idle, 1.2 dB(A) lower at high idle and 0.2 dB(A) lower at wide open throttle. The exterior ambient noise level measured during this test was 47.7 dB(A).

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 9922	Date: 3-24-00
Personnel: S.C., E.D. & R.H.	
Temperature (°F): 48	Humidity (%): 68
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.12	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ⊠ checked by B.L.	
Initial Sound Level Meter Calibration: ⊠ checked by B.L.	
Exterior Ambient Noise Level dB(A): 46.5	

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	72.1	1	72.2
2	71.6	2	72.7
3	72.4	3	72.1
4	72.8	4	73.1
5	72.6	5	72.8
Average of two highest actual noise levels = 72.7 dB(A)		Average of two highest actual noise levels = 73.0 dB(A)	

Final Sound Level Meter Calibration Check: ⊠ checked by B.L.
Comments:

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 9922	Date: 3-24-00
Personnel: S.C., E.D. & R.H.	
Temperature (°F): 48	Humidity (%): 68
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg):30.12	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ⊠ checked by B.L.	
Initial Sound Level Meter Calibration: ⊠ checked by B.L.	
Exterior Ambient Noise Level dB(A): 46.5	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	72.0	1	72.8
2	72.7	2	73.1
3	72.5	3	72.5
4	71.9	4	73.7
5	71.8	5	73.1
Average of two highest actual noise levels = 72.6 dB(A)		Average of two highest actual noise levels = 73.4 dB(A)	

Final Sound Level Meter Calibration Check: ⊠ checked by B.L.
Comments:

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 9922	Date: 3-24-00
Personnel: S.C., E.D. & R.H.	
Temperature (°F): 53	Humidity (%):
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.12	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ⊠ checked by B.L.	
Initial Sound Level Meter Calibration: ⊠ checked by B.L.	
Exterior Ambient Noise Level dB(A): 47.7	

Accessories and Air Conditioning ON			
Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	700	60.9	62.6
High Idle	1,000	61.9	63.6
Wide Open Throttle	2,425	73.3	74.9

Accessories and Air Conditioning OFF			
Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Actual
Low Idle	700	60.4	61.9
High Idle	1,000	61.2	62.0
Wide Open Throttle	2,425	73.0	74.8

Final Sound Level Meter Calibration Check: ⊠ checked by B.L.
Comments:

STURAA TEST

12 YEAR

500,000 MILE BUS

from

GILLIG

MODEL LOW FLOOR

JANUARY 2012

PTI-BT-R1109

PENNSTATE

The Thomas D. Larson
Pennsylvania Transportation Institute
Vehicle Systems and Safety Program

201 Transportation Research Building (814) 865-1891
The Pennsylvania State University
University Park, PA 16802

Bus Testing and Research Center

2237 Old Route 220 N. (814) 695-3404
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ACCREDITED
MECHANICAL TESTING
CERTIFICATE 3172.01

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Gillig submitted a model Low Floor, CNG-powered 26 seat/30-foot bus, for a 12 yr/500,000 mile STURAA test. The odometer reading at the time of delivery was 13,938 miles. Testing started on June 7, 2011 and was completed on January 30, 2012. The Check-In section of the report provides a description of the bus and specifies its major components.

The primary part of the test program is the Structural Durability Test, which also provides the information for the Maintainability and Reliability results. The Structural Durability Test was started on June 15, 2011 and was completed on December 9, 2011.

The interior of the bus is configured with seating for 26 passengers including the driver. (7 seats fold away for 2 wheelchair positions). Free floor space will accommodate 22 standing passengers resulting in a potential load of 48 persons. At 150 lbs per person, this load results in a measured gross vehicle weight of 33,440 lbs. The first segment of the Structural Durability Test was performed with the bus loaded to a GVW of 33,440 lbs. The middle segment was performed at a seated load weight of 30,310 lbs and the final segment was performed at a curb weight of 26,310 lbs. Durability driving resulted in unscheduled maintenance and failures that involved a variety of subsystems. A description of failures, and a complete and detailed listing of scheduled and unscheduled maintenance is provided in the Maintainability section of this report.

Effective January 1, 2010 the Federal Transit Administration determined that the total number of simulated passengers used for loading all test vehicles will be based on the full complement of seats and free-floor space available for standing passengers (150 lbs per passenger). The passenger loading used for dynamic testing will not be reduced in order to comply with Gross Axle Weight Ratings (GAWR's) or the Gross Vehicle Weight Ratings (GVWR's) declared by the manufacturer. Cases where the loading exceeds the GAWR and/or the GVWR will be noted accordingly. During the testing program, all test vehicles transported or operated over public roadways will be loaded to comply with the GAWR and GVWR specified by the manufacturer.

Accessibility, in general, was adequate, components covered in Section 1.3 (Repair and/or Replacement of Selected Subsystems) along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

The Reliability section compiles failures that occurred during Structural Durability Testing. Breakdowns are classified according to subsystems. The data in this section are arranged so that those subsystems with more frequent problems are apparent. The problems are also listed by class as defined in Section 2. The test bus encountered no Class 1 or Class 2 failures. Of the 18 reported failures, 15 were Class 3 and 3 were Class 4.

The Safety Test, (a double-lane change, obstacle avoidance test) was safely performed in both right-hand and left-hand directions up to a maximum test speed of 45

mph. The performance of the bus is illustrated by a speed vs. time plot. Acceleration and gradeability test data are provided in Section 4, Performance. The average time to obtain 50 mph was 29.47 seconds. The Stopping Distance phase of the Brake Test was completed with the following results; for the Uniform High Friction Test average stopping distances were 36.11' at 20 mph, 82.39' at 30 mph, 151.79' at 40 mph and 188.94' at 45 mph. The average stopping distance for the Uniform Low Friction Test was 37.76'. There was no deviation from the test lane during the performance of the Stopping Distance phase. During the Stability phase of Brake Testing the test bus experienced no deviation from the test lane but did experience pull to the left during both approaches to the Split Friction Road surface. The Parking Brake phase was completed with the test bus maintaining the parked position for the full five minute period with no slip or roll observed in both the uphill and downhill positions.

The Shakedown Test produced a maximum final loaded deflection of 0.049 inches with a permanent set ranging between -0.005 to 0.004 inches under a distributed static load of 16,575 lbs. The Distortion Test was completed with all subsystems, doors and escape mechanisms operating properly. No water leakage was observed throughout the test. All subsystems operated properly.

The Static Towing Test was performed using a target load (towing force) of 31,572 lbs. All four front pulls were completed to the full test load with no damage or deformation observed. The Dynamic Towing Test was performed by means of a front-lift tow. The towing interface was accomplished using a hydraulic under-lift wrecker. The bus was towed without incident and no damage resulted from the test. The manufacturer does not recommend towing the bus from the rear; therefore, a rear test was not performed. The Jacking and Hoisting Tests were also performed without incident. The bus was found to be stable on the jack stands, and the minimum jacking clearance observed with a tire deflated was 4.4 inches.

A Fuel Economy Test was run on simulated central business district, arterial, and commuter courses. The results were 0.99 M/lb, 1.07 M/lb, and 1.80 M/lb respectively; with an overall average of 1.17 M/lb.

A series of Interior and Exterior Noise Tests as well as Emissions Testing were performed. These data are listed in Section 7.1, 7.2 and 8 respectively.

ABBREVIATIONS

ABTC - Altoona Bus Test Center
A/C - air conditioner
ADB - advance design bus
ATA-MC - The Maintenance Council of the American Trucking Association
CBD - central business district
CW - curb weight (bus weight including maximum fuel, oil, and coolant; but without passengers or driver)
dB(A) - decibels with reference to 0.0002 microbar as measured on the "A" scale
DIR - test director
DR - bus driver
EPA - Environmental Protection Agency
FFS - free floor space (floor area available to standees, excluding ingress/egress areas, area under seats, area occupied by feet of seated passengers, and the vestibule area)
GVL - gross vehicle load (150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space)
GVW - gross vehicle weight (curb weight plus gross vehicle load)
GVWR - gross vehicle weight rating
MECH - bus mechanic
mpg - miles per gallon
mph - miles per hour
PM - Preventive maintenance
PSBRTF - Penn State Bus Research and Testing Facility
PTI - Pennsylvania Transportation Institute
rpm - revolutions per minute
SAE - Society of Automotive Engineers
SCH - test scheduler
SEC - secretary
SLW - seated load weight (curb weight plus 150 lb for every designed passenger seating position and for the driver)
STURAA - Surface Transportation and Uniform Relocation Assistance Act
TD - test driver
TECH - test technician
TM - track manager
TP - test personnel

TEST BUS CHECK-IN

I. OBJECTIVE

The objective of this task is to log in the test bus, assign a bus number, complete the vehicle data form, and perform a safety check.

II. TEST DESCRIPTION

The test consists of assigning a bus test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer must certify that the bus meets all Federal regulations.

III. DISCUSSION

The check-in procedure is used to identify in detail the major components and configuration of the bus.

The test bus consists of a Gillig, model Low Floor. The bus has a front door, forward of the front axle which is equipped with a Lift-U model LU11-08-05 fold out handicap ramp and a rear door forward of the rear axle. Power is provided by a CNG-fueled, Cummins model ISL G280 engine coupled to an Allison 3000 Series transmission.

The measured curb weight is 7,860 lbs for the front axle and 18,450 lbs for the rear axle. These combined weights provide a total measured curb weight of 26,310 lbs. There are 26 seats including the driver (7 fold away for 2 wheelchair positions) and room for 22 standing passengers bringing the total passenger capacity to 48. Gross load is 150 lb x 48 = 7,200 lbs. At full capacity, the measured gross vehicle weight is 33,440 lbs.

These test results were obtained prior to the accreditation of the lab on November 8, 2011; therefore, are not considered to be accredited in accordance with A2LA policy.

VEHICLE DATA FORM

Bus Number: 1109	Arrival Date: 6-7-11
Bus Manufacturer: Gillig	Vehicle Identification Number (VIN): 15GGE2718B1092262
Model Number: Low Floor	Date: 6-7-11
Personnel: B.L., E.D. & E.L.	Chassis: N/A

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	3,950	3,910	N/A	N/A	9,070	9,380
SLW	4,480	4,420	N/A	N/A	10,580	10,830
GVW	5,160	5,060	N/A	N/A	11,390	11,830

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	7,860	8,900	10,220	11,000
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	18,450	21,410	23,220	23,500
Total	26,310	30,310	33,440	GVWR: 34,500

Dimensions:

Length (ft/in)	30 / 8.5
Width (in)	100.0
Height (in)	133.5
Front Overhang (in)	89.75
Rear Overhang (in)	116.75
Wheel Base (in)	162.0
Wheel Track (in)	Front: 86.2
	Rear: 78.6

Bus Number: 1109	Date: 6-7-11

CLEARANCES:

Lowest Point Outside Front Axle	Location: Frame under radius rod Clearance(in): 8.4
Lowest Point Outside Rear Axle	Location: Transmission hose Clearance(in): 10.5
Lowest Point between Axles	Location: Skid plate Clearance(in): 11.0
Ground Clearance at the center (in)	12.6
Front Approach Angle (deg)	8.7
Rear Approach Angle (deg)	9.0
Ramp Clearance Angle (deg)	8.8
Aisle Width (in)	21.3
Inside Standing Height at Center Aisle (in)	Front – 94.3 Rear – 76.4

BODY DETAILS:

Body Structural Type	Semi – monocoque		
Frame Material	Stainless steal		
Body Material	Aluminum		
Floor Material	Composite rear and plywood low floor		
Roof Material	Aluminum – roof skin is fiberglass		
Windows Type	■ Fixed	■ Movable	
Window Mfg./Model No.	Ricon / AS-3 DOT 322 M-299		
Number of Doors	1 Front	1 Rear	
Mfr. / Model No.	Vapor / Front-Slide Glide Rear Push Out Plug door		
Dimension of Each Door (in)	Front - 75.4 x 32.1	Rear – 77.3 x 38.1	
Passenger Seat Type	☐ Cantilever	■ Pedestal	☐ Other (explain)
Mfr. / Model No.	American Seating / 1MBA36LNNNOBBO8		
Driver Seat Type	■ Air	☐ Spring	☐ Other (explain)
Mfr. / Model No.	Recaro / Liquid Cell		
Number of Seats (including Driver)	26 (7 fold away for 2 wheelchair positions)		

Bus Number: 1109	Date: 6-7-11

BODY DETAILS (Contd..)

Free Floor Space (ft^2)	36.7		
Height of Each Step at Normal Position (in)	Front 1. 16.1 2. N/A 3. N/A		
	Middle 1. N/A 2. N/A 3. N/A		
	Rear 1. 15.5 2. N/A 3. N/A		
Step Elevation Change - Kneeling (in)	Front – 3.9 Rear – 1.3		

ENGINE

Type	☐ C.I.	☐ Alternate Fuel	
	■ S.I.	☐ Other (explain)	
Mfr. / Model No.	Cummins / ISL G280		
Location	☐ Front	■ Rear	☐ Other (explain)
Fuel Type	☐ Gasoline	■ CNG	☐ Methanol
	☐ Diesel	☐ LNG	☐ Other (explain)
Fuel Tank Capacity (indicate units)	21,636 Scf		
Fuel Induction Type	■ Injected	☐ Carburetion	
Fuel Injector Mfr. / Model No.	Cummins / ISL G280		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	Cummins / ISL G280		
Alternator (Generator) Mfr. / Model No.	Delco Remy / 08600083		
Maximum Rated Output (Volts / Amps)	28 / 450		
Air Compressor Mfr. / Model No.	Wabco / Twin 30.4		
Maximum Capacity (ft^3 / min)	30.4		
Starter Type	■ Electrical	☐ Pneumatic	☐ Other (explain)
Starter Mfr. / Model No.	Delco Remy / 8200517		

Bus Number: 1109	Date: 6-7-11

TRANSMISSION

Transmission Type	☐ Manual	■ Automatic	
Mfr. / Model No.	Allison / 3000 Series		
Control Type	☐ Mechanical	■ Electrical	☐ Other
Torque Converter Mfr. / Model No.	Allison / B400R		
Integral Retarder Mfr. / Model No.	Allison / 418		

SUSPENSION

Number of Axles	2		
Front Axle Type	☐ Independent	■ Beam Axle	
Mfr. / Model No.	Arvin Meritor / MF512155ANL33		
Axle Ratio (if driven)	N/A		
Suspension Type	■ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 91 30215P1		
Middle Axle Type	☐ Independent	☐ Beam Axle	
Mfr. / Model No.	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	☐ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	☐ Independent	■ Beam Axle	
Mfr. / Model No.	Arvin Meritor / R523160NFL1844		
Axle Ratio (if driven)	5.38		
Suspension Type	■ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 90 3031		

Bus Number: 1109	Date: 6-7-11

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Alcoa / 22.5 x 8.25
	Tire Mfr./ Model No.	Michelin / 275/70R 22.5
Rear	Wheel Mfr./ Model No.	Alcoa / 22.5 x 8.25
	Tire Mfr./ Model No.	Michelin / 275/70R 22.5

BRAKES

Front Axle Brakes Type	■ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	Meritor / 15 x 6 Q+ (Cast Plus)		
Middle Axle Brakes Type	☐ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	■ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	Meritor / 16.5 x 7 Q+ (Cast Plus)		
Retarder Type	N/A		
Mfr. / Model No.	N/A		

HVAC

Heating System Type	☐ Air	■ Water	☐ Other
Capacity (Btu/hr)	94,000		
Mfr. / Model No.	Thermo King / T14		
Air Conditioner	■ Yes	☐ No	
Location	Rear		
Capacity (Btu/hr)	101,000		
A/C Compressor Mfr. / Model No.	Thermo King / X426		

STEERING

Steering Gear Box Type	Hydraulic gear
Mfr. / Model No.	TRW / TAS65
Steering Wheel Diameter	20.0
Number of turns (lock to lock)	4.75

Bus Number: 1109	Date: 6-7-11

OTHERS

Wheel Chair Ramps	Location: Front	Type: Fold out ramp
Wheel Chair Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	Lift-U / LU11-08-05	
Emergency Exit	Location: Windows Doors Roof hatch	Number: 4 2 1

CAPACITIES

Fuel Tank Capacity (units)	21,636 Scf
Engine Crankcase Capacity (gallons)	7.0
Transmission Capacity (gallons)	7.7
Differential Capacity (gallons)	5.5
Cooling System Capacity (gallons)	15.0
Power Steering Fluid Capacity (quarts)	14.0

VEHICLE DATA FORM

Bus Number: 1109	Date: 6-7-11

List all spare parts, tools and manuals delivered with the bus.

Part Number	Description	Qty.
N/A	N/A	N/A

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 1109	Date: 6-07-11

Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation	**B.R.**	
Body and Sheet Metal	**B.R.**	
Frame	**B.R.**	
Steering	**B.R.**	
Suspension	**B.R.**	
Interior/Seating	**B.R.**	
Axles	**B.R.**	
Brakes	**B.R.**	
Tires/Wheels	**B.R.**	
Exhaust	**B.R.**	
Fuel System	**B.R.**	
Power Plant	**B.R.**	
Accessories	**B.R.**	
Lift System	**B.R.**	
Interior Fasteners	**B.R.**	
Batteries	**B.R.**	

CHECK - IN

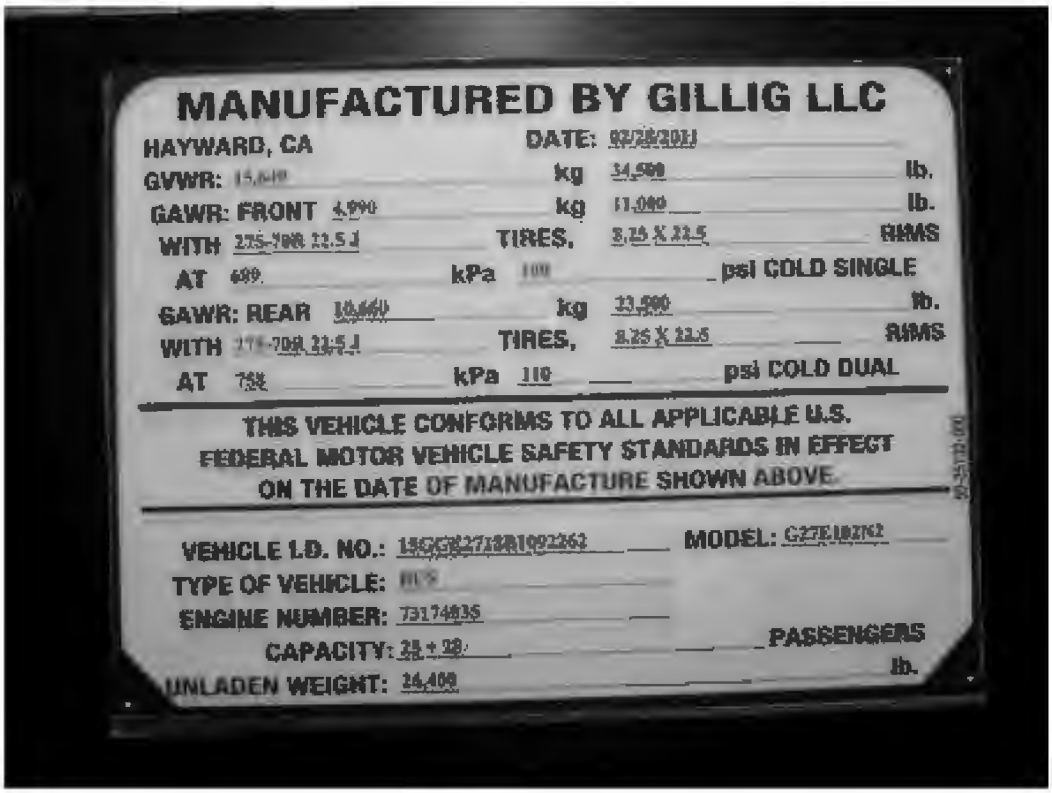
GILLIG
MODEL LOW FLOOR

CHECK - IN CONT.

GILLIG MODEL LOW FLOOR
EQUIPPED WITH A LIFT-U MODEL LU11-08-05
FOLDOUT HANDICAP RAMP

CHECK - IN CONT.

OPERATOR'S AREA



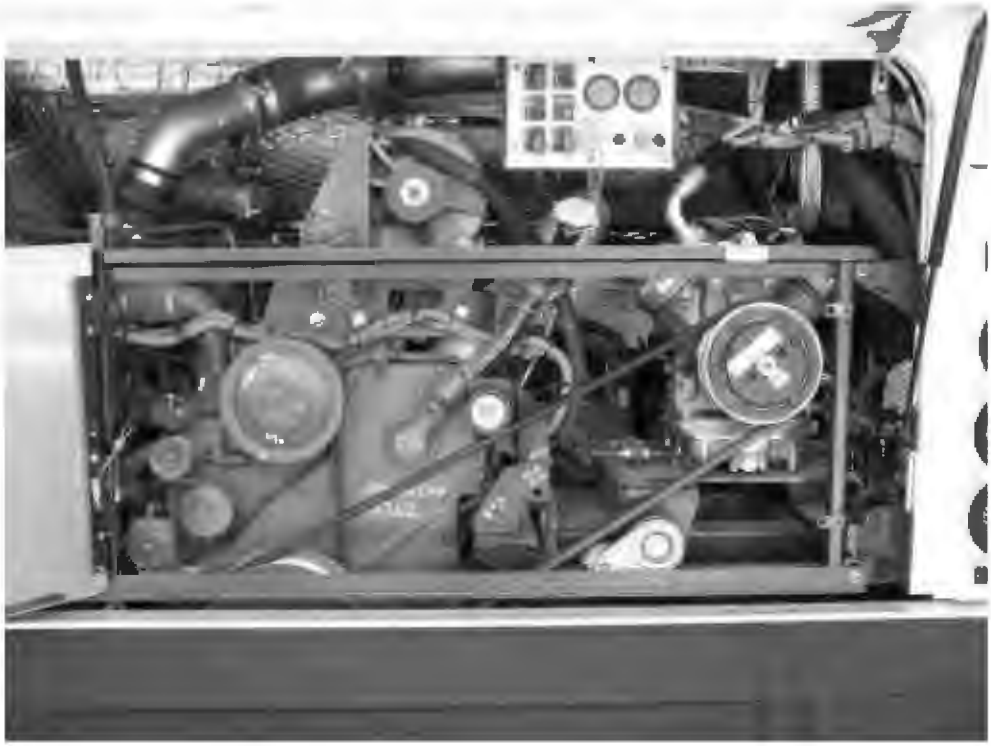
VIN TAG

CHECK - IN CONT.

INTERIOR FORWARD

INTERIOR REAR

CHECK - IN CONT.



ENGINE COMPARTMENT

CNG FUEL TANKS

1. MAINTAINABILITY

1.1 ACCESSIBILITY OF COMPONENTS AND SUBSYSTEMS

1.1-I. TEST OBJECTIVE

The objective of this test is to check the accessibility of components and subsystems.

1.1-II. TEST DESCRIPTION

Accessibility of components and subsystems is checked, and where accessibility is restricted the subsystem is noted along with the reason for the restriction.

1.1-III. DISCUSSION

Accessibility, in general, was adequate. Components covered in Section 1.3 (repair and/or replacement of selected subsystems), along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

ACCESSIBILITY DATA FORM

Bus Number: 1109	Date: 12-14-11

Component	Checked	Comments
ENGINE :		
Oil Dipstick	E.D.	
Oil Filler Hole	E.D.	
Oil Drain Plug	E.D.	
Oil Filter	E.D.	
Fuel Filter	E.D.	
Air Filter	E.D.	
Belts	E.D.	
Coolant Level	E.D.	
Coolant Filler Hole	E.D.	
Coolant Drain	E.D.	
Spark / Glow Plugs	E.D.	
Alternator	E.D.	
Diagnostic Interface Connector	E.D.	
TRANSMISSION :		
Fluid Dip-Stick	E.D.	
Filler Hole	E.D.	
Drain Plug	E.D.	
SUSPENSION :		
Bushings	E.D.	
Shock Absorbers	E.D.	
Air Springs	E.D.	
Leveling Valves	E.D.	
Grease Fittings	E.D.	

ACCESSIBILITY DATA FORM

Bus Number: 1109	Date: 12-14-11

Component	Checked	Comments
HVAC :		
A/C Compressor	E.D.	
Filters	E.D.	
Fans	E.D.	
ELECTRICAL SYSTEM :		
Fuses	E.D.	
Batteries	E.D.	
Voltage regulator	E.D.	
Voltage Converters	E.D.	
Lighting	E.D.	
MISCELLANEOUS :		
Brakes	E.D.	
Handicap Lifts/Ramps	E.D.	
Instruments	E.D.	
Axles	E.D.	
Exhaust	E.D.	
Fuel System	E.D.	
OTHERS :		

1.2 SERVICING, PREVENTIVE MAINTENANCE, AND REPAIR AND MAINTENANCE DURING TESTING

1.2-I. TEST OBJECTIVE

The objective of this test is to collect maintenance data about the servicing, preventive maintenance, and repair.

1.2.-II. TEST DESCRIPTION

The test will be conducted by operating the NBM and collecting the following data on work order forms and a driver log.

1. Unscheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Description of malfunction
    e. Location of malfunction (e.g., in service or undergoing inspection)
    f. Repair action and parts used
    g. Man-hours required

2. Scheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Engine running time (if available)
    e. Results of scheduled inspections
    f. Description of malfunction (if any)
    g. Repair action and parts used (if any)
    h. Man-hours required

The buses will be operated in accelerated durability service. While typical items are given below, the specific service schedule will be that specified by the manufacturer.

A. Service
    1. Fueling
    2. Consumable checks
    3. Interior cleaning

B. Preventive Maintenance
    4. Brake adjustments
    5. Lubrication
    6. 3,000 mi (or equivalent) inspection

7. Oil and filter change inspection
8. Major inspection
9. Tune-up

C. Periodic Repairs
1. Brake reline
2. Transmission change
3. Engine change
4. Windshield wiper motor change
5. Stoplight bulb change
6. Towing operations
7. Hoisting operations

1.2-III. DISCUSSION

Servicing and preventive maintenance were performed at manufacturer-specified intervals. The following Scheduled Maintenance Form lists the mileage, items serviced, the service interval, and amount of time required to perform the maintenance. Table 1 is a list of the lubricating products used in servicing. Finally, the Unscheduled Maintenance List along with Unscheduled Maintenance-related photographs is included in Section 5.7, Structural Durability. This list supplies information related to failures that occurred during the durability portion of testing. The Unscheduled Maintenance List includes the date and mileage at which the malfunction occurred, a description of the malfunction and repair, and the time required to perform the repair.

(Page 1 of 2)

SCHEDULED MAINTENANCE

Gillig Bus #1109

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
06-27-11	1,070	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
07-11-11	1,722	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
07-20-11	3,349	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08-09-11	4,543	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08-25-11	5,451	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08-31-11	6,344	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
09-19-11	7,274	P.M. / Inspection Fuel Economy Prep	Linkage, tie rods, universals/u-joints all lubed. Oil changed. Oil, fuel, and air filters changed. Transmission oil and filter changed.	8.00	8.00

SCHEDULED MAINTENANCE

Gillig Bus #1109

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
10-06-11	8,799	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-27-11	9,600	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-03-11	10,713	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-09-11	11,329	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-17-11	12,351	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-29-11	13,924	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
12-09-11	14,999	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00

Table 1. STANDARD LUBRICANTS

The following is a list of Texaco lubricant products used in bus testing conducted by the Penn State University Altoona Bus Testing Center:

ITEM	PRODUCT CODE	TEXACO DESCRIPTION
Engine oil	#2112	URSA Super Plus SAE 30
Transmission oil	#1866	Automatic Trans Fluid Mercon/Dexron II Multipurpose
Gear oil	#2316	Multigear Lubricant EP SAE 80W90
Wheel bearing & Chassis grease	#1935	Starplex II

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

1.3-I. TEST OBJECTIVE

The objective of this test is to establish the time required to replace and/or repair selected subsystems.

1.3-II. TEST DESCRIPTION

The test will involve components that may be expected to fail or require replacement during the service life of the bus. In addition, any component that fails during the NBM testing is added to this list. Components to be included are:

1. Transmission
2. Alternator
3. Starter
4. Batteries
5. Windshield wiper motor

1.3-III. DISCUSSION

During the test, several additional components were removed for repair or replacement. Following is a list of components and total repair/replacement time.

	MAN HOURS
Right front shock.	1.00
Both lower, rear shock spacers.	1.00
Left front shock.	1.00
Rear lower control arm assembly, track rod & mounting bracket.	24.00
Replaced left rear ABS sensor wire.	1.50
Rear axle lateral bar.	4.50
Left rear brake chamber & bracket.	3.00
Rear suspension beam eye bolt, washers & nut.	2.00
Air tank bracket & drain fitting.	3.00
Upper bracket bolts, front passenger door.	4.50

At the end of the test, the remaining items on the list were removed and replaced. The transmission assembly took 6.00 man-hours (two men 3.00 hrs) to remove and replace. The time required for repair/replacement of the four remaining components is given on the following Repair and/or Replacement Form.

REPLACEMENT AND/OR REPAIR FORM

Subsystem	Replacement Time
Transmission	6.00 man hours
Wiper Motor	1.00 man hours
Starter	1.00 man hours
Alternator	1.50 man hours
Batteries	0.50 man hours

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

TRANSMISSION REMOVAL AND REPLACEMENT (6.00 MAN HOURS)

WIPER MOTOR REMOVAL AND REPLACEMENT (1.00 MAN HOURS)

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS CONT.

STARTER REMOVAL AND REPLACEMENT (1.00 MAN HOURS)

(1.0 MAN HOURS)

ALTERNATOR REMOVAL AND REPLACEMENT (1.50 MAN HOURS)

2. RELIABILITY - DOCUMENTATION OF BREAKDOWN AND REPAIR TIMES DURING TESTING

2-I. TEST OBJECTIVE

The objective of this test is to document unscheduled breakdowns, repairs, down time, and repair time that occur during testing.

2-II. TEST DESCRIPTION

Using the driver log and unscheduled work order forms, all significant breakdowns, repairs, man-hours to repair, and hours out of service are recorded on the Reliability Data Form.

CLASS OF FAILURES

Classes of failures are described below:

(a) Class 1: Physical Safety. A failure that could lead directly to passenger or driver injury and represents a severe crash situation.

(b) Class 2: Road Call. A failure resulting in an en route interruption of revenue service. Service is discontinued until the bus is replaced or repaired at the point of failure.

(c) Class 3: Bus Change. A failure that requires removal of the bus from service during its assignments. The bus is operable to a rendezvous point with a replacement bus.

(d) Class 4: Bad Order. A failure that does not require removal of the bus from service during its assignments but does degrade coach operation. The failure shall be reported by driver, inspector, or hostler.

2-III. DISCUSSION

A listing of breakdowns and unscheduled repairs is accumulated during the Structural Durability Test. The following Reliability Data Form lists all unscheduled repairs under classes as defined above. These classifications are somewhat subjective as the test is performed on a test track with careful inspections every two hours. However, even on the road, there is considerable latitude on deciding how to handle many failures.

The Unscheduled Repair List is also attached to provide a reference for the repairs that are included in the Reliability Data Forms.

The classification of repairs according to subsystem is intended to emphasize those systems which had persistent minor or more serious problems. There were no Class 1 or 2 failures. Of the fifteen Class 3 failures, six involved the suspension system, three each occurred with the brakes and doors and one with the electrical system. These, and the remaining three Class 4 failures are available for review in the Unscheduled Maintenance List, located in Section 5.7 Structural Durability.

RELIABILITY DATA FORMS

Bus Number: 1109	Date: 12-09-11
Personnel: Bob Reifsteck	

Failure Type			
Class 4 Bad Order	Class 3 Bus Change	Class 2 Road Call	Class 1 Physical Safety

Subsystems	Mileage	Mileage	Mileage	Mileage	Man Hours	Down Time
Suspension		1,384			2.00	4.00
	1,463				1.00	118.00
	1,722				1.00	16.00
		3,785			24.00	187.00
	4,146				2.00	1.00
		4,379			2.00	2.00
		5,451			13.00	120.00
		6,614			4.50	184.00
		7,802			2.00	26.00
Brakes		5,451			1.50	1.00
		5,451			10.00	14.00
		6,516			3.00	10.00
Doors		11,291			4.50	4.00
		12,351			1.50	1.50
		13,877			2.00	4.00
Air System		8,074			3.00	20.00
		12,351			1.50	1.50
Electrical		4,730			6.00	77.00

3. SAFETY - A DOUBLE-LANE CHANGE (OBSTACLE AVOIDANCE)

3-I. TEST OBJECTIVE

The objective of this test is to determine handling and stability of the bus by measuring speed through a double lane change test.

3-II. TEST DESCRIPTION

The Safety Test is a vehicle handling and stability test. The bus will be operated at SLW on a smooth and level test track. The bus will be driven through a double lane change course at increasing speed until the test is considered unsafe or a speed of 45 mph is reached. The lane change course will be set up using pylons to mark off two 12 foot center to center lanes with two 100 foot lane change areas 100 feet apart. The bus will begin in one lane, change to the other lane in a 100 foot span, travel 100 feet, and return to the original lane in another 100 foot span. This procedure will be repeated, starting first in the right-hand and then in the left-hand lane.

3-III. DISCUSSION

The double-lane change was performed in both right-hand and left-hand directions. The bus was able to safely negotiate the test course in both the right-hand and left-hand directions up to the maximum test speed of 45 mph.

These test results were obtained prior to the accreditation of the lab on November 8, 2011; therefore, are not considered to be accredited in accordance with A2LA policy.

SAFETY DATA FORM

Bus Number: 1109	Date: 9-23-11
Personnel: B.G., T.S. & B.L.	

Temperature (°F): 66	Humidity (%): 100
Wind Direction: Calm	Wind Speed (mph): Calm
Barometric Pressure (in.Hg): 30.06	

SAFETY TEST: DOUBLE LANE CHANGE	
Maximum safe speed tested for double-lane change to left	45 mph
Maximum safe speed tested for double-lane change to right	45 mph
Comments of the position of the bus during the lane change: A safe profile was maintained through all portions of testing.	
Comments of the tire/ground contact patch: Tire/ground contact was maintained through all portions of testing.	

3. SAFETY

RIGHT - HAND APPROACH

LEFT - HAND APPROACH

4.1 PERFORMANCE - AN ACCELERATION, GRADEABILITY, AND TOP SPEED TEST

4-I. TEST OBJECTIVE

The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus.

4-II. TEST DESCRIPTION

In this test, the bus will be operated at SLW on the skid pad at the PSBRTF. The bus will be accelerated at full throttle from a standstill to a maximum "geared" or "safe" speed as determined by the test driver. The vehicle speed is measured using a Correvit non-contacting speed sensor. The times to reach speed between ten mile per hour increments are measured and recorded using a stopwatch with a lap timer. The time to speed data will be recorded on the Performance Data Form and later used to generate a speed vs. time plot and gradeability calculations.

4-III. DISCUSSION

This test consists of three runs in both the clockwise and counterclockwise directions on the Test Track. Velocity versus time data is obtained for each run and results are averaged together to minimize any test variability which might be introduced by wind or other external factors. The test was performed up to a maximum speed of 50 mph. The fitted curve of velocity vs. time is attached, followed by the calculated gradeability results. The average time to obtain 50 mph was 29.47 seconds.

These test results were obtained prior to the accreditation of the lab on November 8, 2011; therefore, are not considered to be accredited in accordance with A2LA policy.

PERFORMANCE DATA FORM

Bus Number: 1109	Date: 9-23-11
Personnel: B.G., T.S. & B.L.	
Temperature (°F): 66	Humidity (%): 100
Wind Direction: Calm	Wind Speed (mph): Calm
Barometric Pressure (in.Hg): 30.06	
Air Conditioning compressor-OFF	✓ Checked
Ventilation fans-ON HIGH	✓ Checked
Heater pump motor-Off	✓ Checked
Defroster-OFF	✓ Checked
Exterior and interior lights-ON	✓ Checked
Windows and doors-CLOSED	✓ Checked

ACCELERATION, GRADEABILITY, TOP SPEED			
Counter Clockwise Recorded Interval Times			
Speed	Run 1	Run 2	Run 3
10 mph	4.29	3.95	3.89
20 mph	7.19	7.20	7.01
30 mph	12.13	11.79	11.29
40 mph	19.48	19.86	19.35
Top Test Speed(mph) 50	31.50	31.51	30.73
Clockwise Recorded Interval Times			
Speed	Run 1	Run 2	Run 3
10 mph	3.77	4.14	3.85
20 mph	6.61	7.27	7.16
30 mph	10.77	11.39	11.57
40 mph	18.05	19.05	18.73
Top Test Speed(mph) 50	27.33	28.17	27.60

PERFORMANCE SUMMARY SHEET

BUS MANUFACTURER :Gillig
BUS MODEL :Low Floor
BUS NUMBER :1109
TEST DATE :09/23/11

TEST CONDITIONS :

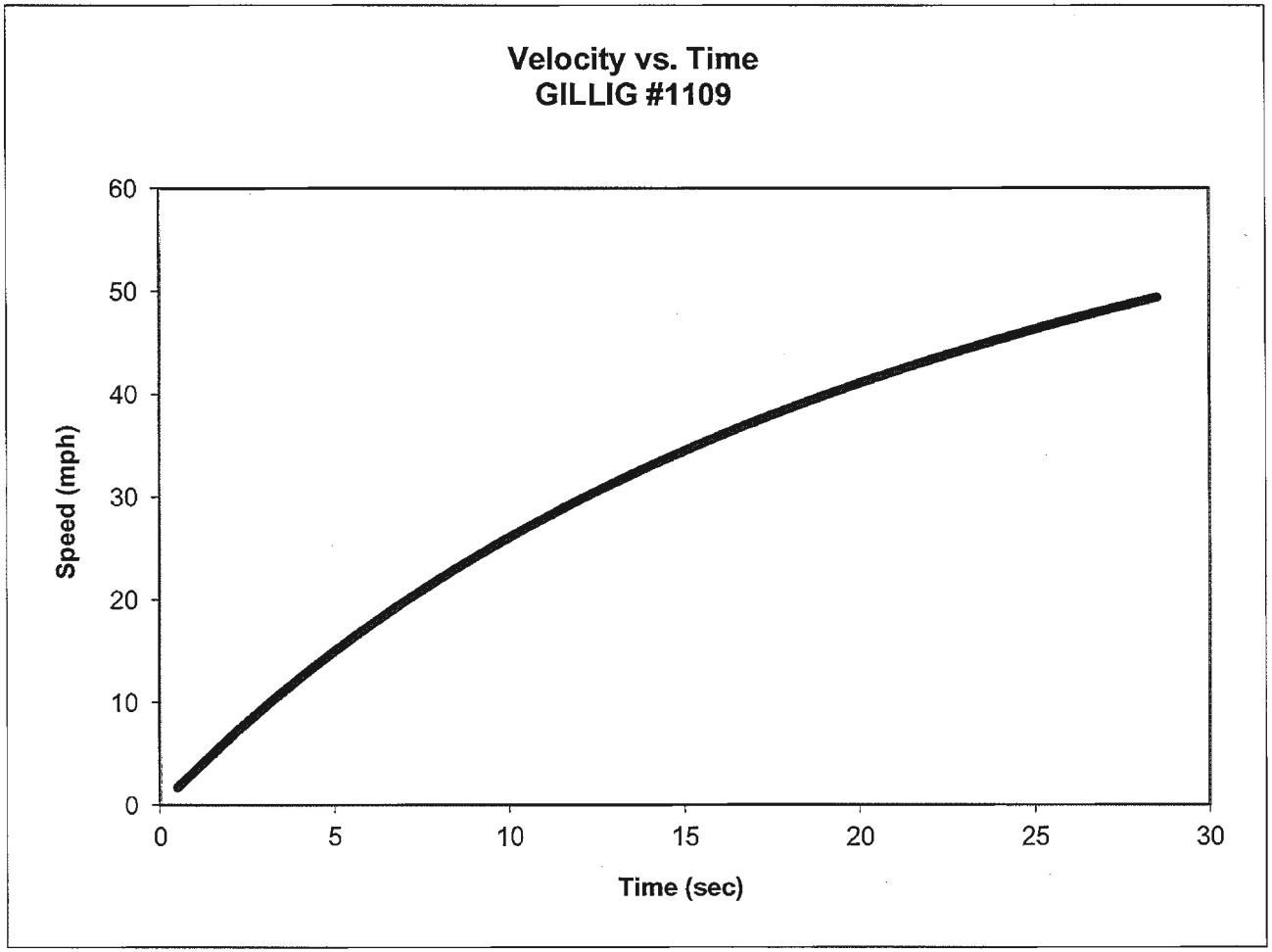
TEMPERATURE (DEG F) : 66.0
WIND DIRECTION : Calm
WIND SPEED (MPH) : .0
HUMIDITY (%) : 100
BAROMETRIC PRESSURE (IN. HG) : 30.1

VEHICLE SPEED	AVERAGE TIME (SEC)		
(MPH)	CCW DIRECTION	CW DIRECTION	TOTAL
10.0	4.04	3.92	3.98
20.0	7.13	7.01	7.07
30.0	11.74	11.24	11.49
40.0	19.56	18.61	19.09
50.0	31.25	27.70	29.47

TEST SUMMARY :

VEHICLE SPEED (MPH)	TIME (SEC)	ACCELERATION (FT/SEC^2)	MAX. GRADE (%)
1.0	.29	5.0	15.8
5.0	1.50	4.7	14.6
10.0	3.16	4.2	13.2
15.0	5.01	3.7	11.7
20.0	7.09	3.3	10.3
25.0	9.45	2.9	9.0
30.0	12.17	2.5	7.8
35.0	15.35	2.1	6.6
40.0	19.11	1.8	5.5
45.0	23.65	1.5	4.5
50.0	29.27	1.2	3.6

NOTE : Gradeability results were calculated from performance test data. Actual sustained gradeability performance for vehicles equipped with auto transmission may be lower than the values indicated here.


Velocity vs. Time
GILLIG #1109
Speed (mph)
60
50
40
30
20
10
0
0
5
10
15
20
25
30
Time (sec)

4.0 PERFORMANCE

4.2 Performance - Bus Braking

4.2 I. TEST OBJECTIVE

The objective of this test is to provide, for comparison purposes, braking performance data on transit buses produced by different manufacturers.

4.2 II. TEST DESCRIPTION

The testing will be conducted at the PTI Test Track skid pad area. Brake tests will be conducted after completion of the GVW portion of the vehicle durability test. At this point in testing the brakes have been subjected to a large number of braking snubs and will be considered well burnished. Testing will be performed when the bus is fully loaded at its GVW. All tires on each bus must be representative of the tires on the production model vehicle

The brake testing procedure comprises three phases:

1. Stopping distance tests

    i. Dry surface (high-friction, Skid Number within the range of 70-76)
    ii. Wet surface (low-friction, Skid Number within the range of 30-36)

2. Stability tests
3. Parking brake test

Stopping Distance Tests

The stopping distance phase will evaluate service brake stops. All stopping distance tests on dry surface will be performed in a straight line and at the speeds of 20, 30, 40 and 45 mph. All stopping distance tests on wet surface will be performed in straight line at speed of 20 mph.

The tests will be conducted as follows:

1. **Uniform High Friction Tests:** Four maximum deceleration straight-line brake applications each at 20, 30, 40 and 45 mph, to a full stop on a uniform high-friction surface in a 3.66-m (12-ft) wide lane.

2. **Uniform Low Friction Tests:** Four maximum deceleration straight-line brake applications from 20 mph on a uniform low friction surface in a 3.66-m (12-ft) wide lane.

When performing service brake stops for both cases, the test vehicle is accelerated on the bus test lane to the speed specified in the test procedure and this speed is maintained into the skid pad area. Upon entry of the appropriate lane of the skid pad area, the vehicle's service brake is applied to stop the vehicle as quickly as

possible. The stopping distance is measured and recorded for both cases on the test data form. Stopping distance results on dry and wet surfaces will be recorded and the average of the four measured stopping distances will be considered as the measured stopping distance. Any deviation from the test lane will be recorded.

Stability Tests

This test will be conducted in both directions on the test track. The test consists of four maximum deceleration, straight-line brake applications on a surface with split coefficients of friction (i.e., the wheels on one side run on high-friction SN 70-76 or more and the other side on low-friction [where the lower coefficient of friction should be less than half of the high one] at initial speed of 30 mph).

(l) The performance of the vehicle will be evaluated to determine if it is possible to keep the vehicle within a 3.66m (12 ft) wide lane, with the dividing line between the two surfaces in the lane's center. The steering wheel input angle required to keep the vehicle in the lane during the maneuver will be reported.

Parking Brake Test

The parking brake phase utilizes the brake slope, which has a 20% grade. The test vehicle, at its GVW, is driven onto the brake slope and stopped. With the transmission in neutral, the parking brake is applied and the service brake is released. The test vehicle is required to remain stationary for five minutes. The parking brake test is performed with the vehicle facing uphill and downhill.

4.2-III. DISCUSSION

The Stopping Distance phase of the Brake Test was completed with the following results; for the Uniform High Friction Test average stopping distances were 36.11' at 20 mph, 82.39' at 30 mph, 151.79' at 40 mph and 188.94' at 45 mph. The average stopping distance for the Uniform Low Friction Test was 37.76' There was no deviation from the test lane during the performance of the Stopping Distance phase.

During the Stability phase of Brake Testing the test bus experienced no deviation from the test lane but did experience pull to the left during both approaches to the Split Friction Road surface.

The Parking Brake phase was completed with the test bus maintaining the parked position for the full five minute period with no slip or roll observed in both the uphill and downhill positions.

These test results were obtained prior to the accreditation of the lab on November 8, 2011; therefore, are not considered to be accredited in accordance with A2LA policy.

Table 4.2-6. Braking Test Data Forms

Bus Number: 1109	Date:8-31-11
Personnel: G.C., T.S. & E.D.	
Amb. Temperature (^{o}F): 72	Wind Speed (mph): 5
Wind Direction: E	Pavement Temp (°F) Start: 80.7 End: 104.9

TIRE INFLATION PRESSURE (psi):				
Tire Type: Front: Michelin XZU 275/70 R22.5 Rear: Michelin XZU 275/70 R22.5				
	Left Tire(s)		Right Tire(s)	
Front	120		120	
	Inner	Outer	Inner	Outer
Rear	120	120	120	120
Rear	120	120	120	120

AXLE LOADS (lb) (GVW)		
	Left	Right
Front	3,910	3,950
Rear	9,070	9,380

FINAL INSPECTION	
Bus Number: 1109	Date: 8-31-11
Personnel: G.C., T.S. & E.D.	

Table 4.2-7. Record of All Braking System Faults/Repairs.

Date	Personnel	Fault/Repair	Description
8-31-11	G.C., T.S. & E.D.	None noted.	

Table 4.2-8.1. Stopping Distance Test Results Form

Stopping Distance (ft)					
Vehicle Direction	CW	CW	CCW	CCW	
Speed (mph)	**Stop 1**	**Stop 2**	**Stop 3**	**Stop 4**	**Average**
20 (dry)	34.67	38.56	32.64	38.55	36.11
30 (dry)	85.23	84.17	78.35	81.78	82.39
40 (dry)	152.45	156.29	145.17	153.22	151.79
45 (dry)	199.12	202.88	174.43	179.32	188.94
20 (wet)	39.08	35.39	36.74	39.80	37.76

Table 4.2-8.2. Stability Test Results Form

Stability Test Results (Split Friction Road surface)		
Vehicle Direction	Attempt	Did test bus stay in 12' lane? (Yes/No)
CW	1	Yes
	2	Yes
CCW	1	Yes
	2	Yes

Table 4.2-8.3. Parking Brake Test Form

PARKING BRAKE (Fully Loaded) - GRADE HOLDING						
Vehicle Direction	Attempt	Hold Time (min)	Slide (in)	Roll (in)	Did Hold	No Hold
Front up	1	5 min			**X**	
	2					
	3					
Front down	1	5 min			**X**	
	2					
	3					

5. STRUCTURAL INTEGRITY

5.1 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL SHAKEDOWN TEST

5.1-I. DISCUSSION

The objective of this test is to determine certain static characteristics (e.g., bus floor deflection, permanent structural deformation, etc.) under static loading conditions.

5.1-II. TEST DESCRIPTION

In this test, the bus will be isolated from the suspension by blocking the vehicle under the suspension points. The bus will then be loaded and unloaded up to a maximum of three times with a distributed load equal to 2.5 times gross load. Gross load is 150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space. For a distributed load equal to 2.5 times gross load, place a 375-lb load on each seat and on every 1.5 sq ft of free floor space. The first loading and unloading sequence will "settle" the structure. Bus deflection will be measured at several locations during the loading sequences.

5.1-III. DISCUSSION

This test was performed based on a maximum passenger capacity of 41 people including the driver plus 2 wheelchair positions. The resulting test load is (41 x 375 lb) = 15,375 lbs. + 1,200 lbs. (2 wheelchair positions) = 16,575 lbs. The load is distributed evenly over the passenger space. Deflection data before and after each loading and unloading sequence is provided on the Structural Shakedown Data Form.

The unloaded height after each test becomes the original height for the next test. Some initial settling is expected due to undercoat compression, etc. After each loading cycle, the deflection of each reference point is determined. The bus is then unloaded and the residual (permanent) deflection is recorded. On the final test, the maximum loaded deflection was 0.049 inches at reference point 9. The maximum permanent deflection after the final loading sequence ranged from -0.005 inches at reference points 1, and 12 to 0.004 inches at reference points 7, 9 and 10.

These test results were obtained prior to the accreditation of the lab on November 8, 2011; therefore, are not considered to be accredited in accordance with A2LA policy.

