

**EQUIPMENT PURCHASE AGREEMENT BETWEEN
THE RALEIGH-DURHAM AIRPORT AUTHORITY AND**

THIS AGREEMENT, made and entered into this _____ day of _____, 20____
by and between the **RALEIGH-DURHAM AIRPORT AUTHORITY**, a public body
chartered by the General Assembly of North Carolina under Chapter 168 of the 1939
Session Laws, as amended, whose address is 1000 Trade Drive, Post Office Box 80001,
RDU Airport, North Carolina, 27623, hereinafter referred to as the “**Authority**,” and

_____ whose address is _____,
_____, _____, hereinafter referred to as the “**Seller**.”

WITNESSETH:

THAT WHEREAS, the Authority desires the Seller to provide Goods and Services as
further described herein (the “**Equipment**”);

WHEREAS, the Seller has represented to the Authority that it is fully qualified to provide
and capable of providing such Equipment in a competent manner; and

WHEREAS, the Authority desires to engage the Seller to provide such Equipment.

NOW, THEREFORE, the Authority and the Seller, for and in consideration of the mutual
covenants and agreements hereinafter set forth, do hereby agree as follows:

I. PURCHASE AND SALE

Subject to the provisions for early termination as set forth herein, the Authority agrees to
purchase and the Seller agrees that it will provide the Equipment described in **Exhibit A**
attached hereto and incorporated herein by reference, subject to the terms and conditions
set forth hereunder.

II. PAYMENTS

(a) The Authority will pay the Seller for the Equipment in the maximum amount of _____ Dollars (\$ _____), and as further described in **Exhibit B** attached hereto and by this reference incorporated herein.

(b) The Authority may provide an invoice form to the Seller for use in the payment process. Each invoice shall detail each fee, subject to the limitations described herein. Any applicable duties and sales, use, excise, value-added, and/or similar taxes will be separately identified. Each invoice shall be accompanied by such documentation as may be requested by the Authority to fully support the claims for payment made. If applicable, each invoice shall include a record of payments to Minority and Women-Owned Small Businesses (“MWSB”), as applicable. Credit for previous payments on account by the Authority shall be recognized on the invoice. Unless freight or other charges are itemized, the Authority may take any offered discount on the full amount of the invoice. Any items that are disputed by the Authority will be so identified by the Authority. The Authority shall pay the undisputed amount certified by the Seller based on terms of Net 30 days from the date of invoice receipt by the Authority’s Accounts Payable department (please e-mail a copy of the invoice to RDUPayables@rdu.com).

(c) In the event that the Authority disputes the Seller’s invoice(s) and documentation, or any portion thereof:

- (1) the Authority will identify the disputed items and pay any undisputed items pursuant to **Section II(b)**;
- (2) the Seller shall continue to perform and to meet the requirements of this Agreement, even in the absence of an agreement regarding the disputed items;
- (3) the parties may reserve all rights related to the disputed items;
- (4) the parties shall negotiate the disputed items in good faith;
- (5) at any time during said negotiations, either of the parties may refer the matter to a mediator certified by the North Carolina Dispute Resolution Commission and agreed upon by the parties; and

(6) any disputed item that is not resolved during negotiations and/or mediation may be referred by either party to the Wake County Superior Court for resolution, which shall have exclusive jurisdiction.

(d) The Seller's final invoice shall be so identified, shall state the total amount which the Seller claims to be due, and shall reflect that the Seller will have received full compensation for all Equipment pursuant to this Agreement upon payment of such invoice by the Authority. Said final invoice shall be submitted by the Seller to the Authority within thirty (30) days after the date the Equipment is provided by Seller to the Authority. The Seller's acceptance of payment pursuant to such final invoice shall constitute a full release of the Authority for any and all claims and payments due or claimed to be due by the Seller under this Agreement. The maximum payment and/or the maximum fees detailed in **Section II(a)** are subject to adjustment under **Section IV** for any expansions or reductions in the scope of work authorized by the Authority pursuant to **Section III**. Under no circumstances will the Authority provide any payments to the Seller in excess of the maximum payment as detailed herein except as provided in **Section II**.

(e) Seller certifies that the prices herein are not higher than the regular market price or prices being charged to other government organizations purchasing identical goods on any similar or smaller quantities at this particular time and do not discriminate against the Authority.

(f) Buyer will not be liable for any charges for transportation, delivery, packing, boxing, crating, or storage, unless specifically agreed to herein.

(g) In addition to any right or set off or recoupment provided by law, the Authority may exercise any and all rights of set off or to recoup from any amounts due to Seller and its affiliates and subsidiaries from the Authority.

(h) (1) If any outstanding check from the Authority to the Seller has not cleared the bank account on which it was drawn and it has been 90 days or more since the issuance of the check, the check will become void due to the Authority's set stale date. If the Seller contacts the Authority, the Authority will reissue the check.

(2) If the outstanding check has not cleared the bank account on which it was drawn and it has been a year or longer since the issuance of the check, the Authority will submit the funds to the North Carolina Department of State Treasurer pursuant to

Article 4 - North Carolina Unclaimed Property Act, N.C.G.S. § 116B-59-1. At this time, the Seller will need to contact the state for payment.

III. CHANGES

(a) The Authority may, at any time, change the Equipment specifications, methods of delivery, place or time of delivery, quantities, or other aspects of the order to meet its needs. In the event that such a change would reduce or increase the payment(s) due the Seller as detailed in **Section II**, the Authority shall notify the Seller in writing and request that the Seller submit to the Authority within ten (10) business days of receipt of said notice a written statement setting forth the amount of the reduction or increase in cost the Seller believes is associated with such change, supported by such documentation related thereto as may be requested by the Authority. The Authority shall notify the Seller in writing of its approval or rejection of such statement, or any part thereof, within ten (10) business days following receipt of said statement. In the event that the Authority rejects the Seller's statement of cost, the parties may negotiate the resulting reduction or increase in the payment(s) due to the Seller in good faith.

(b) In no event shall Seller increase quoted prices or change Equipment specifications or other details of the order other than as set forth in **Exhibit A** without the Authority's written consent. Prior to any consent:

- (1) Seller shall have submit a written statement of cost with respect to the proposed additions or changes in the form required by the Authority;
- (2) Seller shall provide documentation independent of its own assertions as justification for such cost increases;
- (3) the Authority shall have conducted a reasonable investigation of Seller's proposal for additional costs. During any such investigation, the Authority shall have the right to audit/review all books and records related to the Agreement; and
- (4) the parties shall negotiate to a mutually agreed upon additions or changes or costs permitted and payment(s) due to the Seller (Note: the Authority may elect to accept none, all, or to change the request, or any portion thereof).

IV. RESERVED

V. OWNERSHIP AND MANAGEMENT OF WORK PRODUCT

(a) **Definitions.** For the purposes of this Agreement, the following terms shall have the following meanings:

(1) **“Information”** means any writing or other source of recorded information of whatever nature and by whatever means recorded, whether or not claimed to be subject to copyright, including without limitation the following: written memoranda, notes, records, correspondence, reports, drawings or other graphical representations, pictorial reproductions, documents available from electronic data storage equipment, invoices, specifications, spreadsheets, budgets, financial models, forecasts, photocopies, pictures and all other papers and writings, including drafts, originals, and copies.

(2) **“Authority Information”** means any Information the Authority provides to the Seller in any form, including in electronic form.

(3) **“Work Product”** means all Information the Seller prepares or obtains in connection with the Equipment hereunder, except: (i) Information that was in the public domain prior to the execution of this Agreement; (ii) Information that becomes part of the public domain without any breach of this Agreement; and (iii) Information in Seller’s lawful possession prior to the execution of this Agreement.

(b) **Ownership and Management of Authority Information.** All Authority Information is and remains the property of the Authority and is provided to Seller for the sole purpose of the Seller providing the Equipment hereunder. Seller shall not use Authority Information for any purpose except in providing the Equipment hereunder.

(c) **Ownership of Work Product.** All Work Product produced or authored by Seller in the course of assembling the Equipment hereunder, together with any associated copyrights, are works made for hire and are the exclusive property of the Authority. To the extent that any writings or works of authorship may not, by operation of law, be works made for hire, this Agreement shall constitute an irrevocable assignment by Seller to the Authority of the ownership of, and all rights of copyright in, such items, and the Authority

shall have the right to obtain and hold in its own name, rights of copyright, copyright registrations, and similar protections that may be available in the works.

(d) The Seller shall treat all Work Product and Authority Information as confidential information and shall not disclose or make same available to any third party without the Authority's prior written consent. If the Seller becomes legally compelled (by deposition, interrogatory, request for documents, subpoena, investigation, demand, order or similar process or otherwise) to disclose any Authority Information or Work Product to any third party, then before such disclosure is made, Seller shall notify the Authority of the disclosure demand or obligation, consult with the Authority on the advisability of taking steps to narrow such demand or obligation, and cooperate with the Authority in any attempt to obtain a protective order or other appropriate remedy or assurance that the Authority Information or Work Product shall be afforded confidential treatment. If such protective order or other appropriate remedy is not obtained, the Seller shall disclose only that portion of the Authority Information or Work Product which Seller's legal counsel specifies in writing actually is subject to the disclosure obligation.

(e) The Seller shall return any Authority Information or Work Product to the Authority if the Authority makes a written request to the Seller.

(f) Prior to destroying or disposing of any Authority Information or Work Product upon the termination of the three (3) year period referenced in **Section V(e)**, the Seller shall notify the Authority of its intent to do so and shall give the Authority a reasonable time within which to take custody of said Authority Information or Work Product. Within such reasonable time, the Seller shall furnish those materials to the Authority without charge except for the reasonable cost of transporting and delivering the materials.

(g) In addition to any other remedies to which the Authority may be entitled by law or in equity, the Authority may enforce the provisions of this **Section V** in an action for equitable relief, including without limitation temporary and permanent injunctions (or their functional equivalents) and/or specific performance of this Section.

VI. WARRANTIES; DELIVERY; INSPECTION; LIENS

(a) Seller warrants that any work shall be performed with promptness and diligence. For a period of twelve (12) months after the delivery and acceptance of the Equipment,

Seller warrants that all goods, equipment, and similar tangible items provided hereunder will be in full conformity with all specifications and other descriptions provided, fit for their particular purpose, and will be merchantable and of good quality material and workmanship, free from defects. The Authority shall be entitled to all rights and remedies provided by the Uniform Commercial Code, Chapter 25 of the NC General Statutes, for breach of express warranties and implied warranties. Seller has, and will maintain in effect, all professional licenses, certificates, permissions, authorizations, consents, and permits it needs to carry out its obligations under this Agreement. These warranties shall be in addition to any warranties of broader scope and services warranties and guarantees given the Authority by Seller. Equipment required to be corrected or replaced shall be subject to this warranty and a new warranty period to the same extent as Equipment originally delivered under this Agreement. Neither review nor approval of the Seller's work by the Authority shall in any way limit or remove the Seller's liability therefore.

(b) Time and rate of delivery are of the essence, except when delay is due to causes beyond the Seller's reasonable control and without Seller's fault or negligence. Risk of loss or damage to the Equipment prior to the time of their acceptance by the Authority is upon the Seller. All shipments are U.S. F.O.B. Destination for domestic shipping or Incoterms DDP for international shipments.

(c) Acceptance shall be after inspection and testing, or no later than 30 days after delivery, whichever is sooner. Testing will include having purchased materials perform acceptably to Buyer under Buyer's normal usage. Payment should not be construed as acceptance, and signature of Buyer's receiving agent at time of delivery should not be construed as acceptance of merchandise or of any terms that conflict with this Purchase Order. All material which is discovered to be defective or which does not conform to any warranty or specifications of the Seller upon initial inspection, or at any later time if the defects contained in the material were not reasonably ascertainable upon the initial inspection, may be returned to the Seller for full credit or replacement at the election of the Authority. All transportation charges on rejected materials, both to and from the original destination, shall be at the expense of Seller. No goods returned as defective shall be replaced without the Authority's written authorization.

(d) Upon request of the Authority, Seller shall furnish the Authority with written proof of payment of all costs of labor, material and other charges that entered into the cost of

work performed by Seller, including its agents and contractors, which proof shall be in the form of waiver of lien or right of lien, and Seller hereby waives and relinquishes all liens and claims statutory or otherwise, which Seller now has or may hereafter have arising hereunder.

VII. TERMINATION

(a) The Authority may by written notice of default to Seller (a) terminate the whole or any part of this Agreement in any one of the following circumstances: (1) if Seller fails to make shipment of the Equipment or fails to perform within the time specified herein or any extension thereof; or (2) if Seller fails to comply with the other terms and conditions of this Agreement, and (b) procure upon such terms as the Authority shall deem appropriate, Equipment substantially similar to those so terminated, in which case Seller shall continue performance of this Agreement to the extent not terminated and shall be liable to Authority for any excess costs for such similar Equipment and any expenses incurred in connection therewith.

(b) In addition to all of the other rights which the Authority may have to cancel this Agreement, the Authority may terminate this Agreement in whole or in part at any time prior to delivery and acceptance for any reason upon written notice to the Seller. If the termination is not due to Seller's breach of its obligations: (a) the Authority will pay the order price for all Equipment completed in accordance with this Agreement prior to the date of termination unless said Equipment is part of Seller's standard commercial product; and (b) the Authority will pay an equitable proportion of the order price for Equipment in process and for all materials acquired for the purpose of fulfilling this order which Seller is unable to cancel, return or otherwise use in its operations. The Authority will not be liable to Seller for any costs for completed Equipment, goods in process or materials acquired or contracted for if such costs were incurred prior to the date of this Order. Cancellation charges shall be subject to Authority audit.

VIII. RESERVED

IX. COMPLIANCE WITH APPLICABLE LAWS

(a) The Seller shall comply with all applicable federal, state and local laws, codes and regulations, including the ordinances, rules, policies, bulletins, notices, directives and regulations of the Authority, the Transportation Security Administration, and the U.S. Customs and Border Protection Service as amended from time to time. Nothing in this Agreement shall be construed to conflict with any applicable Federal, state or local law, code or regulation, including the ordinances, rules, policies, bulletins, notices, directives and regulations of the Authority, the Transportation Security Administration, and the U.S. Customs and Border Protection Service as amended from time to time.

(b) **PROHIBITION AGAINST CONTINGENT FEES AND GRATUITIES:** Seller warrants that it has not paid, and agrees not to pay, any bonus, commission, fee, or gratuity to any employee or official of the Authority for the purpose of obtaining any contract or award issued by the Authority. Subsequent discovery by the Authority of non-compliance with these provisions shall constitute sufficient cause for immediate termination of all outstanding Agreements with Seller and potential debarment of the Seller as permitted by applicable law.

(c) The Authority shall have the right to audit the Seller's accounting, operational and business records as necessary to verify compliance with all applicable laws, regulations, orders, ordinances, codes, notices, requirements and standards, and correction of violations of the same. Seller will permit the Authority-designated representatives to examine, at a reasonable time and during normal business hours, all records, data, information and Work Product that the Authority may reasonably require in order to confirm that the services provided by Seller are (i) being conducted in conformance with this Agreement and (ii) in compliance with applicable laws and regulations. If any audit conducted pursuant to this paragraph reveals that the Seller has breached its obligations under applicable law, this Agreement, the Authority may conduct follow-up audits to ensure that any such breach has been cured.

(d) Seller certifies that, as of the date written above, it, and all subcontractors, are not on the Final Divestment List created by the State Treasurer pursuant to N.C.G.S. §143-6A-4. Seller shall not utilize in the performance of this Agreement any subcontractor that is identified on the Final Divestment List.

X. RIGHTS AND REMEDIES

The Authority's rights and remedies as set forth herein shall be in addition to any other right or remedy now and hereafter provided by law or in equity. All rights and remedies shall be cumulative and not exclusive of each other. No delay by the Authority in exercising a right or remedy shall constitute acquiescence thereof.

XI. FORCE MAJEURE

(a) A party hereto shall have no liability to the other hereunder due to circumstances beyond its control, including, but not limited to, acts of God, terrorism, flood, natural disaster, regulation or governmental acts, fire, civil disturbance, or extreme weather (a "**Force Majeure Event**"). Notwithstanding anything to the contrary herein, the Authority may terminate this Agreement in its entirety and without penalty if a Force Majeure Event continues for more than ten (10) consecutive days and prevents or delays Seller from delivering the Equipment.

(b) Any and all payments by the Authority are expressly contingent upon and subject to the appropriation, allocation and availability of funds to the Authority for the purposes set forth in this Agreement. If this Agreement or any purchase order issued hereunder is funded in whole or in part by federal funds, the Authority's performance and payment shall be subject to and contingent upon the continuing availability of said federal funds for the purposes of the Agreement or purchase order. If the term of this Agreement extends into fiscal years subsequent to that in which it is approved, such continuation of the Agreement *is expressly contingent upon* the appropriation, allocation, and availability of funds in each such subsequent fiscal year for the purposes set forth in the Agreement. If funds to effect payment are not available, the Authority will provide written notification to Seller. If the Agreement is terminated under this paragraph, Seller agrees to terminate any services supplied to the Authority under this Agreement, and relieve the Authority of any further obligation thereof. The Authority shall remit payment for services performed and accepted on or prior to the date of the aforesaid notice in conformance with the payment terms.

XII. OTHER CONDITIONS

(a) The Seller’s Contract Manager shall be _____. The Seller shall not replace or substitute for the Contract Manager during the Term except upon written notice to and receipt of written approval of the Authority. Said notice to the Authority shall state the reason(s) for the proposed replacement or substitution.

(b) The Authority’s Contract Administrator shall be Brian McLean. The Seller shall communicate and coordinate all matters related to this Agreement through and with Brian Mclean or his designee.

(c) Notices required to be given under this Agreement shall be delivered to:

FOR THE AUTHORITY:

Michael J. Landguth, President & CEO
PO Box 80001
1000 Trade Dr.
RDU Airport, NC 27623

FOR THE SELLER:

XIII. DISADVANTAGED BUSINESS ENTERPRISE (DBE) PROGRAM

(a) The Authority has established a Disadvantaged Business Enterprise (DBE) Program to encourage equal opportunity for DBEs to compete for employment as contractors, subcontractors, suppliers and service providers.

(b) DBE Goals for DBE participation on this contract represent the total dollars that will be spent with DBEs as a percentage of the total contract amount, including any change orders and contingency (“**DBE Goals**”). The Authority has assigned the following DBE Goals for work assigned to the Contractor hereunder:

1. Disadvantaged business Enterprise participation: 10%.

Such participation can be included in any portion of the Contractor's Scope of Services. DBE Goals for DBE participation on this contract represent the total dollars that will be spent with DBEs as a percentage of the total contract amount.

(c) If the Contractor proposes to terminate or substitute a DBE after submitting a proposal, the Contractor must make good faith efforts to find a substitute DBE for the original DBE to meet its DBE commitment. The Contractor must give the DBE notice in writing, with a copy to Authority, of its intent to request to terminate and/or substitute, and the detailed reasons for the request. All substitutions shall be coordinated with and approved by the Authority prior to being made.

(d) The Contractor has a continuing obligation to meet the DBE utilization to which it committed at contract award, inclusive of change orders, amendments, and modifications. The Authority reserves the right to modify any portion of this Agreement (up to and including termination of all of the Agreement) if it determines, in its sole discretion, that the Contractor has failed to make a good faith effort to secure DBE participation at a percentage equal to or greater than the goal stated above.

(e) The Contractor shall maintain records and submit monthly reports of DBE payments, concurrent with the Contractor's submission of invoices, with each invoice. The report shall include a certification by the Contractor and DBE regarding payment to each DBE subcontractor for the prior month's work. These reports will be certified as true and correct by an appropriate Contractor representative.

XIV. TAXES

All sales and use taxes applicable to the Equipment for the Authority shall be paid by the Authority to Seller, as invoiced, and subsequently remitted by Seller to the applicable tax collection agency, unless otherwise agreed upon or required by applicable law. North Carolina Sales and Use tax applies to Authority purchases. The Authority is exempt from Federal Excise Tax under Registry No. 56-70-0047K as provided by Chapter 23 of the Internal Revenue Code.

XV. RECORDS REQUIRED FOR GOVERNMENTAL FUNDING

To the extent applicable, records to be furnished by Seller to assist or enable the Authority to obtain governmental funding for any specific task assigned to Seller hereunder will be provided to the Authority upon request.

XVI. ASSIGNMENT

Neither the rights nor the obligations of either party arising under this Agreement shall be transferred or assigned without the prior written consent of the other party.

XVII. SUCCESSORS AND ASSIGNS

All covenants and agreements in this Agreement by or on behalf of either of the parties hereto shall bind the successors and assigns of such party and shall inure to the benefit of the successors and assigns of the other party.