STRUCTURAL SHAKEDOWN DATA FORM

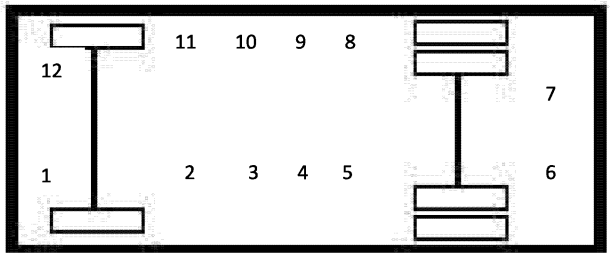
Bus Number: 1109	Date: 6-14-11
Personnel: T.S., E.L., E.D, J.P. & B.L.	Temperature (°F): 65
Loading Sequence: ■ 1 ☐ 2 ☐ 3 (check one) Test Load (lbs): 16,575 (19 seated, 22 standees & 2 wheelchair positions)	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus

Left



Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	0	.023	.023	.015	.-15
2	0	.030	.030	.009	.009
3	0	.036	.036	.010	.010
4	0	.052	.052	.012	.012
5	0	.045	.045	.011	.011
6	0	.030	.030	-.003	-.003
7	0	.035	.035	-.002	-.002
8	0	.053	.053	.010	.010
9	0	.150	.150	.102	.102
10	0	.044	.044	.005	.005
11	0	.039	.039	.004	.004
12	0	.021	.021	.015	.015

STRUCTURAL SHAKEDOWN DATA FORM

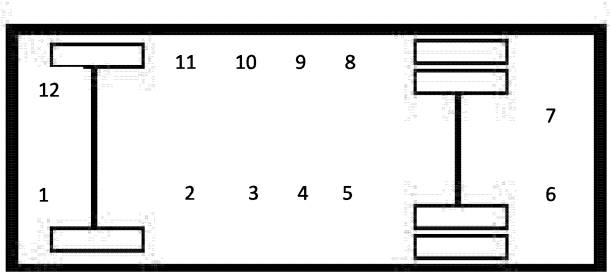
Bus Number: 1109	Date: 6-14-11
Personnel: T.S., E.L., E.D., B.L., S.C. & J.P.	Temperature (°F): 69
Loading Sequence: ☐ 1 ■ 2 ☐ 3 (check one) Test Load (lbs): 16,575 (19 seated, 22 standees & 2 wheelchair positions)	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus

Left



Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	.015	.023	.008	.010	-.005
2	.009	.031	.022	.008	-.001
3	.010	.037	.027	.009	-.001
4	.012	.051	.039	.011	-.001
5	.011	.045	.034	.010	-.001
6	-.003	.027	.030	.000	.003
7	-.002	.034	.036	.002	.004
8	.010	.056	.046	.013	.003
9	.102	.151	.049	.106	.004
10	.005	.047	.042	.009	.004
11	.004	.040	.036	.005	.001
12	.015	.023	.008	.010	-.005

5.1 STRUCTURAL SHAKEDOWN TEST

DIAL INDICATORS IN POSITION

BUS LOADED TO 2.5 TIMES GVL (16,575 LBS)

5.2 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL DISTORTION

5.2-I. TEST OBJECTIVE

The objective of this test is to observe the operation of the bus subsystems when the bus is placed in a longitudinal twist simulating operation over a curb or through a pothole.

5.2-II. TEST DESCRIPTION

With the bus loaded to GVWR, each wheel of the bus will be raised (one at a time) to simulate operation over a curb and the following will be inspected:

1. Body
2. Windows
3. Doors
4. Roof vents
5. Special seating
6. Undercarriage
7. Engine
8. Service doors
9. Escape hatches
10. Steering mechanism

Each wheel will then be lowered (one at a time) to simulate operation through a pothole and the same items inspected.

5.2-III. DISCUSSION

The test sequence was repeated ten times. The first and last test is with all wheels level. The other eight tests are with each wheel 6 inches higher and 6 inches lower than the other three wheels.

All doors, windows, escape mechanisms, engine, steering and handicapped devices operated normally throughout the test. The undercarriage and body indicated no deficiencies. No water leakage was observed during the test. The results of this test are indicated on the following data forms.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1109	Date: 6-15-11
Personnel: T.S., E.D., E.L. & B.L.	Temperature(°F): 74

Wheel Position : (check one)		
All wheels level	■ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1109	Date: 6-15-11
Personnel: T.S., E.D., E.L. & B.L.	Temperature(°F): 74

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	■ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1109	Date: 6-15-11
Personnel: T.S., E.D., E.L. & B.L.	Temperature(°F): 74

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	■ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1109	Date: 6-15-11
Personnel: T.S., E.D., E.L. & B.L.	Temperature(°F): 74

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	■ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1109	Date: 6-15-11
Personnel: T.S., E.D., E.L. & B.L.	Temperature(°F): 74

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	■ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1109	Date: 6-15-11
Personnel: T.S., E.D., E.L. & B.L.	Temperature(°F): 74

Wheel Position : (check one)		
All wheels level	□ before	□ after
Left front	□ 6 in higher	■ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1109	Date: 6-15-11
Personnel: T.S., E.D., E.L. & B.L.	Temperature(°F): 74

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	■ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1109	Date: 6-15-11
Personnel: T.S., E.D., E.L. & B.L.	Temperature(°F): 74

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	■ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1109	Date: 6-15-11
Personnel: T.S., E.D., E.L. & B.L.	Temperature(°F): 74

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	■ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1109	Date: 6-15-11
Personnel: T.S., E.D., E.L. & B.L.	Temperature(°F): 74

Wheel Position : (check one)		
All wheels level	□ before	■ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

5.2 STRUCTURAL DISTORTION TEST

LEFT REAR WHEEL SIX INCHES LOWER

RIGHT FRONT WHEEL SIX INCHES HIGHER

5.3 STRUCTURAL STRENGTH AND DISTORTION TESTS - STATIC TOWING TEST

5.3-I. TEST OBJECTIVE

The objective of this test is to determine the characteristics of the bus towing mechanisms under static loading conditions.

5.3-II. TEST DESCRIPTION

Utilizing a load-distributing yoke, a hydraulic cylinder is used to apply a static tension load equal to 1.2 times the bus curb weight. The load will be applied to both the front and rear, if applicable, towing fixtures at an angle of 20 degrees with the longitudinal axis of the bus, first to one side then the other in the horizontal plane, and then upward and downward in the vertical plane. Any permanent deformation or damage to the tow eyes or adjoining structure will be recorded.

5.3-III. DISCUSSION

The load-distributing yoke was incorporated as the interface between the Static Tow apparatus and the test bus tow hook/eyes. The test was performed to the full target test weight of 31,572 lbs (1.2 x 26,310 lbs CW). No damage or deformation was observed during all four front pulls of the test. Rear towing is not recommended.

STATIC TOWING TEST DATA FORM

Bus Number: 1109	Date: 12-9-11
Personnel: E.L., T.S., J.P., B.L. & E.D.	Temperature (°F): 38

Inspect right front tow eye and adjoining structure.
Comments: No damage or deformation observed.
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: Torques verified.
Inspect left tow eye and adjoining structure.
Comments: No damage or deformation observed.
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: Torques verified.
Inspect right rear tow eye and adjoining structure.
Comments: N/A
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: N/A
Inspect left rear tow eye and adjoining structure.
Comments: N/A
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: N/A
General comments of any other structure deformation or failure: None noted.
All 4 front pulls were completed to the target test load of 31,572 lbs.
1.2 x 26,310 lbs CW

5.3 STATIC TOWING TEST

FRONT 20° UPWARD PULL

FRONT 20° DOWN PULL

5.3 STATIC TOWING TEST CONT.

FRONT 20° LEFT PULL

FRONT 20° RIGHT PULL

5.4 STRUCTURAL STRENGTH AND DISTORTION TESTS - DYNAMIC TOWING TEST

5.4-I. TEST OBJECTIVE

The objective of this test is to verify the integrity of the towing fixtures and determine the feasibility of towing the bus under manufacturer specified procedures.

5.4-II. TEST DESCRIPTION

This test requires the bus be towed at curb weight using the specified equipment and instructions provided by the manufacturer and a heavy-duty wrecker. The bus will be towed for 5 miles at a speed of 20 mph for each recommended towing configuration. After releasing the bus from the wrecker, the bus will be visually inspected for any structural damage or permanent deformation. All doors, windows and passenger escape mechanisms will be inspected for proper operation.

5.4-III. DISCUSSION

The bus was towed using a heavy-duty wrecker. The towing interface was accomplished by incorporating a hydraulic under lift. A front lift tow was performed. Rear towing is not recommended. No problems, deformation, or damage was noted during testing.

DYNAMIC TOWING TEST DATA FORM

Bus Number: 1109	Date: 12-9-11
Personnel: T.S., J.P., B.L. & E.D.	

Temperature (°F): 42	Humidity (%): 49
Wind Direction: SW	Wind Speed (mph): 2
Barometric Pressure (in.Hg): 30.26	

Inspect tow equipment-bus interface.
Comments: A safe and adequate connection was made between the tow equipment and the bus.
Inspect tow equipment-wrecker interface.
Comments: A safe and adequate connection was made between the tow equipment and the wrecker.
Towing Comments: A front lift tow was performed incorporating a hydraulic under lift wrecker.
Description and location of any structural damage: No damage or deformation was observed.
General Comments: No problems were encountered with the tow or towing interface.

5.4 DYNAMIC TOWING TEST

TOWING INTERFACE

TEST BUS IN TOW

5.5 STRUCTURAL STRENGTH AND DISTORTION TESTS – JACKING TEST

5.5-I. TEST OBJECTIVE

The objective of this test is to inspect for damage due to the deflated tire, and determine the feasibility of jacking the bus with a portable hydraulic jack to a height sufficient to replace a deflated tire.

5.5-II. TEST DESCRIPTION

With the bus at curb weight, the tire(s) at one corner of the bus are replaced with deflated tire(s) of the appropriate type. A portable hydraulic floor jack is then positioned in a manner and location specified by the manufacturer and used to raise the bus to a height sufficient to provide 3-in clearance between the floor and an inflated tire. The deflated tire(s) are replaced with the original tire(s) and the hack is lowered. Any structural damage or permanent deformation is recorded on the test data sheet. This procedure is repeated for each corner of the bus.

5.5-III. DISCUSSION

The jack used for this test has a minimum height of 8.75 inches. During the deflated portion of the test, the jacking point clearances ranged from 4.4 inches to 11.9 inches. No deformation or damage was observed during testing. A complete listing of jacking point clearances is provided in the Jacking Test Data Form.

JACKING CLEARANCE SUMMARY

Condition	Frame Point Clearance
Front axle – one tire flat	8.7”
Rear axle – one tire flat	11.8”
Rear axle – two tires flat	8.8”

These test results were obtained prior to the accreditation of the lab on November 8, 2011; therefore, are not considered to be accredited in accordance with A2LA policy.

JACKING TEST DATA FORM

Bus Number: 1109	Date: 6-8-11
Personnel: E.D., E.L. & B.L.	Temperature (°F): 78

Record any permanent deformation or damage to bus as well as any difficulty encountered during jacking procedure.

Deflated Tire	Jacking Pad Clearance Body/Frame (in)	Jacking Pad Clearance Axle/Suspension (in)	Comments
Right front	11.5“ I 8.9“ D	7.7“ I 4.4” D	
Left front	11.2“ I 8.7“ D	7.7“ I 4.5“ D	
Right rear—outside	12.7“ I 11.9“ D	9.9“ I 9.3“ D	
Right rear—both	12.7“ I 9.8“ D	9.9“ I 7.8“ D	
Left rear—outside	12.5“ I 11.8“ D	9.8“ I 9.3“ D	
Left rear—both	12.5“ I 8.8“ D	9.8“ I 7.3“ D	
Right middle or tag—outside	NA	NA	
Right middle or tag—both	NA	NA	
Left middle or tag—outside	NA	NA	
Left middle or tag—both	NA	NA	

Additional comments of any deformation or difficulty during jacking:

5.6 STRUCTURAL STRENGTH AND DISTORTION TESTS - HOISTING TEST

5.6-I. TEST OBJECTIVE

The objective of this test is to determine possible damage or deformation caused by the jack/stands.

5.6-II. TEST DESCRIPTION

With the bus at curb weight, the front end of the bus is raised to a height sufficient to allow manufacturer-specified placement of jack stands under the axles or jacking pads independent of the hoist system. The bus will be checked for stability on the jack stands and for any damage to the jacking pads or bulkheads. The procedure is repeated for the rear end of the bus. The procedure is then repeated for the front and rear simultaneously.

5.6-III. DISCUSSION

The test was conducted using four posts of a six-post electric lift and standard 19 inch jack stands. The bus was hoisted from the front wheel, rear wheel, and then the front and rear wheels simultaneously and placed on jack stands.

The bus easily accommodated the placement of the vehicle lifts and jack stands and the procedure was performed without any instability noted.

These test results were obtained prior to the accreditation of the lab on November 8, 2011; therefore, are not considered to be accredited in accordance with A2LA policy.

HOISTING TEST DATA FORM

Bus Number: 1109	Date: 6-9-11
Personnel: E.D., E,L, & B.L.	Temperature (°F): 80

Comments of any structural damage to the jacking pads or axles while both the front wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the rear wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the front and rear wheels are supported by the jack stands:
None noted.

5.7 STRUCTURAL DURABILITY TEST

5.7-I. TEST OBJECTIVE

The objective of this test is to perform an accelerated durability test that approximates up to 25 percent of the service life of the vehicle.

5.7-II. TEST DESCRIPTION

The test vehicle is driven a total of 15,000 miles; approximately 12,500 miles on the PSBRTF Durability Test Track and approximately 2,500 miscellaneous other miles. The test will be conducted with the bus operated under three different loading conditions. The first segment will consist of approximately 6,250 miles with the bus operated at GVW. The second segment will consist of approximately 2,500 miles with the bus operated at SLW. The remainder of the test, approximately 6,250 miles, will be conducted with the bus loaded to CW. If GVW exceeds the axle design weights, then the load will be adjusted to the axle design weights and the change will be recorded. All subsystems are run during these tests in their normal operating modes. All recommended manufacturers servicing is to be followed and noted on the vehicle maintainability log. Servicing items accelerated by the durability tests will be compressed by 10:1; all others will be done on a 1:1 mi/mi basis. Unscheduled breakdowns and repairs are recorded on the same log as are any unusual occurrences as noted by the driver. Once a week the test vehicle shall be washed down and thoroughly inspected for any signs of failure.

5.7-III. DISCUSSION

The Structural Durability Test was started on June 15, 2011 and was conducted until December 9, 2011. The first 6,250 miles were performed at a GVW of 33,440 lbs. and completed on August 29, 2011. The next 2,500 mile SLW segment was performed at 30,310 lbs and completed on October 21, 2011, and the final 6,250 mile segment was performed at a CW of 26,310 lbs and completed on December 9, 2011.

The following mileage summary presents the accumulation of miles during the Structural Durability Test. The driving schedule is included, showing the operating duty cycle. A detailed plan view of the Test Track Facility and Durability Test Track are attached for reference. Also, a durability element profile detail shows all the measurements of the different conditions. Finally, photographs illustrating some of the failures that were encountered during the Structural Durability Test are included.

GILLIG - TEST BUS #1109

MILEAGE DRIVEN/RECORDED FROM DRIVER'S LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
06/13/11 TO 06/19/11	193.00	55.00	248.00
06/20/11 TO 06/26/11	731.00	45.00	776.00
06/27/11 TO 07/03/11	420.00	19.00	439.00
07/04/11 TO 07/10/11	168.00	20.00	188.00
07/11/11 TO 07/17/11	941.00	39.00	980.00
07/18/11 TO 07/24/11	1058.00	96.00	1154.00
07/25/11 TO 07/31/11	0.00	0.00	0.00
08/01/11 TO 08/07/11	482.00	20.00	502.00
08/08/11 TO 08/14/11	414.00	29.00	443.00
08/15/11 TO 08/21/11	658.00	63.00	721.00
08/22/11 TO 08/28/11	185.00	302.00	487.00
08/29/11 TO 09/04/11	247.00	438.00	685.00
09/05/11 TO 09/11/11	0.00	0.00	0.00
09/12/11 TO 09/18/11	463.00	72.00	535.00

GILLIG - TEST BUS #1109

MILEAGE DRIVEN/RECORDED FROM DRIVER'S LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
09/19/11 TO 09/25/11	98.00	175.00	273.00
09/26/11 TO 10/02/11	613.00	39.00	652.00
10/03/11 TO 10/09/11	579.00	210.00	789.00
10/10/11 TO 10/16/11	0.00	0.00	0.00
10/17/11 TO 10/23/11	0.00	69.00	69.00
10/24/11 TO 10/30/11	873.00	154.00	1027.00
10/31/11 TO 11/06/11	742.00	32.00	774.00
11/07/11 TO 11/13/11	1151.00	74.00	1225.00
11/14/11 TO 11/20/11	710.00	34.00	744.00
11/21/11 TO 11/27/11	764.00	68.00	832.00
11/28/11 TO 12/04/11	1012.00	71.00	1083.00
12/05/11 TO 12/11/11	0.00	382.00	382.00
TOTAL	12502.00	2506.00	15008.00

Table 4. Driving Schedule for Bus Operation on the Durability Test Track.

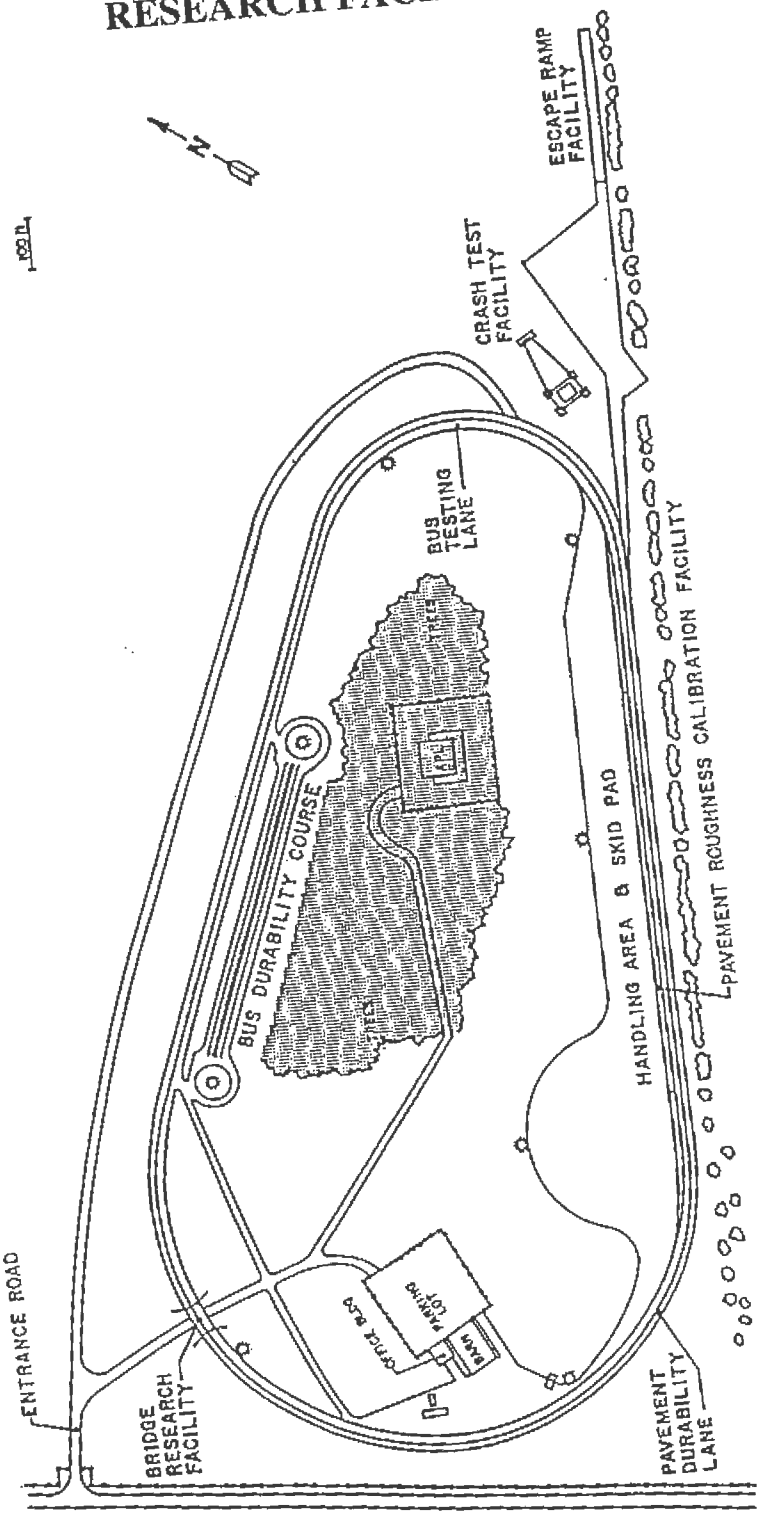
STANDARD OPERATING SCHEDULE

Monday through Friday

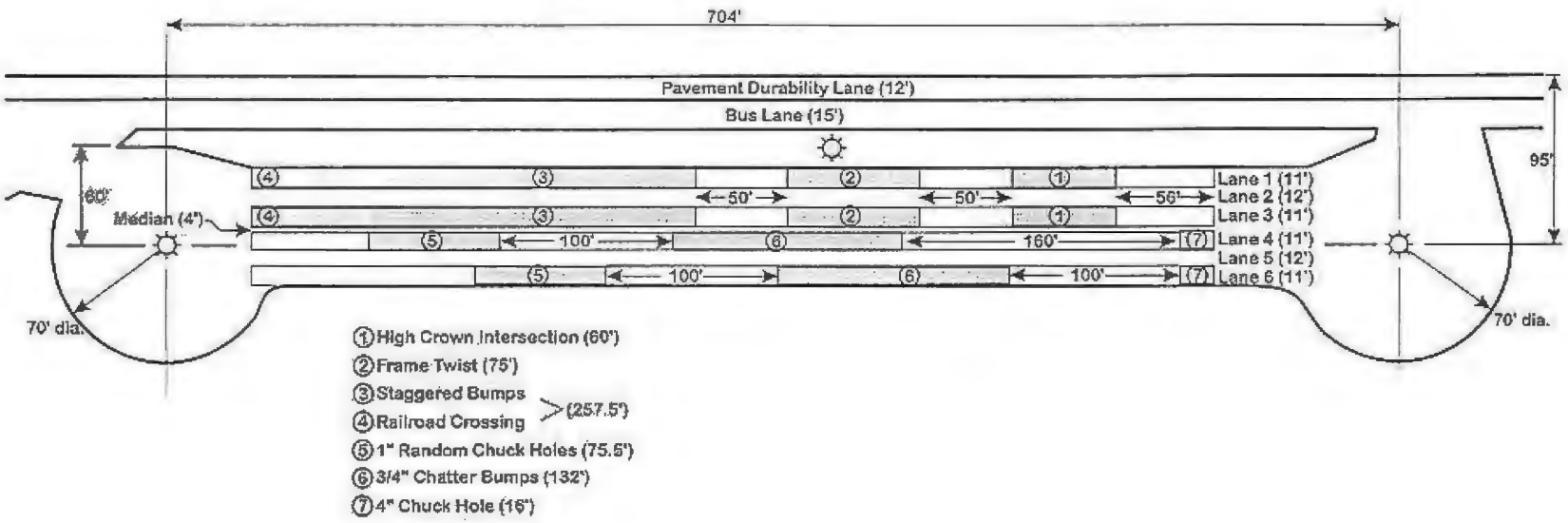
	HOUR	ACTION
Shift 1	midnight	D
	1:40 am	C
	1:50 am	B
	2:00 am	D
	3:35 am	C
	3:45 am	B
	4:05 am	D
	5:40 am	C
	5:50 am	B
	6:00 am	D
	7:40 am	C
	7:50 am	F
Shift 2	8:00 am	D
	9:40 am	C
	9:50 am	B
	10:00 am	D
	11:35 am	C
	11:45 am	B
	12:05 pm	D
	1:40 pm	C
	1:50 pm	B
	2:00 pm	D
	3:40 pm	C
	3:50 pm	F
Shift 3	4:00 pm	D
	5:40 pm	C
	5:50 pm	B
	6:00 pm	D
	7:40 pm	C
	7:50 pm	B
	8:05 pm	D
	9:40 pm	C
	9:50 pm	B
	10:00 pm	D
	11:40 pm	C
	11:50 pm	F

B—Break
C----Cycle all systems five times, visual inspection, driver's log entries
D—Drive bus as specified by procedure
F----Fuel bus, complete driver's log shift entries

"PLAN VIEW OF PENN STATE BUS TESTING AND RESEARCH FACILITY"