XVIII. CONSTRUCTION OF AGREEMENT

In the event of any conflict between the terms of this Agreement and the terms of any document attached hereto and incorporated herein by reference, this Agreement shall control and the conflicting provision of the attachment shall, to the extent of the conflict, be null and void. The headings contained in this Agreement are for reference only and shall not affect the rights or obligations of either of the parties hereunder. The term “Authority” shall mean and include the Authority and its Board, officers, employees and

agents, and the term “Seller” shall mean and include the Seller, its employees, suppliers and agents.

XIX. GOVERNING LAW

This Agreement and the duties, responsibilities, obligations and rights of the respective parties hereunder shall be governed by the laws of the State of North Carolina. The exclusive venue for any action between the Authority and Seller arising out of or in connection with this Agreement shall be in Wake County, North Carolina. In addition, the Federal Aviation Authority requires the Authority and its vendors, suppliers, Sellers and consultants to comply with certain contracting requirements. Those relevant additional provisions are contained in **Exhibit C** which by this reference is hereby incorporated herein.

XX. SURVIVAL

Any right or obligation of either party to this Agreement that, by its nature, should survive termination or expiration of this Agreement, will survive any such termination or expiration of this Agreement. Such rights and obligations include but are not limited to those set forth in **Articles V, VI, VII, IX, X, XV, XIX, and XX**.

XXI. WAIVER

No waiver by any party of any of the provisions of this Agreement shall be effective unless explicitly set forth in writing and signed by the party so waiving. Except as otherwise set forth in this Agreement, no failure to exercise, or delay in exercising, any rights, remedy, power, or privilege arising from this Agreement shall operate or be construed as a waiver thereof, nor shall any single or partial exercise of any right, remedy, power, or privilege hereunder preclude any other or further exercise thereof or the exercise of any right, remedy, power, or privilege.

XXII. COUNTERPARTS

This Agreement may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument. A facsimile or PDF signature on this Agreement shall for all purposes be the equivalent to, and shall have the same force and effect as, an original signature.

XXIII. ENTIRE AGREEMENT

This Agreement, including all attachments hereto, and the Authority's solicitation document number 554-2023-0054, all addenda thereto and the Seller's submitted response, constitutes the entire agreement between the parties with respect to the subject matter hereof and supersedes all prior agreements, whether oral or written, between the parties hereto with respect to such subject matter. This Agreement may be modified only by written agreement between the Seller and the Authority.

[REMAINDER OF PAGE INTENTIONALLY LEFT BLANK]

IN WITNESS WHEREOF, the parties, by and through their duly authorized agents, have hereunto set their hands and seal(s), all as of the day and year first above written.

RALEIGH-DURHAM AIRPORT AUTHORITY

BY: _____

DATE: _____

NAME: MICHAEL J. LANDGUTH, A.A.E.

TITLE: PRESIDENT & CEO

INSERT NAME OF COMPANY

BY: _____

DATE: _____

NAME: _____

TITLE: _____

This instrument has been pre-audited in the manner required by the Local Government Budget and Fiscal Control Act.

Chief Financial Officer

Approved as to form:

General Counsel

EXHIBIT A

SCOPE OF SERVICES

General Specifications and Scope of Services:

The Raleigh-Durham Airport Authority (RDUAA) seek to purchase a **minimum of eight (8) and a maximum of twelve (12) 40 foot low-floor electric buses, a minimum of eight (8) and a maximum of twelve (12) charging stations, and design and construction services.** The bus manufacturer will be the prime contractor for this project.

Buses shall have a minimum expected life of twelve (12) years or 500,000 miles, whichever comes first, and are intended for a wide possible spectrum of passengers with luggage, including children, adults, the elderly and people with disabilities. The buses shall be Altoona tested and meet any other bus testing requirements under MAP-21.

Additional detailed technical specifications are included in separate downloadable document

Drawings of current Zero Emission Electric Buses



Interior Photos (example only):

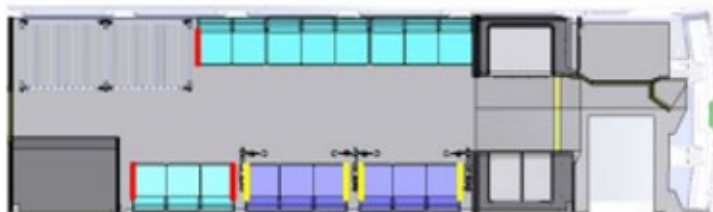








Preferred Seating Layout for RDU:



Front of the Bus



Rear of the Bus

The Scope of Services for the Design and Construction Services:

Project Description: The scope of work requires the successful bidder to design-build a charging station with a minimum of eight (8) and a maximum of twelve (12) individual charging stations. The charging station requirements are to be compatible with the Electric Low Floor 40 ft Transit Bus technical specifications (Section II). The standalone charging stations must be minimum 120 kW or larger and capable of charging a bus from 0% to 100% full charge within 4-6 hours. The buses shall be compliant with North American automotive standard for plug-in charging, SAE J1772 CCS Type 1 standard charging protocol. The successful bidder/contractor shall lead all efforts in coordination with the charging infrastructure OEM, Duke Energy, Engineering Consultant, and RDUAA staff for charging station power requirement, accurate sizing of the transformer capacity, switchgear, all associated components, and location based on the documents contained within the solicitation. Calculations will be based on the Bus OEM provider requirements and possibly the Authority. The Engineering Consultant will be hired by the successful bidder/contractor. This may be done by a separate Task Order to an Engineering Consultant and/or require the Prime Contractor to provide a turnkey Design Build procurement. Once those requirements are known and agreed upon, the successful bidder/contractor can then proceed with the next step on this project. The project site is located at the RDU Maintenance Facility. See attached picture for the proposed site location.

This shall be a turnkey (design and construction) project entailing the preparation of Design Documents (Plans and specifications) and Construction Services prepared by NC licensed professionals. Bidders are required to provide information as to their experience in the design and construction management of similar charging stations provided for in similar solicitations and procurements.

As a turnkey construction project all relevant design and construction prevailing building codes, (2018 International Building Code (IBC) and the 2020 National Electric Code (NFPA 70); regulations, and Wake County building/permitting requirements.

The project scope is generally described is for the installation of twelve (12) new electric (Buses) vehicle charging stations for the charging of a minimum of eight (8) and a maximum of 12 electric 40 ft buses. The work will require providing all electrical and civil work (Connection to existing power source, site preparation installation of branch circuits to charging stations from new panelboard, coordination of underground trenching with most current site survey and disturbing existing impervious surface, and installation of 8 charging stations: utilities installation, and associated controls and electrical distribution.

The bidder shall provide examples of similar work.

The work shall be executed by a licensed Contractor experienced in the installation of electrical systems and EV charging Systems.

PROVIDE DESIGN SERVICES

The design phase will consist of the following activities:

1. Conduct a site visit to examine the proposed site, utilities and existing physical conditions as they pertain to the development of the design.
2. Based on the site visit and project scoping, conduct a consultation session with the Owner to clarify and define the requirements for the project, review proposed conceptual design plans

and in coordination with the RDU Authority, decide upon a preferred option/design/project scope.

3. Prepare and submit of 30% design documents and Cost Estimate.
4. Conduct a 30% design review with the Authority.
5. Prepare 90% Construction Documents, project schedule and 90% cost estimate.
6. Conduct 90% CD review with the Authority
7. Prepare 100% CD's for permitting and submission to the Authority and AHJ.
8. The Construction Documents shall consist of drawings and notes detailing the quality levels and other requirements for construction of the work. Technical specifications will consist of notes on the drawings.
9. Coordination with CM and RDU staff.

PERMITTING

1. The Contractor/Subcontractor shall obtain all required permits for the project execution.
2. Respond to AHJ review comments pertaining to review comments of the project.

SITE LOCATION



Liquidated Damages:

The Authority is relying upon the Seller to complete the Agreement by the Agreement delivery date. In the event the delivery is not complete by the Agreement delivery date, the Authority will be materially damaged. In view of the difficulty of estimating such damages, it is agreed by the Authority and Seller that the Seller shall be liable to the Authority if the Authority's acceptance of the Equipment shall be delayed for more than 7 days beyond the set Agreement delivery date provided in the Agreement for any reason for which delay is not excused. The Seller shall pay the Authority liquidated damages to compensate Authority for its losses caused by such delay equal to \$1,000 daily flat rate of the Agreement Price for each day of such delay, up to a maximum of 360 days. The Seller shall not be required to pay the Authority liquidated damages for delay to the extent that such damages would in the aggregate exceed 10% of the Agreement Price. If the aggregate amount of liquidated damages for delay payable under this section shall exceed 10% of the Agreement Price, such delay shall constitute a material default by the Seller of its obligations under the Agreement.

TECHNICAL SPECIFICATIONS

1 GENERAL

1.1 Scope

The Raleigh-Durham Airport Authority (RDUAA) seek to purchase a minimum of eight (8) to a maximum of twelve (12) 40 foot low- floor electric buses. Buses shall have a minimum expected life of twelve (12) years or 500,000 miles, whichever comes first, and are intended for a wide possible spectrum of passengers with luggage, including children, adults, the elderly, and people with disabilities. The buses shall be Altoona tested and meet any other bus testing requirements under MAP-21.

1.2 Definitions

Ambient Temperature: The temperature of the surrounding air. For testing purposes, 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.

Cells: Individual components (i.e., battery or capacitor cells).

Code: A legal requirement.

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 which converts a source of direct current (DC) from one voltage level to another.

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.

Electric Bus Definition: A vehicle that is battery powered with electrically driven motor(s)

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 high- voltage electrical energy and for which its supply of energy is rechargeable by a PPU and/or an off-vehicle energy source.

Fusible Material: A metal, alloy, or other material capable of being melted by heat.

Fire Resistant: Materials that have a flame spread index 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 that protrudes into the standee area.

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: 150 lbs. for every designed passenger seating position, for the driver, and for each 1.5 square feet 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 Voltage (HV): Greater than 50 volts (AC and DC).

Hose: Flexible line.

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 crack. See *Rupture*.

Line: All tubes, flexible and hard, that 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 to remove the need for steps in the aisle between the doors and in the vicinity of these doors.

Low Voltage (LV): 50 volts or less (AC and DC).

Metallic Hose: A hose whose strength depends primarily on the strength of its metallic parts; it can have metallic liners or covers, or both.

Module: 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.

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.

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, the energy storage system.

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.

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: 150 lbs. for every designated 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.

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

Special Tools: Tools not normally stocked by the RDUAA.

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: Standards referenced in “Part 5: 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 percent. 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 “pig-tails” commonly used to absorb flexing in piping.

Structure. The structure shall be defined as the basic body, including floor deck material and installation, load bearing external panels, structural components, axle mounting provisions and suspension beams and attachment points.

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.

1.3 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.

1.4 Legal Requirements

The Contractor 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 and shall accommodate all applicable FMCSR regulations in effect at location of the RDUAA 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.

1.5 Overall Requirements

The Contractor shall ensure that the application and installation of major bus subcomponents and systems are compliant with all such subcomponent vendors' requirements and recommendations. Contractor and RDUAA 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.

Chassis structure (integrity & Corrosion)	12 year/500,000 Miles
Transmission	5 year/Unlimited Mile
Axle Rear & Front	5 Year/300,000 Miles
Basic Bus Structure	3 year/150,000 Mile

The buses shall afford features essential for safe, efficient, and comfortable operation by the operator. This implies the utmost in road and traffic visibility under all driving conditions and adequate means for safe passenger movement. The bus must be maneuvered easily in normal and heavy traffic. All Proposers must conform to these specifications and the product they furnish shall be of first-class quality, and workmanship, and shall be of the best obtainable in the various trades. The design of the body, chassis, and equipment, which the manufacturer proposes to furnish, shall be such as to produce a vehicle of substantial and durable construction in all respects.

To the extent practical, all systems, major sub-systems, and components shall be individually and permanently labeled with Manufacturer, Part Number, and Serial Number. Label is to be located, in each instance, for easiest access for reading while installed for use in the bus. List of all systems, subsystems, and components shall accompany each bus either on paper, CD or DVD.

The manufacturer shall be responsible for providing all parts or details which make each bus complete and ready for service, even though such part(s) or details(s) are not mentioned in these specifications.

All buses shall be in compliance with the Americans with Disabilities Act (ADA). These buses shall be new, unused, current model specifically designed for either intra or inter-city service as applicable and substantially manufactured in the United States (in accordance with "Buy America" requirements). These units must meet all Federal requirements applicable to this type of vehicle. Buses provided under this contract shall be 40 foot in length, 102 inches wide, nominal with a low floor designs.

1.6 Worker and Protective Measures

All bolts or rods passing through wood shall be sealed with zinc chromate or other approved sealing compound. Where wood and wood are placed together, all outer edges of wood, as well as the edges of holes, cutouts and notches shall be coated with a linseed oil and titanium dioxide sealer or zinc chromate or other appropriate sealing compound.

All exterior light fixtures shall be fitted to the contour of the bus body and sealed to prevent entrance of water.

All rubber seals on ventilator doors and compartment cabinet doors shall be placed in 'U' shaped channels to firmly hold the rubber in place. Equally, self-adhering closed cell neoprene seals may be used, without 'U' channels.

All burrs and sharp edges shall be dressed to prevent injury to passengers and employees, or damage to their clothing.

All buses shall be subjected to water tests simulating the severe rain conditions experienced in the North Carolina environment. Windows, escape hatches, doors, etc. are subject to an approved water test to be conducted at the manufacturer's facility by the manufacturer and shall be observed by the Resident Inspector(s). Water testing may be verified by further testing at the RDUAA's Maintenance Facility prior to the acceptance of each vehicle if test observation or verification of leak repair is missed on or not observed by the Resident Inspector on any bus built. Any bus that fails to pass the water test shall be corrected by the contractor. The retest/corrective repair cycle shall repeat until the leak(s) have been eliminated to the RDUAA's satisfaction.

1.7 Water Test Description

The roof, roof hatches, front cap, rear cap, sidewalls, passenger windows, driver's windows, destination sign windows, windshields, wheel wells and all doors of all coaches shall be water tested prior to the delivery of each unit as follows:

1. The water test shall consist of a series of nozzles which are strategically located around the perimeter of the vehicle to spray water over the entire surface of the vehicle.
2. The nozzles shall eject a volume of water no less than 2.6 gallons per minute per nozzle under a pressure of no less than 22 lbs. per minute measured at the nozzle tip.
3. The contractor shall be required to water test each vehicle under the conditions described above for no less than 30 minutes (15 minutes with A/C off, then 15 minutes with A/C on) to ensure there are no water leaks in the bus.
4. Bus road testing shall be conducted immediately after the water test.

Contractor shall take the necessary steps of corrective action to repair any leaks found as a result of the described test and shall repeat the 30-minute water test to ensure that corrective steps have been successful. This process shall be repeated until no leaks are found. Documentation of each bus shall be kept by the manufacturer as to the location of the leak, what caused the leak to occur and shall describe the repair action taken to prevent the leak from reoccurring.

If the Contractor's bus manufacturing process water test differs from the water test process and criteria

described above, then any deviations shall be approved by the RDUAA.

1.8 Total Bus Operation

Total bus operation shall be evaluated during road tests. The purpose of the road tests is to observe and verify the operation of the bus as a system and to verify the functional operation of the subsystems that can be operated only while the bus is in motion. Each bus shall be driven for a minimum of 25 miles during the road tests. The plan shall be submitted to the RDUAA for approval.

All zerk grease testing fittings shall be accessible from a lift location with a standard straight nose grease gun.

All vehicles will be road-tested or dyno-tested.

1.9 Weight

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.

1.10 Capacity

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

1.11 Service Life

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.

1.12 Maintenance and Inspection

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 shall be provided for commonly checked functions on the bus, such as hydraulic, pneumatic, HVAC systems, drive systems, transmission, etc.

The coach manufacturer shall give prime consideration to 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 which 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.

Contractor shall provide a list of all special tools and pricing required for maintaining this equipment. Said list shall be submitted with bids.

NOTE: Tools such as compartment door and compartment access keys shall not be included in the special tool list and shall be furnished for each coach.

1.13 Interchangeability

Unless otherwise agreed, all units and components procured under this Contract, whether provided by Suppliers or manufactured by the Contractor, 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. Contractor shall identify and secure approval for any changes in components or unit construction provided within a Contract.

If the Contractor is unable to comply with the interchangeability requirement, the Contractor must notify the RDUAA and obtain RDUAA's prior written approval, including any changing in pricing.

RDUAA 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 as least as well as the originally supplied products.

1.14 Training

Along with the purchase of new buses, it is RDUAA's requirements to have the manufacturer provide an appropriate program of instruction targeted to the operator, servicing, emergency response, and maintenance personnel. This will be accomplished through a combination of RDUAA on-site and contractor and/or supplier site training. Training will consist of Train the Trainer, Technical, and OEM.

Programs shall include training and testing materials, specific tools, equipment, and identified training aids. The RDUAA shall indicate the training desired and, by mutual agreement, when the performance period is to begin. The contractor will provide RDUAA with a CD-ROM using Portable Document Format (PDF) of all applicable lesson plans, training guides, student workbooks, along with any other videos, transparencies, or additional instructional training aids. The contractor shall inform the RDUAA of any training support equipment and/or supplies required to be supplied by the RDUAA for the contractor portion of the training.

All training instructors shall be competent to teach the course area they are instructing. Further, all instructors shall speak English and have a complete understanding of the English language. If the instructor or vendor presenter lacks the skill or knowledge to provide instruction, or cannot communicate with the students, RDUAA reserves the right to request that the instructor be replaced, and the area of training be repeated.

1.15 Train the Trainer

The Contractor shall provide two (2) complete "Train the Trainer" programs of instruction for the RDUAA's training department personnel. One program, **Operator Orientation**, will be designed for Bus Operator Instructors, Street Supervisors and Dispatchers. A second program, **Maintenance Orientation**, will be designed

for maintenance training personnel. This training is to be conducted at the RDUAA's facility and will be developed to encompass familiarization, operation, unique characteristics, service, and safety concerns of the vehicle and its systems. The Operator Orientation programs will be approximately four (4) hours in length and shall be a combination of classroom instruction and hands-on instruction, the latter being presented on and around the bus. The Maintenance Orientation shall be minimum of two (2) four-hour sessions in length and shall be a combination of classroom and hands-on instruction. The Contractor shall also provide a training video for instructors to use for training bus operators on the operation of the bus.

1.16 Operator Orientation

The Contractor shall provide complete training and instruction for RDUAA designated personnel. Class size is not to exceed 10 employees per session. The program shall include, but not be limited to the following:

Operator Compartment; Controls and Switches; Warning Indicators and Gauges; Seat Adjustment; Door Control; Walk Around Inspection; Compartment-by-Compartment Explanation; Mirror Adjustments; Climate Control system; Driving Instruction; Turns; Braking; Transmission; Backing; Wheelchair Ramp Equipment; Controls; Safety; Emergency Procedures; Securing Wheelchairs and Riders; Loading and Unloading.

Each trainee will be given an opportunity to operate the bus with the Contractor's instructor on board while driving the existing RDU bus routes. The training shall be delivered on a schedule coordinated between the RDUAA's training department and the contractor. The Contractor shall provide 4 sessions to cover the existing staff up to a total of 40 drivers.

1.17 Maintenance Orientation

The Contractor shall provide complete training and instruction for RDUAA designated Maintenance personnel. Class size is not to exceed 8 employees per session. The program shall include, but not be limited to the following:

All items indicated in Operator Orientation, in addition to Suspension; Steering; Axles; Electrical systems; Body; Parts; Vehicle Service Instruction; Air Conditioning; Doors; Towing; Brakes; Fire Suppression and Air System. For electric buses propulsion batteries, battery systems, battery management systems, charging systems, drive motors and drive motor controllers offered.

1.18 Each trainee will be given an opportunity to operate the bus with the Contractor's instructor on board. The training shall be delivered on a schedule coordinated between RDUAA and the contractor. See Section 1.15 for the minimum required training Emergency Response Orientation

The contractor shall provide a structured program of training for RDUAA emergency response and mutual aid personnel which will consist of instruction on proper safety techniques when responding to a vehicle accident, fire, or other incident involving the bus. Training shall include detailed information on aspects of fire suppression system, propulsion batteries, battery systems, battery management systems, charging systems, drive motors and drive motor controllers that could impact the safety of first responders. The training shall be delivered on a schedule coordinated between RDUAA and the contractor. 4 training sessions shall be provided to cover various RDUAA shift personnel.

1.19 OEM

The contractor shall provide four (4) class slots at the manufacturer's suppliers training facility for a "train-the-trainer" technical instruction course on the operation, diagnostics, troubleshooting, repair, and servicing of the below listed areas:

1. Electric Drive and Battery System

RDUAA shall coordinate the scheduling of training with the contractor.

1.20 Operating Environment

The bus shall achieve normal operation in ambient temperature ranges of 10 °F to 115 °F, at relative humidity between 5 percent and 100 percent. Degradation of performance due to atmospheric conditions shall be minimized at temperatures below 10 °F, above 115 °F. Speed, gradeability and acceleration performance requirements shall be met at, or corrected to, 77 °F, 29.31 in. Hg, dry air per SAE J1995.

2 NOISE

2.1 Interior Noise

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 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.

2.2 Exterior Noise

Airborne noise generated by the bus and measured from either side shall not exceed 80 dBA under full power acceleration when operated 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 65 dBA. If the noise contains an audible discrete frequency, a penalty of 5 dBA shall be added to the sound level measured. All noise readings shall be taken fifty (50) feet from, and perpendicular to, the centerline of the bus with all accessories operating. The Contractor shall comply with the exterior noise requirements defined in local laws and ordinances identified by the RDUAA and SAE J366.

2.3 Fire Safety

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.

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, dated October 20, 1993. Materials entirely

enclosed from the passenger compartment, such as insulation within the sidewalls and sub-floor, need not comply. In addition, smaller components, and items, such as seat grab rails, switch knobs and small light lenses, shall be exempt from this requirement.

2.4 Respect for the Environment

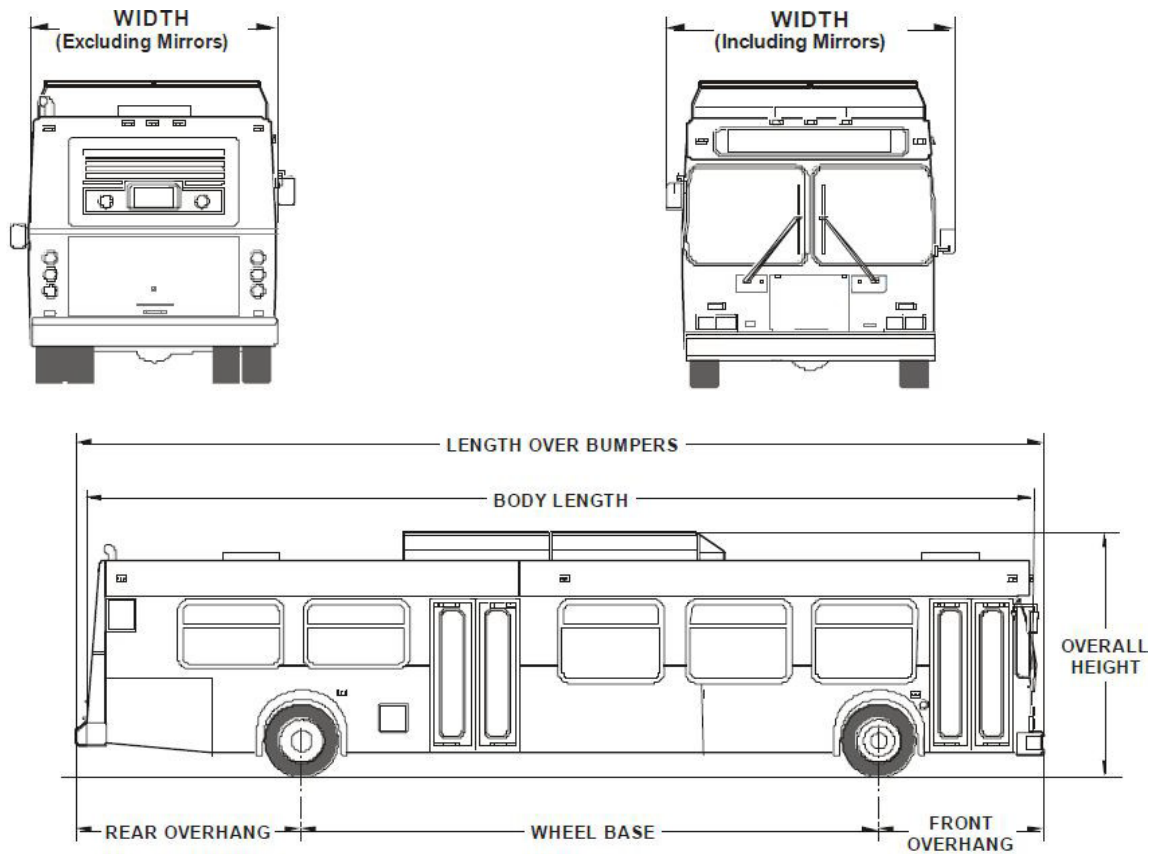
In the design and manufacture of the bus, the Contractor shall make every effort to reduce the amount of potentially hazardous waste. In accordance with Section 6002 of the Resource Conservation and Recovery Act, the Contractor shall use, whenever possible and allowed by the specifications, recycled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

3 DIMENSIONS

3.1 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



3.2 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.

1. **40-ft bus:** 40 ft to 44 ft, 11 in.

3.3 Bus Width

Body width shall be 102 in. (+0, -2 in.).

3.4 Bus Height

Maximum overall height shall be 130 in., including all rigid, roof-mounted items such as A/C, antennas, etc. while bus is empty. This is a critical measurement as the bus must pass below an existing bridge at the RDU airport with a height restriction.



3.5 Step Height

The step height shall not exceed 16.5 in. (+.5, -.5 in.) at either doorway without kneeling and shall not exceed 15.5 in. at the step. A maximum of two steps is allowed to accommodate a raised aisle floor in the rear of the bus.

3.6 Underbody Clearance

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

3.7 Ramp Clearances

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 2

Angle	30 to 45ft Bus	60ft Bus
Approach	8.6 degrees (min.)	8.6 degrees (min.)
Front breakover	7.0 degrees (min.)	10.2 degrees (min.)
Departure	7.5 degree (min)	8.6 degree (min.)

3.8 Ground Clearance

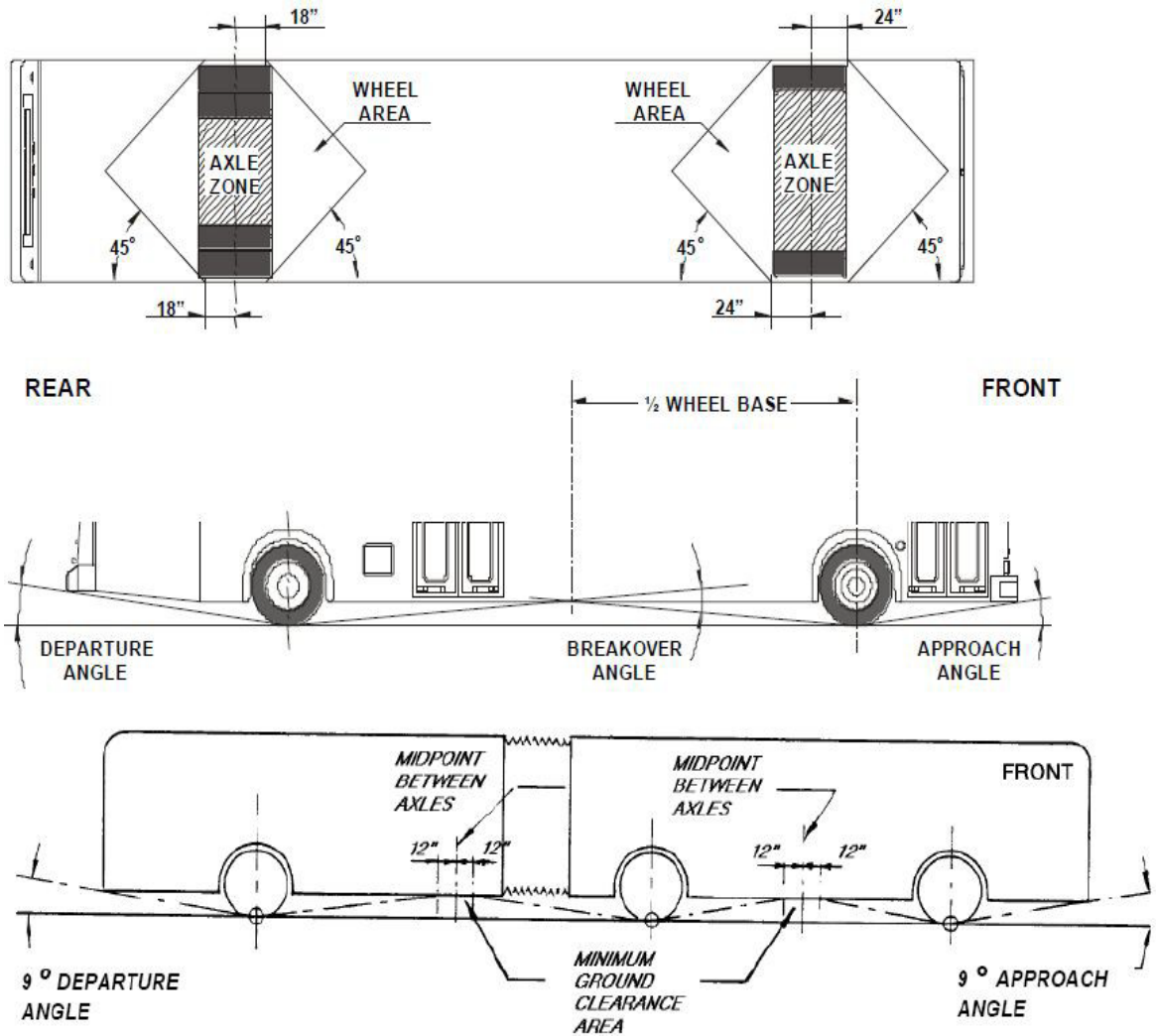
Ground clearance shall be no less than 9 in., (8 in. at jacking pad) except within the axle zone and wheel area.

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



3.9 Floor Height

Height of the step above the street shall be no more than 16 in., 17.5 in. for electric buses with floor mounted batteries, measured at the centerline of the front and rear doorway. The floor may be inclined along the longitudinal axis of the bus, and the incline shall not exceed 3.5 degrees off the horizontal except locally at the doors where up to 4-degree slope toward the door is allowed. 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 is allowed to accommodate a raised aisle floor in the rear of the bus.

3.10 Interior Headroom

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.

3.11 Aisle Width

The minimum clear aisle width between pairs of transverse seats with all attached hardware shall be at least 22 in.

The aisle width between the front wheelhouses shall be at least 34 inches, and the entire area between the front wheelhouses shall be available for passengers and mobility aid devices.

4 VEHICLE PERFORMANCE

4.1 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.

4.2 Top Speed

The bus shall be capable of achieving a top speed as indicated in the speed table below when driving 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.

Speed Table

Power Plant

Miles per Hour (Speed)

Electric	65
----------	----

NOTE: Values are assumed to be sustained. Manufacturer shall supply RDUAA with data if there is a variance between peak performance and sustained vehicle performance.

4.3 Gradeability

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

4.4 Default

The propulsion system and drivetrain shall enable the bus to achieve and maintain a speed of 40 mph on a 2½ percent ascending grade and 14 mph on a 10 percent ascending grade continuous.

NOTE: Values are assumed to be sustained. Manufacturer shall supply RDUAA with data if there is a variance between peak performance and sustained vehicle performance.

4.5 Acceleration

The acceleration shall meet the requirements 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 Surface¹ with full throttle and full brake applied starts.

Speed (mph)	Max Time (Seconds)
10	5
20	10
30	18
40	30
50	60
Top speed	

1. Vehicle weight = GVWR

4.6 Electric

The propulsion and braking systems shall meet the performance requirements of the Duty Cycle. Braking application and performance shall remain consistent regardless of Electric 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.

Electric bus must report a minimum range and operating cycle whether operating on a full charge system.

4.7 Charging Stations / Charging Protocol

As part of this IFB, the turn-key design and installation of eight (8) new charging stations is part of the scope of services. The standalone charging stations must be a minimum of 120 kW or larger and capable of charging a bus from 0% to 100% full charge withing 4-6 hours. The buses shall be compliant with North American automotive standard for plug-in charging, SAE J1772 CCS Type 1 standard charging protocol. Two (2) ports per bus (one on either side) are required to allow charging from both sides of each bus.

4.8 Operating Range

The operating range of the coach shall be designed to meet the operating profile as stated in the “Design Operating Profile” section.

4.9 Battery Electric

The operating range of the coach when run on the design operating profile “Design Operating Profile” shall be at least 175 miles on a full charge at any point during the 12- year useful life of the vehicle, regardless of seasonal loads and driver efficiency.

4.10 Energy Economy/Range Test (Design Operating Profile)

Test results from the Altoona energy economy tests or other applicable test procedures shall be provided to the RDUAA. Results shall include vehicle configuration and test environment information. Energy economy data shall be provided for each design operating profile. The design operating profile is assumed to be defined by the Altoona fuel duty cycle.

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

- Duty Cycles (avg speed)
- Manhattan: 6.8 mph
- Orange County: 12.7 mph
- UDDS: 19 mph Idle time

Results from Testing of Battery Electric Buses shall be reported in kWh per mile.

5 Propulsion System (Electric)

5.1 Propulsion System Description (Electric)

The bus shall be powered by a battery electric propulsion system. Function and operation of the bus shall be transparent to the Bus Operator and passengers. The OEM shall assure 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 producing zero emissions. The propulsion system shall comply with local, state, and federal (maintenance) and other applicable sections.

The Electric Drive System shall be rated for the GVWR or greater of the bus.

5.2 Propulsion System Service

The propulsion system shall be arranged so that accessibility for all routine maintenance is assured. No special tools, other than dollies and hoists, shall be required to remove the propulsion system or any subsystems. Contractor shall provide all specialty tools and diagnostic equipment required for maintaining the Propulsion System in accordance with Special Tools List.

5.3 Propulsion System Controller

Motor Controller(s) shall regulate energy flow throughout system components. The controller(s) shall monitor and process inputs and execute outputs as appropriate to control the operation of all propulsion system components. Controller(s) shall have bi- directional power control providing drive and charging functions with inverter and motor control.

Propulsion system controller shall have onboard diagnostic (OBD) capabilities able to monitor vital motor functions, store, and time stamp parameter conditions in memory, and communicate faults and vital

conditions to service personnel. Diagnostic reader device connector ports, suitably protected against dirt and moisture, shall be provided in the operator's area. The OBD system shall inform the operator via visual and/or audible alarms when out of parameter conditions exist for vital functions. The OBD system shall have capabilities for storing hard and soft codes and processing data and provide detailed information/reports on various aspect of fleet usage. The information shall be retrievable via cabling or wireless transmission to a laptop.

5.4 Traction System

The traction system shall provide the necessary torque to meet the gradeability, start ability, and acceleration specifications.

The motor(s) drive system shall protect the drive system against damage. The system shall monitor conditions critical for safe operation and automatically derate power and/or speed and initiate motor shutdown as needed. The OBD system shall trigger a visual and audible alarm to the operator when the motor control unit detects a malfunction and the protection system is activated.

Automatic shutdown shall only occur when parameters established for the functions below are exceeded:

Over Temp Inverter Fault Over Voltage Broken Wire

Loss of Electrical Communications Communications Safety

A control shall be available to the operator to allow a 30-second override, which, when depressed, will allow the operator to delay the drive system shutdown but not the activation and alarm system.

The manufacturer shall comply with all subcomponent vendor's requirements and recommendations regarding motor design, sizing, and method of cooling or loading specifications. The inverter/motor combination shall be designed to operate for not less than 200,000 miles in the anticipated duty cycle without major failure or significant deterioration.

Adequate provision for lubrication, cooling, and monitoring of these functions shall be provided. The motor(s) are to be mounted on resilient mounts to provide for maximum isolation of noise and vibration.

5.5 Energy Storage and Controller

Battery containers shall be constructed to withstand the rigors of transit service for the design life of the buses. Connector and cabling design shall be such that inappropriate or unsafe connections are not possible. Vent-and-fill system components for individual packs or containers shall not require any disassembly on removal or installation of the battery packs or containers. Battery pack design shall ensure the protection of battery cabling and vent/watering system components during pack removal and installation. The batteries, when installed, shall be secured to prevent any movement while the vehicle is in operation.

The energy controller shall be provided with operating software capable of monitoring features such as temperature, voltage, current.

5.6 Battery Management System

An imbedded battery management system (BMS) shall be provided for diagnostic and management of power to the batteries. At minimum the BMS shall manage the charging and discharging of the battery power contactors, power limit, current detection, battery temperature, and voltage sampling. The primary function of

the BMS is to protect power batteries by controlling battery power contactors at the conditions of leakage, collision, voltage irregularity (too high or too low), and temperature levels (too high or too low). Battery Management System shall be capable of balancing the voltage among the individual cells within the battery modules.

The primary charging of the energy storage system shall be accomplished by a stationary EVSE via a mechanical plug. The energy storage system shall also make use of regenerative braking. The Energy Storage System shall comply with UN/DOT 38.3 requirements for lithium batteries or similar standards for non-lithium batteries.

Bid shall include a detailed analysis of expected battery performance in the Design Operating Profile. The proposal shall also include a comprehensive statement of the warranty items relating to the battery, including explanation of all disclaimers within the warranty. The charge cycle and cycle life should be stated in the bid and a life cycle cost analysis of the proposed battery system in the specified application shall be provided.

The battery system shall be capable of withstanding the high current and voltage profiles necessary to accomplish daily recharge events without reducing the life of the battery.

5.7 Battery Thermal Management

If required by the battery manufacturer, thermal management via refrigeration or external cooling shall be provided to ensure optimal life and performance of the ESS over the environmental operating range. Battery temperatures must never exceed the manufacturers recommended range during operation in the design operating profile and specified ambient conditions.

Battery thermal management must be always powered from an onboard source. Thermal management must be continuously always monitored with appropriate safety interlocks installed to react to adverse conditions stated in SAE J1772.

5.8 Motor Cooling System (Electric)

The cooling system fan controls shall sense the temperatures of the operating fluids and the intake air and will engage the cooling fan to ensure safe operating conditions. The fan control system shall be designed with a fail-safe mode of "fan on." The cooling fan shall be temperature controlled.

The radiator shall be of durable corrosion-resistant construction with non-removable tanks. The radiator shall be designed to withstand thermal fatigue and vibration associated with the installed configuration

The motors shall be liquid cooled. Motor temperature sensors shall be easily accessible for replacement. Motor temperature sensors shall not disable the bus at any time.

The bus shall be equipped with an electric fan drive bus cooling system. A screen guard shall be installed on electric motor fans per SAE J1308. The cooling fan and mounting bracket shall be designed to withstand thermal fatigue and vibration associated with the installed configuration.

The cooling fan shall be temperature controlled. Variable fan speed shall be used to keep the engine within operation temperature.

5.9 Transmission Cooling

The transmission, if used, shall be cooled to maintain operating fluids within the transmission manufacturer's

recommended parameters of flow, pressure and temperature. The cooling system shall be able to cool the transmission while operating continuously at highway speeds.

5.10 Electric Drive System Cooling

Thermal management system shall maintain electric drive system components within design operating temperature limits in all driving conditions.

5.11 Transmission Cooling

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 retarder and engine cooling systems to ensure that all operating fluids remain within recommended temperature limits established by each component manufacturer.

5.12 Electric Drive System Cooling

Thermal management system shall maintain electric system components within design operating temperature limits.

5.13 Retarder- Regenerative Braking (Electric Bus)

The powertrain shall be equipped with regenerative braking designed to improve energy efficiency and extend brake lining service life. The application of regenerative braking shall cause a smooth blending of both regenerative and service brake function and need not activate the brake lights.

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

The system shall be designed whereby increasing the pressure on the brake pedal increases the amount of regenerative capability up until a preset point is reached within the brake pedal travel whereby the mechanical brake is engaged. Regenerative braking shall continue to operate during mechanical braking.

Red lights shall illuminate when regenerative braking is activated. The regenerative braking shall be adjustable within the limits of the powertrain and activated when the brake pedal is depressed or upon release of accelerator pedal.

5.14 TS 12.2 Braking Resistors

The system shall include a means of maintaining dynamic braking (braking retardation) after the energy storage system can no longer accept regenerative braking energy. The system may use air cooled braking resistors, liquid cooled braking resistors, other means, or a combination of means. The system shall be sized to dissipate sufficient energy to allow the bus to maintain a speed of no greater than 30 mph on a 6% downgrade for a minimum of 4 miles at GVWR. The system shall allow the bus to maintain this speed without engaging the service brakes.