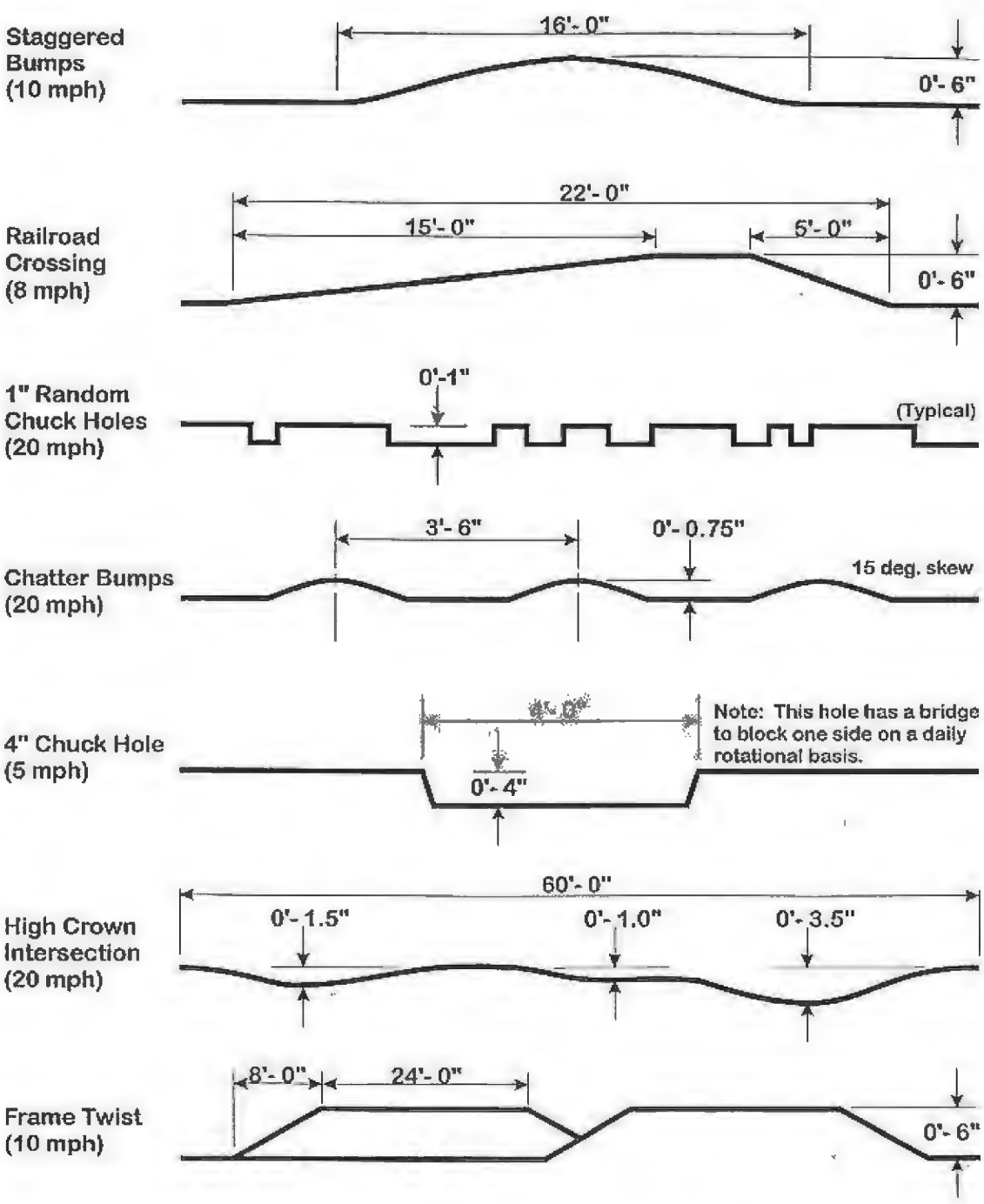
BUS TESTING AND RESEARCH TEST TRACK
UNIVERSITY PARK, PA



Plan View

Vehicle Durability Test Track

The Pennsylvania Transportation Institute
Penn State



Durability Element Profiles

The Pennsylvania Transportation Institute
Penn State

(Page 1 of 3)
UNSCHEDULED MAINTENANCE
Gillig Bus #1109

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
06-30-11	1,384	The right front shock is leaking oil, and the right rear lower shock bushing is missing.	Replaced right front and right rear shocks.	2.00	4.00
07-07-11	1,463	The manufacturer's rep requests the lower, rear shock spacers be replaced.	Replaced rear lower shock spacers.	1.00	118.00
07-12-11	1,722	The left front shock is leaking oil.	Replaced left front shock.	1.00	16.00
08-03-11	3,785	The traverse bar in the rear, lower control arm assembly is cracked. The track rod and bracket are cracked.	Removed rear lower control arm assembly. Replaced new lower control arm assembly, track rod and mounting bracket.	24.00	187.00
08-05-11	4,146	Manufacturer requests both front shocks be replaced.	Replaced both front shocks.	2.00	1.00
08-08-11	4,379	The front shocks are leaking oil and the right front shock is missing the lower shock bushing.	Replaced both front shocks and bushings.	2.00	2.00
08-15-11	4,730	The charging system is not charging.	Troubleshoot charging system, wiring and connections. Check I/O system operation and voltage regulator. Replaced alternator.	6.00	77.00
08-24-11	5,451	The "ABS" light is on.	The left rear sensor wire is cut. Replaced left rear sensor.	1.50	1.00

(Page 2 of 3)
UNSCHEDULED MAINTENANCE
Gillig Bus #1109

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
08-25-11	5,451	The eye bushing is worn in the rear axle lateral bar.	Removed rear axle to replace rear axle lateral bar with strain gauged lateral bar. Installed rear axle and rear lateral bar.	13.00	120.00
08-25-11	5,451	The left rear brake chamber/S-cam bracket is broken.	Replaced brake chamber and bracket.	10.00	14.00
09-02-11	6,516	The right rear brake chamber/S-cam bracket is broken.	Replaced brake chamber and bracket.	3.00	10.00
09-14-11	6,614	The eye bushing is out of the rear axle lateral bar.	Replaced rear lateral bar.	4.50	184.00
09-15-11	6,749	The manufacturer requests information on the alternator build tag.	Removed rear seat to gain access to alternator. Information acquired and replaced seat.	2.00	4.00
09-29-11	7,802	The left rear suspension beam eye bolt will not maintain torque and the alignment eccentric washers are moving out of alignment.	Replaced eye bolt washers and lock nut. Realigned eccentric washers and torque to 600 ft/lbs.	2.00	26.00
10-03-11	8,074	The air tank bracket is broken near the air dryer.	Removed tank and bracket. Welded/repaired bracket. Replaced broken drain fitting in tank. Reinstalled tank and bracket.	3.00	20.00

UNSCHEDULED MAINTENANCE
Gillig Bus #1109

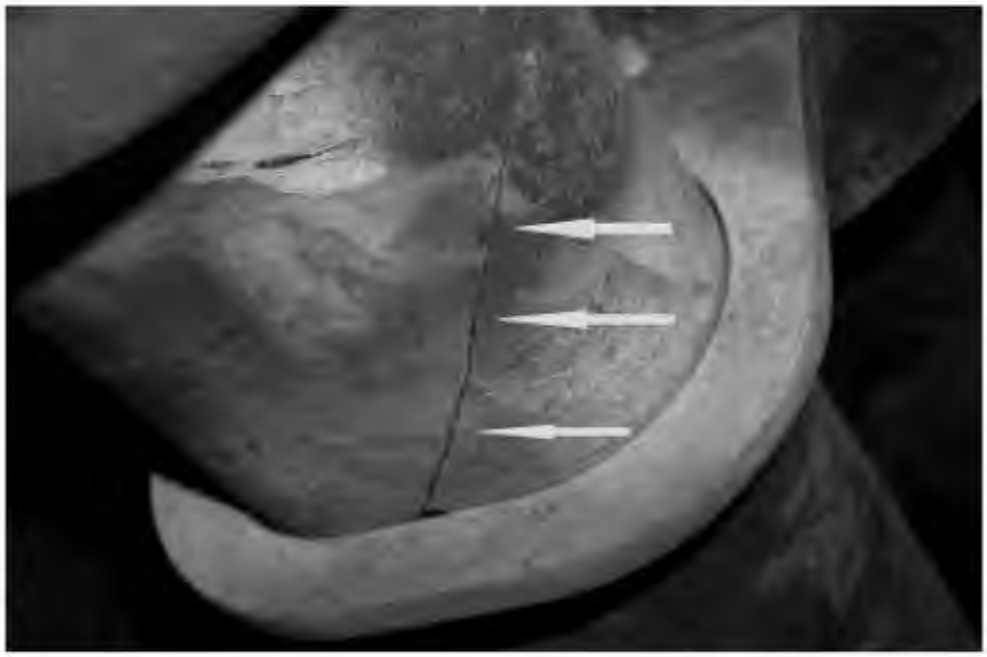
DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
11-09-11	11,291	The upper bracket bolts are broken on the front entrance door support.	Removed privacy panel, bracket cover and door support to replace broken bolts.	4.50	4.00
11-17-11	12,351	Four bolts are broken on the front door support bracket.	Removed broken bolts and installed new nuts and bolts.	1.50	1.50
11-17-11	12,351	The right rear air tank bracket is broken.	Replaced right rear air tank bracket.	1.50	1.50
11-29-11	13,877	Three bolts are broken on the front door support bracket.	Replaced three broken bolts.	2.00	4.00

UNSCHEDULED MAINTENANCE

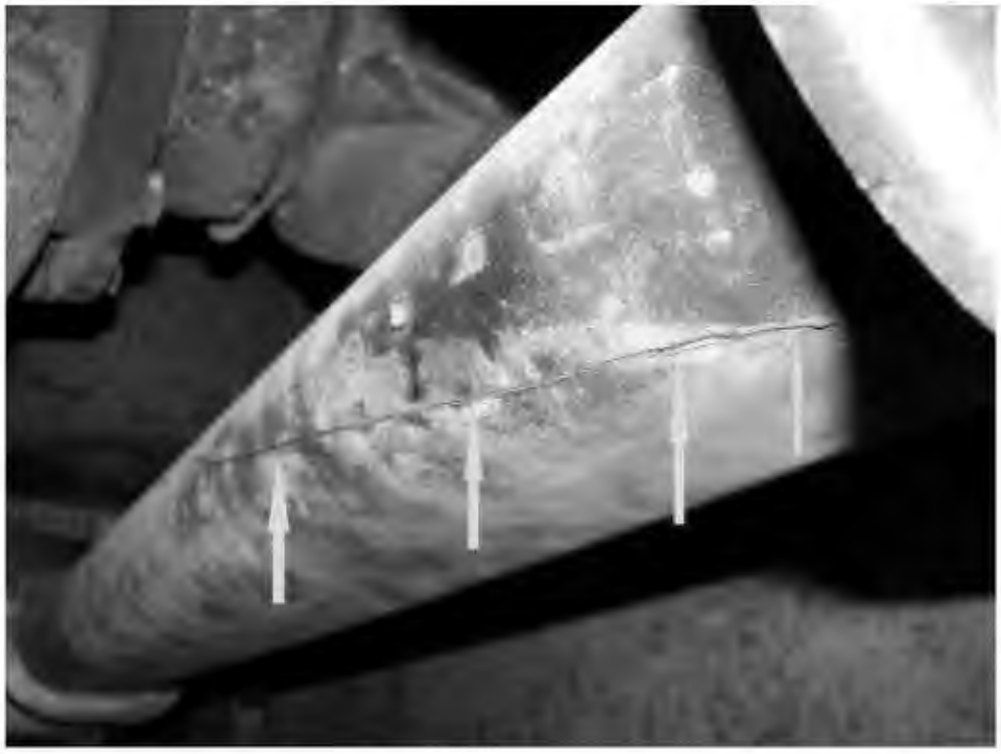
LEAKING RIGHT FRONT SHOCK
(1,384 TEST MILES)

NEW REAR, LOWER SHOCK SPACERS
(1,463 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



CRACKED TRANSVERSE BAR IN REAR, LOWER CONTROL ARM ASSEMBLY (3,785 TEST MILES)



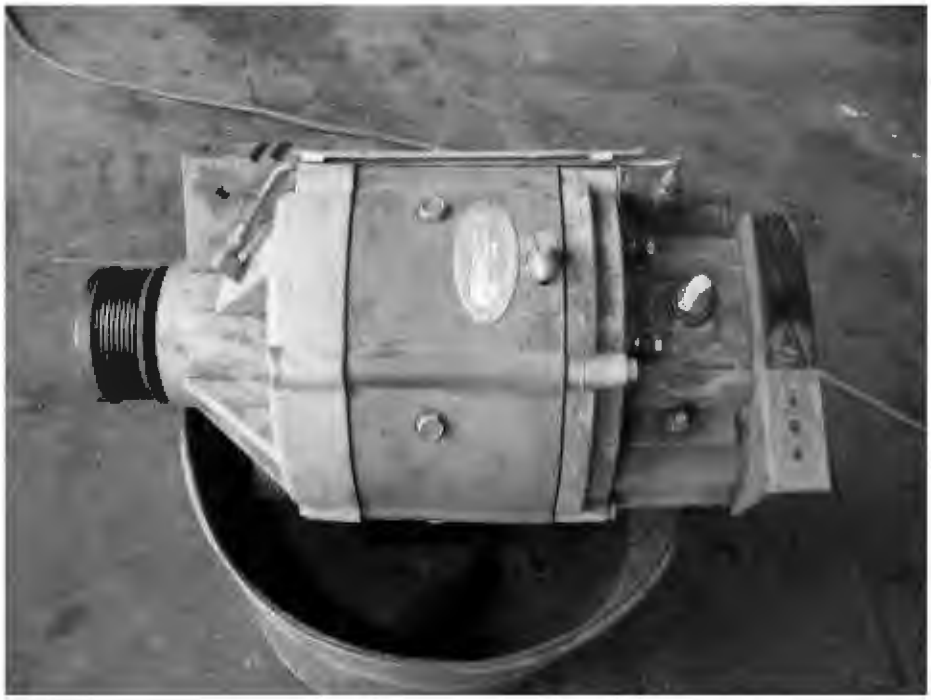
UNSCHEDULED MAINTENANCE CONT.

CRACKED TRANSVERSE BAR IN REAR, LOWER CONTROL ARM ASSEMBLY (3,785 TEST MILES)

BROKEN TRACK ROD EYE (3,785 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

FRONT SHOCK LEAKING OIL
(4,379 TEST MILES)



FAILED ALTERNATOR
(4,730 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

BROKEN LEFT REAR ABS SENSOR
(5,451 TEST MILES)

BROKEN LEFT REAR BRAKE CHAMBER BRACKET
(5,451 TEST MILES)

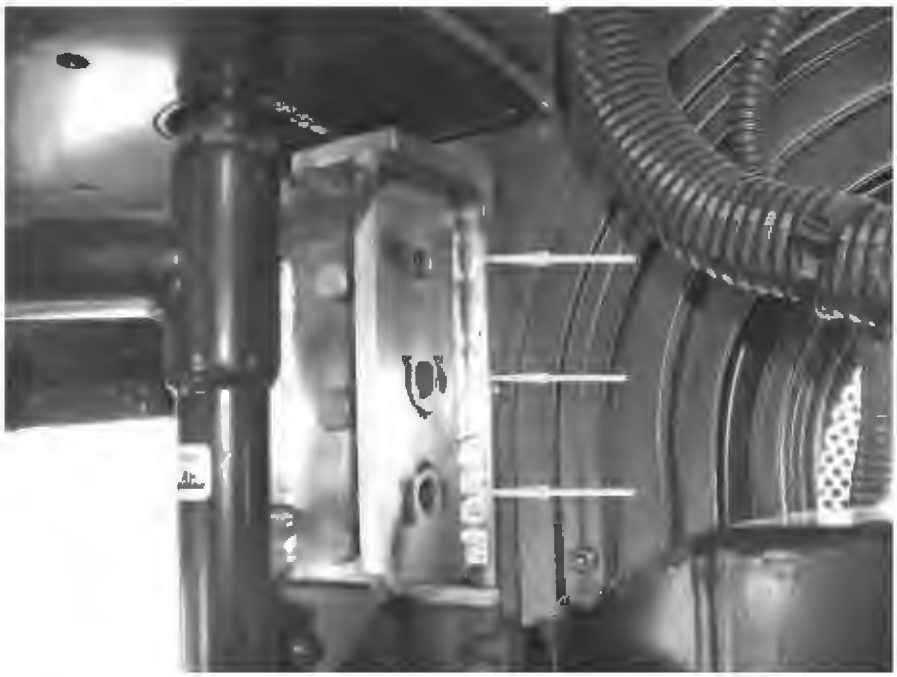
UNSCHEDULED MAINTENANCE CONT.

BROKEN RIGHT REAR BRAKE CHAMBER BRACKET
(6,516 TEST MILES)

FAILED BUSHING; REAR AXLE LATERAL BAR
(6,614 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

FAILED AIR TANK MOUNTING BRACKET (8,074 TEST MILES)



BROKEN BOLTS FRONT DOOR; UPPER SUPPORT BRACKET (13,877 TEST MILES)

6. FUEL ECONOMY TEST - A FUEL CONSUMPTION TEST USING AN APPROPRIATE OPERATING CYCLE

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable fuel consumption data on transit buses produced by different manufacturers. This fuel economy test bears no relation to the calculations done by the Environmental Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This fuel economy test, as designated here, is a measurement of the fuel expended by a vehicle traveling a specified test loop under specified operating conditions. The results of this test will not represent actual mileage but will provide data that can be used by recipients to compare buses tested by this procedure.

6-II. TEST DESCRIPTION

This test requires operation of the bus over a course based on the Transit Coach Operating Duty Cycle (ADB Cycle) at seated load weight using a procedure based on the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82. The procedure has been modified by elimination of the control vehicle and by modifications as described below. The inherent uncertainty and expense of utilizing a control vehicle over the operating life of the facility is impractical.

The fuel economy test will be performed as soon as possible (weather permitting) after the completion of the GVW portion of the structural durability test. It will be conducted on the bus test lane at the Penn State Test Facility. Signs are erected at carefully measured points which delineate the test course. A test run will comprise 3 CBD phases, 2 Arterial phases, and 1 Commuter phase. An electronic fuel measuring system will indicate the amount of fuel consumed during each phase of the test. The test runs will be repeated until there are at least two runs in both the clockwise and counterclockwise directions in which the fuel consumed for each run is within ± 4 percent of the average total fuel used over the 4 runs. A 20-minute idle consumption test is performed just prior to and immediately after the driven portion of the fuel economy test. The amount of fuel consumed while operating at normal/low idle is recorded on the Fuel Economy Data Form. This set of four valid runs along with idle consumption data comprise a valid test.

These test results were obtained prior to the accreditation of the lab on November 8, 2011; therefore, are not considered to be accredited in accordance with A2LA policy.

The test procedure is the ADB cycle with the following four modifications:

1. The ADB cycle is structured as a set number of miles in a fixed time in the following order: CBD, Arterial, CBD, Arterial, CBD, and Commuter. A separate idle fuel consumption measurement is performed at the beginning and end of the fuel economy test. This phase sequence permits the reporting of fuel consumption for each of these phases separately, making the data more useful to bus manufacturers and transit properties.

2. The operating profile for testing purposes shall consist of simulated transit type service at seated load weight. The three test phases (figure 6-1) are: a central business district (CBD) phase of 2 miles with 7 stops per mile and a top speed of 20 mph; an arterial phase of 2 miles with 2 stops per mile and a top speed of 40 mph; and a commuter phase of 4 miles with 1 stop and a maximum speed of 40 mph. At each designated stop the bus will remain stationary for seven seconds. During this time, the passenger doors shall be opened and closed.

3. The individual ADB phases remain unaltered with the exception that 1 mile has been changed to 1 lap on the Penn State Test Track. One lap is equal to 5,042 feet. This change is accommodated by adjusting the cruise distance and time.

4. The acceleration profile, for practical purposes and to achieve better repeatability, has been changed to "full throttle acceleration to cruise speed".

Several changes were made to the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82:

1. Sections 1.1, and 1.2 only apply to diesel, gasoline, methanol, and any other fuel in the liquid state (excluding cryogenic fuels).

1.1 SAE 1376 July 82 requires the use of at least a 16-gal fuel tank. Such a fuel tank when full would weigh approximately 160 lb. It is judged that a 12-gal tank weighing approximately 120 lb will be sufficient for this test and much easier for the technician and test personnel to handle.

1.2 SAE 1376 July 82 mentions the use of a mechanical scale or a flow meter system. This test procedure uses a load cell readout combination that provides an accuracy of 0.5 percent in weight and permits on-board weighing of the gravimetric tanks at the end of each phase. This modification permits the determination of a fuel economy value for each phase as well as the overall cycle.

2. Section 2.1 applies to compressed natural gas (CNG), liquefied natural gas (LNG), cryogenic fuels, and other fuels in the vapor state.

2.1 A laminar type flow meter will be used to determine the fuel consumption. The pressure and temperature across the flow element will be monitored by the flow computer. The flow computer will use this data to calculate the gas flow rate. The flow computer will also display the flow rate (scfm) as well as the total fuel used (scf). The total fuel used (scf) for each phase will be recorded on the Fuel Economy Data Form.

3. Use both Sections 1 and 2 for dual fuel systems.

FUEL ECONOMY CALCULATION PROCEDURE

A. For diesel, gasoline, methanol and fuels in the liquid state.

The reported fuel economy is based on the following: measured test quantities--distance traveled (miles) and fuel consumed (pounds); standard reference values--density of water at 60°F (8.3373 lbs/gal) and volumetric heating value of standard fuel; and test fuel specific gravity (unitless) and volumetric heating value (BTU/gal). These combine to give a fuel economy in miles per gallon (mpg) which is corrected to a standard gallon of fuel referenced to water at 60°F. This eliminates fluctuations in fuel economy due to fluctuations in fuel quality. This calculation has been programmed into a computer and the data processing is performed automatically.

The fuel economy correction consists of three steps:

1.) Divide the number of miles of the phase by the number of pounds of fuel consumed

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$\mathbf{FEo_{mi/lb}} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{lb of fuel}}$$

2.) Convert the observed fuel economy to miles per gallon [mpg] by multiplying by the specific gravity of the test fuel Gs (referred to water) at 60°F and multiply by the density of water at 60°F

$$\mathbf{FEo_{mpg}} = \mathbf{FEc_{mi/lb}} \times Gs \times Gw$$

where **Gs** = Specific gravity of test fuel at 60°F (referred to water)
Gw = 8.3373 lb/gal

3.) Correct to a standard gallon of fuel by dividing by the volumetric heating value of the test fuel (H) and multiplying by the volumetric heating value of standard reference fuel (Q). Both heating values must have the same units.

$$\mathbf{FEc} = \mathbf{FEo_{mpg}} \times \frac{Q}{H}$$

where

H = Volumetric heating value of test fuel [BTU/gal]
Q = Volumetric heating value of standard reference fuel

Combining steps 1-3 yields

$$\Rightarrow FEc = \frac{miles}{lbs} \times (Gs \times Gw) \times \frac{Q}{H}$$

4.) Covert the fuel economy from mpg to an energy equivalent of miles per BTU. Since the number would be extremely small in magnitude, the energy equivalent will be represented as miles/BTUx10^6.

Eq = Energy equivalent of converting mpg to mile/BTUx10^6.

Eq = ((mpg)/(H))x10^6

B. CNG, LNG, cryogenic and other fuels in the vapor state.

The reported fuel economy is based on the following: measured test quantities--distance traveled (miles) and fuel consumed (scf); density of test fuel, and volumetric heating value (BTU/lb) of test fuel at standard conditions (P=14.73 psia and T=60 EF).

These combine to give a fuel economy in miles per lb. The energy equivalent (mile/BTUx10^6) will also be provided so that the results can be compared to buses that use other fuels.

1.) Divide the number of miles of the phase by the number of standard cubic feet (scf) of fuel consumed.

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$\mathbf{FEo_{mi/scf}} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{scf of fuel}}$$

2.) Convert the observed fuel economy to miles per lb by dividing FEo by the density of the test fuel at standard conditions (Lb/ft^3).

Note: The density of test fuel must be determined at standard conditions as described above. If the density is not defined at the above standard conditions, then a correction will be needed before the fuel economy can be calculated.

$$\mathbf{FEo_{mi/lb}} = FEo / Gm$$

where Gm = Density of test fuel at standard conditions

3.) Convert the observed fuel economy (FEomi/lb) to an energy equivalent of (miles/BTUx10^6) by dividing the observed fuel economy (FEomi/lb) by the heating value of the test fuel at standard conditions.

$$Eq = ((FEomi/lb)/H)x10^6$$

where

Eq = Energy equivalent of miles/lb to mile/BTUx10^6
H = Volumetric heating value of test fuel at standard conditions

6-III. DISCUSSION

This is a comparative test of fuel economy using CNG fuel with a heating value of 1,008.1 btu/lb. The driving cycle consists of Central Business District (CBD), Arterial (ART), and Commuter (COM) phases as described in 6-II. The fuel consumption for each driving cycle and for idle is measured separately. The results are corrected to a reference fuel with a volumetric heating value of 126,700.0 btu/gal.

An extensive pretest maintenance check is made including the replacement of all lubrication fluids. The details of the pretest maintenance are given in the first three Pretest Maintenance Forms. The fourth sheet shows the Pretest Inspection. The next sheet shows the correction calculation for the test fuel. The next four Fuel Economy Forms provide the data from the four test runs. Finally, the summary sheet provides the average fuel consumption. The overall average is based on total fuel and total mileage for each phase. The overall average fuel consumption values were; CBD – 0.92 M/lb, ART – 0.99 M/lb, and COM – 1.67 M/lb. Average fuel consumption at idle was 4.73 lb/hr.

FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 1109	Date: 9-19-11	SLW (lbs): 30,310
Personnel: S.C. & T.S.		