5.15 Mounting

All powerplant 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 powerplant so as not to affect performance of belt-driven accessories or cause strain in piping and wiring connections to the

powerplant.

5.16 Service (Electric)

The Propulsion System shall be arranged for ease of access and maintenance. The Contractor shall list all special tools, fixtures or facility requirements recommended for servicing. The air compressor, radiator, all accessories and any other component requiring service or replacement shall be easily removable.

Radiator filler caps shall be 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.

5.17 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.

5.18 Hydraulic System Sensors

Sensors in the main hydraulic system, excluding those in the power steering system, shall indicate on the driver's on-board diagnostic panel conditions of low hydraulic fluid level.

5.19 Fluid Lines

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.

All hydraulic hoses in engine compartment should have outer cover or sheath to reduce the chance of a fluid leak contacting hot exhaust.

5.20 Fittings and Clamps

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.

5.21 Oil and Hydraulic Lines

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.

5.22 Fire Suppression System

A fire suppression system to detect fire in the battery compartments and/or electric motors shall be listed as an option.

6 STRUCTURE

6.1 General Design

The structure of the bus shall be designed to withstand the transit service conditions typical of an urban 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 RDUAA shall be considered for this purpose.

6.2 Altoona Testing

Prior to acceptance of first bus, the vehicle must have completed any FTA-required Altoona testing. Any items that required 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 all such failures will not occur shall be submitted to the RDUAA. Buses must meet new MAP-21 Altoona pass/fail testing requirements.

6.3 Altoona Test Report Provided to RDUAA Prior to Start of Bus Production

Prior to the start of any bus manufacturing or assembly processes, the structure of the proposed bus model shall have undergone appropriate structural testing and/or analysis, including the complete regimen of FTA required Altoona tests. Prior to assembly of the first bus, the OEM shall provide the RDUAA with a completed report of Altoona testing for the proposed bus model along with a plan of corrective action to address deficiencies, breakdowns and other issues identified during Altoona testing. The bus model tested shall match the bus model proposed for procurement, including structure, axles and drivetrain. Base model and partial Altoona test reports are acceptable when the combination of these tests adequately represents the proposed bus model per SAFETEA- LU and MAP-21.

6.4 Structural Validation - 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).

6.5 Distortion

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.

6.6 Resonance and Vibration

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.

6.7 Motor Compartment Bulkheads

The passenger and motor compartment shall be separated by fire-resistant bulkheads. This bulkhead shall preclude or retard propagation of a motor 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 motor 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. Motor 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.

6.8 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 4000-pound 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.

The transit bus, at GVWR and under static conditions, shall not exhibit deformation or deflection that impairs operation of doors, windows, or other mechanical elements. Static conditions include the vehicle at rest with any one wheel or dual set of wheels on a 6-inch curb or in a 6-inch-deep hole.

The sidewall structure shall be capable of withstanding impacts of 200-foot pounds of energy from a steel

faced spherical missile no less than 9 inches in diameter and of a 500- pound load applied anywhere along their length by a rigid plate 1 foot in length with no visible damage to the supporting structure. A damaged portion of the supporting structure shall be replaceable without requiring removal or replacement of the entire structure.

6.9 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 RDUAA'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.

6.10 Corrosion-Resistance Requirements for Exposed and Interior Surfaces of Tubing Below Lower Window Level

All exposed surfaces and the interior surfaces of tubing and other enclosed members below lower window line shall be corrosion resistant through application of a corrosion protection system.

6.11 Towing

Each towing device shall withstand, without permanent deformation, tension loads up to 1.2 times the curb weight of the bus within 20 degrees 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.

A plug connector permanently mounted at the front of the bus shall provide for bus tail lamp, marker, stop and turn signal lamp operation as controlled from the towing vehicle. The connector shall include a spring-loaded dust- and water-resistant cap.

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.

6.12 Lifted (Supported) Front Axle and Flat Towing Capability (additional requirement)

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. Two rear recovery devices/tie downs shall permit lifting and towing of the bus for a short distance, such as in cases of an emergency, to allow access to provisions for front towing of bus. The method of attaching the tow bar or adapter shall require the specific approval of the RDUAA. Any tow bar or adapter exceeding 50 lbs. should have means to maneuver or allow for ease of use and application. Each towing device shall accommodate a crane hook with at least a 1 in. throat.

6.13 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.

6.14 Yellow Pads

Jacking pads/points shall be painted safety yellow.

6.15 Hoisting

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.

7 FLOOR

7.1 Design

The floor shall be Altro floor or approved equal with 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 area of the entrance and exit doors shall have a lateral slope not exceeding 2 degrees to allow for drainage.

7.2 Strength

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-inch radius, without permanent visible deformation.

7.3 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.

7.4 Pressure-Preserved Plywood Panel

If plywood is utilized, plywood shall be certified at the time of manufacturing by an industry-approved third-party inspection RDUAA 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 RDUAA. Pressure-preservative treated plywood shall have a moisture content at or below 15 percent.

7.5 Platforms

7.10 Drivers 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.

7.10 Driver’s Platform

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 degrees. A warning decal or sign shall be provided to alert the driver to the change in floor level.

7.10 Rear Step Area

If the vehicle is of a bi-level floor design, 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.

8 WHEEL HOUSING

8.1 Design and Construction

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.

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 floor shall be equipped with stainless steel trim.

Wheel housings, as installed and trimmed, shall withstand impacts of a 2 in. steel ball with at least 200 ft lbs. of energy without penetration.

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.

9 CHASSIS

9.1 Suspension - General Requirements

The front, rear 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.

9.2 Alignment

All axles should be properly aligned so the vehicle tracks accurately within the size and geometry of the vehicle.

9.3 Springs and Shock Absorbers - Suspension Travel

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.

9.4 Damping

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.

9.5 Lubrication - 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.

9.6 Kneeling

A kneeling system shall lower the entrance(s) of the bus a minimum of 2.5 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 3 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.

10 WHEELS AND TIRES

10.1 Wheels

All wheels shall be interchangeable and shall be removable without a puller. Wheels shall be durable, bright polished, compatible with tires in size and load-carrying capacity. Front wheels and tires shall be balanced as an assembly per SAE J1986. Rims shall be aluminum and shall resist rim flange wear and have a low maintenance surface finish. Valves stem extension shall include chrome lug nut covers for all lug nuts. A spare tire and wheel assembly shall also be included per bus.

10.2 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.

10.3 Steering

Electrically assisted steering shall be provided to reduce steering effort. A remote mounted fluid sampling port shall be provided for the hydraulic system.

10.4 Steering Axle Transit Coach - Solid Beam or Independent suspension type Axle and Grease-Type Front Bearings and Seals

The front axle shall be solid beam or independent suspension type, 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.

All friction points on the front axle shall be equipped with replaceable bushings or inserts and lubrication fittings easily accessible from a pit or hoist.

10.5 Steering Wheel - Turning Effort

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 degrees 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.

10.6 Steering Wheel, General

The steering wheel diameter shall be approximately 18-20 in.; the rim diameter shall be $\frac{7}{8}$ in. to $1\frac{1}{4}$ 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.

10.7 Steering Column Tilt

The steering column shall have full tilt capability with an adjustment range of no less than 40

degrees from the vertical and easily adjustable by the driver.

10.8 Steering Wheel Telescopic Adjustment

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 5

Steering Wheel Height¹ 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 degrees	29 in.	0 degrees	34 in
15 degrees	26.2 in	15 degrees	31.2 in
25 degrees	24.6 in	25 degrees	29.6 in
35 degrees	22.5 in	35 degrees	27.5 in

1. Measured from bottom portion closest to driver.

10.9 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 and/or reduction 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.

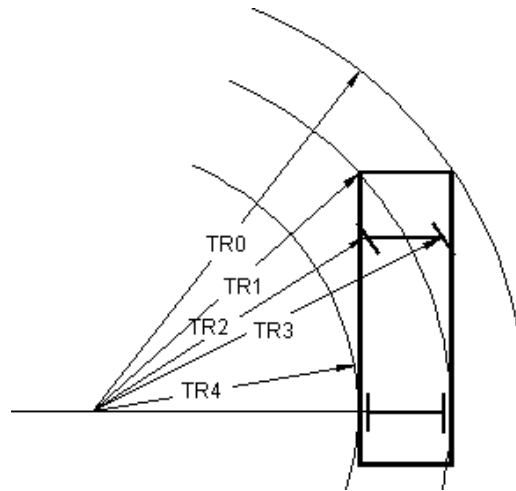
NOTE: The retardation duty cycle can be more aggressive than propulsion. The drive shaft shall be guarded to prevent hitting any critical systems, including brake lines, coach floor or the ground, in the event of a tube or universal joint failure.

10.10Turning Radius

Bus Length (approximate)	Maximum Turning Radius (see Figure 4)
40 ft	45 ft (TR0)

FIGURE 4

Turning Radius (copy for APTA chart TS36)



11 BRAKES

11.1 Brakes

Brakes shall be all wheel disc brakes.

11.2 Service Brake

Brakes shall be self-adjusting. Brake wear indicators (visible brake sensors) shall be provided on exposed push rods if applicable.

Visible stroke indicators may be combined with electronic brake monitoring system and vehicle brake warning system to notify driver and maintenance of unsafe brake conditions.

11.3 Actuation - Air-Actuated Brakes

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 70 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 between all wheels in such a ratio as to ensure equal friction material wear rate at all wheel locations. Manufacturer shall demonstrate compliance by providing a copy of a thermo dynamic brake balance test upon request.

11.4 Automatic Traction Control

Microprocessor controlled automatic traction control (ATC) shall be provided.

11.5 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 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.

11.6 Hubs

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.

11.7 Parking/Emergency Brake

11.10 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.

11.10 Hydraulic Brakes

If the bus is equipped with hydraulic brakes, then the braking system must comply with FMVSS 105, including both service and parking brake features.

12 INTERLOCKS

12.1 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 and unsecured condition, unless the door master switch has been actuated to

intentionally release the interlocks.

12.2 Accelerator Interlock Whenever Front Doors Are Open

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 whenever front doors are open.

12.3 Pneumatic System - General

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 5 psi over a 15-minute period as indicated on the dash gauge.

Provision shall be made to apply shop air to the bus air systems. A quick disconnect fitting with check valve 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 fitting against dirt and moisture when not in use. Air for the compressor shall be filtered. The air system shall be protected per FMVSS 121.

12.4 Air Compressor

The electrically driven air compressor shall be sized to charge the air system from 40psi to the governor cutoff pressure in less than 4 minutes while not exceeding the fast idle speed setting of the engine. The electrically driven air compressor shall be available as an option for diesel and hybrid buses if available. The air compressor shall have external fresh air intake.

12.5 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 oF. 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:

- **Green:** Indicates primary brakes and supply.
- **Red:** Indicates secondary brakes.
- **Brown:** Indicates parking brake
- **Yellow:** Indicates compressor governor signal.
- **Black:** Indicates accessories.

Line supports shall prevent movement, flexing, tension, strain and vibration. Copper lines shall be supported to prevent the lines from touching one another or any component of the bus. To the extent practicable and before installation, the lines shall be pre-bent on a fixture that prevents tube flattening or excessive local strain. Copper lines shall be bent only once at any point, including pre-bending and installation. Rigid lines shall be supported at no more than 5-ft intervals. Nylon lines may be grouped and shall be supported at 30 in. intervals or less.

The compressor discharge line between powerplant and body-mounted equipment shall be flexible

convoluted copper or stainless steel line or may be flexible Teflon hose with a braided stainless-steel jacket. Other lines necessary to maintain system reliability shall be flexible Teflon hose with a braided stainless-steel jacket. End fittings shall be standard SAE or JIC brass or steel, flanged, swivel-type fittings. Flexible hoses shall be as short as practicable and individually supported. They shall not touch one another or any part of the bus except for the supporting grommets. Flexible lines shall be supported at 2-ft intervals or less.

Air lines shall be clean before installation and shall be installed to minimize air leaks. All air lines shall be routed to prevent water traps to the extent possible. Grommets or insulated clamps shall protect the air lines at all points where they pass through understructure components.

12.6 Air Reservoirs

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.

12.7 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.

The air system shall be equipped with an air dryer located before the no. 1 air tank and as far from the compressor as possible to allow air to cool prior to entering the air dryer.

13 ELECTRICAL, ELECTRONIC AND DATA COMMUNICATION SYSTEMS

13.1 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.

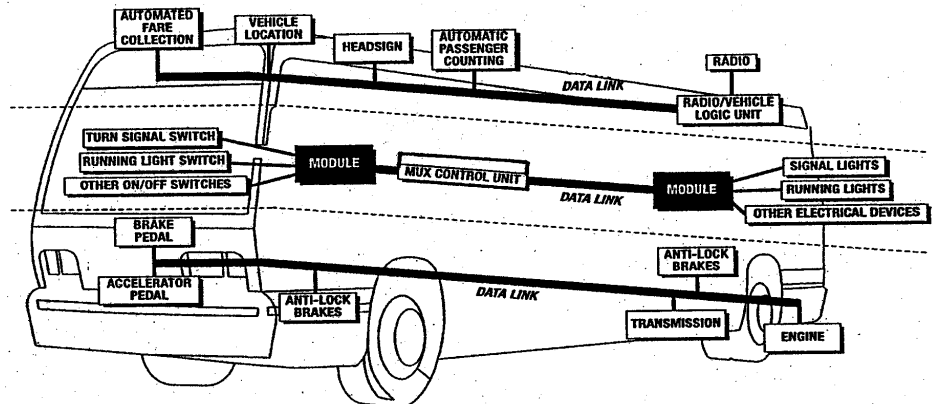
Data communications systems are divided into three levels to reflect the use of multiple data networks:

- **Drivetrain level:** Components related to the drivetrain including the propulsion system components (transmission, electric energy storage, motors, inverters/converters), and anti-lock braking system (ABS), which may include traction control.
- **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, 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; and gateway devices.

FIGURE 5

Data Communications Systems Levels

Information level Multiplex
level Drivetrain level



13.2 Modular Design

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.

Powerplant 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.

13.3 Environmental and Mounting Requirements

The electrical system and its electronic components shall be capable of operating in the area of the vehicle in which they will be installed, as recommended in SAE J1455.

Electrical and electronic equipment shall not be located 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 SAE J1113 and UNECE Council Directive 95/54 (R 10).

RDUAA shall follow recommendations from bus manufacturers and subsystem Suppliers regarding methods to prevent damage from voltage spikes generated from welding, jump starts, shorts, etc.

All electrical/electronic hardware mounted in the interior of the vehicle shall be inaccessible 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.

The voltage regulator shall be a solid-state type coordinated with and adjusted for the alternator and batteries used. The regulator shall be remotely mounted and be easily accessible for maintenance purposes. The stainless-steel battery tray and slide shall be protected against the accumulation of debris and road spray. The battery tray shall slide out, on stainless steel rollers, with less than 50 lbs. of effort.

The battery tray shall have drain holes. Electric buses which shall be supplied with at minimum two group AGM Group 31 batteries each with a minimum of 1150 cold cranking amps. Protective interlocks or programming shall be provided so the starter will not operate if the engine is running, or the transmission is not in neutral. Electrical cables and wiring shall be adequate for all anticipated loads. The main wiring harness shall, to the maximum extent practical, be installed inside the bus body passenger compartment and, where that is not practical, shall be secured in frame rail raceways. The Contractor shall route and secure all wiring so that it does not rub anywhere. Routing of step well light wiring shall be such as to avoid rubbing door posts, etc. When wires or looms pass through metal, the wires shall be protected by a rubber grommet. Each electrical panel i.e., front and exit door panels, battery compartment, and front electrical panel shall provide an explanation of the respective electrical circuits and components contained within and shall be furnished in a silk-screened or water/oil proof diagram on the inside of the door panel.

Electrical equipment, junction boxes and connectors shall not be placed where they are subjected to excessive heat, oil, grease, or road spray. All multiple terminal connectors shall be military (cannon plug) type, fully sealed and protected with a potting compound to prevent outside dirt and corrosives from entering the wiring, connectors, or plugs.

All main power supply terminals shall be covered with electric post rubber cover. All electrical end plugs shall be covered. The wiring harnesses shall incorporate 10% spare wires. Wiring shall be routed away from high-heat sources or shielded and/or insulated from temperatures exceeding the wiring and connector operating requirements. All cables and harnesses shall be secured to prevent chafing or shorting against each other or any part of the vehicle. Clamps shall be rubber or PVC clad aircraft type. Grommets or other protective material shall be installed at points where wiring penetrates metal structures.

All wiring shall start and end at a junction block or component. All inline and bulkhead connectors are to be of the weather pack sealed type.

Multi-pin connectors shall be protected internally from corrosion with silicone dielectric grease, if required. All circuits except emergency shut-off and speedometer circuits must be protected by reset circuit breakers that clearly indicate their position when tripped.

Each breaker must be labeled. Circuit breakers must have plastic dust caps. Provide constant power for powering systems, such as but not limited to the fire suppression, radio, and DC-DC converter that require constant power when battery cutoff switch is off.

The vehicle shall be equipped with a 12VDC and 24VDC quick disconnect switch. The battery compartment door shall conveniently accommodate operation of the 12VDC and 24VDC quick disconnect switch.

The battery switch 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.

Remote (divorce) mount alternator voltage regulator with jumper cable and 5-amp fuse shall be provided. This requirement does not apply to battery electric buses.

The windshield wiper and headlamps electric circuit shall be protected by modified auto- reset circuit breakers sized to the requirement of the load or run through the multiplex - programmable logic controller (PLC), and are fuse protected.

Rubber Covers shall be provided for all the Electric Posts.

Major junction panels shall be readily accessible for maintenance, not located behind or alongside seat or other fixed/semi-fixed obstructions. Access panels and junction box covers shall have seals which will preclude entry of rain, wash water, road debris, etc. All wiring and junction panel terminals shall be numbered, and color coded for easy identification. A diagram showing the coding as the bus was built shall be furnished.

The Contractor shall supply at least two spare circuits in the main harness between the front and rear of the bus. The main harness from the engine compartment shall be equipped with multiple circuit cannon type connectors.

13.4 Hardware Mounting

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 inaccessible 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.

14 GENERAL ELECTRICAL REQUIREMENTS BATTERIES

14.1 Low-Voltage Batteries (24V)

The system shall supply a nominal 12V and/or 24V of direct current (DC). Batteries, except those used for auxiliary power, shall be easily accessible for inspection and service from the outside of the vehicle only.

Two (2) Group 31 Series deep cycling maintenance free battery units shall be provided. Each battery shall have a minimum of 700 cold cranking amps. Each battery shall have a purchase date no more than 120 days from date of release for shipment to the customer.

14.2 Battery Cables

The battery terminal ends and cables 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 possible, be flexible and 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 SGT, SGX or GXL and SAE Recommended Practice J541.

2100 strand 4/0 cable or greater recommended.

14.3 Jump-Start Connector

A jump-start connector, red for 24V and blue for 12V, whichever is applicable, shall be provided at the rear engine bay and shall be equipped with dust cap and adequately protected from moisture, dirt and debris.

14.4 Battery Compartment

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 door shall 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 vehicle shall be equipped with a 12VDC and 24VDC quick disconnect switch(es). The battery compartment door shall conveniently accommodate operation of the 12VDC 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 than 3.5 × 5 in. (8.89 × 12.7 cm).

The battery hold-down bracket shall be constructed of a non-metallic 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 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 and filled. A locking device shall retain the battery tray to the stowed position.

If not located in the motor compartment, the same fire-resistant properties must apply to the battery compartment. No sparking devices should be located within the battery box.

14.5 Auxiliary Electronic Power Supply

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.

14.6 Master Battery Switch

A single master switch shall be provided near the battery compartment for the disconnecting of all battery positives (12V and 24V), except for safety devices such as the fire suppression system and other systems as specified. The location of the master battery switch shall be clearly identified on the exterior access panel, be accessible in less than 10 seconds for deactivation and prevent corrosion from fumes and battery acid when the batteries are washed off or are in normal service. The access door shall be labeled "Battery Emergency Shut-Off Switch." A 12V power supply with cover shall be provided in the driver's area.

Turning the master switch off with the powerplant operating 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.

14.7 Single Switch

The batteries shall be equipped with a single switch for disconnecting both 12V and 24V power.

14.8 Low-Voltage Generation and Distribution

A low voltage generating system shall be a solid-state DC/DC converter for Battery Electric buses. 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.

Continuous power to the DC-DC converter must be supplied with the master run switch in "off"

position.

14.9 Circuit Protection

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. The circuit breakers or 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 Contractor 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 RDUAA mechanic with visible indication of open circuits. The RDUAA shall consider the application of automatic reset circuit breakers on a case-by-case basis. The Contractor shall show all in-line fuses in the final harness drawings. All manually resettable circuit breakers 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.

14.10 Grounds

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 shall be grounded to the frame in multiple locations, evenly distributed throughout the vehicle to eliminate ground loops. No more than four ground ring/spade terminal connections shall be made per ground stud. Electronic equipment requiring an isolated ground to the battery (i.e., electronic ground) shall not be grounded through the chassis.

14.11 Low Voltage/Low Current Wiring and Terminals

All power and ground wiring shall conform to specification requirements of SAE Recommended Practice J1127, J1128 and J1292. Double insulation shall be maintained as close to the junction box, electrical compartment or terminals as possible. The requirement for double insulation shall 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 present in 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 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 shall include 10 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 either use 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 or 1/16 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 7 AWG 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-heat sources or shielded and/or insulated from temperatures exceeding the wiring and connector 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.

14.12 Electrical Components

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 than 40,000 hours. All electric motors shall be easily accessible for servicing.

14.13 Electrical Compartments

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 serviceable from the driver's seat, vestibule or from the outside if applicable. The interior electrical compartments shall have twelve (12) 24V expansion power and ground studs.

14.14 General Electronic Requirements

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 also 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.

14.15 Wiring and Terminals

Kinking, grounding at multiple points, stretching and reducing the bend radius below the manufacturer's recommended minimum shall not be permitted.

14.16 Discrete I/O (Inputs/Outputs)

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.

14.17 Shielding

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 at one end of the cable. However certain standards or special 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.

14.18 Communications

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.

14.19 Radio Frequency (RF)

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 have a loss that will attribute 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 of cables.

14.20 Audio

Cabling used for microphone level and line level signals shall be 22 AWG minimum with shielded twisted pair. Cabling used for amplifier level signals shall be 18 AWG minimum.

15 MULTIPLEXING

15.1 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 through the addition of new modules and/or the utilization of 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. 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.

15.2 System Configuration

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.

15.3 I/O Signals

The input/output for the multiplex system may contain three types of electrical signals: discrete, analog or 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.

16 DATA COMMUNICATIONS

16.1 General

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 RDUA 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 levels 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.

16.2 Drivetrain Level

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 engine, transmission and hybrid units or electric energy storage, motors, inverters/converters 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.

16.3 Diagnostics, Fault Detection and Data Access

Drivetrain 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.

16.4 Programmability (Software)

The drivetrain level components shall be programmable by the RDUA with limitations as specified

by the sub-system Supplier.

17 MULTIPLEX LEVEL

17.1 Data Access

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 RDUAA. The communication port(s) shall be located as specified by the RDUAA.

17.2 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 onboard 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.

17.3 Programmability (Software)

The multiplex system shall have security provisions to protect its software from unwanted changes. This shall be achieved through any or all 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 of 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 displays the most recent revision number
- a method of determining which version of the software is currently in use in the multiplex system

17.4 Electronic Noise Control

Electrical and electronic sub-systems 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 sub-systems 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.

18 DRIVER PROVISIONS, CONTROLS AND INSTRUMENTATION

18.1 Driver's Area Controls - General

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."

18.2 Glare

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.

18.3 Visors/Sunshades Front and Side Sunshade/Visor

An adjustable roller type sunscreen shall be provided over the driver's windshield and/or the driver's side window. The sunscreen shall be capable of being lowered to the midpoint of the driver's window. When deployed, the screen shall be secure, stable and shall not rattle, sway or intrude into the driver's field of view due to the motion of the coach or as a result of air movement. Once lowered, the screen shall remain in the lowered position until returned to the stowed position by the driver. Sunscreen shall be shaped to minimize light leakage between the visor and windshield pillars to the extent possible.

18.4 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 for 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. 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.

18.5 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 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 3 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, as appropriate to the bus's fuel type bid.

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	
Vehicle Start	Momentary switch	Side console	Activates High Voltage System	
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	
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	
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. Ext alarm and Amber light
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
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Rear door override	Two-position switch in approved location	Side console, forward	Allows driver to override activation of rear door passenger tape switches	
Hazard flashers	Two-position switch	Side console or Dash right wing	Activates emergency flashers	Two green lights
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	Detented 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 console or dash center	Permits driver to push and hold to release brakes	
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Master door/ interlock	Multi-pole toggle, detented	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 drive that interlocks have been deactivated	Red light
Alarm acknowledge	Push button momentary	Approved location	Permits driver to acknowledge alarm condition	
Indicator/ alarm test button	Momentary switch or programming1	Dash center panel	Permits driver to activate test of sentry, indicators and audible alarms	All visuals and audibles
Auxiliary power	110-volt power receptacle	Approved location		
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
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
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Low system air pressure	Sensing low primary and secondary air tank pressure	Dash center	Indication of low air system pressure	Buzzer and red light
ABS indicator	Detects system status	Dash center	Displays system failure	Amber light
HVAC indicator	Detects system status	Dash center	Displays system failure	Amber or red light
Charging System Indicator (12/24V)	Detect charging system status	Dash Center	Detects no charge condition and detects high, low, imbalance and no charge condition	Red or yellow light based on condition
High Voltage battery system state of charge	Analog gauge and digital display	Dash Center	Indication of high voltage battery system state of charge	Analog dial and digital bar
Active charge, regeneration, and power draw	Detects Status	Dash center	Indication of electric regeneration, charging, and power draw	Analog dial and digital bar

1. Indicate area by drawing. Break up switches control from indicator lights.

18.6 Driver Foot Controls

Accelerator and brake pedals shall be designed for ankle motion. Foot surfaces of the pedals shall be faced with wear-resistant, nonskid, replaceable material.

18.7 Pedal Angle

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 50 degrees at the point of initiation of contact and extend downward to an angle of 10 to 18 degrees 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.

18.8 Pedal Dimensions and Position

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.

1 to 2 in. Between Brake and Accelerator Pedals

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.

Brake and Accelerator Pedals

18.9 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 degrees and a maximum of 37 degrees. It shall be located no closer to the seat front than the heel point of the accelerator pedal.

Turn Signal Controls

Turn signal controls shall be floor-mounted, foot-controlled, water-resistant, heavy-duty, momentary contact switches.

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 location.

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.

Other Floor-Mounted Controls

The following may be floor mounted, momentary or latching, as identified by the RDUAA at the

preproduction meeting.

- hazard
- silent alarm

18.10 Driver's Amenities

Coat Hook

A suitable hanger shall be installed in a convenience, approved location for the driver coat. (Coat hook and loop is optional)

Drink Holder

A device shall be provided to securely hold the driver's drink container, which may vary widely in diameter. It must be mounted within easy reach of the driver and must have sufficient vertical clearance for easy removal of the container. When the container is in the device, the driver's view of the road must not be obstructed, and leakage from the container must not fall on any switches, gauges or controls.

18.11 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. Electric wipers will be used.

Intermittent Wiper with Variable Control

A variable-speed feature shall be provided to allow adjustment of wiper speed for each side of the windshield between approximately five (5) and twenty-five (25) cycles per minute.

Non-Synchronized Wipers

For non-synchronized wipers, separate controls for each side shall be supplied. A single control switch for non-synchronized wipers is optional.

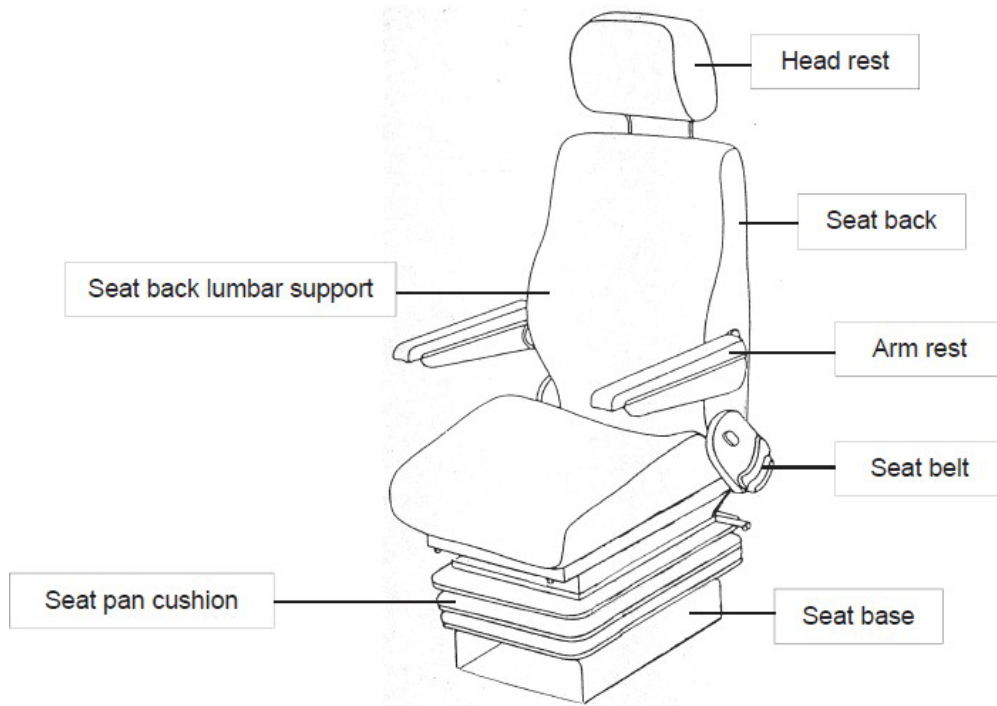
Windshield Washers

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 2.5-gallon reservoir, located for easy refilling from outside of the bus. Reservoir pumps, lines and fittings shall be corrosion-resistant and must include a means to determine fluid level.

19 DRIVER'S SEAT

FIGURE 6

Driver's Seat



19.1 Dimensions

The driver's seat shall be Recaro, comfortable and adjustable so that people ranging in size from a 95th-percentile male to a 5th-percentile female may operate the bus.

19.2 Seat Pan Cushion Length

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.

19.3 Seat Pan Cushion Height 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 of 14 in., with a minimum 6 in. vertical range of adjustment.

19.4 Seat Pan Cushion Slope

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 degrees). The seat pan shall adjust in its slope from no less than plus 12 degrees (rearward "bucket seat" incline), to no less than minus 5 degrees (forward slope).

19.5 Seat Base Fore/Aft Adjustment

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.

19.6 Seat Pan Cushion Width

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.

19.7 Seat Suspension

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 snubbers shall be provided to prevent metal-to-metal contact.

19.8 Seat Back - 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.

19.9 Height

Standard height seat back

19.10 Headrest

Adjustable headrest

19.11 Seat Back Lumbar Support

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.

19.12 Seat Back Angle Adjustment

The seat back angle shall be measured relative to a level seat pan, where 90 degrees is the upright position and 90 degrees-plus represents the amount of recline.

The seat back shall adjust in angle from a minimum of no more than 90 degrees (upright) to at least 105 degrees (reclined), with infinite adjustment in between.

19.13 Seat Belt

The belt assembly should be an auto-locking retractor (ALR) lap seat belt with contrasting color. 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 seat belt assemblies as installed in the bus shall withstand static horizontal forces as required in FMVSS 207 and 210. Seatbelt webbing shall be black in color.

19.14 Seat Control Locations

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.

19.15 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. Seat material should be black vinyl.

19.16 Cushion Materials

All materials used on the seat assembly, passenger and driver's seat shall meet the flammability requirements of the FMVSS #302. Proof of Compliance must be submitted with proposals.

19.17 Pedestal

Powder-coated steel.

20 MIRRORS

20.1 Exterior Mirrors

All mirrors must conform to the current requirements of the state in which the bus is operating in. Exterior mirrors shall be remote controlled motorized with stainless steel arms that return to original position when moved.

Mirrors shall be powder coated and heated.

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.

A three-inch convex mirror shall be mounted in the lower right corner of the right-side flat mirror. Mirrors must fold out of way of automatic washer. Metal mirror parts to be chrome plated or stainless steel. The backs of inside mirrors shall be painted flat black where necessary to comply with FMVSS.

20.2 Interior Mirrors

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, anywhere in the aisle, and in the rear seats.

A (min) 8 1/2" x 16" rear view mirror shall be provided on the front sign header. A 6" diameter adjustable convex mirror over and forward of the front door shall be provided. An adjustable convex mirror shall be provided over/above and to the rear of the rear exit door. Mirror must be on solid mount to eliminate vibration. (Convex mirrors described above are to be used in conjunction with each other.) The glass in this mirror shall be replaceable.

21 WINDOWS

21.1 General

A minimum of 10,000 sq in. of window area, including operator and door windows, shall be required on each side of the standard 40-ft length configured bus.

21.2 Windshield

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 14 degrees, measured above the horizontal and excluding any shaded band. The vertically downward view shall permit detection of an object 3½ ft high no more than 2 ft in front of the bus. The horizontal view shall be a minimum of 90 degrees above the line of sight. Any binocular obscuration due to a center divider may be ignored when determining the 90-degree requirement, provided that the divider does not exceed a 3-degree angle in the operator's field of view. Windshield pillars shall not exceed 10 degrees 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.

21.3 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 1A and the Recommended Practices defined in SAE J673.

21.4 Driver's Side Window

The driver's side window shall be the sliding type, requiring only the rear half of 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.

The driver's side window glazing material shall have a ¼ in. nominal thickness laminated safety glass conforming with the requirements of ANSI Z26.1-1996 Test Grouping 2 and the Recommended Practices defined in SAE J673.

The design shall prevent sections from freezing closed in the winter. Light transmittance shall be 75 percent on the glass area below 53 in. from the operator platform floor. On the top fixed over bottom slider configuration, the top fixed area above 53 in. may have a maximum 5 percent light transmittance.

21.5 Side Windows

The side windows shall be fixed framed transom. Except for the upper portion of first right-hand and /or left-hand window where the side destination sign shall be located, all other shall be glazed with tinted, flat panel, uniform sized, transit application approved laminated safety glass (ANSI 25.1). Glazing in the sash shall be easily replaced without removing the sash from the bus.

All windows shall be of 7/32" 50% gray tinted safety glass and frame windows will have black (dark) polyester powder coat aluminum frames inside and out. Glass shall be mounted in removable rubber retaining strips/seals.

Flush mounted windows will also be accepted as an approved equal.

Frame shall be assembled with anti-corrosion coated screws and fasteners to enable changing glass. A positive lock type emergency latch meeting the FMVSS-217 shall be furnished on each window frame.

Emergency egress window shall have a permanent decal describing emergency window operation procedures. Side windows shall be designed to prevent the entrance of air and water when windows are closed. The window seal rubber must be installed so that passengers cannot remove it and rubber shall be of such quality to resist adhering to other sash sill.

Color of glazing material in all side windows, except for the side destination sign window, shall be of Gray 50% or equivalent. The side destination sign windows shall be clear.

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, and the luminous transmittance shall be no less than 16 percent, as measured by ASTM D-1003.

Window at the destination/location sign shall not be tinted in the vicinity of the sign.

22 HEATING, VENTILATING AND AIR CONDITIONING

22.1 Capacity and Performance

Interior climate control will be automated controls capable of maintaining the interior of the bus at a level suitable for all climate conditions found in the continental United States. The heating, ventilating, and cooling systems shall maintain an average passenger compartment temperature between 65- and 80-degrees F with a relative humidity of 50 percent or less. The system shall maintain these conditions in ambient temperatures of -10 to 110 degrees F with ambient humidities of 5 to 85 percent while the bus is running on the design operating profile with a full-seated load of passengers with door openings for 30 seconds or more every 3 minutes. In ambient temperatures of 10 to -10 degrees F, the average temperature shall not fall below 65 degrees F while the bus is running on design operating profile with no passengers. The temperature measured from a height of 6 inches below the ceiling shall be within +/- 5 degrees F of the average temperature at the top surface of the seat cushions. Temperatures measured more than 3 inches above the floor shall be within +/- 5 degrees F of the average temperature at the top surface of the seat cushions. The interior temperature, from front to rear of the bus, shall not vary more than a +/- 5 degrees F from the average. System shall be programmable by each technician.

The cooling mode shall be capable of reducing the passenger compartment temperature from 100 degrees F to 80 degrees F in less than 30 minutes after the engine start up under the following conditions. The bus shall be parked in direct sunlight with ambient temperature at 100 degrees F and humidity less than 85 percent.

There shall be no passengers onboard and the doors shall be closed. The cooling mode may operate independent of the propulsion system and outside air may be cut off during the cool down period.

Manually controlled shutoff valves in the refrigerant lines shall allow isolation of the compressor and receiver for service. To the extent practicable, self-sealing couplings shall be used to isolate the refrigerant lines during removal of major components such as refrigerant compressor or condenser. The condenser shall be located to efficiently transfer heat to the atmosphere and shall not ingest air warmed by the bus mechanical equivalent above the ambient temperature or 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.

The lower A/C compressor and upper condenser/evaporator package shall be of the same manufacturer. Freon shall be 134A.

The door opening average is approximately every 2 minutes; the A/C system must be capable of handling the heat load by maintaining a temperature of 20 degrees less than ambient and humidity level less than 40% at any point or time with 40 plus passengers at 100 degrees in direct sun light.

For Electric Buses provide Electric A/C rear mounted with intelligent controls and CAN Based diagnostics or equivalent. Provide two sets of software, including diagnostic cables, with the first production bus in each order group.

The HVAC system excluding the operator's heater/defroster shall be centrally controlled with an advanced electronic/diagnostic control system with provisions for extracting/reading data.

Driver's control shall be a standard four-key keypad. Settings will not be lost when the master switch is turned off.

Manufacturers shall provide 2 sets of software, including diagnostic cables, with the first production bus in each order group. Provide an additional data port in or near the driver's area. The HVAC system excluding the operator's heater/defroster shall be centrally controlled with an advanced electronic/diagnostic control system with provisions for extracting/reading data. Settings will not be lost when the master switch is turned off.

There shall be manual shut off valves to isolate the drier, receiver, and compressor.

The interior heating system shall maintain the interior of the bus at a level suitable for all climate conditions found throughout the state of Washington the heating, ventilation, and cooling system shall maintain an average passenger compartment temperature between 65 degrees and 80 degrees Fahrenheit with a relative humidity of 50 percent or less.

Manually controlled corrosion resistant shut-off valves in the refrigerant lines shall allow isolation of the compressor and receiver for service. To the extent practicable, self-sealing couplings shall be used to break and seal the refrigerant lines during removal of major components such as the refrigerant compressor or condenser. Suction and discharge lines shall be positioned and secured not to contact each other or any part of the body or frame of the bus.

The air conditioning system shall be a rear mount unit and utilize Refrigerant R134a .

System capacity shall have a minimum of 45,000 BTUs with 1,800 CFM at 0.5" water static in duct however overly performance must meet or exceed design requirements in this specification. This may require a system capacity greater than this stated minimum so contractor shall size the unit appropriately.

The condenser fans and evaporator blowers shall have brushless motors with 3-year warranty.

Suction and discharge ports shall be easily accessible through the main engine compartment door.

Manual shutoff valves in the refrigerant lines shall allow isolation of the compressor and dryer unit for service.

A safety lanyard on overhead HVAC filter/return air grilles shall be provided.

The Air Conditioning unit installation shall be certified in writing by the vehicle manufacturer as being designed, manufactured, and installed in accordance with the manufacturer's requirements before acceptance and delivery of vehicles.

22.2 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.

22.3 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.

22.4 Manually Adjustable Temperature Control Set Point

The climate control system shall have the provision to allow the driver to adjust the temperature control set-point at a minimum of between 68 and 72 °F. From then on, all interior climate control system requirements shall be attained automatically, unless re-adjusted by driver.

The driver shall have full control over the defroster and driver's heater. The driver shall be able to adjust the temperature in the driver's area through air distribution and fans. The interior climate control system shall switch automatically to the ventilating mode if the refrigerant compressor or condenser fan fails.

Interior temperature distribution shall be uniform to the extent practicable to prevent hot and/or cold spots. After stabilization with doors closed, the temperatures between any two points in the passenger compartment in the same vertical plane, and 6 to 72 in. above the floor, shall not vary by more than 5 °F with doors closed. The interior temperatures, measured at the same height above the floor, shall not vary more than ± 5 °F from the front to the rear from the average temperature determined in accordance with APTA's "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System." Variations of greater than ± 5 °F will be allowed for limited, localized areas provided the majority of the measured temperatures fall within the specified requirement.

22.5 Air Flow - 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 several 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.

22.6 Driver's Area

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.

22.7 Controls for the Climate Control System (CCS)

- 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 RDUAA, 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, 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 RDUAA project manager.