FUEL SYSTEM	OK	Date	Initials
Install fuel measurement system	✓	9-19-11	S.C.
Replace fuel filter	✓	9-19-11	S.C.
Check for fuel leaks	✓	9-19-11	S.C.
Specify fuel type (refer to fuel analysis)	CNG		
Remarks: None noted.			
BRAKES/TIRES	**OK**	**Date**	**Initials**
Inspect hoses	✓	9-19-11	S.C.
Inspect brakes	✓	9-19-11	S.C.
Relube wheel bearings	✓	9-19-11	T.S
Check tire inflation pressures (mfg. specs.)	✓	9-19-11	S.C.
Remarks: None noted.			
COOLING SYSTEM	**OK**	**Date**	**Initials**
Check hoses and connections	✓	9-19-11	S.C.
Check system for coolant leaks	✓	9-19-11	S.C.
Remarks: None noted.			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 2)

Bus Number: 1109	Date: 9-19-11
Personnel: S.C. & T.S.	

ELECTRICAL SYSTEMS	OK	Date	Initials
Check battery	✓	9-19-11	S.C.
Inspect wiring	✓	9-19-11	S.C.
Inspect terminals	✓	9-19-11	S.C.
Check lighting	✓	9-19-11	S.C.
Remarks: None noted.			
DRIVE SYSTEM	OK	Date	Initials
Drain transmission fluid	✓	9-19-11	T.S.
Replace filter/gasket	✓	9-19-11	T.S.
Check hoses and connections	✓	9-19-11	T.S.
Replace transmission fluid	✓	9-19-11	T.S.
Check for fluid leaks	✓	9-19-11	T.S.
Remarks: None noted.			
LUBRICATION	OK	Date	Initials
Drain crankcase oil	✓	9-19-11	T.S.
Replace filters	✓	9-19-11	T.S.
Replace crankcase oil	✓	9-19-11	T.S.
Check for oil leaks	✓	9-19-11	T.S.
Check oil level	✓	9-19-11	T.S.
Lube all chassis grease fittings	✓	9-19-11	T.S.
Lube universal joints	✓	9-19-11	T.S.
Replace differential lube including axles	✓	9-19-11	T.S.
Remarks: None noted.			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 3)

Bus Number: 1109	Date: 9-19-11
Personnel: S.C. & T.S.	

EXHAUST/EMISSION SYSTEM	OK	Date	Initials
Check for exhaust leaks	✓	9-19-11	S.C.
Remarks: None noted.			
ENGINE	**OK**	**Date**	**Initials**
Replace air filter	✓	9-19-11	T.S.
Inspect air compressor and air system	✓	9-19-11	S.C.
Inspect vacuum system, if applicable	**N/A**	9-19-11	S.C.
Check and adjust all drive belts	✓	9-19-11	S.C.
Check cold start assist, if applicable	✓	9-19-11	S.C.
Remarks: None noted.			
STEERING SYSTEM	**OK**	**Date**	**Initials**
Check power steering hoses and connectors	✓	9-19-11	S.C.
Service fluid level	✓	9-19-11	S.C.
Check power steering operation	✓	9-19-11	S.C.
Remarks: None noted.			
	OK	**Date**	**Initials**
Ballast bus to seated load weight	✓	9-19-11	S.C.
TEST DRIVE	**OK**	**Date**	**Initials**
Check brake operation	✓	9-19-11	S.C.
Check transmission operation	✓	9-19-11	S.C.
Remarks: None noted.			

FUEL ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 1109	Date: 9-22-11
Personnel: S.C.	

PRE WARM-UP	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	S.C.
Cold tire pressure (psi): Front 120 Middle N/A Rear 120	S.C.
Tire wear:	S.C.
Engine oil level	S.C.
Engine coolant level	S.C.
Interior and exterior lights on, evaporator fan on	S.C.
Fuel economy instrumentation installed and working properly.	S.C.
Fuel line -- no leaks or kinks	S.C.
Speed measuring system installed on bus. Speed indicator installed in front of bus and accessible to TECH and Driver.	S.C.
Bus is loaded to SLW	S.C.
WARM-UP	**If OK, Initial**
Bus driven for at least one hour warm-up	S.C.
No extensive or black smoke from exhaust	S.C.
POST WARM-UP	**If OK, Initial**
Warm tire pressure (psi): Front 122 Middle N/A Rear 124	S.C.
Environmental conditions Average wind speed <12 mph and maximum gusts <15 mph Ambient temperature between 30°(-1°) and 90°F(32°C) Track surface is dry Track is free of extraneous material and clear of interfering traffic	S.C.

FUEL ECONOMY DATA FORM (Gaseous Fuels)

Bus Number: 1109	Manufacturer: Gillig	Date: 9-22-11
Run Number: 1	Personnel: B.G., B.L. & S.C.	
Test Direction: □CW or ■CCW	Ambient Temperature (°F): 68	Humidity (%): 93
SLW (lbs): 30,310	Wind Speed (mph) & Direction: Calm	Barometric Pressure (in.Hg): 30.12

Cycle Type	Run Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°F)	Total Measured Fuel Used (SCF)	+ 8% Carbon Balance Correction
	Start	Finish		Start		
CBD #1	0	8:43	8:43	74	48	51.8
ART #1	0	4:04	4:04	80	44	47.5
CBD #2	0	8:39	8:39	81	48	51.8
ART #2	0	3:59	3:59	81	46	49.7
CBD #3	0	8:31	8:31	81	48	51.8
COMMUTER	0	5:59	5:59	81	53	57.2
						Total Fuel: 309.8 SCF

20 minute idle : Total Fuel Used = 38 SCF (41.0)* * +8% Carbon Balance Correction	
No Load Flow Rate at Idle = 1.85 SCFM	No Load Flow Rate at Full Throttle = 9.45 SCFM
Heating Value = 1,008.1 BTU/LB	
Comments: None noted.	

FUEL ECONOMY DATA FORM (Gaseous Fuels)

Bus Number: 1109	Manufacturer: Gillig	Date: 9-22-11
Run Number: 2	Personnel: B.G., B.L. & S.C.	
Test Direction: ■CW or □CCW	Ambient Temperature (°F): 68	Humidity (%): 93
SLW (lbs): 30,310	Wind Speed (mph) & Direction: Calm	Barometric Pressure (in.Hg): 3.0.12

Cycle Type	Run Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°F)	Total Measured Fuel Used (SCF)	+8% Carbon Balance Correction
	Start	Finish		Start		
CBD #1	0	8:43	8:43	80	47	50.8
ART #1	0	4:05	4:05	82	43	46.4
CBD #2	0	8:39	8:39	83	48	51.8
ART #2	0	4:00	4:00	83	43	46.4
CBD #3	0	8:36	8:36	83	47	50.8
COMMUTER	0	6:03	6:03	82	51	55.1
						Total Fuel: 301.2 SCF

20 minute idle : Total Fuel Used = N/A SCF	
No Load Flow Rate at Idle = N/A SCFM	No Load Flow Rate at Full Throttle = N/A SCFM
Heating Value = 1,008.1 BTU/LB	
Comments: None noted.	

FUEL ECONOMY DATA FORM (Gaseous Fuels)

Bus Number: 1109	Manufacturer: Gillig	Date: 9-22-11
Run Number: 3	Personnel: B.G., B.L. & S.C.	
Test Direction: □CW or ■CCW	Ambient Temperature (°F): 73	Humidity (%): 82
SLW (lbs): 30,310	Wind Speed (mph) & Direction: Calm	Barometric Pressure (in.Hg): 30.12

Cycle Type	Run Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°F)	Total Measured Fuel Used (SCF)	+8% Carbon Balance Correction
	Start	Finish		Start		
CBD #1	0	8:33	8:33	80	45	48.6
ART #1	0	4:01	4:01	85	44	47.5
CBD #2	0	8:35	8:35	87	47	50.8
ART #2	0	4:02	4:02	86	44	47.5
CBD #3	0	8:34	8:34	86	47	50.8
COMMUTER	0	5:58	5:58	85	53	57.2
						Total Fuel: 302.4 SCF

20 minute idle : Total Fuel Used = N/A SCF	
No Load Flow Rate at Idle = N/A SCFM	No Load Flow Rate at Full Throttle = N/A SCFM
Heating Value = 1,008.1 BTU/LB	
Comments: None noted.	

FUEL ECONOMY DATA FORM (Gaseous Fuels)

Bus Number: 1109	Manufacturer: Gillig	Date: 9-22-11
Run Number: 4	Personnel: B.G., B.L. & S.C.	
Test Direction: ■CW or □CCW	Ambient Temperature (°F): 74	Humidity (%): 80
SLW (lbs): 30,310	Wind Speed (mph) & Direction: Calm	Barometric Pressure (in.Hg): 30.12

Cycle Type	Run Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°F)	Total Measured Fuel Used (SCF)	+8% Carbon Balance Correction
	Start	Finish		Start		
CBD #1	0	8:35	8:35	84	48	51.8
ART #1	0	4:04	4:04	86	44	47.5
CBD #2	0	8:41	8:41	86	48	51.8
ART #2	0	4:04	4:04	87	43	46.4
CBD #3	0	8:39	8:39	88	49	52.9
COMMUTER	0	6:02	6:02	87	52	56.1
						Total Fuel: 306.5 SCF

20 minute idle : Total Fuel Used = 34 SCF (36.7)*	* +8% Carbon Balance Correction
No Load Flow Rate at Idle = 1.64 SCFM	No Load Flow Rate at Full Throttle = 9.40 SCFM
Heating Value = 1,008.1 BTU/LB	
Comments: None noted.	

1109 .ful
FUEL ECONOMY SUMMARY SHEET

BUS MANUFACTURER :Gillig
BUS MODEL :Low Floor
BUS NUMBER :1109
TEST DATE :09/22/11

FUEL TYPE : NATURAL GAS
SP. GRAVITY : .5570
HEATING VALUE : 1008.10 BTU/cf
FUEL TEMPERATURE : 60.00 deg F
Standard Conditions : 60 deg F and 14.7 psi
Density of Air : 0.0729 lb/scf

CYCLE	TOTAL FUEL USED (Scf)	TOTAL MILES	FUEL ECONOMY M/Scf(Measured)	FUEL ECONOMY M/Lb(Corrected)
Run # :1, CCW				
CBD	155.4	5.73	.04	.91
ART	97.2	3.82	.04	.97
COM	57.2	3.82	.07	1.64
TOTAL	309.8	13.37	.04	1.06
Run # :2, CW				
CBD	153.4	5.73	.04	.92
ART	92.8	3.82	.04	1.01
COM	55.1	3.82	.07	1.71
TOTAL	301.3	13.37	.04	1.09
Run # :3, CCW				
CBD	150.2	5.73	.04	.94
ART	95.0	3.82	.04	.99
COM	57.2	3.82	.07	1.64
TOTAL	302.4	13.37	.04	1.09
Run # :4, CW				
CBD	156.5	5.73	.04	.90
ART	93.9	3.82	.04	1.00
COM	56.1	3.82	.07	1.68
TOTAL	306.5	13.37	.04	1.07

IDLE CONSUMPTION (MEASURED)

First 20 Minutes Data : 41.0 Scf Last 20 Minutes Data : 36.7 Scf
Average Idle Consumption : 116.6 Scf/Hr

RUN CONSISTENCY: % Difference from overall average of total fuel used

Run 1 : -1.6 Run 2 : 1.2 Run 3 : .9 Run 4 : -.5

SUMMARY (CORRECTED VALUES)

Average Idle Consumption : 4.73 LB/Hr
Average CBD Phase Consumption : .92 M/Lb
Average Arterial Phase Consumption : .99 M/Lb
Average Commuter Phase Consumption : 1.67 M/Lb
Overall Average Fuel Consumption : 1.08 M/Lb
Overall Average Fuel Consumption : 43.49 Miles/ Million BTU

7. NOISE

7.1 INTERIOR NOISE AND VIBRATION TESTS

7.1-I. TEST OBJECTIVE

The objective of these tests is to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level will be measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system shall provide a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories will be switched off and all openings including doors and windows will be closed. This test will be performed at the ABTC.

2. The bus accelerating at full throttle from a standing start to 35 mph on a level pavement. All openings will be closed and all accessories will be operating during the test. This test will be performed on the track at the Test Track Facility.

3. The bus will be operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles will be noted. This test will be performed on the test segment between the Test Track and the Bus Testing Center.

All tests will be performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions will be recorded in the test data.

7.1-III. DISCUSSION

This test is performed in three parts. The first part exposes the exterior of the vehicle to 80.0 dB(A) on the left side of the bus and the noise transmitted to the interior is measured. The overall average of the six measurements was 50.1 dB(A); ranging from 48.7 dB(A) at the rear passenger seats to 51.9 dB(A) at the driver's seat. The interior ambient noise level for this test was < 34.0 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 75.2 dB(A) at the middle passenger seats to 78.2 dB(A) at the rear passenger seats. The overall average was 76.7 dB(A). The interior ambient noise level for this test was < 34.0 dB(A).

The third part of the test is to listen for resonant vibrations, rattles, and other noise sources while operating over the road. No vibrations or rattles were noted.

These test results were obtained prior to the accreditation of the lab on November 8, 2011; therefore, are not considered to be accredited in accordance with A2LA policy.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise

Bus Number: 1109	Date: 6-7-11
Personnel: B.L., E.D. & E.L.	
Temperature (°F): 70	Humidity (%): 65
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.05	
Initial Sound Level Meter Calibration: ■ checked by: B.L.	
Interior Ambient Noise Level dB(A): < 34.0	Exterior Ambient Noise Level dB(A): 49.6
Microphone Height During Testing (in): 48	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	51.9
Front Passenger Seats	49.9
In Line with Front Speaker	49.5
In Line with Middle Speaker	50.3
In Line with Rear Speaker	50.1
Rear Passenger Seats	48.7

Final Sound Level Meter Calibration: ■ checked by: B.L.

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test

Bus Number: 1109	Date: 9-23-11
Personnel: B.G., T.S. & B.L.	
Temperature (°F): 66	Humidity (%): 100
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.05	
Initial Sound Level Meter Calibration: ■ checked by: T.S.	
Interior Ambient Noise Level dB(A): < 34.0	Exterior Ambient Noise Level dB(A): 36.3
Microphone Height During Testing (in): 48”	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	77.3
Front Passenger Seats	76.0
Middle Passenger Seats	75.2
Rear Passenger Seats	78.2

Final Sound Level Meter Calibration: ■ checked by: T.S.

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test

Bus Number: 1109	Date: 9-23-11
Personnel: B.G., T.S. & B.L.	
Temperature (°F): 66	Humidity (%): 100
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.05	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location
Engine and Accessories	None noted.
Windows and Doors	None noted.
Seats and Wheel Chair lifts	None noted.

Comment on any other vibration or noise source which may have occurred
that is not described above: None noted.

7.1 INTERIOR NOISE TEST

TEST BUS SET-UP FOR 80 dB(A)
INTERIOR NOISE TEST

7.2 EXTERIOR NOISE TESTS

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus will be operated at a SLW in three different conditions using a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed at or below 35 mph and just prior to transmission upshift.
2. Accelerating at full throttle from standstill.
3. Stationary, with the engine at low idle, high idle, and wide open throttle.

In addition, the buses will be tested with and without the air conditioning and all accessories operating. The exterior noise levels will be recorded.

The test site is at the PSBRTF and the test procedures will be in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The test site is an open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus will measure the noise level.

During the test, special attention should be paid to:

1. The test site characteristics regarding parked vehicles, signboards, buildings, or other sound-reflecting surfaces
2. Proper usage of all test equipment including set-up and calibration
3. The ambient sound level

7.2-III. DISCUSSION

The Exterior Noise Test determines the noise level generated by the vehicle under different driving conditions and at stationary low and high idle, with and without air conditioning and accessories operating. The test site is a large, level, bituminous paved area with no reflecting surfaces nearby.

With an exterior ambient noise level of 37.1 dB(A), the average test result obtained while accelerating from a constant speed was 70.1 dB(A) on the right side and 69.1 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 37.1 dB(A), the average of the results obtained were 70.0 dB(A) on the right side and 70.9 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 57.0 dB(A) at low idle, 56.1 dB(A) at high idle, and 71.4 dB(A) at wide open throttle. With the accessories and air conditioning off, the readings averaged 4.1 dB(A) lower at low idle, 1.5 dB(A) lower at high idle, and 0.7 dB(A) lower at wide open throttle. The exterior ambient noise level measured during this test was 37.1 dB(A).

These test results were obtained prior to the accreditation of the lab on November 8, 2011; therefore, are not considered to be accredited in accordance with A2LA policy.

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 1109	Date: 9-23-11
Personnel: B.G., T.S. & B.L.	
Temperature (°F): 68	Humidity (%): 94
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.06	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: T.S.	
Initial Sound Level Meter Calibration: ■ checked by: B.L.	
Exterior Ambient Noise Level dB(A): 37.1	

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	70.5	1	68.9
2	69.5	2	69.0
3	69.1	3	69.0
4	69.7	4	69.1
5	69.6	5	69.1
Average of two highest actual noise levels = 70.1 dB(A)		Average of two highest actual noise levels = 69.1 dB(A)	

Final Sound Level Meter Calibration Check: ■ checked by: T.S.
Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 1109	Date: 9-23-11
Personnel: B.G., T.S. & B.L.	
Temperature (°F): 68	Humidity (%): 94
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.06	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: B.L.	
Initial Sound Level Meter Calibration: ■ checked by: B.L.	
Exterior Ambient Noise Level dB(A): 37.1	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	69.7	1	70.1
2	69.4	2	70.9
3	70.3	3	69.7
4	69.6	4	70.8
5	69.7	5	70.8
Average of two highest actual noise levels = 70.0 dB(A)		Average of two highest actual noise levels = 70.9 dB(A)	

Final Sound Level Meter Calibration Check: ■ checked by: T.S.
Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 1109	Date: 9-23-11
Personnel: B.G., T.S. & B.L.	
Temperature (°F): 68	Humidity (%): 94
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.06	

Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: T.S.

Initial Sound Level Meter Calibration: ■ checked by: T.S.

Exterior Ambient Noise Level dB(A): 37.1

Accessories and Air Conditioning ON

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	695	59.8	54.2
High Idle	996	56.7	55.4
Wide Open Throttle	2,360	71.9	70.8

Accessories and Air Conditioning OFF

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	700	54.3	51.5
High Idle	998	55.5	53.7
Wide Open Throttle	2,406	70.8	70.5

Final Sound Level Meter Calibration Check: ■ checked by: B.L.

Comments: None noted.

7.2 EXTERIOR NOISE TESTS

TEST BUS UNDERGOING
EXTERIOR NOISE TESTING

8. EMISSIONS TEST – DYNAMOMETER-BASED EMISSIONS TEST USING TRANSIT DRIVING CYCLES

8-I. TEST OBJECTIVE

The objective of this test is to provide comparable emissions data on transit buses produced by different manufacturers. This chassis-based emissions test bears no relation to engine certification testing performed for compliance with the Environmental Protection Agency (EPA) regulation. EPA's certification tests are performed using an engine dynamometer operating under the Federal Test Protocol. This emissions test is a measurement of the gaseous engine emissions CO, CO2, NOx, HC and particulates (diesel vehicles) produced by a vehicle operating on a large-roll chassis dynamometer. The test is performed for three differed driving cycles intended to simulate a range of transit operating environments. The cycles consist of Manhattan Cycle, the Orange County Bus driving cycle, and the Urban Dynamometer Driving Cycle (UDDS) and. The test is performed under laboratory conditions in compliance with EPA 1065 and SAE J2711. The results of this test may not represent actual in-service vehicle emissions but will provide data that can be used by recipients to compare buses tested under different operating conditions.

8-II. TEST DESCRIPTION

This test is performed in the emissions bay of the LTI Vehicle Testing Laboratory. The Laboratory is equipped with a Schenk Pegasus 300 HP, large-roll (72 inch diameter) chassis dynamometer suitable for heavy-vehicle emissions testing. The dynamometer is located in the end test bay and is adjacent to the control room and emissions analysis area. The emissions laboratory provides capability for testing heavy-duty diesel and alternative-fueled buses for a variety of tailpipe emissions including particulate matter, oxides of nitrogen, carbon monoxide, carbon dioxide, and hydrocarbons. It is equipped with a Horiba full-scale CVS dilution tunnel and emissions sampling system. The system includes Horiba Mexa 7400 Series gas analyzers and a Horiba HF47 Particulate Sampling System. Test operation is automated using Horiba CDTCS software. The computer controlled dynamometer is capable of simulating over-the-road operation for a variety of vehicles and driving cycles.

The emissions test will be performed as soon as permissible after the completion of the GVW portion of the structural durability test. The driving cycles are the Manhattan cycle, a low average speed, highly transient urban cycle (Figure 1), the Orange County Bus Cycle which consists of urban and highway driving segments (Figure 2), and the EPA UDDS Cycle (Figure 3). An emissions test will comprise of two runs for the three different driving cycles, and the

average value will be reported. Test results reported will include the average grams per mile value for each of the gaseous emissions for gasoline buses, for all the three driving cycles. In addition, the particulate matter emissions are included for diesel buses, and non-methane hydrocarbon emissions (NMHC) are included for CNG buses. Testing is performed in accordance with EPA CFR49, Part 1065 and SAE J2711 as practically determined by the FTA Emissions Testing Protocol developed by West Virginia University and Penn State University.

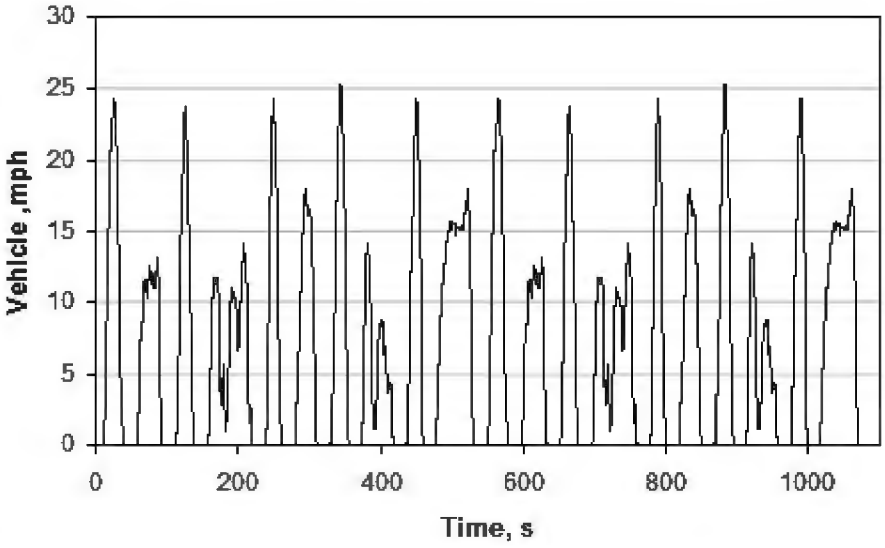


***Figure 1**. Manhattan Driving Cycle (duration 1089 sec, Maximum speed 25.4mph, average speed 6.8mph)*

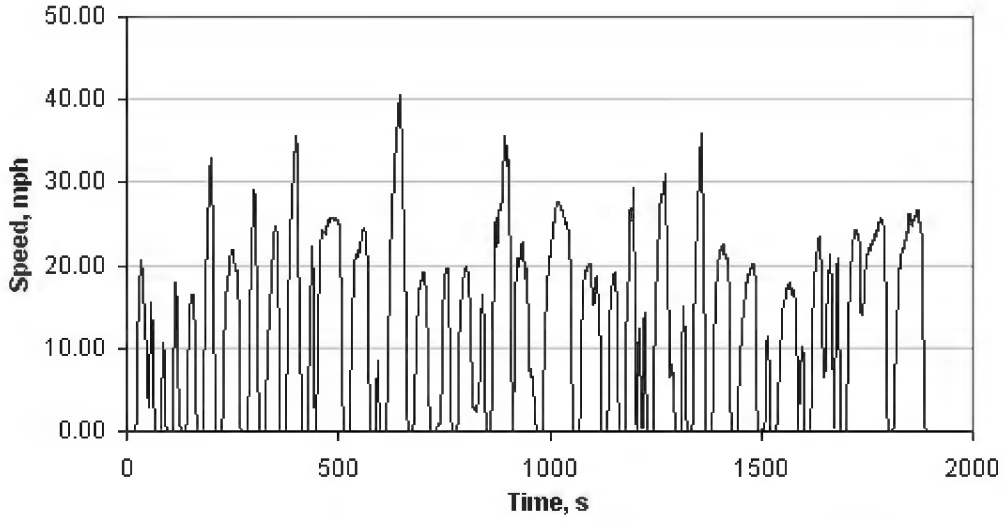


***Figure 2**. Orange County Bus Cycle (Duration 1909 Sec, Maximum Speed 41mph, Average Speed 12mph)*

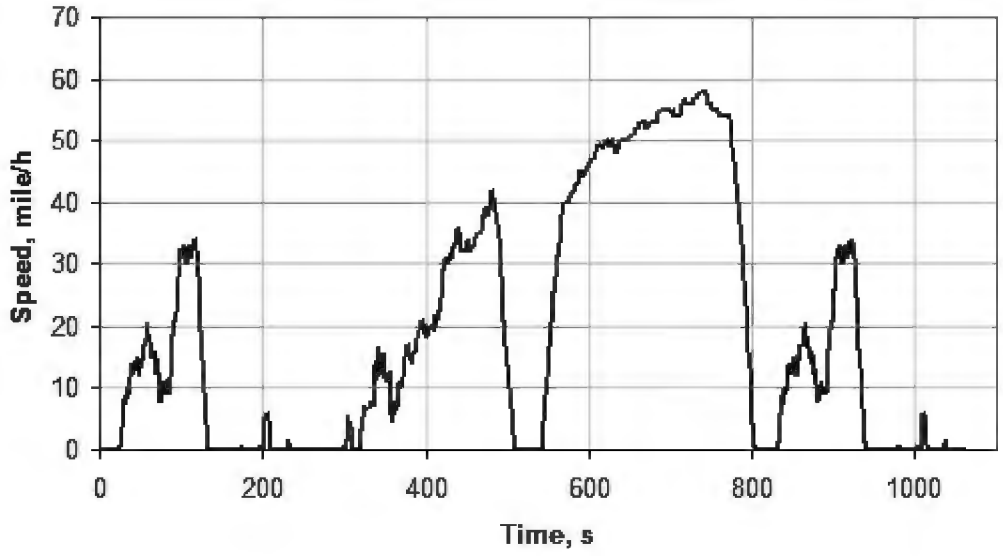


***Figure 3**. HD-UDDS Cycle (duration 1060seconds, Maximum Speed 58mph, Average Speed 18.86mph)*

8-III. TEST ARTICLE

The test article is a Gillig, Low Floor model transit bus equipped with CNG-fueled Cummins model ISL G280 engine. The bus was tested on October 19, 2011.