22.8 Driver's Compartment Requirements

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 the 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 the driver's area. 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 if applicable.

The bus interior climate control system shall deliver at least 100 cubic feet per minute of air to the driver's area when operating in the ventilation, heating, and cooling modes without use of the driver's booster fan. The climate control system blower motors will operate at the set speed during all operating modes. All return air ducts will be protected by guards constructed of a sturdy mesh which will resist damage.

Adjustable nozzles shall permit variable distribution or shut down of all air flow. The defroster and/or interior climate control system shall maintain visibility through the driver's side window. A booster fan with driver control shall be provided in the ductwork at the driver's area, forward of the operator's position, for increased air flow to the operator.

The windshield defroster unit shall meet or exceed all 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.

22.9 Air Filtration

Air shall be filtered before discharge 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 arrestance, and a minimum dust holding capacity of 120 g per 1000 cfm cell. Air filters shall be easily removable for service.

22.10 Cleanable Filters

Air filters shall be cleanable.

22.11 Roof Ventilators - One Roof Ventilators

A minimum of one (1) roof ventilators shall be provided in the roof of the bus.

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.

22.12 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.

High and low refrigerant pressure analog gauges to be in the return air area.

22.13 Entrance/Exit Area Heating

No requirements for entrance/exit area heating.

22.14 Floor-Level Heating

No requirements for floor-level heating.

23 EXTERIOR PANELS, FINISHES AND EXTERIOR LIGHTING

23.1 Design

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 any body 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.

23.2 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.

23.3 Pedestrian Safety

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.

23.4 Repair and Replacement - 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.

23.5 Rain Gutters

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.

23.6 License Plate Provisions

Provisions shall be made to mount standard-size U.S. 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.

23.7 Fender Skirts

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.

23.8 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 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. An approved method of grounding static electricity shall be provided on each bus such as a conductive nylon grounding strap.

23.9 Service Compartments and Access Doors - Access Doors

Conventional or pantograph hinged doors shall be used for the drive system compartment and for all auxiliary equipment compartments including doors for checking the quantity and adding to the drive system (motor and controller) coolant, power steering fluid, windshield washer fluid 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.

23.10 Access Door Latch/Locks

Battery disconnect switch, fuel and air tank drain valve doors will be OEM standard doors and latch.

23.11 Bumpers - Location

Bumpers shall provide impact protection for the front and rear of the bus with the top of the bumper being 27 in., \pm 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.

23.12 Front Bumper

No part of the bus, including the bumper, shall be damaged as a result of a 5-mph 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 4000 lbs. parallel to the longitudinal centerline of the bus. It shall protect the bus from damage as a result of 5.5 mph impacts into the corners at a 30-degree 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.

23.13 Rear Bumper

No part of the bus, including the bumper, shall be damaged as a result of a 2-mph 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 30-degree angle 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 inches.

23.14 Bumper Material

Bumper material shall be corrosion-resistant and withstand repeated impacts of the specified loads without sustaining damage. Visible surfaces shall be black. These bumper qualities shall be sustained throughout the service life of the bus.

24 FINISH AND COLOR

24.1 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 assure 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 completely 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.

Composite bus body may use gel coat as applicable.

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 patch 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. Bus exteriors shall be painted and numbered to include numbers on the roof to the general design to be provided with each order. Minor variations to this color scheme may be required in order to accommodate the specific styling of the Contractor's buses. Within 30 days of execution of contract, the Contractor shall supply to RDUAA the detailed drawings of the front, rear, both sides, and roof of the bus that will be supplied. Within 60 days of execution of the contract, the RDUAA will return these drawings to the Contractor with details of the color schemes included.

The bus exterior shall be primed as recommended by the manufacturer of the final finish and shall be finished with the color scheme specified in the order. Proposers should provide listings of available colors.

There shall be no bare or exposed metal surfaces showing on the exterior of the bus, exclusive of ornamentation and accessories. The display of manufacturer's name or insignia on the exterior of the bus will be as specified in the individual order.

24.2 Decals, Numbering and Signing

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 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, Subpart B, 38.27.

Exterior decal/paint scheme shall match the existing RDUAA bus fleet. See attached diagram showing existing scheme.

24.3 Passenger Information

ADA priority seating signs as required and defined by 49 CFR, Part 38.27 shall be provided to identify the seats

designated for passengers with disabilities.

Requirements for a public information system in accordance with 49 CFR, Part 38.35 shall be provided.

Interior decals such as but not limited to the following, No Smoking, Exit door, Emergency Exit, Watch Your Step, Wheelchair instructions and "Reserved for Wheelchairs," etc. shall be provided. All decals shall be in English and Spanish. Decals containing identification of windows, hatches, etc., shall also be provided. All decals shall conform to North Carolina state law.

24.4 Exterior Lighting

Exterior lighting and reflectors shall comply, as applicable, with Part 393, Subpart B of the FMCSA and FMVSS 108.

All exterior lights shall be designed to prevent entry and accumulation of moisture or dust. Commercially available LED-type lamps shall be utilized at all exterior lamp locations. 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 service doors are opened. Light lenses shall be designed and located to prevent damage when running the vehicle through an automatic bus washer. Front marker (clearance) lights along with lights located on the roof and sides of the bus shall have protective shields or be of the flush mount type to protect the lens against minor impacts.

Exterior lighting shall comply with all applicable State and Federal regulations. Replacement lamps shall be readily available from commercial sources; they shall not be a bus manufacturer unique item. Those applications which will not accommodate an LED lamp shall have a replaceable bulb with access to the bulb by removing the lens from outside the bus. LED headlamps, if available, shall be offered as standard equipment.

If LED headlamps are not available, Halogen sealed beam headlights are required with high and low beams controlled from a sealed, moisture-protected foot switch located on the floor in the driver's station.

The sealed beam units shall be of the latest heavy-duty type and be ruggedly mounted to maintain adjustment under transit operating conditions. Headlights shall be wired to operate on reduced voltage in the run position.

All other lights shall be LED as allowed by applicable State Laws. The stop lights and taillights shall be 4", seven inches as an option. Rear turn indicator lights shall be separate from the stop-tail lights.

The LED marker lights at the front and rear upper corners of the bus shall be of flush mounted type to preclude breakage by tree limbs, bus washers, etc.

Each doorway shall have an outside light(s) which, when the door is open, provides at least one foot candle of illumination of the street surface for a distance of three feet perpendicular to the bottom step tread outer edge. Light (s) shall be located below window level and shielded to protect the eyes of entering and exiting passengers.

24.5 Backup Light/Alarm

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.

24.6 Doorway Lighting

Lamps at the front and rear passenger doorways shall comply with ADA requirements and shall activate only when the doors open. Lamps shall illuminate the street surface to a level of no less than 1 footcandle for a distance of 3 ft outward from the outboard edge of the door threshold. The lights shall be shielded to protect passengers' eyes from glare.

24.7 Service Area Lighting (Interior and Exterior)

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 motor 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.

An adequate number of LED lights located in convenient locations that fully illuminate the drive system compartment shall be controlled by switches mounted near the rear start controls. All other service area lamps shall be controlled by switches mounted on or convenient to the lamp assemblies.

25 INTERIOR PANELS AND FINISHES

25.1 General Requirements

Materials shall be selected based on 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 proximity to these surfaces shall also be resistant to this cleaning method.

25.2 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.

25.3 Driver Area Barrier

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 passenger 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 entire partition assembly for mounting of such equipment as flare kits, fire extinguishers (1.2 kg), microcomputer, public address amplifier, etc. Dark or black panels are preferred behind the driver's head. The panel should be isolated for noise control and attached with rubber grommets.

25.4 Wheel-Well-to-Ceiling Configuration of Driver's Barrier

The driver's barrier shall extend from the top of the wheel well to the ceiling the level of the seated driver and shall fit close to the bus side windows and wall to prevent passengers from reaching the driver or the driver's personal effects.

25.5 Full-Height (Floor-to-Ceiling) Configuration of Driver's Barrier

The driver's barrier shall extend continually from the floor area to the ceiling and from the bus wall to the first stanchion immediately behind the driver to provide security to the driver and limit passenger conversation.

25.6 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 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 passengers assist 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.

25.7 Front End

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.

25.8 Rear Bulkhead

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, 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.

25.9 Headlining

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.

25.10 Fastening

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.

25.11 Insulation

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. Insulation shall meet the requirements of FMVSS 302.

25.12 Floor Covering

The floor covering shall have a non-skid walking surface that remains effective in all weather conditions.

The floor covering, as well as transitions of flooring material to the main floor and to the entrance and exit area, shall be wherever possible a one-piece construction with no openings for water and dirt to enter below the floor. It must be smooth and present no tripping hazards. Seams shall be welded per manufacturer's specifications. The standee line shall be a Minimum of 2 inches wide and shall extend across the bus aisle. This line and the edge of the steps shall be Yellow. The color and pattern shall be consistent throughout the floor covering. The color and quality of the flooring shall be provided after award.

Any areas on the floor that are not intended for standees, such as areas "swept" during passenger door operation, shall be clearly and permanently marked. The floor shall be easily cleaned and shall be arranged to minimize debris accumulation.

The main floor area will be one piece and if the floor is of a bi-level construction, then it shall be one piece at each level. The covering between the center strip and the wheel housings may be separate pieces but all seams must be welded or sealed per manufacturer's specifications to prevent water and dirt intrusion. At the rear door, a separate strip as wide as the door shall extend from the center strip to the outboard edge of the rear/exit area. The floor covering shall closely fit the sidewall in a fully sealed butt joint or extend to the top of the cove with no exposed edges. Flooring must meet ASTM E662, ASTM E648, ASTM D2047 and FMVSS 302.

25.13 Interior Lighting

In general, all interior lights are to be LED. 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.

25.14 Passenger

The passenger interior lighting system shall be a LED lighting system. The interior lighting system shall provide a minimum 15 foot-candle illumination on a 1 square foot plane at an angle of 45 degree from horizontal, center 33 inches above the floor and 24 inches in front of the seat back at each seat position.

Allowable average light level for the rear bench seats shall be 7 foot-candles. Floor surface in the aisles shall be a minimum of 10 foot-candles, vestibule area a minimum of 4 foot-candles with the front doors open and 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 rear door is unlocked.

Step lighting for the intermediate platform between lower and upper floor levels shall be provided and shall illuminate in all engine run positions. The step lighting shall be low-profile to minimize tripping and snagging hazard for passengers and shall be shielded as necessary to protect passengers' eyes from glare.

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 bus shall be equipped with interior advertising card tracks on each side of the interior passenger compartment, running the length of the bus, to hold 11" high ad cards. High-power solid-state LED strip shall be in one-foot section increment with high power LED manufactured with expectation to maintain on average 60-70% of original brightness after 60,000 hours of operation. The brightness of each individual light fixture shall be software programmable to adjust the interior light level relative to ambient light for passenger comfort.

Lens material shall be clear polycarbonate. Lens shall be designed to effectively "mask" all individual LEDs to make them invisible and there shall be no "hot spot" or "dark spot". Lens shall be sealed to inhibit incursion of dust and insects yet are easily removable for service. If threaded fasteners are used, they must be held captive in the lens. Access panels shall be provided to allow servicing of components located behind light panels.

Individual driver module shall be provided for each light fixture. Driver module shall have built-in self-protection of thermal shut-down and restart, PWM (Pulse Width Modulation) output to regulate light level, reverse polarity protects and re-buildable.

When the master switch is in the RUN or NITE/RUN mode, the first light module on each side of the coach shall slowly fade to darkness when the front door is in the closed position and light output shall gradually illuminate to reach maximum light level when the door is opened. Solid state LED lighting shall have unlimited on-off cycles.

Failure of any light fixture or driver module shall be broadcasted via telltale light panel or dashboard display. The system will look for supply current and lighting fixture temperature to be approximately the same for all the driver modules and will show which module(s) seem to have a problem.

The light system may be designed to form part of the entire air distribution duct.

Emergency backup system shall keep the light fixtures over the front and rear doors illuminated at minimum light output under a separated battery power for 10 to 15 minutes allowing passengers visibility and timely evacuation from the vehicle during emergency conditions.

25.15 Driver Area

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. This light shall be controlled by a toggle switch that is convenient to the driver. This light will automatically come on whenever the front doors are opened, and the run switch is in the "night run" or "night park" position

25.16 Seating Areas

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.

25.17 Vestibules/Doors

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.

25.18 Step Lighting

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.

25.19 Ramp Lighting

Exterior and interior ramp lighting shall comply with CFR Part 49, Sections 19.29 and 19.31.

25.20 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. Access doors shall be secured with hand screws or latches. All fasteners that retain access panels shall be captive in the cover.

25.21 Floor Panels

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 RDUAA 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.

26 PASSENGER ACCOMMODATIONS

26.1 Passenger Seating- Arrangements and Seat Style

The passenger seating shall be Freedman and shall be arranged in the bus shall be such that seating capacity is maximized and in compliance to the following requirements.

Seating shall be in perimeter seating arrangement and shall match the existing RDUAA bus fleet configuration to the greatest extent possible. Photos of an existing RDU bus showing this layout is attached. Seating shall match the existing 4 ONE Shuttle perimeter seating.

Any exposed metal of the frame will be powder coated, color coordinated to match the seat inserts, or brushed aluminum, or brushed stainless steel.

Proposer shall include a stainless-steel luggage platform capable of holding airline passenger luggage. This shall be like existing RDU buses as shown in the photos attached. Shop drawing shall be provided for RDU review and approval prior to fabrication.

NOTE: Proposers shall provide a proposed seating layout with their proposal. The handholds shall be colored the same as the back panels of the passenger seats.

The top area of the seat back shell will wrap around the upper portion of the seat back (below the grab rail) in a "bubble" to form a crash pad on the rear of each seat. The crash pad will be of continuous construction with the back.

Rear seat platform shall be hinged or easily removable.

Proposers shall submit a certified test report as evidence of compliance with all testing activities, test diagrams, test equipment as well as test data related to loads, deflections and permanent deformation of the seat assembly as defined in the APTA Standard Bus Procurement Guidelines manual.

26.2 Hip-to-Knee Room

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 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 26.5 inches.

26.3 Foot Room

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.

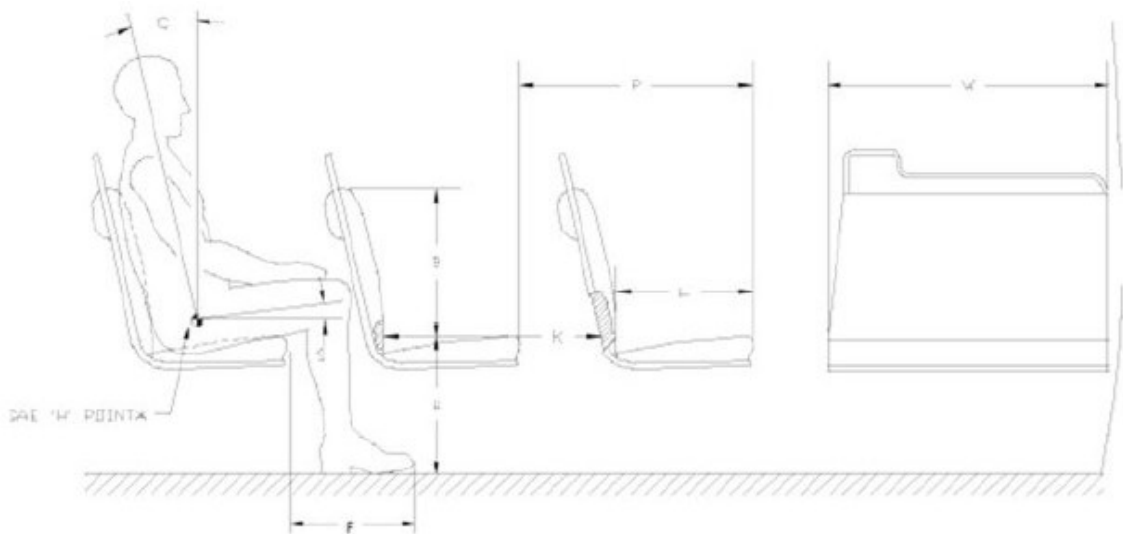
26.4 Aisles

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).

26.5 Dimensions

FIGURE 7

Seating Dimensions and Standard Configuration



26.6 Structure and Design

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 1000 lbs. 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 shall peak at 0.05 to 0.015 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 ¼-in. 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 ¼-in. 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 36-in. 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.

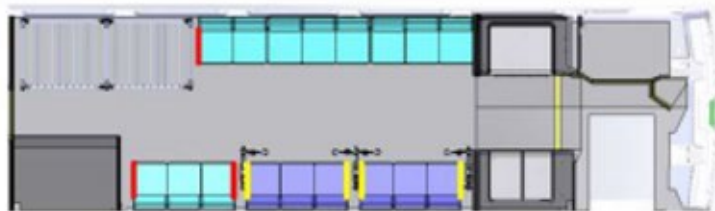
The seat back handhold may be deleted from seats that do not have another transverse seat directly behind and where a vertical assist is provided.

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 ¼-in. permanent deformation and without visible deterioration.

Preferred Seating Layout



Front of the Bus



Rear of the Bus

26.7 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 $\frac{1}{4}$ -in. 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, allow the passenger to deform the seating materials in the impact areas. Complete seat assemblies shall be interchangeable to the extent practicable. Fabric shall be level 5 seat fabric with color and style selected by RDUAA.

26.8 Passenger Assists

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 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 front doorway and at interior steps for bi-level designs shall be powder coated in a high-contrast yellow color. The forward-most vertical stanchions on either side of the aisle immediately behind the driver's area shall be: Stainless steel finish.

26.9 Assists

Excluding those mounted on the seats and doors, the assists shall have a cross-sectional diameter between $1\frac{1}{4}$ and $1\frac{1}{2}$ in. or shall provide an equivalent gripping surface with no corner radii less than $\frac{1}{4}$ in. All passenger assists shall permit a full hand grip with no less than $1\frac{1}{2}$ 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 12-in. 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.

26.10 Front Doorway

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.

26.11 Vestibule

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 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. 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. A Stainless-steel molding to cover edges on entrance and rear riser shall be provided.

26.12 Rear Doorway(s)

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.

26.13 Overhead

Except forward of the front wheel well 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.

Overhead assists shall simultaneously support 150 lbs. on any 12-in. length. No more than 5 percent of the full grip feature shall be lost due to assist supports.

26.14 Longitudinal Seat Assists

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 inches apart.

26.15 Wheel Housing Barriers/Assists

Unless passenger seating is provided on top of wheel housing, 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 housing.

26.16 Passenger Doors

The front door shall be a "slide glide" type inward opening, driver controlled, of corrosion-resistant construction. Minimum clear opening shall be 33" inches. The front door shall have a minimum height of 75" inches. The overhead clearance between the top of the door opening and the highest point of the ramp shall be a minimum of 68 inches.

The step height shall not exceed 16.5 in. at either doorway without kneeling and shall not exceed 15.5 in. at the step. A maximum of two steps is allowed to accommodate a raised aisle floor in the rear of the bus. Operation of, and power to, the front door shall be controlled by the driver. Door shall be opened completely in 1 to 3.5 seconds from the time of control actuation and shall be subject to adjustment requirements of this specification. A control valve in the driver'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.

The rear or exit door shall be a two panel swing out type designed or slide glide, if applicable, to provide a minimum clear opening of 38" inches and a minimum height of 75 inches. Rear doors shall be operator opened and spring closed or equal. The closing of the door shall begin after the control has been moved to the closed position, and after the door has been fully opened. Door opening and closing speeds shall be adjustable. The rear door shall be equipped with a sensitive edge which will open the door automatically if an object is trapped between the doors. The doors shall have handrails (1.25 inches or equivalent surface area with a 1.50-inch knuckle clearance) mounted on the door panels and/or a modesty panel in the door well/step well. The clear opening dimension shall apply inside these handrails. Handrails whether on the door panel or in the body, shall be part of the systematic set of passenger assists.

To preclude movement of the bus, an accelerator interlock shall lock the accelerator in the closed position and a brake interlock shall engage the rear axle service brake system when the front and rear door control is activated, and the vehicle is moving below 3 mph. When vehicle is moving above 3 mph the rear door shall remain locked. The braking effort shall be to the maximum capability of the rear axle brakes.

When the front door and/or exit door open flashing lights shall be activated. There shall be a switch on the left dash panel that will override the flashers and turn them off when the doors are open.

Entrance and exit door motors and actuators shall be specified. At a minimum, both front and rear doors shall meet ADA requirements.

An emergency door switch which is not in reach of a seated driver shall close the rear doors, deactivate the door control system, and permit only emergency operation of the doors.

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.

A switch located within reach of the seated operator shall, when actuated, restore rear door function to complete operator control.

Doors that employ a "swing" or pantograph geometry and/or are closed by a return spring or counterweight-type device shall be equipped with a positive mechanical holding device that automatically engages and prevents the actuation mechanism from being back-driven from the fully closed position.

The holding device shall be overcome only when the driver's door control is moved to an "Exit Door Enable" position and the vehicle is moving at a speed of less than 2 mph, or in the event of actuation of the emergency door release.

Locked doors shall require a force of more than 300 lbs. to open manually. When the locked doors are manually forced to open, damage shall be limited to the bending of minor door linkage with no resulting damage to the doors, actuators or complex mechanism.

26.17 Rear Door Interlocks

See "Hardware Mounting" for door system interlock requirements.

26.18 Emergency Operation

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.

26.19 Door Control

The door control shall be 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.

26.20 Door Controller - Five-Position or Two Momentary Push Buttons 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.

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(s) closed or set to lock.
- First position forward: Front door open, rear door(s) closed or set to lock.
- Second position forward: Front door open, rear door(s) open or set to open.
- First position back: Front door closed, rear door(s) open or set to open.
- Second position back: Front door open, rear door(s) open or set to open.
- For electric buses consideration should be given for electrically or pneumatically operated door controller

26.21 Door Open/Close - Operator-Controlled Front and Rear Doors

Operation of, and power to, the front passenger doors shall be completely controlled by the operator.

Power to rear doors shall be controlled by operator. A switch shall be provided to enable the driver to obtain full control of the rear doors.

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/center doors, deactivate the door control system, release the interlocks, and permit only manual operation of the rear/center doors.

26.22 Accessibility Provisions

Space and body structural provisions shall be provided at the front or rear door of the bus to accommodate a wheelchair loading system.

26.23 Loading Systems

The bus shall be Ricon and equipped with a front door ramp mechanism that conforms to all requirements of the Americans with Disabilities Act (ADA). It is to be an all electrically operated system which will assume the normal entrance configuration when stowed. When stowed, the ramp should not exceed any of the normal bus undercarriage clearances. All ramp components and mechanisms shall be constructed of corrosion resistant materials and incorporate a design which affords maximum protection from the elements during normal bus operations. Ease of maintenance and servicing shall be a prime consideration in system design and construction.

Wheelchair tie-downs will be incorporated and located as close to the front door of the bus as practical to ensure maximum aisle width and wheelchair maneuverability. The wheelchair ramp shall have a manual release, deploy, and stow mechanism. The components involved with manual operation shall be completely accessible. If ramp provides for a nylon strap, it must be located on the forward side of the ramp to preclude a trip hazard.

26.24 Dimensions and capabilities:

Ramp Length shall provide for a minimum 1:6 slope when the bus is kneeled, and the ramp deployed to ground level.

- Ramp Width 30.5 min.
- Load Capacity Must meet current ADA regulations
- Cycle Speed not to exceed 12" per sec.

The ramp shall be controlled by toggle switches, master on-off, up-down and stow- deploy. The control switches shall be of the spring loaded to a safe position type so that constant manual pressure is required by the operator during ramp operation. All controls shall be clearly identified by function and present a reasonably foolproof and natural sequence of operation.

Visual and audible warning devices shall be located immediately to the rear of the front door. The audible warning device shall be activated only when the ramp is functioning. Interlocking and fast idle provisions shall be incorporated so the ramp cannot be extended unless the entrance door is in the fully open position, the transmission in neutral, and the parking brake engaged. The entrance door cannot be closed unless the ramp is in the fully stowed position. The bus service brakes shall be automatically applied when the ramp is in any position other than the stowed and locked position. All ramp components mounted under the bus shall be protected from dirt, debris, and road splash using appropriate enclosures, mud flaps, or sealed compartments, subject to approval by RDUAA.

Weatherproof access panels/doors shall be provided to allow for servicing and troubleshooting both ramp and under-floor bus components. Lubing the ramp shall be accomplished without removing the belly pan.

The electrical interfacing connections between the bus and the ramp shall be of the quick disconnect type to facilitate ramp removal and installation.

Components known to meet these requirements include, but are not limited to equipment manufactured by Lift-U Inc., the Lift U LU-18 2 dual mode, and Ricon, Inc.

26.25 Wheelchair Securing System

Proposer shall provide a telescope restraint system at each wheelchair position. At a minimum, all restraint systems must meet CFR 49, FMVSS, FTA and ADA standards. **If wheelchair securing strap systems are installed then the following applies:** Wheelchair securing strap assemblies and suitable compartment for storing straps for the installation on accessible transit buses as required, to be in complete compliance with all ADA/FTA regulations in effect at time of manufacture. The securing system shall be provided by the individual seating manufacturer.

Each securing strap assembly shall include but not limited to the following: Each securing strap shall be equipped with a male and female connector. When fully extended, the strap shall be 51.5 inches long from the mounting hole to the end of the female buckle. The strap webbing shall be red in color and shall be equal to automobile seat belt webbing material.

An automotive type of retractor for stowing webbing shall be provided. In the stowed position, no more than 11 inches of the securing straps shall be outside of the retractor assembly. The retractor assembly shall be black in color or approved equal.

The securing strap assembly shall be used in a set of 2 units. A 2 unit set of securing straps shall hold a wheelchair and passenger up to the maximum load as specified by current ADA regulations.

26.26 Interior Circulation

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 90-degree turns of wheelchairs should have a clearance arc dimension no less than 45 in., and in the parking area where 180-degree turns are expected, space should be clear in a full 60-in.-diameter circle. A vertical clearance of 12 in. above the floor surface should be provided on the outside of turning areas for wheelchair footrest.

27 SIGNAGE AND COMMUNICATION

Destination Signs

An LED automatic electronic destination sign system shall be Hanover, furnished and installed in each bus by the manufacturer. The destination sign system shall consist of:

- One (1) Front sign 16 rows x 160 columns; display height minimum 7.9 inches, display width 63", or a 24 rows x 200 columns sign.
- One (1) Side sign, on the curb side, 14 rows x 108 columns; display height minimum 4.2 inches, display width 42".
- One (1) Rear sign 16 rows x 48 columns; display height minimum 6.1 inches, display width 17".
- Operators Control Unit (OCU)

27.1 Cables and Accessories

The Front Sign shall be mounted on the front of the Bus, near the top edge of the body, behind windshield protection, and in an enclosed but accessible compartment. The Side Sign shall be located on the right side (curb side) of the bus near the front door, mounted near the top of an existing window. The Rear Sign (external) shall be mounted on the rear of the vehicle on an appropriately sized cutout.

The entire display area of all signs shall be readable in direct sunlight, at night, and in all lighting conditions between those two lighting extremes, with evenly distributed illumination appearance to the un-aided eye.

The system shall be microprocessor-based, utilizing approved bi-directional serial communications, such as S.A.E J1708 or IBIS, E.I.A. RS-485, between system components, and shall utilize error detection techniques within the communication protocol.

Independent Controller Boards shall be mounted in the front & side destination Sign. The system shall be capable of communicating with additional information devices, such as interior information Signs, Voice Annunciation devices, etc. The system shall provide for destination and/or Public Relations (P/R) message entry.

Flash memory integrated circuits shall be capable of storing and displaying up to 10,000 message lines.

Message memory shall be changeable using a USB memory stick of not less than one (1) gigabyte memory capacity but sized according to the message listing noted herein.

The System shall have the ability to sequentially display multi-line destination messages, with the route number portion always remaining in a constant "on" mode, if so programmed. It shall also be capable of accepting manual entry of Route Alpha/Numeric information on any/all signs.

The various Signs shall be programmable to display independent messages or the same messages; up to two destination messages and one public relations message shall be pre-selectable. The operator shall be able to quickly change between the pre-selected messages without re-entering a message code. Public relations messages shall be capable of being displayed alternately with the regular text and route messages or displayed separately.

An emergency message shall be activated by a push button or toggle switch. The emergency message shall be displayed on signs facing outside the vehicle while signs inside the vehicle, including the OCU display, remain unchanged. The emergency message shall be canceled by entering a new destination code, or power cycling (after removal of the emergency signal).

The programming software shall provide means of adjusting the length of time messages are displayed in 0.1 second increments up to twenty-five seconds.

Power to the Sign system shall be controlled by the Master Bus Run Switch. The signs shall operate in

all positions of this switch except off. The signs shall be internally protected against voltage transients and RFI interference to ensure proper operation in the local environment.

27.2 Display and Display Illumination

All Sign displays shall consist of pixels utilizing High Intensity Light Emitting Diodes ("LED"), for superior outdoor environmental performance, (of Amber illumination appearance of light wavelength of 590 NM). LED should be made of AlInGaP II, superior UV resistant Epoxy lens and superior resistance to the effects of moisture. Each pixel shall have a dedicated LED for illumination of that pixel in all lighting conditions. The sign system shall have multi-level intensity changes, which adjust automatically as a function of ambient lighting conditions. There shall be no requirement for any fan or any specialized cooling or air circulation.

This LED shall be mounted such as to be visible directly to the observer positioned in the viewing cone, allowing for full readability 65 degrees either side of the destination sign centerline. The LEDs shall be the only means of illumination of the sign system. The LED illumination source shall have an operating life M.T.B.F. of not less than 100,000 hours. Each LED shall not consume more than 0.02 Watts.

The characters formed by the System shall meet the requirements of the Americans with Disabilities Act (ADA) of 1990 Reference 49 CFR Section 38.39.

27.3 Sign Enclosures

All Signs shall be enclosed in a manner such as to inhibit entry of dirt, dust, water and other contaminants during normal operation or cleaning. Access shall be provided to clean the inside of the Bus window(s) associated with the Sign and to remove or replace the Sign components. Access panels and display boards shall be mounted for ease of maintenance/replacement. Any exterior Rear Sign enclosure used shall be made of Polycarbonate material containing fiberglass reinforcement. The vehicle manufacturer shall comply with the Sign manufacturer's recommended mounting, mounting configuration, and installation procedures to assure optimum visibility and service accessibility of the Sign System and System components.

27.4 Electronic System Requirements:

All electronic circuit boards used in the Sign System shall be conformal coated to meet the requirements of military specification MIL-I-46058C. All Sign System components shall be certified to have been subjected to a "burn-in" test of a minimum of twelve (12) hours operation in a temperature of 150 degrees F. prior to final inspection.

27.5 Operator Control Unit (OCU)

The OCU Unit shall be used to view and update display messages. It shall be recess mounted on the Bus vehicle front Sign compartment access cover or door. The OCU shall utilize a multi-key conductive rubber pad keyboard and be designed for transit operating conditions. Other mounting locations for the OCU shall be made available, with selection made at the pre-production meeting.

The OCU Unit shall contain a display of at least two-lines of 20-character capability. The OCU Unit shall contain an audio annunciation that beeps indicating that a key is depressed. The OCU Unit shall continuously display the message associated with the selected destination readings (except the emergency message feature as noted above).

If the IBIS interface is required in the Destination Sign System, an auxiliary RS232 (DB9) port shall be made optionally available on the OCU under frame for inputs from any wireless technology that might be envisioned in the future. This auxiliary RS232 port shall operate at 9600 baud and accept commands from a wireless source (such as Spread Spectrum receivers) and will set destination sign addresses as if manually operated by the OCU operator.

If the J1708 interface is selected for the Destination Sign System, an auxiliary J1708 port shall be

made available on the J1708 OCU so that auxiliary J1708 commands may be provided to the Destination Sign system from a wireless source that conforms to the J1708 command structure.

27.6 Programming

A programming software package consistent with what the RDUAA currently is using shall be supplied to generate message lists for the Sign system.

27.7 Message Memory Transfer and UPDATE

The Sign system shall be reprogrammable on the Bus vehicle with the use of a data transfer device. A data transfer device slot shall be provided on the OCU face for this purpose. (Data transfer is via USB) The maximum reprogramming time for a 10,000-line listing shall be one minute. A data transfer device, of appropriate memory capacity based on requirements of the message listing noted below (but not less than 0.5 Megabyte) shall be supplied at the rate of one device for each 50 systems, or fraction thereof, but in any event not less than two such devices shall be supplied. Alternate: 1 device per vehicle.

27.8 Interconnecting Cabling

Data Communication Single twisted pair (two conductors) cable.

Power Cabling, three conductors connecting to the switched and unswitched (battery) power and a return (battery).

OCU Unit cable single twisted pair cable between the OCU and front

27.9 Passenger Information and Advertising - Interior Displays

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. The interior LED/changeable sign to be center-mounted above front windshield that integrates with an automated on-board audio-visual announcement system which announces upcoming stops and other information such as date, time, route information, custom messaging per ADA requirements.

27.10 Exterior Displays

Not applicable.

27.11 Passenger Stop Request/Exit Signal

The ambulatory passenger signal shall be the yellow pull cords, push button, or clear pull cords conveniently located so standing and seated passengers can easily reach it, this includes down the mullions. The pull cords shall be accessible from the exit door area, or a button to actuate the signal shall be placed on the door motor cover. There shall be a lighted display sign which indicates "STOP REQUESTED" when the signal is activated. The signal chime shall operate once, and the sign shall light and remain lit with the chime disabled until the next stop when the front doors or rear doors have been opened, resetting the system.

The chime shall be distinctive. The volume on the chime shall be adjustable between 90 and 55 Db. The lighted display shall be located on or near the ceiling at the front of the bus in view of the passengers. A light on the instrument panel shall be lit when the display sign is lit.

There shall be a second passenger signal of a different tone that meets the ADA requirements mounted to the bottom of the flip seat for the mobility aid users to alert the operator when a mobility aid user wishes to disembark. There shall be two lights on the operator's front dash that indicate when an ambulatory or non-ambulatory passenger wishes to disembark.

27.12 Communications - Camera Surveillance System

Not Applicable

27.13 Mobile Radio System

A separate electrical circuit protected with the circuit breaker shall be provided to the radio transceiver location. The radio circuit shall be connected and placed to minimize electrical noise and transients.

Each bus shall include a two-way voice communication system including radio and all other equipment necessary to regular operation of the radio. Proposers shall include installation of the radio system and other equipment necessary to regular operation of the radio including radio VLU, TCH, handset, cab speaker antenna, and cables. Radio system shall be minimum 35W, 764-870 MHz.

27.14 Radio Mounting

A suitable area shall be provided for the mounting of communication Radio. This mounting could range from a simple plate to a box to contain the radio. A factor governing the mounting of the radio is what space is available. Another provision is that the cable that connects the radio and control head switch must be routed to an area immediately accessible to the driver.

27.15 Radio Transmitter

A Radio control head and speaker mounting plate shall be installed in a location to provide easy access for driver operation. The handset shall be handheld and be equipped with a cradle harness. The radio handset will be a telephone hand set with magnetic hang up cup. All switches and controls shall be permanently and clearly labeled.

27.16 Antenna

Antenna(s) will be mounted on each bus that will accommodate RF/GPS/Cellular. Antenna(s) shall be located as close to midpoint between the two sides as practical, but not on a seam, and as close to the area of the radio, as to preclude a long run of coaxial cable that connects equipment and the antenna(s), to provide access below, should an antenna ever need to be changed. A 1" inside diameter flexible conduit with pull cord shall be incorporated into the roof and sidewall of the bus from the immediate area of the antenna so that the coaxial cable can be easily repaired as needed. Height of antenna(s) shall not cause the bus to exceed the overall 130" maximum height.

27.17 Antenna and Access Panel

An antenna access panel shall be installed in the ceiling of each bus at a point from the centerline of the bus, four (4) feet from the front of the bus. The access panel shall be located as close to a structural member as practical in order to provide a mounting base for the radio antenna.

All antenna cables shall be run in 1 inch diameter conduit to the radio box. Removable access covers shall be provided in the ceiling of the bus in order to allow access to the antenna and conduit. Three antennas shall be installed on every bus. Antenna locations shall be as close as possible to the center line of the bus and have a separation of approximately 3 feet. All mounting locations shall be approved by the appropriate municipality prior to bus manufacture.

27.18 Public Address System

Each bus shall have a public announcement system. The system shall be configured so it is completely independent from the bus radio system, APC, On-Board Display and Announcement and other systems. The system shall incorporate provisions to allow a second handheld microphone to be plugged in and used. The hand-held microphone shall have a plug in on the right end of the primary driver's panel, but shall not be installed, but shall be shipped with the bus.

Keying either microphone shall not cause the other to be activated. Six (6) speakers flush mounted shall be installed to ensure adequate sound distribution. The system shall have a volume control knob located on the driver's panel, unless volume is incorporated with the individual units.

27.19 Automatic Passenger Counting/AVL/GPS/On Board Display and Announcement System

All required equipment shall be provided and installed by the Contractor at the factory prior to delivery. See detailed specifications on the attachments following page 119 below.

28 Additional Diagrams

Existing RDUAA Bus Paint Scheme – See pictures provided within Section II of the IFB Photos of

Existing RDUAA Interiors - See pictures provided within Section II of the IFB

TransLoc Fixed Route

Experience total control of your operations powered by one simple management tool.

MORE RELIABLE THAN EVER

CAD/AVL provides vital data such as bus GPS locations within seconds, schedule adherence status, breakdowns and emergencies reducing response times to _____ unplanned service disruptions.

STREAMLINED DISPATCH SITE

Create a dispatch dashboard customized to your needs. Easily access real-time vehicle GPS location, performance, and capacity while managing customizable vehicle assignments and filtering views based on block schedules, routes, or vehicles.

DETAILED REPORTING

Gain in-depth reports on key metrics, such as fleet management, on-time performance, headway, dispatch, geo-fence, arrival and departure, ridership, vehicle history (with location), speed and NTD reports.

RIDER FACING MOBILE APP

Riders can view real-time vehicle locations, set stop reminders and ETA alerts, favorite key stops, provide feedback, make fare payments and receive important transit updates through the mobile app. These features are available in the TransLoc and white-label app.

HARDWARE OFFERINGS

Improve data and system efficiency while enhancing the rider experience with our hardware offerings including: Automatic Voice Annunciation (AVA), Automatic Passenger Counters (APC), badge scanners, WiFi, signage and more. [Learn more about vendor partnerships here.](#)





ADVANCED PEOPLE SENSOR

APS-R



MULTI-DIRECTIONAL PASSENGER COUNTING

- Count boarding and alighting passengers with the highest accuracy available in the market (Accuracy of at least 99 %)
- The APS-R fulfills VDV 457-2 accuracy requirements
- Up to 10 individual counting lines are possible per device
- Capture separate figures for interior doors, left and right side or upper and lower deck, without the need of additional units
- Detection and exclusion of U-turns

OCCUPANCY MONITORING IN AN AREA

- Real-time passenger detection to determine the occupancy of individual areas for optimized capacity planning

OBJECT CLASSIFICATION

- Separate counting results for adults and children
- Detection of bicycles and wheelchairs

VIDEO RECORDING FOR COUNT VERIFICATION

- Recording of color VGA video files alongside caption of measurement results
- Recording can be triggered via digital inputs (door contact)
- Privacy option: Individuals are not recognizable on videos

REAL-TIME DATA

- Very short latency time of 50 ms
- Start-stop detection using the integrated accelerometer
- Suitable for solutions that require an instant event-triggered activity, e.g. the reopening of a door if a passenger approaches

EASY SETUP AND COMMISSIONING

- Automatic determination of mounting angles
- Automatic determination of the floor profile and ceiling height
- Intuitive and straight-forward setup of all other parameters via the web user interface
- Instant full performance, no calibration required
- Easy demonstration to the end user using color videos with synchronized data records

TECHNICAL DATA

Operating voltage	12 V DC to 24 V DC (nom.)
Protected against short-circuit and inverse polarity	
Power consumption	5 W
Operating temperature	EN 50125-1 class T3 -25 °C to +70 °C (-13 °F to +158 °F)
Storage temperature	EN 50125-1 class T3 -40 °C to +85 °C (-40 °F to +185 °F)
Ingress protection	IP65
EMC	EN 50121-3-2:2015 EMV 06
Shock and vibration	EN 50125-1 IEC 61373 cat. 1, class B
Coverage	Ceiling height: 2.00 m to 4.00 m (6.6 ft to 13.1 ft) Coverable door width: 1.60 m to 5.60 m (5.2 ft to 18.4 ft) depends on installation height
Dimensions	141 mm x 98 mm x 35 mm (5.6 in x 3.9 in x 1.4 in)
Weight	440 g (15.5 oz)
Housing	Aluminum
Light sensitivity	3 Lux to 300,000 Lux High Dynamic Range (HDR) 2,000 FIT (= MTBF 500,000 h)
Failure rate	in a typical railway environment
Type approvals	Railway conformity according to EN 50155 ECE Type approval for road vehicles CE Declaration of Conformity

INTERFACES

Ethernet	10/100 Mbit/s, full duplex TCP, UDP, FTP, HTTP, HTTPS,
Communication protocols	SOAP, VDV-300 (IBIS), VDV-301 (IBIS-IP), ITxPT, SSH
Inputs/outputs	digital inputs, 1 programmable digital output
Door coding	4 coding jumpers to select 16 individual door configurations
Setup/service	Integrated web interface

ACCESSORIES

Generic mounting kits for surface mount, flush mount and variable tilt angles are available from stock

SETUP AND SERVICE

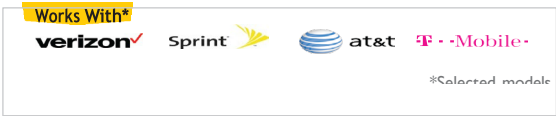
- ✓ Secured by multilevel user and rights management
- ✓ Customizable WebGUI (logo, colors)
- ✓ Automatic setup of floor profile and tilt angles
- ✓ Remote maintenance and updates via PS.Platform
- ✓ GDPR - Data protection by design and default ensured
- ✓ High level of privacy with the privacy mode

Product features and technical specifications are subject to change without further notice / Version no. 08/2020 / All rights reserved.