8-IV. TEST EQUIPMENT

Testing is performed in the LTI Vehicle Testing Laboratory emissions testing bay. The test bay is equipped with a Schenk Pegasus 72-inch, large-roll chassis dynamometer. The dynamometer is electronically controlled to account for vehicle road-load characteristics and for simulating the inertia characteristics of the vehicle. Power to the roller is supplied and absorbed through an electronically controlled 3-phase ac motor. Absorbed power is dumped back onto the electrical grid.

Vehicle exhaust is collected by a Horiba CVS, full-flow dilution tunnel. The system has separate tunnels for diesel and gasoline/natural gas fueled vehicles. In the case of diesel vehicles, particulate emissions are measured gravimetrically using 47mm Teflon filters. These filters are housed in a Horiba HF47 particulate sampler, per EPA 1065 test procedures.. Heated gaseous emissions of hydrocarbons and NOx are sampled by Horiba heated oven analyzers. Gaseous

emissions for CO, CO2 and cold NOx are measured using a Horiba Mexa 7400 series gas analyzer. System operation, including the operation of the chassis dynamometer, and all calculations are controlled by a Dell workstation running Horiba CDCTS test control software. Particulate Filters are weighed in a glove box using a Sartorius microbalance accurate to 1 microgram.

8-V. TEST PREPARATION AND PROCEDURES

All vehicles are prepared for emissions testing in accordance with the Fuel Economy Pre-Test Maintenance Form. (In the event that fuel economy test was performed immediately prior to emissions testing this step does not have to be repeated) This is done to ensure that the bus is tested in optimum operating condition. The manufacturer-specified preventive maintenance shall be performed before this test. The ABS system and when applicable, the regenerative braking system are disabled for operation on the chassis dynamometer. Any manufacturer-recommended changes to the pre-test maintenance procedure must be noted on the revision sheet. The Fuel Economy Pre-Test Inspection Form will also be completed before performing. Both the Fuel Economy Pre-Test Maintenance Form and the Fuel Economy Pre-Test Inspection Form are found on the following pages.

Prior to performing the emissions test, each bus is evaluated to determine its road-load characteristics using coast-down techniques in accordance with SAE J1263. This data is used to program the chassis dynamometer to accurately simulate over-the-road operation of the bus.

Warm-up consists of driving the bus for 20 minutes at approximately 40 mph on the chassis dynamometer. The test driver follows the prescribed driving cycle watching the speed trace and instructions on the Horiba Drivers-Aid monitor which is placed in front of the windshield. The CDCTS computer monitors driver performance and reports any errors that could potentially invalidate the test.

All buses are tested at half seated load weight. The base line emissions data are obtained at the following conditions:

1. Air conditioning off
2. Evaporator fan or ventilation fan on
3. One Half Seated load weight
4. Appropriate test fuel with energy content (BTU/LB) noted in CDTCS software
5. Exterior and interior lights on
6. Heater Pump Motor off
7. Defroster off
8. Windows and Doors closed

The test tanks or the bus fuel tank(s) will be filled prior to the fuel economy test with the appropriate grade of test fuel.

8-VI DISCUSSION

The following Table 1 provides the emissions testing results on a grams per mile basis for each of the exhaust constituents measured and for each driving cycle performed.

TABLE 1 Emissions Test Results

Driving Cycle	Manhattan	Orange County Bus	UDDS
CO_2, gm/mi	2,409	1,641	1,199
CO, gm/mi	11.9	12.8	7.2
THC, gm/mi	1.08	1.45	0.81
NMHC, gm/mi	0.06	0.07	0.04
NO_x, gm/mi	0.75	0.77	0.59
Particulates. gm/mi	na	na	na
Fuel consumption scf/mi	43.6	29.9	21.7

Exhibit 'G' - Pricing

(On the following pages)

PRICING FORM – BAFO
30 Foot Buses

Please check the type: ☐ CNG ☑ DIESEL ☐ HYBRID

Proposers must submit separate pricing forms for each type.

	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
Base Bus	1	30 FT Buses	$583,209.00	$583,209.00
Total for Base Bus			$583,209.00	$583,209.00
(SOW) SECTION NUMBER(S)	**QUANTITY**	**BASE BUS SYSTEMS THAT MUST BE PRICED FOR FIXED ASSETS ON ORIGINAL PURCHASE**	**UNIT PRICE**	**TOTAL PRICE**
TS 9	1	Engine - with aftertreatment Cummins L9	$61,378.00	$61,378.00
TS 10	1	Engine Cooling System - EMP MH4	$8,594.00	$8,594.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Transmission Voith DIWA NXT	$17,812.00	$17,812.00
TS 17.2.2	1	CNG Fuel Tanks	$N/A	$N/A
TS 51.1	1	HVAC System - Thermo King T14 w X430 compressor	$25,705.00	$25,705.00
TS 5.10	1	Fire Suppression System - Fogmaker	$4,977.00	$4,977.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 9,344.00	$ 9,344.00
TS 11	1	Powertrain (ID the Type) -Transmission	Voith DIWA NXT	Voith DIWA NXT
	1	General Bus – Everything not broken out above	$455,399.00	$455,399.00
		Total (Should Match Bus Total Above)	$583,209.00	$583,209.00
1002	1	Delivery of Buses	$7,190.00	$7,190.00

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After the 180 day period from the effective date of the contract, all prices shall be subject to the US Bureau of Labor Statistics Producer Price Index (PPI)Series ID: WPU1413 Truck and bus Bodies and will be capped at Eight percent (8%) per year.

PRICING FORM – BAFO
30 Foot Buses

Please check the type: ☑ CNG ☐ DIESEL ☐ HYBRID

Proposers must submit separate pricing forms for each type.

	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
Base Bus	1	30 FT Buses	$639,285.00	$639,285.00
Total for Base Bus			$639,285.00	$639,285.00
(SOW) SECTION NUMBER(S)	**QUANTITY**	**BASE BUS SYSTEMS THAT MUST BE PRICED FOR FIXED ASSETS ON ORIGINAL PURCHASE**	**UNIT PRICE**	**TOTAL PRICE**
TS 9	1	Engine - with aftertreatment Cummins L9N	$70,101.00	$70,101.00
TS 10	1	Engine Cooling System - EMP MH4	$8,594.00	$8,594.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Transmission Voith DIWA.6	$17,187.00	$17,187.00
TS 17.2.2	1	CNG Fuel Tanks - 5 Tank Assembly with Structure and Plumbing	$38,465.00	$38,465.00
TS 51.1	1	HVAC System - Thermo King T14 w X430 compressor	$25,705.00	$25,705.00
TS 5.10	1	Fire Suppression System - Fogmaker	$7,731.00	$7,731.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 9,344.00	$ 9,344.00
TS 11	1	Powertrain (ID the Type) - Transmission	Voith DIWA.6	Voith DIWA.6
	1	General Bus – Everything not broken out above	$462,158.00	$462,158.00
		Total (Should Match Bus Total Above)	$639,285.00	$639,285.00
1002	1	Delivery of Buses	$7,190.00	$7,190.00

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PRICING FORM – BAFO
35 Foot Buses

Please check the type: ☐ CNG ☑ DIESEL ☐ HYBRID

Proposers must submit separate pricing forms for each type.

	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
Base Bus	1	35 FT Buses	$589,282.00	$589,282.00
Total for Base Bus			$589,282.00	$589,282.00
(SOW) SECTION NUMBER(S)	**QUANTITY**	**BASE BUS SYSTEMS THAT MUST BE PRICED FOR FIXED ASSETS ON ORIGINAL PURCHASE**	**UNIT PRICE**	**TOTAL PRICE**
TS 9	1	Engine - with aftertreatment Cummins L9	$61,378.00	$61,378.00
TS 10	1	Engine Cooling System - EMP MH4	$8,594.00	$8,594.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Transmission Voith DIWA NXT	$17,812.00	$17,812.00
TS 17.2.2	1	CNG Fuel Tanks	$N/A	$N/A
TS 51.1	1	HVAC System - Thermo King T14 w X430 compressor	$25,705.00	$25,705.00
TS 5.10	1	Fire Suppression System - Fogmaker	$4,977.00	$4,977.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 9,344.00	$9,344.00
TS 11	1	Powertrain (ID the Type) - Transmission	Voith DIWA NXT	Voith DIWA NXT
	1	General Bus – Everything not broken out above	$461,472.00	$461,472.00
		Total (Should Match Bus Total Above)	$589,282.00	$589,282.00
1002	1	Delivery of Buses	$7,190.00	$7,190.00

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PRICING FORM – BAFO
35 Foot Buses

Please check the type: ☑ **CNG** ☐ **DIESEL** ☐ **HYBRID**

Proposers must submit separate pricing forms for each type.

	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
Base Bus	1	35 FT Buses	$645,358.00	$645,358.00
Total for Base Bus			$645,358.00	$645,358.00
(SOW) SECTION NUMBER(S)	**QUANTITY**	**BASE BUS SYSTEMS THAT MUST BE PRICED FOR FIXED ASSETS ON ORIGINAL PURCHASE**	**UNIT PRICE**	**TOTAL PRICE**
TS 9	1	Engine with aftertreatment - Cummins L9N	$70,101.00	$70,101.00
TS 10	1	Engine Cooling System - EMP MH4	$8,594.00	$8,594.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Transmission Voith DIWA.6	$17,187.00	$17,187.00
TS 17.2.2	1	CNG Fuel Tanks - 5 Tank Assembly with Structure and Plumbing	$38,465.00	$38,465.00
TS 51.1	1	HVAC System - Thermo King T14 w X430 compressor	$25,705.00	$25,705.00
TS 5.10	1	Fire Suppression System - Fogmaker	$7,731.00	$7,731.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 9,344.00	$ 9,344.00
TS 11	1	Powertrain (ID the Type) - Transmission	Voith DIWA.6	Voith DIWA.6
	1	General Bus – Everything not broken out above	$468,231.00	$468,231.00
		Total (Should Match Bus Total Above)	$645,358.00	$645,358.00
1002	1	Delivery of Buses	$7,190.00	$7,190.00

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PRICING FORM – BAFO
35 Foot Buses

Please check the type: ☐ CNG ☐ DIESEL ☑ HYBRID

Proposers must submit separate pricing forms for each type.

	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
Base Bus	1	35 FT Buses	$913,118.00	$913,118.00
Total for Base Bus			$913,118.00	$913,118.00
(SOW) SECTION NUMBER(S)	**QUANTITY**	**BASE BUS SYSTEMS THAT MUST BE PRICED FOR FIXED ASSETS ON ORIGINAL PURCHASE**	**UNIT PRICE**	**TOTAL PRICE**
TS 9	1	Engine with Aftertreatment - Cummins B6.7	$50,638.00	$50,638.00
TS 10	1	Engine Cooling System - EMP MH5	$10,749.00	$10,749.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Allison Supplied Equipment Only (Traction Motor, ESS, Inverter)	$200,976.00	$200,976.00
TS 17.2.2	1	CNG Fuel Tanks	$N/A	$N/A
TS 51.1	1	HVAC System - Thermo King TE14 w electric scroll compressor	$27,997.00	$27,997.00
TS 5.10	1	Fire Suppression System - Fogmaker	$4,977.00	$4,977.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 9,344.00	$ 9,344.00
TS 11	1	Powertrain (ID the Type)	Allison eGen Flex	Allison eGen Flex
	1	General Bus – Everything not broken out above	$608,437.00	$608,437.00
		Total (Should Match Bus Total Above)	$913,118.00	$913,118.00
1002	1	Delivery of Buses	$7,190.00	$7,190.00

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PRICING FORM – BAFO
40 Foot Buses

Please check the type: ☐ CNG ☑ DIESEL ☐ HYBRID

Proposers must submit separate pricing forms for each type.

	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
Base Bus	1	40 FT Buses	$593,587.00	$593,587.00
Total for Base Bus			$593,587.00	$593,587.00
(SOW) SECTION NUMBER(S)	**QUANTITY**	**BASE BUS SYSTEMS THAT MUST BE PRICED FOR FIXED ASSETS ON ORIGINAL PURCHASE**	**UNIT PRICE**	**TOTAL PRICE**
TS 9	1	Engine - with aftertreatment Cummins L9	$61,378.00	$61,378.00
TS 10	1	Engine Cooling System - EMP MH4	$8,594.00	$8,594.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Transmission Voith DIWA NXT	$17,812.00	$17,812.00
TS 17.2.2	1	CNG Fuel Tanks	$N/A	$N/A
TS 51.1	1	HVAC System - Thermo King T14 w X430 compressor	$25,705.00	$25,705.00
TS 5.10	1	Fire Suppression System - Fogmaker	$4,977.00	$4,977.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 9,344.00	$ 9,344.00
TS 11	1	Powertrain (ID the Type) - Transmission	Voith DIWA NXT	Voith DIWA NXT
	1	General Bus – Everything not broken out above	$465,777.00	$465,777.00
		Total (Should Match Bus Total Above)	$593,587.00	$593,587.00
1002	1	Delivery of Buses	$7,190.00	$7,190.00

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PRICING FORM – BAFO
40 Foot Buses

Please check the type: ☑ **CNG** ☐ **DIESEL** ☐ **HYBRID**

Proposers must submit separate pricing forms for each type.

	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
Base Bus	1	40 FT Buses	$649,663.00	$649,663.00
Total for Base Bus			$649,663.00	$649,663.00
(SOW) SECTION NUMBER(S)	**QUANTITY**	**BASE BUS SYSTEMS THAT MUST BE PRICED FOR FIXED ASSETS ON ORIGINAL PURCHASE**	**UNIT PRICE**	**TOTAL PRICE**
TS 9	1	Engine with aftertreatment - Cummins L9N	$70,101.00	$70,101.00
TS 10	1	Engine Cooling System EMP MH4	$8,594.00	$8,594.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Transmission Voith DIWA.6	$17,187.00	$17,187.00
TS 17.2.2	1	CNG Fuel Tanks - 5 Tank Assembly with Structure and Plumbing	$38,465.00	$38,465.00
TS 51.1	1	HVAC System - Thermo King T14 w X430 compressor	$25,705.00	$25,705.00
TS 5.10	1	Fire Suppression System - Fogmaker	$7,731.00	$7,731.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 9,344.00	$ 9,344.00
TS 11	1	Powertrain (ID the Type) - Transmission	Voith DIWA.6	Voith DIWA.6
	1	General Bus – Everything not broken out above	$472,536.00	$472,536.00
		Total (Should Match Bus Total Above)	$649,663.00	$649,663.00
1002	1	Delivery of Buses	$7,190.00	$7,190.00

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PRICING FORM – BAFO
40 Foot Buses

Please check the type: ☐ CNG ☐ DIESEL ☑ HYBRID

Proposers must submit separate pricing forms for each type.

	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
Base Bus	1	40 FT Buses	$917,423.00	$917,423.00
Total for Base Bus			$917,423.00	$917,423.00
(SOW) SECTION NUMBER(S)	**QUANTITY**	**BASE BUS SYSTEMS THAT MUST BE PRICED FOR FIXED ASSETS ON ORIGINAL PURCHASE**	**UNIT PRICE**	**TOTAL PRICE**
TS 9	1	Engine with Aftertreatment - Cummins B6.7	$50,638.00	$50,638.00
TS 10	1	Engine Cooling System - EMP MH5	$10,749.00	$10,749.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Allison Supplied Equipment Only (Traction Motor, ESS, Inverter)	$200,976.00	$200,976.00
TS 17.2.2	1	CNG Fuel Tanks	$N/A	$N/A
TS 51.1	1	HVAC System - Thermo King T14 w X430 compressor	$27,997.00	$27,997.00
TS 5.10	1	Fire Suppression System - Fogmaker	$4,977.00	$4,977.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 9,344.00	$ 9,344.00
TS 11	1	Powertrain (ID the Type)	Allison eGen Flex	Allison eGen Flex
	1	General Bus – Everything not broken out above	$612,742.00	$612,742.00
		Total (Should Match Bus Total Above)	$917,423.00	$917,423.00
1002	1	Delivery of Buses	$7,190.00	$7,190.00

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PRICING FORM – BAFO
30 Foot Buses

Please check the type: ☐ CNG ☑ DIESEL ☐ HYBRID

Proposers must submit separate pricing forms for each type..

(SOW) SECTION NUMBER(S)	QUANTITY	EQUIPMENT DESCRIPTION(S) FOR AFTERMARKET COMPONENTS	UNIT PRICE	TOTAL PRICE
TS 9	1	Engine - with aftertreatment Cummins L9	$67,109.00	$67,109.00
TS 10	1	Engine Cooling System - EMP MH4	$9,396.00	$9,396.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Transmission Voith DIWA NXT	$19,475.00	$19,475.00
TS 17.2.2	1	CNG Fuel Tanks	$N/A	$N/A
TS 51.1	1	HVAC System - Thermo King T14 w X430 compressor	$28,105.00	$28,105.00
TS 5.10	1	Fire Suppression System - Fogmaker	$5,442.00	$5,442.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 10,217.00	$ 10,217.00
TS 11	1	Powertrain (ID the Type) - Transmission	Voith DIWA NXT	Voith DIWA NXT
	1	Final drive - Complete Rear Axle Assembly Meritor RS23160	$11,813.00	$11,813.00
	1	Steering front axle - Meritor MFS-12-155	$7,983.00	$7,983.00
	1	Center axle - Carrier Assembly Only Meritor 79163	$8,827.00	$8,827.00
	1	Hubs - Front & Rear- Meritor MFS-12-155, Meritor RS23160	$1,181.00	$1,181.00
	1	Air compressor - WABCO	$7,610.00	$7,610.00
	1	Air system dryer - SKF H.C. Dual Turbo- 2000	$791.00	$791.00
	1	Heating ventilating and air conditioning - Compressor Only Thermo King X430	$5,808.00	$5,808.00
	1	CNG methane detection	$N/A	$N/A
	1	Fast idle device	$N/A	$N/A
	1	Engine starter - Delco 24V 42MT	$880.00	$880.00
		Total for Aftermarket Prices	$184,637.00	$184,637.00

*Aftermarket components pricing above will require a quote beyond year one.

PRICING FORM – BAFO
30 Foot Buses

Please check the type: ☑ CNG ☐ DIESEL ☐ HYBRID

Proposers must submit separate pricing forms for each type..

(SOW) SECTION NUMBER(S)	QUANTITY	EQUIPMENT DESCRIPTION(S) FOR AFTERMARKET COMPONENTS	UNIT PRICE	TOTAL PRICE
TS 9	1	Engine - with aftertreatment Cummins L9N	$76,647.00	$76,647.00
TS 10	1	Engine Cooling System - EMP MH4	$9,396.00	$9,396.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Transmission Voith DIWA.6	$18,792.00	$18,792.00
TS 17.2.2	1	CNG Fuel Tanks - 5 Tank Assembly with Structure and Plumbing	$42,057.00	$42,057.00
TS 51.1	1	HVAC System - Thermo King T14 w X430 compressor	$28,105.00	$28,105.00
TS 5.10	1	Fire Suppression System - Fogmaker	$8,453.00	$8,453.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 10,217.00	$ 10,217.00
TS 11	1	Powertrain (ID the Type) - Transmission	Voith DIWA.6	Voith DIWA.6
	1	Final drive - Complete Rear Axle Assembly Meritor RS23160	$11,813.00	$11,813.00
	1	Steering front axle - Meritor MFS-12-155	$7,983.00	$7,983.00
	1	Center axle - Carrier Assembly Only Meritor 79163	$8,827.00	$8,827.00
	1	Hubs - Front & Rear- Meritor MFS-12-155, Meritor RS23160	$1,181.00	$1,181.00
	1	Air compressor - WABCO	$7,610.00	$7,610.00
	1	Air system dryer - SKF H.C. Dual Turbo-2000	$791.00	$791.00
	1	Heating ventilating and air conditioning - Compressor Only Thermo King X430	$5,808.00	$5,808.00
	1	CNG methane detection	$ Included in Fire Suppression System Above	$ Included in Fire Suppression System Above
	1	Fast idle device	$N/A	$N/A
	1	Engine starter - Delco 24V 42MT	$880.00	$880.00
		Total for Aftermarket Prices	$238,560.00	$238,560.00

*Aftermarket components pricing above will require a quote beyond year one.

PRICING FORM – BAFO
35 Foot Buses

Please check the type: ☐ CNG ☑ DIESEL ☐ HYBRID

Proposers must submit separate pricing forms for each type..

(SOW) SECTION NUMBER(S)	QUANTITY	EQUIPMENT DESCRIPTION(S) FOR AFTERMARKET COMPONENTS	UNIT PRICE	TOTAL PRICE
TS 9	1	Engine - with aftertreatment Cummins L9	$67,109.00	$67,109.00
TS 10	1	Engine Cooling System - EMP MH4	$9,396.00	$9,396.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Transmission Voith DIWA NXT	$19,475.00	$19,475.00
TS 17.2.2	1	CNG Fuel Tanks	$N/A	$N/A
TS 51.1	1	HVAC System - Thermo King T14 w X430 compressor	$28,105.00	$28,105.00
TS 5.10	1	Fire Suppression System - Fogmaker	$5,442.00	$5,442.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 10,217.00	$ 10,217.00
TS 11	1	Powertrain (ID the Type) - Transmission	Voith DIWA NXT	Voith DIWA NXT
	1	Final drive - Complete Rear Axle Assembly Meritor 79163	$14,196.00	$14,196.00
	1	Steering front axle - Meritor FH-946	$7,983.00	$7,983.00
	1	Center axle - Carrier Assembly Only Meritor 79163	$8,827.00	$8,827.00
	1	Hubs - Front & Rear- Meritor FH-946, Meritor 79163	$1,606.00	$1,606.00
	1	Air compressor - WABCO	$7,610.00	$7,610.00
	1	Air system dryer - SKF H.C. Dual Turbo-2000	$791.00	$791.00
	1	Heating ventilating and air conditioning - Compressor Only Thermo King X430	$5,808.00	$5,808.00
	1	CNG methane detection	$N/A	$N/A
	1	Fast idle device	$N/A	$N/A
	1	Engine starter - Delco 24V 42MT	$880.00	$880.00
		Total for Aftermarket Prices	$187,445.00	$187,445.00

*Aftermarket components pricing above will require a quote beyond year one.

PRICING FORM – BAFO
35 Foot Buses

Please check the type: ☑ CNG ☐ DIESEL ☐ HYBRID

Proposers must submit separate pricing forms for each type..

(SOW) SECTION NUMBER(S)	QUANTITY	EQUIPMENT DESCRIPTION(S) FOR AFTERMARKET COMPONENTS	UNIT PRICE	TOTAL PRICE
TS 9	1	Engine with aftertreatment - Cummins L9N	$ $76,647.00	$ $76,647.00
TS 10	1	Engine Cooling System - EMP MH4	$ $9,396.00	$ $9,396.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Transmission Voith DIWA.6	$18,972.00	$18,972.00
TS 17.2.2	1	CNG Fuel Tanks - 5 Tank Assembly with Structure and Plumbing	$42,057.00	$42,057.00
TS 51.1	1	HVAC System - Thermo King T14 w X430 compressor	$28,105.00	$28,105.00
TS 5.10	1	Fire Suppression System - Fogmaker	$8,453.00	$8,453.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 10,217.00	$ 10,217.00
TS 11	1	Powertrain (ID the Type) - Transmission	Voith DIWA.6	Voith DIWA.6
	1	Final drive - Complete Rear Axle Assembly Meritor 79163	$14,196.00	$14,196.00
	1	Steering front axle - Meritor FH-946	$7,983.00	$7,983.00
	1	Center axle - Carrier Assembly Only Meritor 79163	$8,827.00	$8,827.00
	1	Hubs Front & Rear- Meritor FH-946, Meritor 79163	$1,606.00	$1,606.00
	1	Air compressor - WABCO	$7.610.00	$7.610.00
	1	Air system dryer - SKF H.C. Dual Turbo-2000	$791.00	$791.00
	1	Heating ventilating and air conditioning - Compressor Only Thermo King X430	$5,808.00	$5,808.00
	1	CNG methane detection	$ Included in Fire Suppression System Above	$ Included in Fire Suppression System Above
	1	Fast idle device	$N/A	$N/A
	1	Engine starter - Delco 24V 42MT	$880.00	$880.00
		Total for Aftermarket Prices	$241,368.00	$241,368.00

*Aftermarket components pricing above will require a quote beyond year one.

PRICING FORM – BAFO
35 Foot Buses

Please check the type: ☐ CNG ☐ DIESEL ☑ HYBRID

Proposers must submit separate pricing forms for each type.

(SOW) SECTION NUMBER(S)	QUANTITY	EQUIPMENT DESCRIPTION(S) FOR AFTERMARKET COMPONENTS	UNIT PRICE	TOTAL PRICE
TS 9	1	Engine with Aftertreatment - Cummins B6.7	$55,366.00	$55,366.00
TS 10	1	Engine Cooling System - EMP MH5	$11,753.00	$11,753.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Allison Supplied Equipment Only (Traction Motor, ESS, Inverter)	$252,443.00	$252,443.00
TS 17.2.2	1	CNG Fuel Tanks	$N/A	$N/A
TS 51.1	1	HVAC System - Thermo King TE14 w electric scroll compressor	$30,611.00	$30,611.00
TS 5.10	1	Fire Suppression System - Fogmaker	$5,442.00	$5,442.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 10,217.00	$ 10,217.00
TS 11	1	Powertrain (ID the Type)	Allison eGen Flex	Allison eGen Flex
	1	Final drive - Complete Rear Axle Assembly Meritor 79163	$14,196.00	$14,196.00
	1	Steering front axle - Meritor FH-946	$7,983.00	$7,983.00
	1	Center axle - Carrier Assembly Only Meritor 79163	$8,827.00	$8,827.00
	1	Hubs Front & Rear- Meritor FH-946, Meritor 79163	$1,394.00	$1,394.00
	1	Air compressor - Powerex	$12,051.00	$12,051.00
	1	Air system dryer - Bendix Single AD-IP	$819.00	$819.00
	1	Heating ventilating and air conditioning - electric scroll compressor only	$4,741.00	$4,741.00
	1	CNG methane detection	$N/A	$N/A
	1	Fast idle device	$N/A	$N/A
	1	Engine starter	$N/A	$N/A
		Total for Aftermarket Prices	$415,843.00	$415,843.00

*Aftermarket components pricing above will require a quote beyond year one.

PRICING FORM – BAFO
40 Foot Buses

Please check the type: ☐ CNG ☑ DIESEL ☐ HYBRID

Proposers must submit separate pricing forms for each type..

(SOW) SECTION NUMBER(S)	QUANTITY	EQUIPMENT DESCRIPTION(S) FOR AFTERMARKET COMPONENTS	UNIT PRICE	TOTAL PRICE
TS 9	1	Engine - with aftertreatment Cummins L9	$67,109.00	$67,109.00
TS 10	1	Engine Cooling System - EMP MH4	$9,396.00	$9,396.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Transmission Voith DIWA NXT	$19,475.00	$19,475.00
TS 17.2.2	1	CNG Fuel Tanks	$N/A	$N/A
TS 51.1	1	HVAC System - Thermo King T14 w X430 compressor	$28,105.00	$28,105.00
TS 5.10	1	Fire Suppression System - Fogmaker	$5,442.00	$5,442.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 10,217.00	$ 10,217.00
TS 11	1	Powertrain (ID the Type) - Transmission	Voith DIWA NXT	Voith DIWA NXT
	1	Final drive - Complete Rear Axle Assembly Meritor 79163	$14,196.00	$14,196.00
	1	Steering front axle - Meritor FH-946	$7,983.00	$7,983.00
	1	Center axle - Carrier Assembly Only Meritor 79163	$8,827.00	$8,827.00
	1	Hubs - Front & Rear- Meritor FH-946, Meritor 79163	$1,606.00	$1,606.00
	1	Air compressor - WABCO	$7,610.00	$7,610.00
	1	Air system dryer - SKF H.C. Dual Turbo-2000	$791.00	$791.00
	1	Heating ventilating and air conditioning - Compressor Only Thermo King X430	$5,808.00	$5,808.00
	1	CNG methane detection	$N/A	$N/A
	1	Fast idle device	$N/A	$N/A
	1	Engine starter - Delco 24V 42MT	$880.00	$880.00
		Total for Aftermarket Prices	$187,445.00	$187,445.00

*Aftermarket components pricing above will require a quote beyond year one.

PRICING FORM – BAFO
40 Foot Buses

Please check the type: ☑ CNG ☐ DIESEL ☐ HYBRID

Proposers must submit separate pricing forms for each type..

(SOW) SECTION NUMBER(S)	QUANTITY	EQUIPMENT DESCRIPTION(S) FOR AFTERMARKET COMPONENTS	UNIT PRICE	TOTAL PRICE
TS 9	1	Engine with aftertreatment - Cummins L9N	$ $76,647.00	$ $76,647.00
TS 10	1	Engine Cooling System EMP MH4	$ $9,396.00	$ $9,396.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Transmission Voith DIWA.6	$ 18,972.00	$ 18,972.00
TS 17.2.2	1	CNG Fuel Tanks - 5 Tank Assembly with Structure and Plumbing	$ 42,057.00	$ 42,057.00
TS 51.1	1	HVAC System - Thermo King T14 w X430 compressor	$ 28,105.00	$ 28,105.00
TS 5.10	1	Fire Suppression System - Fogmaker	$ 8,453.00	$ 8,453.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 10,217.00	$ 10,217.00
TS 11	1	Powertrain (ID the Type) - Transmission	Voith DIWA.6	Voith DIWA.6
	1	Final drive - Complete Rear Axle Assembly Meritor 79163	$ 14,196.00	$ 14,196.00
	1	Steering front axle - Meritor FH-946	$ 7,983.00	$ 7,983.00
	1	Center axle - Carrier Assembly Only Meritor 79163	$ 8,827.00	$ 8,827.00
	1	Hubs Front & Rear- Meritor FH-946, Meritor 79163	$ 1,606.00	$ 1,606.00
	1	Air compressor - WABCO	$ 7.610.00	$ 7.610.00
	1	Air system dryer - SKF H.C. Dual Turbo-2000	$ 791.00	$ 791.00
	1	Heating ventilating and air conditioning - Compressor Only Thermo King X430	$ 5,808.00	$ 5,808.00
	1	CNG methane detection	$ Included in Fire Suppression System Above	$ Included in Fire Suppression System Above
	1	Fast idle device	$ N/A	$ N/A
	1	Engine starter - Delco 24V 42MT	$ 880.00	$ 880.00
		Total for Aftermarket Prices	$ 241,368.00	$ 241,368.00

*Aftermarket components pricing above will require a quote beyond year one.

PRICING FORM – BAFO
40 Foot Buses

Please check the type: ☐ CNG ☐ DIESEL ☑ HYBRID

Proposers must submit separate pricing forms for each type..

(SOW) SECTION NUMBER(S)	QUANTITY	EQUIPMENT DESCRIPTION(S) FOR AFTERMARKET COMPONENTS	UNIT PRICE	TOTAL PRICE
TS 9	1	Engine with Aftertreatment - Cummins B6.7	$55,366.00	$55,366.00
TS 10	1	Engine Cooling System - EMP MH5	$11,753.00	$11,753.00
TS 10.3	1	Transmission - Cooler	$ Included in Powertrain -Transmission Below	$ Included in Powertrain -Transmission Below
TS 11	1	Powertrain - Allison Supplied Equipment Only (Traction Motor, ESS, Inverter)	$252,443.00	$252,443.00
TS 17.2.2	1	CNG Fuel Tanks	$N/A	$N/A
TS 51.1	1	HVAC System - Thermo King TE14 w electric scroll compressor	$30,611.00	$30,611.00
TS 5.10	1	Fire Suppression System - Fogmaker	$5,442.00	$5,442.00
TS 78.2	1	ADA Lift - Lift-U Front Door Ramp	$ 10,217.00	$ 10,217.00
TS 11	1	Powertrain (ID the Type)	Allison eGen Flex	Allison eGen Flex
	1	Final drive - Complete Rear Axle Assembly Meritor 79163	$14,196.00	$14,196.00
	1	Steering front axle - Meritor FH-946	$7,983.00	$7,983.00
	1	Center axle - Carrier Assembly Only Meritor 79163	$8,827.00	$8,827.00
	1	Hubs Front & Rear- Meritor FH-946, Meritor 79163	$1,394.00	$1,394.00
	1	Air compressor - Powerex	$12,051.00	$12,051.00
	1	Air system dryer - Bendix Single AD-IP	$819.00	$819.00
	1	Heating ventilating and air conditioning - electric scroll compressor only	$4,741.00	$4,741.00
	1	CNG methane detection	$N/A	$N/A
	1	Fast idle device	$N/A	$N/A
	1	Engine starter	$N/A	$N/A
		Total for Aftermarket Prices	$415,843.00	$415,843.00

*Aftermarket components pricing above will require a quote beyond year one.

Options Pricing
State of Florida Heavy Duty Transit Buses - 30', 35', 40' P-23-030

CNG SYSTEM	
Add Second Fast Fuel Fill to Low Mount Position	$967.00
Add Smart Gauge with Electric Solenoid Valves at Tanks	$4,355.00
Electric Solenoid Fuel Tank Shut-Off Valves	$2,734.00
STYLING PACKAGES	
BRT Front Cap Styling Only	$10,035.00
BRT Front Cap, Rear Cap and Engine Door Styling	$14,299.00
BRT PLUS Front Cap, Rear Cap, Roof Line and Engine Door Styling	$19,424.00
BRT Roof Fairings, Front or Rear (each)	$1,281.00
Low Floor Plus Design	$13,069.00
OIL SYSTEM	
Titan Probalizer OD-1014 Extraction Port (per fitting)	$63.00
KP Extraction Port (per fitting)	$63.00
Femco Auto Drain	$50.00
COOLING SYSTEM	
Modine E-Cool Electric Cooling System without E-Coat	($1,151.00)
Add E-Coat to Diesel or CNG	$2,842.00
Add E-Coat to Hybrid	$3,867.00
Radiator Tank Guard	$416.00
Radiator Tank Guard, with Splash Shield	$536.00
ALTERNATOR	
Niehoff C803 (525 Amp for Electric Radiator)	$317.00
TRANSMISSION	
Allison B400R, GEN IV	$1,223.00
Allison B3400R, xFE	$2,248.00
Allison Fuel Sense Software	$706.00
ZF 6AP1400 ECOLIFE	($1,036.00)
Femco Auto Drain	$50.00
KP Push Button	$63.00
Transmission Temperature Gauge (Dash)	$141.00
Keyed Transmission Lockout Switch on Dash	$514.00
AXLE HUBS & SEALS	
Synthetic 75W90 Gear Oil for Rear Axle	$141.00
HUBODOMETER	
Data Trac Pro 600-9999	$82.00
Engler (Stemco) Mechanical without Tenths and without Guard	$63.00
Veeder Root Mechanical without Tenths and without Guard	$93.00
S & A Fleetwatch TX200 with JX200 Logger.	$1,304.00
Hubodometer Guard	$182.00

After the 180 day period from the effective date of the contract, all prices shall be subject to the US Bureau of Labor Statistics Producer Price Index (PPI)Series ID: WPU1413 Truck and bus Bodies and will be capped at Eight percent (8%) per year.

Options Pricing
State of Florida Heavy Duty Transit Buses - 30', 35', 40' P-23-030

BRAKES	
Automatic Traction Control	$128.00
Disc Brakes with Wabco ABS System (Diesel & CNG)	$4,421.00
MGM E-Stroke Brake Monitoring System for Drum Brakes	$2,624.00
MGM E-Stroke Brake Monitoring System for Disc Brakes	$2,666.00
WHEELS\TIRES	
(6) Powder Coated White Steel Wheels	($1,804.00)
Bendix Tire Pressure Monitoring System	$1,234.00
(6) Customer Supplied Tires	($3,437.00)
Add DuraFlange	$619.00
Add Spare Steel Wheel with Tire	$1,260.00
Add Spare Aluminum Wheel with Tire	$1,646.00
STEERING SYSTEM	
ZF REAX, Electric Assisted Steering Column	$3,117.00
VIP Textured Steering Wheel	No Charge
FUEL SYSTEM	
Standard Gravity Fuel Fill	($267.00)
80 gal Net Useable Split Fuel Tanks (29' LF with No Rear Door)	$1,493.00
Davco Fuel Pro 245	$491.00
Diesel Fuel Gauge on Dash	$154.00
REAR RUN BOX	
Post Mounted Mechanical Gauges - Murphy Oil Pressure and Coolant Temperature	$408.00
SWAT Switch	$256.00
Rear Hand Throttle Control	$212.00
AIR SYSTEM	
Bendix ADIP , Heated, Air Dryer (Dual Air Dryers with Haldex Dual Concep Air Filter/Oil Separator)	$859.00
Cole Hersee #12063 Electrical Tow Connector	$269.00
Curbside Rear Kneeling	$531.00
Haldex Consep Moisture Ejector, Heated, at Air Dryer	$431.00
FRAME	
Engine Skid Protection w/Extended Tow Eyes	$152.00
Engine Skid Protection w/Extended Tow Eyes & 2" Thick x 2" Wide Wear Plate	$344.00
Reinforced A-Post Skid Plates (Per Side)	$71.00
BATTERIES	
(4) DEKA Group 31 Top Post Connections (Diesel & CNG)	No Charge
(2) AGM Glass Matt 8D Side Lug or Top Post Connections (Diesel & CNG)	$494.00
(4) AGM Glass Matt Group 31 Top Post Connections (Diesel & CNG)	$623.00
(4) Odyssey PC2150 AGM Group 31 Batteries	$1,404.00
KBI Super Capacitor With (2) DEKA Group 31 Batteries (Diesel & CNG)	$4,061.00
Ultra Capacitors –Vanner Start Sentry	$5,223.00
(1) Anderson 350 Jump Start Connector Located In Battery Box	$123.00
Marine Cabling for Charging System	$1,261.00
Vanner 80-series Smart Battery Equalizer w/CAN	$722.00

After the 180 day period from the effective date of the contract, all prices shall be subject to the US Bureau of Labor Statistics Producer Price Index (PPI)Series ID: WPU1413 Truck and bus Bodies and will be capped at Eight percent (8%) per year.

Options Pricing
State of Florida Heavy Duty Transit Buses - 30', 35', 40' P-23-030

HEATING / AIR CONDITIONING	
TK T-14 w/S391	$1,409.00
TK T-14 w/S616	$3,075.00
TK All-Electric HVAC - Diesel & CNG	$2,130.00
Delete TK Pressure and Return Display Mounted to Unit	($232.00)
R134A Refrigerant	No Charge
Thermo King Air Purification System	$4,023.00
Climate Comfort Technologies CCT-24	$3,151.00
USSC Active Air Purification System	$4,763.00
DRIVERS HEATERS & ADDITIONAL PASSENGER HEATERS	
MCC Drivers Heater - Brushless Motor, Left Foot Vent, 1/4 Turn Valves	($298.00)
MCC Drivers Heater - Brush Motor, Left Foot Vent, 1/4 Turn Valves	($488.00)
Front Stepwell Threshold Heater - MCC with Brushless Motor	$551.00
Streetside Underseat Heater - MCC with Brushless Motor	$687.00
Streetside Underseat Heater Mtd in Theater Step - MCC with Brushless Motor	$821.00
Curbside Rear Stepwell Heater - MCC with Brushless Motor	$1,198.00
AUXILIARY COOLANT HEATER	
Dometic X30 Heater	$3,665.00
REAR DOOR	
Delete Rear Door	($1,400.00)
48" or 56" Rear Door (Requires Air Open / Air Close Door)	$3,982.00 - $5,110.00
Delete Vapor CLASS (Change to Full Driver's Control)	($2,712.00)
Vapor vTouch Electronic Touch Bars with Green LED Lamp	$943.00
Vapor Electric Doors (40" front / 34" rear) Electric Open / Electric Close	$8,845.00 - $10,455.00
Vapor Electric Doors (40" front / 48"/56" rear) Electric Open / Electric Close	$12,827.00 - $16,605.00
Exterior Air Release Front Door Control Valve	$64.00
Vapor Digital Door Control	$787.00
Push Button Door Control	$87.00
Vapor Optical Pressure Switch	$613.00
ELECTRICAL EQUIPMENT CABINET	
44"Hx22.5"Wx20"D (33") with Key Lock and (2) 5/16' Square Key Locks & 11" Drivers Storage	$180.00
44"Hx34"Wx20"D with Key Lock and (2) 5/16' Square Key Locks	$650.00
Storage Box on Curbside Forward Wheel Well (8.25"H x 22.5"W x 13"D)	$564.00
ADVERTISING FRAMES - EXTERIOR	
Exterior, 21" X 40", Front Clear or Black Anodized, Powder Coated	$198.00
Exterior, 30" X 88", Curbside or Streetside	$296.00
Exterior, 30" X 144", Clear or Black Anodized, Powder Coated	$494.00
Exterior, 21" X 72", Rear	$212.00
ADVERTISING FRAMES - INTERIOR	
Innocom 19/21 4P 2L Information Holder	$381.00
(1) Information Board (15-55401-000)	$197.00
Interior, 22" X 21", Black, RH Load, Open Back	$282.00

After the 180 day period from the effective date of the contract, all prices shall be subject to the US Bureau of Labor Statistics Producer Price Index (PPI)Series ID: WPU1413 Truck and bus Bodies and will be capped at Eight percent (8%) per year.

Options Pricing
State of Florida Heavy Duty Transit Buses - 30', 35', 40' P-23-030

PASSENGER SEATING	
AMSECO Insight	$0.00 - $25,625.00
AMSECO Insight Prime	$0.00 - $25,625.00
AMSECO Insight Prime +	$0.00 - $25,625.00
AMSECO VISION	$0.00 - $25,625.00
4ONE Aries	$6,150.00 - 25,625.00
Add FTA Docket 90A	$3,536.00 - $10,250.00
Hinged Settee	$359.00
Seat Mounted USB Ports (up to 17 ports)	$3,491.00
Add--3rd Step To Perimeter Seating (Except Settee)	$3,229.00
DRIVERS SEAT	
USSC 9100 ALX with 3-Point Belt	($416.00)
USSC Q Series with 3-Point Belt	($25.00)
Recaro Ergo Metro AM80/AM384 with Headrest and 3-Point Belt	($834.00)
Delete 3-Point & Shoulder Belt	($183.00)
Add Adjustable D-Ring	$282.00
Add Seat Belt Alarm	$189.00
Add Seat Cushion Alarm	$189.00
Add RH Armrest	$239.00
WHEELCHAIR SECUREMENT	
AMSECO - A.R.M. System (Selectable with AMSECO Passenger Seats)	$0.00 - $5,125.00
Quantum Unit without seats	$14,949.00 - $17,938.00
Quantum Unit with (3) wall mount seats	$18,024.00 - 21,013.00
AMSECO Q'Pod Assembly - Per Unit (Selectable with AMSECO Passenger Seats)	$2,563.00 - $4,100.00
USSC Q'Pod Assembly - Per Unit (Selectable with USSC Passenger Seats)	$3,229.00 - $4,664.00
PASSENGER SIGNALS	
Pull Cords (Neutral or Yellow) with Touch Pad at Wheelchair Location	($855.00)
Stop Request Button at Rear Door Stanchion	$99.00
Additional Amber Stop Request Lamp Mounted on Driver's Dash	$50.00
DRIVER'S BARRIER	
Wrap Around Fiberglass with (3) Schedule Rack Cutouts (35' & 40' Only)	$494.00
Arrow Driver's Barrier W/ Extended Glass (MV3080-0139)	$6,399.00
Arrow Driver's Barrier W/O Extended Glass (MV308-0018)	$5,609.00
Vapor vShield, With Power Glass & Fans	$7,877.00
GILLIG Plexiglass Driver's Partition	$1,145.00
GILLIG Extended Plexiglass Driver's Partition	$2,277.00
STANCHIONS & GRAB RAILS	
Powdercoated Yellow Door Handles, Vertical Stanchions, Hand Rails & Modesty Panel Tubes	$705.00
Modesty Panel Forward of Exit Door	$338.00
Vinyl/Fabric Grab Straps (each)	$35.00
Upper Clear Plexiglas Modesty Panel	$247.00
SSTL Spring Loaded Grab Handle (each)	$173.00

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Options Pricing
State of Florida Heavy Duty Transit Buses - 30', 35', 40' P-23-030

WINDOWS	
Arow Global Standard Frame - Full Slider	$3,646.00 - $4,740.00
Arow Global Standard Frame - Transom	$3,349.00 - $4,353.00
Arow Global Hidden Frame/Bonded - Full Fixed	$6,483.00 - $8,429.00
Arow Global Hidden Frame/Bonded - Transom	$12,556.00 - $16,287.00
Ricon Hidden Frame/Bonded - Full Fixed	$7,867.00 - $10,014.00
Ricon Hidden Frame/Bonded - Transom	$15,461.00 - $19,680.00
Ricon Hidden Frame/Bonded - Full Fixed Energy Saver Glass	$26,445.00 - $33,620.00
Ricon Hidden Frame/Bonded - Transom Energy Saver Glass	$41,589.00 - $52,936.00
ThermoGuard Passenger Windows Standard Frame - Full Fixed	$21,397.00 - $31,647.00
ThermoGuard Passenger Windows Standard Frame - Transom	$29,674.00 - $39,924.00
ThermoGuard Passenger Windows Hidden Frame/Bonded - Full Fixed	$35,926.00 - $51,763.00
ThermoGuard Passenger Windows Hidden Frame/Bonded - Transom	$40,026.00 - $55,863.00
ThermoGuard Driver's Window Only	$3,531.00 - $5,125.00
Add Window Guards (Acrylic or Film) - VS-12 Single Layer Film	$1,666.00
HEADLAMPS	
(2) Dialite LED Headlights	$746.00
(4) Dialite LED Headlights (High & Low Beam)	$1,539.00
Dinex STAR LED Headlight System (Low Beam Only)	$2,471.00
AUXILIARY EXTERIOR LAMPS	
7" Round LED Tail Lights IPO 4"	$282.00
Add 18" LED Strip Brake Light--Each	$82.00
(1) Red LED "STOP" Sign Mounted to Bottom of HVAC Door	$491.00
(2) 4" Round Amber LED Turn Lamps Mounted to Top of HVAC Door	$329.00
(1) Triangle Style Amber LED Yield Sign Mounted on Streetside of HVAC Door	$885.00
(1) 7" Round Dialight LED Yield Sign Mounted on Streetside of HVAC Door	$312.00
(2) Additional Turn Signals Mounted On Each Side Of Bus (Total 4 Per Side)	$303.00
Add 2 Dialight 7" Round Red LED with "Stop" on Lenses	$426.00
PLEASURE RADIO	
REI AM/FM/CD/MP3-USB/SD PLAYER,	$456.00
COMMUNICATION RADIO SYSTEM	
Gillig Provide 2-Way Antenna	$573.00
GPS Antenna	$540.00
Motorola APX4500 Full Installation (including antenna)	$8,174.00 - $10,035.00
Motorola APX6500 Full Installation (including antenna)	$9,994.00 - $13,274.00
Harris XG-25M	$5,789.00 - $7,103.00
INTELLIGENT VEHICLE SYSTEM	
(On-Board Hardware Only)	
ITS Pre-Wire Only	$3,664.00 - $56,375.00
Clever Devices IVN5 Full ITS Installation	$30,750.00 - $76,875.00
Avail Full ITS Installation	$30,750.00 - $76,875.00
Conduent Full ITS Installation	$30,750.00 - $76,875.00
INIT Full ITS Installation	$30,750.00 - $76,875.00
Vontas Full ITS Installation	$30,750.00 - $76,875.00

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Options Pricing
State of Florida Heavy Duty Transit Buses - 30', 35', 40' P-23-030

Traffic Priority System	
GTT Opticom 2101 GPS Vehicle Kit	$6,524.00 - $8,303.00
GTT Opticom 792	$2,445.00 - $3,106.00
GTT Opticom 794TM	$2,352.00 - $2,993.00
Advanced Driver Assistance System	
Rosco Mobileye EyeWatch 630 Pedestrian Display	$14,658.00 - $17,323.00
Rosco Mobileye Shield+ V4.0	$13,428.00 - $15,785.00
**Safe Fleet MirrorLESS Video Mirror System, Base (2 camera + 2 Monitors)	$7,252.00 - $9,302.00
**Safe Fleet MirrorLESS Video Mirror System, Base 2 (2 camera +A-Pillar LH Only + 2 Monitors)	$8,072.00 - $10,122.00
**Safe Fleet MirrorLESS Video Mirror System, Base 3 (2 camera +A-Pillar LH/RH + 2 Monitors)	$8,687.00 - $10,737.00
**"MirrorLESS" system is in addition to physical mirrors, but must still have exterior mirrors per FMVSS guidelines	
DESTINATION SIGNS	
Add Hanover White LED Dash Sign	$1,163.00
Add Hanover White LED Rear Sign	$1,522.00
Hanover 100% Amber LED Front & Curbside Signs	($308.00)
Add Hanover Amber LED Dash Sign	$980.00
Add Hanover Amber LED Rear Sign	$1,522.00
Hanover 100% Full Color LED Front & Curbside Signs	$1,581.00
Add Hanover Full Color LED Dash Sign	$1,375.00
Add Hanover Full Color LED Rear Sign	$2,438.00
Luminator Gen 4 SMT 100% Amber LED Front & Curbside Signs	$1,731.00
Add Luminator Gen 4 SMT 100% Amber LED Dash Sign	$1,238.00
Add Luminator Gen 4 SMT 100% Amber LED Rear Sign	$1,238.00
Twin Vision SS3 100% Amber LED Front & Curbside Signs	$303.00
Add Twin Vision SS3 100% Amber LED Dash Sign	$1,238.00
Add Twin Vision SS3 100% Amber LED Rear Sign	$1,238.00
Twin Vision SS3 100% Silver LED Front & Curbside Signs	$3,614.00
Add Twin Vision SS3 100% Silver LED Dash Sign	$1,635.00
Add Twin Vision SS3 100% Silver LED Rear Sign	$1,894.00
Luminator Gen 4 SMT 100% White LED Front & Curbside Signs	$3,782.00
Add Luminator Gen 4 SMT 100% White LED Dash Sign	$1,635.00
Add Luminator Gen 4 SMT 100% White LED Rear Sign	$1,894.00
Luminator Gen 4 SMT 100% Titan Color LED Front & Curbside Signs	$10,969.00
Add Luminator Gen 4 SMT 100% Color LED Dash Sign	$3,946.00
Add Luminator Gen 4 SMT 100% Color LED Rear Sign	$4,736.00
Luminator Destination Sign Wireless Programming	$304.00
Heated/Defroster for Front Sign Glazing	$282.00
INFOTAINMENT SYSTEM	
(On-Board Hardware Only)	
Luminator InfoTransit--1 Monitor System	$20,346.00 - $30,596.00
Luminator InfoTransit--2 Monitor System	$26,804.00 - $37,054.00
Clever Vision 1 Monitor System	$17,375.00 - $27,625.00
Clever Vision 2 Monitor System	$25,471.00 - $35,721.00
FARE COLLECTION	
GFI 41" Fast Fare	$20,500.00 - $30,750.00
Diamond Model SV with Spare Vault	$3,639.00 - $4,274.00
LED Fare Box Lamp, Ceiling Mounted	$96.00

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Options Pricing
State of Florida Heavy Duty Transit Buses - 30', 35', 40' P-23-030

FLOORING	
Gerflor Floor Coverling (Selection from Standard Offering)	$800.00
Full Composite Flooring	$4,510.00
Stainless Steel Trim on Risers and Wheel housings	$450.00
ROOF HATCHES	
Delete Roof Hatch	($220.00)
Electric Roof Hatch w/ Driver Control (per position)	$784.00
Upgrade Hatch to Transparent Skylight Hatch (per position, manual hatch only)	$367.00
EXTERIOR MIRRORS	
B&R 10"x11", 2 Piece Flat Faced/CVX, Remote Streetside/Remote Curbside, Non-Heated	$56.00
B&R 8"x15", 2 Piece Flat Faced/CVX, Remote Streetside/Remote Curbside, Non-Heated	$56.00
B&R Class A 9"x13", 2 Piece Flat Faced/CVX, Remote Streetside/Remote Curbside, Non-Heated	$480.00
B&R Class A 8"x18", 2 Piece Flat Faced/CVX, Remote Streetside/Remote Curbside, Non-Heated	$282.00
B&R 8"x8", 1 Piece Flat Faced, Remote, Non-Heated	No Charge
B&R 10"x13", 1 Piece Flat Faced, Remote, Non-Heated	$223.00
Turn Signal Indicator On Outboard Edge Of Mirror Head (if available) Per Side	$128.00
5" Mirror Front Bike Rack Mirror	$31.00
ELECTRICAL / MULTIPLEXING	
Multiplexing Wireless Gateway	$1,208.00
DRIVERS SUN SHADES	
AutoMotion Push/Pull Sun Shade (per side)	$41.00
FIRE SUPPRESSION & METHANE DETECTION	
Amerex V25 System Fire Suppression System (Diesel, CNG & Hybrid)	($1,103.00)
Amerex Safety Net Fire Suppression & Methane Detection System (CNG Only)	($1,346.00)
SURVEILLANCE CAMERA SYSTEMS	
REI Surveillance System	$5,125.00 - $12,300.00
Safety Vision Surveillance System	$10,250.00 - $20,500.00
Angel Trax Surveillance System	$5,125.00 - $12,300.00
Safe Fleet Surveillance System	$10,250.00 - $20,500.00
TSI Surveillance System	$12,300.00 - $22,550.00
March Networks Surveillance System	$10,250.00 - $20,500.00
BICYCLE RACKS	
Sportworks DL2, Two Bikes, Stainless Steel	$1,838.00
Sportworks DL2, Two Bikes, Black Powdercoated	$1,633.00
Sportworks APEX 2, 2-Position, Stainless Steel	$1,850.00
Sportworks APEX 2, 2-Position, Powder Coated	$1,892.00
Byk-Rak, Two Bikes, Stainless Steel	$1,844.00
Bike Rack Deployed Indicator Lamp on Driver's Dash	$282.00
Sportworks Mounting Brackets Only	$190.00
Sportworks Pivot Plate Only	$386.00
Bike Rack Mounted Advertising Frame, 21" X 40"	$347.00
BYK-RAK, Three Bike Rack, Stainless Steel (Requires LF+ Model with Auxiliary Headlamps)	$20,647.00
BYK-RAK, Three Bike Rack, Powder Coated (Requires LF+ Model with Auxiliary Headlamps)	$20,696.00
BYK-RAK Mounting Brackets Only	$240.00
BYK-RAK Pivot Plate Only	$424.00

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Options Pricing
State of Florida Heavy Duty Transit Buses - 30', 35', 40' P-23-030

SAFETY EQUIPMENT	
Wheel Chocks (Per Set)	$36.00
DRIVER'S DASH	
Additional Gauges (each)	$65.00
I/O Multi Function Display (MFD)	$3,645.00
12v Power Port	$128.00
Big Gulp Cup Holder	$36.00
Euramatic Folding Style Cup Holder	$26.00
Trash Bag Holder	$36.00
Wheel Well Mounted Waste Container & Bracket	$297.00
ACCELERATOR / BRAKE FOOT CONTROLS	
Kongsberg Adjustable Throttle / Brake Pedal	$1,350.00
TROLLEY OPTIONS	
Exterior Wood Like Trim Installed On: Cupola, Front & Rear Overhand Eves, Arches, Window Mullions, Window Sills, Rub Rails, Skirt Panels, Front & Rear Door, Front & Rear Bumper. **(Diesel Only, CNG & Hybrid require additional Styling)**	$138,337.00
Front Center Trolley Light	$1,172.00
Exterior Roof Mounted Sign Boards	$7,802.00
Cow Catcher on Front Bumper	$5,195.00
Front Roof Hatch Accommodations	$730.00
Hybrid or CNG Bus Compatible Cupola Package	$12,420.00
Interior Vinyl Seat Cushions	$7,626.00
Roof Accent LED Rope Lighting - Diesel	$5,636.00
PAINT/DECALS	
(1) Paint Pass Black Masking (Required if Hidden Frame Window Option Selected)	$2,930.00
Add Each Paint Pass	$2,930.00
Add Clear Coat (Per Paint Pass)	$636.00
Customer Specific Graphics Design	$2,050.00 - $35,875.00
BUS NUMBERS	
Roof Numbers (Up to Four 24" High Decals)	$250.00
EXTENDED COVERAGE - WARRANTIES	
***Extended coverage terms are shown as Total New Terms, it is not additive to standard warranty terms**	
Body Structure 36 Months / 150,000 Miles	($488.00)
Structural Integrity (Corrosion) 84 Months / 350,000 Miles	($488.00)
L9 Engine Extended Coverage 60 Months/300,000 Miles	$6,370.00
L9N Engine Extended Coverage 60 Months/300,000 Miles	$9,138.00
B6.7 Engine Extended Coverage 60 Months/300,000 Miles	$5,863.00
Transmission Coverage 24 Months/Unlimited Miles	($2,896.00)
Allison E-Gen Flex Coverage 24 Months / Unlimited Miles	($34,530.00)
Lift-U LU18 Warranty Coverage 24 Months / Unlimited Miles	($293.00)
ThermoKing HVAC Warranty Coverage 24 Months / Unlimited Miles (Diesel & CNG)	($1,533.00)
ThermoKing HVAC Warranty Coverage 24 Months / Unlimited Miles (Hybrid)	($2,121.00)
Passenger Doors Warranty Coverage 36 Months / 150,000 Miles	($146.00)
Exterior Paint Warranty Coverage 60 Months / Unlimited Miles	($146.00)
Luminator Surveillance System Coverage 12 Months / Unlimited Miles	No Charge

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Options Pricing
State of Florida Heavy Duty Transit Buses - 30', 35', 40' P-23-030

Training	
(24) Hour GILLIG Training at Customer Site - class max 12 students	$9,840.00
Cummins Training (at Dealer) per student per day, travel costs not included	Quote
Voith Training (at Dealer) per student per day, travel costs not included	Quote
Allison Training (at Dealer) per student per day, travel costs not included	Quote

After the 180 day period from the effective date of the contract, all prices shall be subject to the US Bureau of Labor Statistics Producer Price Index (PPI)Series ID: WPU1413 Truck and bus Bodies and will be capped at Eight percent (8%) per year.

Exhibit 'H' - Warranty Requirements

(On the following pages)

WARRANTY REQUIREMENTS

WR 1. Basic Provisions

WR 1.1 Warranty Requirements

WR 1.1.1 Supplier Warranty

Warranties in this document are in addition to any statutory remedies or warranties imposed on the Supplier. Consistent with this requirement, the Supplier warrants and guarantees to the original Agency each complete bus and specific subsystems and components as follows. Performance requirements based on design criteria shall not be deemed a warranty item.

WR 1.1.2 Complete Bus

The complete bus, propulsion system, components, major subsystems and body and chassis structure are warranted to be free from Defects and Related Defects for one (1) year/unlimited miles, whichever comes first, beginning on the date of revenue service." The warranty is based on regular operation of the bus under the operating conditions prevailing in the Agency's locale.

WR 1.1.3 Body and Chassis Structure

Body, body structure, structural elements of the suspension and engine cradle are warranted to be free from Defects and Related Defects for seven (7) years/300,000 miles, whichever comes first.

Primary load-carrying members of the bus structure, including structural elements of the suspension, are warranted against corrosion failure and/or Fatigue Failure sufficient to cause a Class 1 or Class 2 Failure for a period of twelve (12) years or 500,000 miles, whichever comes first.

WR 1.1.4 Propulsion System

Propulsion system components, including the engine, transmission or drive motors, and generators (for hybrid technology) and drive and non-drive axles shall be warranted to be free from Defects and Related Defects as stated below:

Engine (Base Coverage Includes Towing & Travel)-2 Years/Unlimited Miles
Transmission (Base Coverage Includes Towing & Travel)--5 Years/Unlimited Miles
Hybrid Drive System (Base Coverage Includes Towing & Travel)--5 Years/Unlimited Miles
Differential (Base Coverage Includes Towing & Travel)--2 Years/Unlimited Miles

The propulsion system manufacturer's standard warranty, delineating items excluded from the Extended Warranty, should be submitted in accordance with the Request for Pre-Offer Change or Approved Equal or with the Form for Proposal Deviation.

WR 1.1.5 Emission Control System (ECS)

The Supplier warrants the emission control system for five (5) years/unlimited miles, whichever comes first. The ECS shall include, but is not limited to, the following components:

- complete exhaust system, including catalytic converter (if required)
- after treatment device
- components identified as emission control devices

WR 1.1.5 Subsystems

Other subsystems shall be warranted to be free from Defects and Related Defects. The Original Equipment Manufacturer warranty will take precedent when in the best interest of the agency.

Other subsystems are listed below:

HVAC: Roof and/or main unit only, includes compressor, condenser, evaporator, electric motors, etc.--3 Years/Unlimited Miles
Wheelchair Ramp: Includes Parts & Labor--3 Years/Unlimited Miles
Door Systems: Door operating actuators and linkages—2 Years/Unlimited Miles
Air Compressor: 2 Years/Unlimited Miles
Exterior Paint (Base Coverage)--7 Years/Unlimited Miles
Starter—2 Years/Unlimited Miles
Air Dryer—2 Years/Unlimited Miles
Destination Signs: All destination sign equipment for the front, side and rear signs (front run dash sign if applicable) power modules and operator control—2 Years/Unlimited Miles
Alternator: Alternator only. Does not include the drive system.—2 Years/Unlimited Miles
Charge Air Cooler: Charge air cooler including core, tanks, and including related surrounding framework and fittings.—2 Years/Unlimited Miles
Fire Suppression System: Fire suppression system including tank, sensors, detection devices, and extinguishing agent dispensing system.—2 Years/Unlimited Miles
Hydraulic Systems: Including radiator fan drive and power steering as applicable.—2 Years/Unlimited Miles
Engine Cooling Systems: Radiator including core, tanks, and related framework, including surge tank, transmission cooler, hydraulic cooler, if applicable.—2 Years/Unlimited Miles
Passenger Seating: 2 Years/Unlimited Miles
Fuel Storage and Delivery System: 2 Years/Unlimited Miles
Surveillance System: Includes cameras, recording system, WLAN, and sensors.—2 Years/Unlimited Miles
Brake System: Foundation brake components, including advancing mechanisms, as supplied with the axles, excluding friction material. 1 Year Unlimited Miles
Electrical System (Base Coverage)--1 Year/Unlimited Miles
Suspension System--2 Years/Unlimited Miles

WR 1.1.6 Extended Warranty

The Agency requires the following additional subsystems to be warranted to be free from Defects and Related Defects:

Exterior Paint (Base Coverage)--7 Years/Unlimited Miles
Structure/Body Integrity Against Corrosion (Base Coverage)--12 Years/500,000 Miles
Sub-Floor (Base Coverage)--12 Years/Unlimited Miles
Flooring (Rubber) (Base Coverage Includes Parts & Labor)--12 Years/Unlimited Miles
Flooring (Composite) (Base Coverage Includes Parts & Labor)--7 Years/Unlimited Miles
Body and Window Frames Against Leakage (Includes Parts & Labor)--7 Years/Unlimited Miles
Suspension System--2 Years/Unlimited Miles

WR 1.1.7 Serial Numbers

Upon delivery of each bus, the Supplier shall provide a complete electronic list of serialized units installed on each bus to facilitate warranty tracking. The list shall include, but is not limited to the following:

- engine
- transmission
- alternator
- starter
- A/C compressor and condenser/evaporator unit
- drive axle
- power steering unit
- fuel cylinders (if applicable)
- air compressor
- wheelchair ramp
- surveillance system

The Supplier shall provide updated serial numbers resulting from warranty campaigns. The format of the list shall be approved by the Agency prior to delivery of the first production bus. The Serial Number List shall be provided to the lead agency, purchasing agency, or designated representative.

WR 1.1.8 Extension of Warranty

If, during the warranty period, repairs or modifications on any bus are made necessary by defective design, materials or workmanship but are not completed due to lack of material or inability to provide the proper repair for thirty (30) calendar days, then the applicable warranty period shall be extended by the number of days equal to the delay period.

WR 1.2 Voiding of Warranty

The warranty shall not apply to the failure of any part or component of the bus that directly results from misuse, negligence, accident or repairs not conducted in accordance with the Supplier-provided maintenance manuals and with workmanship performed by adequately trained personnel in accordance with recognized standards of the industry. The warranty also shall be void if the Agency fails to conduct normal inspections and scheduled preventive maintenance procedures as recommended in the Supplier's maintenance manuals and if that omission caused the part or component failure. The Agency shall maintain documentation, auditable by the Supplier, verifying service activities in conformance with the Supplier's maintenance manuals.

WR 1.3 Exceptions and Additions to Warranty

The warranty shall not apply to the following items:

- scheduled maintenance items
- normal wear-out items
- items furnished by the Agency

Should the Agency require the use of a specific product and has rejected the Supplier's request for an alternate product, then the standard Supplier warranty for that product shall be the only warranty provided to the Agency. This product will not be eligible under "Fleet Defects," below.

The Supplier shall not be required to provide warranty information for any warranty that is less than or equal to the warranty periods listed.

WR 1.3.1 Pass-Through Warranty

Should the Supplier elect to not administer warranty claims on certain components and wish to transfer this responsibility to the sub-suppliers, or to others, the Supplier shall request this waiver. The Supplier shall state in writing that the Agency's warranty reimbursements will not be impacted. The Supplier also shall state in writing any exceptions and reimbursement including all costs incurred in transport of vehicles and/or components. At any time during the warranty period, the Supplier may request approval from the Agency to assign its warranty obligations to others, but only on a case-by-case basis approved in writing by the Agency. Otherwise, the Supplier shall be solely responsible for the administration of the warranty as specified. Warranty administration by others does not eliminate the warranty liability and responsibility of the Supplier. The Supplier will be responsible for settling all disputes with sub suppliers.

WR 1.3.2 Superior Warranty

The Supplier shall pass on to the Agency any warranty offered by a component Supplier that is superior to that required herein. The Supplier shall provide a list to the Agency noting the conditions and limitations of the Superior Warranty not later than the start of production. The Superior Warranty shall not be administered by the Supplier.

WR 1.4 Fleet Defects

WR 1.4.1 Occurrence and Remedy

A Fleet Defect is defined as cumulative failures of twenty-five (25) percent of the same components in the same or similar application in a minimum fleet size of twelve (12) or more buses where such items are covered by warranty. A Fleet Defect shall apply only to the base warranty period in sections entitled "Complete Bus," "Propulsion System" and "Major Subsystems." When a Fleet Defect is declared, the remaining warranty on that item/component stops. The warranty period does not restart until the Fleet Defect is corrected. The Supplier will notify the lead agency, or it's designee, of all warranty claims within the same production year for all buses purchased off this contract. The lead agency, or its designee, will determine when these warranty claim reports shall be furnished by the Supplier.

For the purpose of Fleet Defects, each option order shall be treated as a separate bus fleet. In addition, should there be a change in a major component within either the base order or an option order, the buses containing the new major component shall become a separate bus fleet for the purposes of Fleet Defects.

The Supplier shall correct a Fleet Defect under the warranty provisions defined in "Repair Procedures." After correcting the Defect, the Agency and the Supplier shall mutually agree to and the Supplier shall promptly undertake and complete a work program reasonably designed to prevent the occurrence of the same Defect in all other buses and spare parts purchased under this Contract. Where the specific Defect can be solely attributed to particular identifiable part(s), the work program shall include redesign and/or replacement of only the defectively designed and/or manufactured part(s). In all other cases, the work program shall include inspection and/or correction of all the buses in the fleet via a mutually agreed- to arrangement. The Supplier shall update, as necessary, technical support information (parts, service and operator's manuals) due to changes resulting from warranty repairs. The Agency may immediately declare a Defect in design resulting in a safety hazard to be a Fleet Defect. The Supplier shall be responsible to furnish, install and replace all defective units. That information will be shared with all contract participants.

When it is determined that a field service representative is required onsite the Supplier will have 36 hours to have the representative in place. The field service representative must be capable of performing technical repairs onsite.

As a part of the corrective action pertaining to fleet defects the Supplier will be required to send their field representative to each property with buses built in the production year that is experiencing the defect.

WR 1.4.2 Exceptions to Fleet Defect Provisions

The Fleet Defect component warranty provisions shall not apply to Agency-supplied items, such as radios, fare collection equipment, communication systems and tires. Repair Procedures

WR 1.5 Repair Performance

The Supplier is responsible for all warranty-covered repair Work. To the extent practicable, the Agency will allow the Supplier or its designated representative to perform such Work. At its discretion, the Agency may perform such Work if it determines it needs to do so based on transit service or other requirements. Such Work shall be reimbursed by the Supplier.

WR 1.6 Repairs by the Supplier

If the Agency detects a Defect within the warranty periods defined in this section, it shall, within thirty (30) days, notify the Supplier's designated representative. The Supplier or its designated representative shall, if requested, begin Work on warranty-covered repairs within five calendar days after receiving notification of a Defect from the Agency. The Agency shall make the bus available to complete repairs timely with the Supplier's repair schedule.

The Supplier shall provide at its own expense all spare parts, tools and space required to complete repairs. At the Agency's option, the Supplier may be required to remove the bus from the Agency's property while repairs are being effected. If the bus is removed from the Agency's property, then repair procedures must be diligently pursued by the Supplier's representative.

WR 1.7 Repairs by the Agency

WR 1.7.1 Parts Used

If the Agency performs the warranty-covered repairs, then it shall correct or repair the Defect and any Related Defects utilizing parts supplied by the Supplier specifically for this repair. At its discretion, the Agency may use Supplier-specified parts available from its own stock if deemed in its best interests.

WR 1.7.2 Supplier-Supplied Parts

The Agency may require that the Supplier supply parts for warranty-covered repairs being performed by the Agency. Those parts may be remanufactured but shall have the same form, fit and function, and warranty. The parts shall be shipped prepaid to the Agency from any source selected by the Supplier within fourteen (14) days of receipt of the request for said parts and shall not be subject to an Agency handling charge.

WR 1.7.3 Defective Component Return

The Supplier may request that parts covered by the warranty be returned to the manufacturing plant. The freight costs for this action shall be paid by the Supplier. Materials should be returned in accordance with the procedures outlined in "Warranty Processing Procedures."

WR 1.7.4 Failure Analysis

The Supplier shall, upon specific request of the Agency, provide a failure analysis of Fleet Defect or safety-related parts, or major components, removed from buses under the terms of the warranty that could affect fleet operation. Such reports shall be delivered within 60 days of the receipt of failed parts.

WR 1.7.5 Reimbursement for Labor and Other Related Costs

The Agency shall be reimbursed by the Supplier for labor. The amount shall be determined by the Agency for a qualified mechanic at a straight time wage rate of $125.00 per hour, which includes fringe benefits and overhead adjusted for the Agency's most recently published rate in effect at the time the Work is performed, plus the cost of towing the bus if such action was necessary and if the bus was in the normal service area. These wage and fringe benefit rates shall not exceed the rates in effect in the Agency's service garage at the time the Defect correction is made.

WR 1.7.6 Reimbursement for Parts

The Agency shall be reimbursed by the Supplier for defective parts and for parts that must be replaced to correct the Defect. The reimbursement shall be at the current price at the time of repair and shall include taxes where applicable, plus 15 percent handling costs. Handling costs shall not be paid if parts are supplied by the Supplier and shipped to the Agency.

WR 1.7.7 Reimbursement Requirements

The Supplier shall respond to the warranty claim with an accept/reject decision including necessary failure analysis no later than thirty (30) days after the Agency submits the claim and defective part(s), when requested. Reimbursement for all accepted claims shall occur no later than thirty (30) days from the date of acceptance of a valid claim. The Agency may dispute rejected claims or claims for which the Supplier did not reimburse the full amount. The parties agree to review disputed warranty claims during the following quarter to reach an equitable decision to permit the disputed claim to be resolved and closed. The parties also agree to review all claims at least once per quarter throughout the entire warranty period to ensure that open claims are being tracked and properly dispositioned.

WR 1.8 Warranty after Replacement/Repairs

If any component, unit or subsystem is repaired, rebuilt or replaced by the Supplier or by the Agency with the concurrence of the Supplier, then the component, unit or subsystem shall have the unexpired warranty period of the original. Repairs shall not be warranted if Supplier-provided or authorized parts are not used for the repair, unless the Supplier has failed to respond within five days, in accordance with "Repairs by the Supplier."

If an item is declared to be a Fleet Defect, then the warranty stops with the declaration of the Fleet Defect. Once the Fleet Defect is corrected, the item(s) shall have three (3) months or remaining time and/or miles of the original warranty, whichever is greater. This remaining warranty period shall begin on the repair/replacement date for corrected items on each bus if the repairs are completed by the Supplier or on the date the Supplier provides all parts to the Agency.

Warranty Processing Procedures

The following list represents requirements by the Supplier to the Agency for processing warranty claims. One failure per bus per claim is allowed.

- bus number and VIN
- total vehicle life mileage at time of repair
- date of failure/repair
- acceptance/in-service date
- Supplier part number and description
- component serial number
- description of failure
- all costs associated with each failure/repair (invoices may be required for third-party costs):
    - towing
    - road calls
    - labor
    - materials
    - parts
    - handling
    - troubleshooting time

WR 1.9 Forms

The Agency's forms will be accepted by the Supplier if all of the above information is included. Electronic submittal must be made available between the Supplier and the Agency.

WR 1.10 Return of Parts

When returning defective parts to the Supplier, the Agency shall tag each part with the following:

- bus number and VIN
- claim number
- part number
- serial number (if available)

WR 1.11 Timeframe

Each claim must be submitted no more than forty five(45) days from the date of failure and/or repair, whichever is later. All defective parts must be returned to the Supplier, when requested, no more than forty-five (45) days from the date of repair.

WR 1.12 Reimbursements

Reimbursements are to be transmitted to the reporting Authority

WR 1.13 Reporting

The Supplier shall provide warranty reporting on a periodic basis as determined by the ordering Transit Agency and as mutually agreed to by the Parties.