HELLA Aglaia Mobile Vision GmbH, A member of the HELLA Group / info@people-sensing.com / www.people-sensing.com

Ullsteinstraße 140, 12109 Berlin, Germany / Tel. +49 (0) 30 2000 429-625 / Fax +49 (0) 30 2000 429-149

Multi-LTE Router for Transportation Wi-Fi



Built for Transportation Deployments

With a compact form factor, simultaneous dual-band 11ac Wi-Fi, the MAX Transit is ready to deliver fast, reliable Wi-Fi to passengers.



Dual Embedded Cellular[#] and Redundant SIM Slots

Up to two cellular modems and redundant SIM slots allow you to use up to four different cellular providers for bandwidth bonding, data overage protection or eliminating blind spots.



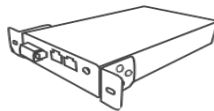
Simultaneous Dual-Band Wi-Fi

Reduce Wi-Fi congestion and interference. Simultaneous dual-band Wi-Fi gives you two independent networks that also work together, maximizing the throughput that your passengers can enjoy.



Captive Portal with Social Login

The MAX Transit comes with a captive portal that allows passengers to login with Facebook. As they login, you can use InControl 2 to see insightful demographic data.



External Captive Portal for Advertising Servers

The MAX Transit also supports external captive portals, enabling you to connect to an advertising server. That way, your Wi-Fi hotspots can become a source of revenue.

[#]Applies only to the MAX-TST-DUO

Certified Toughness

In addition to rugged metal enclosure, the MAX Transit has certifications on:

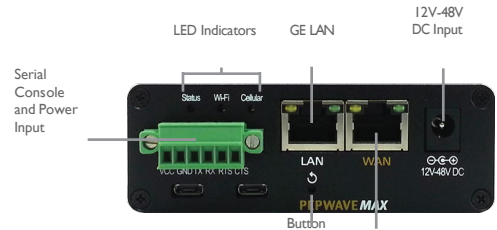
Shock and vibration resistance

(EN 61373:1999, IEC 61373:1999)

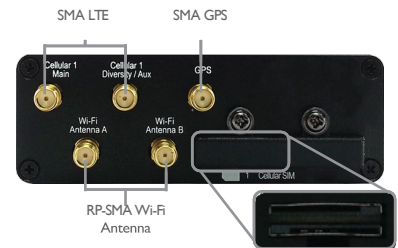
Railway applications (EN 50155) Electromagnetic Compatibility (EN 61000) eMark (ref: E13*10R00*10R05*13664*00)

Specifications

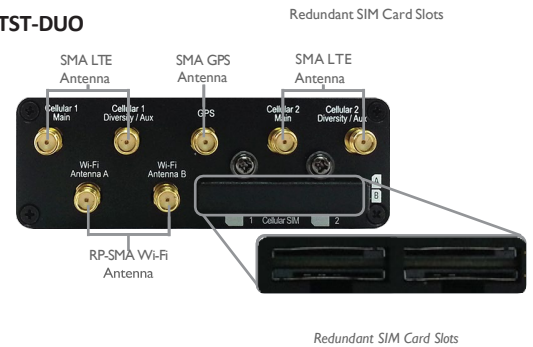
	MAX-TST	MAX-TST-DUO
Cellular WAN Interfaces	Single LTE Modem	Dual LTE Modems
SpeedFusion Hot Failover	●	●
SpeedFusion WAN Smoothing	○	○ #
SpeedFusion Bandwidth Bonding	○	○ #
WAN Interface		1x GE*
LAN Interface		1x GE
Load Balancing/Failover		●
Router Throughput		400Mbps
SpeedFusion Throughput (No Encryption)		100Mbps
SpeedFusion Throughput (256-bit AES)		60Mbps
Recommended Users		150
LTE Modem		Downlink/Uplink Datarate: 100Mbps/50Mbps
LTE-A Modem		Downlink/Uplink Datarate: 300Mbps/50Mbps
Wi-Fi Standard		802.11ac/a/b/g/n 2x2 MIMO
2.4GHz/5GHz		300Mbps / 866Mbps
Simultaneous Dual-Band Wi-Fi AP		●
Antenna Connectors		2x SMA Cellular*, 1x SMA GPS, 2x RP-SMA Wi-Fi
Power Input		Device: 12V – 48V DC AC Adapter: AC Input 100V – 240V / DC Output 12V Terminal Block: 12V – 48V DC
Power Consumption		18W (max.)
Dimensions		7.3 x 3.8 x 1.3 inches 185 x 97 x 33.5 mm (L x W x H)
Weight		1.3 pounds 590 grams
Operating Temperature		-40° – 149°F -40° – 65°C
Humidity		15% – 95% (non-condensing)
Warranty		1-Year Limited Warranty



MAX-TST



MAX-TST-DUO



* The WAN port can act as a LAN port if needed. ^ Available as a license add-on.

* the MAX-TST-DUO has 4x SMA cellular antenna connectors.

Ordering Information

Product Code	Embedded Modems	Carrier / Region	Cellular Standard	4G Bands/Frequencies (MHz)	3G Bands/Frequencies (MHz)
MAX-TST-LTEA-W-T	1	Worldwide^	LTEAdvanced	B1/2100, B2/1900, B3/1800, B4/AWS, B5/850, B7/2600, B8/900GSM, B12/700a, B13/700c,	WCDMA/HSPA+/DC-HSPA+: B1/2100 B2/1900, B3/1800, B4/AWS, B5/850,
MAX-TST-DUO-LTEA-W-T	2			B20/800DD, B25/1900+, B26/850+, B29/700d, B30/2300WCS, B41/TD2500	B8/900
MAX-TST-LTEA-P-T	1	Asia-Pacific	LTEAdvanced	B1/2100, B3/1800, B5/850, B7/2600, B8/900, B18/800 Lower, B19/800 Upper, B21/1500 Upper, B28/700 APT, B38/TD 2600, B39/TD 1900+, B40/TD 2300, B41/TD 2500	WCDMA/HSPA+/DC-HSPA+: B1/2100, B5/850, B8/900, B9/1800, B19/800 Upper UMTS: B6/800 TD-SCDMA: B39/1900
MAX-TST-DUO-LTEA-P-T	2				
MAX-TST-LTE-US-T	1	Verizon/Sprint/ AT&T-Mobile	LTE	B2/1900, B4/AWS, B5/850, B13/700, B17/700, B25/1900	WCDMA/HSPA+/DC-HSPA+: B1/2100, B2/1900, B4/AWS, B5/850, B8/900 EV-DO Rev.A: BC0/800, BC1/1900, BC10/800
MAX-TST-DUO-LTE-US-T	2				
MAX-TST-LTE-E-T	1	Europe/ International	LTE	B1/2100, B3/1800, B7/2600, B8/900, B20/800	WCDMA/HSPA+/DC-HSPA+: B1/2100, B2/1900, B5/850, B6/800, B8/900
MAX-TST-DUO-LTE-E-T	2				

Pending certification by Verizon and Sprint in the US

Add-On License

MAX-TST-DUO-LC-SF	SpeedFusion License for MAX-TST-DUO	Enables SpeedFusion Bandwidth Bonding and WAN Smoothing for MAX-TST-DUO
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EXHIBIT B

COMPENSATION FOR EQUIPMENT

The attached **Exhibit** describes Seller's payment for Equipment. To the extent it includes expenses, profits, overhead, etc. (collectively, "**Cost Components**"), the Cost Components herein shall not be exceeded except by prior written agreement of the Authority pursuant to the terms of the Agreement.

EXHIBIT C

REQUIRED FEDERAL AVIATION AUTHORITY CONTRACT PROVISIONS

A1 ACCESS TO RECORDS AND REPORTS

The Contractor must maintain an acceptable cost accounting system. The Contractor agrees to provide the Owner, the Federal Aviation Administration and the Comptroller General of the United States or any of their duly authorized representatives access to any books, documents, papers and records of the Contractor which are directly pertinent to the specific contract for the purpose of making audit, examination, excerpts and transcriptions. The Contractor agrees to maintain all books, records and reports required under this contract for a period of not less than three years after final payment is made and all pending matters are closed.

A2 AFFIRMATIVE ACTION REQUIREMENT

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables

Goals for minority participation for each trade: See DBE Goal (Section III of IFB for details)
Goals for female participation in each trade: See DBE Goal (Section III of IFB for details)

These goals are applicable to all of the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the Contractor also is subject to the goals for both its federally involved and non-federally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a) and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and

the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs (OFCCP) within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.
4. As used in this notice and in the contract resulting from this solicitation, the "covered area" is North Carolina, Wake County, Raleigh.

A3 BREACH OF CONTRACT TERMS

Any violation or breach of terms of this contract on the part of the Contractor or its subcontractors may result in the suspension or termination of this contract or such other action that may be necessary to enforce the rights of the parties of this agreement.

Owner will provide Contractor written notice that describes the nature of the breach and corrective actions the Contractor must undertake in order to avoid termination of the contract. Owner reserves the right to withhold payments to Contractor until such time the Contractor corrects the breach or the Owner elects to terminate the contract. The Owner's notice will identify a specific date by which the Contractor must correct the breach. Owner may proceed with termination of the contract if the Contractor fails to correct the breach by the deadline indicated in the Owner's notice.

The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder are in addition to, and not a limitation of, any duties, obligations, rights and remedies otherwise imposed or available by law.

A4 BUY AMERICAN PREFERENCE

The Contractor certifies that its bid/offer is in compliance with 49 USC § 50101, BABA and other related Made in America Laws,¹ U.S. statutes, guidance, and FAA policies, which provide that Federal funds may not be obligated unless all iron, steel and manufactured goods used in AIP funded projects are produced in the United States, unless the Federal Aviation Administration has issued a waiver for the product; the product is listed as an Excepted Article, Material Or Supply in Federal Acquisition Regulation subpart 25.108; or is included in the FAA Nationwide Buy American Waivers Issued list.

The bidder or offeror must complete and submit the certification of compliance with FAA's Buy American Preference, BABA and Made in America laws included herein with their bid or offer. The Airport Sponsor/Owner will reject as nonresponsive any bid or offer that does not include a completed certification of compliance with FAA's Buy American Preference and BABA.

The bidder or offeror certifies that all construction materials, defined to mean 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 are or consist 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 used in the project are manufactured in the U.S.

¹ Per Executive Order 14005 "Made in America Laws" means all statutes, regulations, rules, and Executive Orders relating to federal financial assistance awards or federal procurement, including those that refer to "Buy America" or "Buy American," that require, or provide a preference for, the purchase or acquisition of goods, products, or materials produced in the United States, including iron, steel, and manufactured products offered in the United States.

A4 . 3 . 2 Certification of Compliance with FAA Buy American Preference – Construction Projects

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with its proposal. The bidder or offeror must indicate how it intends to comply with 49 USC § 50101, BABA and other related Made in America Laws, U.S. statutes, guidance, and FAA policies, by selecting one of the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (i.e., not both) by inserting a checkmark (✓) or the letter "X".

- Bidder or offeror hereby certifies that it will comply with 49 USC § 50101, BABA and other related U.S. statutes, guidance, and policies of the FAA by:
 - a) Only installing iron, steel and manufactured products produced in the United States;
 - b) Only installing construction materials defined as: 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 are or consist 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 that have been manufactured in the United States.

- c) Installing manufactured products for which the Federal Aviation Administration (FAA) has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or
- d) Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

- a) To provide to the Airport Sponsor or the FAA evidence that documents the source and origin of the iron, steel, and/or manufactured product.
- b) To faithfully comply with providing U.S. domestic products.
- c) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.
- d) Certify that all construction materials used in the project are manufactured in the U.S.

- The bidder or offeror hereby certifies it cannot comply with the 100 percent Buy American Preferences of 49 USC § 50101(a) but may qualify for a Type 3 or Type 4 waiver under 49 USC

§ 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:

- e) To submit to the Airport Sponsor or FAA within 15 calendar days of being selected as the responsive bidder, a formal waiver request and required documentation that supports the type of waiver being requested.
- f) That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination that may result in rejection of the proposal.
- g) To faithfully comply with providing U.S. domestic products at or above the approved

U.S. domestic content percentage as approved by the FAA.

- h) To furnish U.S. domestic product for any waiver request that the FAA rejects.
- i) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

Required Documentation

Type 2 Waiver (Nonavailability) - The iron, steel, manufactured goods or construction materials or manufactured goods are not available in sufficient quantity or quality in the United States. The required documentation for the Nonavailability waiver is

- a) Completed Content Percentage Worksheet and Final Assembly Questionnaire
- b) Record of thorough market research, consideration where appropriate of qualifying alternate items, products, or materials including;
- c) A description of the market research activities and methods used to identify domestically manufactured items capable of satisfying the requirement, including the timing of the research and conclusions reached on the availability of sources.

Type 3 Waiver – The cost of components and subcomponents produced in the United States is more than 60 percent of the cost of all components and subcomponents of the “facility/project.” The required documentation for a Type 3 waiver is:

- a) Completed Content Percentage Worksheet and Final Assembly Questionnaire including;
- b) Listing of all manufactured products that are not comprised of 100 percent U.S. domestic content (excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non- domestic products in their entirety).
- c) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly and installation at project location.
- d) Percentage of non-domestic component and subcomponent cost as compared to total “facility” component and subcomponent costs, excluding labor costs associated with final assembly and installation at project location.

Type 4 Waiver (Unreasonable Costs) - Applying this provision for iron, steel, manufactured goods or construction materials would increase the cost of the overall project by more than 25 percent. The required documentation for this waiver is:

- a) A completed Content Percentage Worksheet and Final Assembly Questionnaire from
- b) At minimum two comparable equal bids and/or offers;
- c) Receipt or record that demonstrates that supplier scouting called for in Executive Order 14005, indicates that no domestic source exists for the project and/or component;
- d) Completed waiver applications for each comparable bid and/or offer.

False Statements: Per 49 USC § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

Date	Signature

Company Name

Title

**A4.3.3 Certification of Compliance with FAA Buy American Preference – Equipment
/
Building Projects**

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with their proposal. The bidder or offeror must indicate how they intend to comply with 49 USC § 50101, and other Made in America Laws, U.S. statutes, guidance, and FAA policies by selecting one on the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (not both) by inserting a checkmark (✓) or the letter “X”.

- Bidder or offeror hereby certifies that it will comply with 49 USC § 50101, BABA and other related U.S. statutes, guidance, and policies of the FAA by:
 - a) Only installing steel and manufactured products produced in the United States;
 - b) Only installing construction materials defined as: 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 are or consist 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 that have been manufactured in the United States.
 - c) Installing manufactured products for which the Federal Aviation Administration (FAA) has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or
 - d) Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

- a) To provide to the Airport Sponsor or FAA evidence that documents the source and origin of the steel and manufactured product.
 - b) To faithfully comply with providing U.S. domestic product.
 - c) To furnish U.S. domestic product for any waiver request that the FAA rejects.
 - d) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.
- The bidder or offeror hereby certifies it cannot comply with the 100 percent Buy American Preferences of 49 USC § 50101(a) but may qualify for a Type 3 waiver under 49 USC § 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:
 - e) To submit to the Airport Sponsor or FAA within 15 calendar days of being selected as the responsive bidder, a formal waiver request and required documentation that supports the type of waiver being requested.
 - f) That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination that may result in rejection of the proposal.
 - g) To faithfully comply with providing U.S. domestic products at or above the approved U.S. domestic content percentage as approved by the FAA.

- h) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

Required Documentation

Type 2 Waiver (Nonavailability) - The iron, steel, manufactured goods or construction materials are not available in sufficient quantity or quality in the United States. The required documentation for the Nonavailability waiver is:

- a) Completed Content Percentage Worksheet and Final Assembly Questionnaire
- b) Record of thorough market research, consideration where appropriate of qualifying alternate items, products, or materials including;
- c) A description of the market research activities and methods used to identify domestically manufactured items capable of satisfying the requirement, including the timing of the research and conclusions reached on the availability of sources.

Type 3 Waiver – The cost of the item components and subcomponents produced in the United States is more than 60 percent of the cost of all components and subcomponents of the “item”. The required documentation for a Type 3 waiver is:

- a) Completed Content Percentage Worksheet and Final Assembly Questionnaire including;
- b) Listing of all product components and subcomponents that are not comprised of 100 percent U.S. domestic content (Excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108 (products of unknown origin must be considered as non-domestic products in their entirety).
- c) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly at place of manufacture.
- d) Percentage of non-domestic component and subcomponent cost as compared to total “item” component and subcomponent costs, excluding labor costs associated with final assembly at place of manufacture.

Type 4 Waiver (Unreasonable Costs) - Applying this provision for iron, steel, manufactured goods or construction materials, would increase the cost of the overall project by more than 25 percent. The required documentation for this waiver is:

- a) Completed Content Percentage Worksheet and Final Assembly Questionnaire from
- b) At minimum two comparable equal bidders and/or offerors;
- c) Receipt or record that demonstrates that supplier scouting called for in Executive Order 14005, indicates that no domestic source exists for the project and/or component;
- d) Completed waiver applications for each comparable bid and/or offer.

False Statements: Per 49 USC § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

_____	_____
Date	Signature
_____	_____
Company Name	Title

A5 CIVIL RIGHTS - GENERAL

In all its activities within the scope of its airport program, the Contractor agrees to comply with pertinent statutes, Executive Orders, and such rules as identified in Title VI List of Pertinent Nondiscrimination Acts and Authorities to ensure that no person shall, on the grounds of race, color, national origin (including limited English proficiency), creed, sex (including sexual orientation and gender identity), age, or disability be excluded from participating in any activity conducted with or benefiting from Federal assistance.

This provision is in addition to that required by Title VI of the Civil Rights Act of 1964.

A5.3.2 Specific Clause that is used for General Contract Agreements

The above provision binds the Contractor and subcontractors from the bid solicitation period through the completion of the contract.

A6 CIVIL RIGHTS – TITLE VI ASSURANCE

A6 CIVIL RIGHTS – TITLE VI ASSURANCE

A6.3.1 Title VI Solicitation Notice Title

VI Solicitation Notice:

The **Authority**, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 USC §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders or offerors that it will affirmatively ensure that for any contract entered into pursuant to this advertisement, [select businesses, or disadvantaged business enterprises or airport concession disadvantaged business enterprises] will be afforded full and fair opportunity to submit bids in response to this invitation and no businesses will be discriminated against on the grounds of race, color, national origin (including limited English proficiency), creed, sex (including sexual orientation and gender identity), age, or disability in consideration for an award.

A6 . 4 MANDATORY CONTRACT CLAUSES

A6 . 4 . 1 Title VI List of Pertinent Non discrimination Acts and Authorities

Insert this list in every contract or agreement, unless the Sponsor has determined and the FAA concurs, that the contract or agreement is not subject to the Nondiscrimination Acts and Authorities. This list can be omitted if the FAA has determined that the contractor or company is already subject to nondiscrimination requirements, which is a rare occurrence.

Title VI List of Pertinent Nondiscrimination Acts and Authorities

During the performance of this contract, the Contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “Contractor”) agrees to comply with the following non- discrimination statutes and authorities; including but not limited to:

- Title VI of the Civil Rights Act of 1964 (42 USC § 2000d *et seq.*, 78 stat. 252) (prohibits discrimination on the basis of race, color, national origin);
- 49 CFR part 21 (Non-discrimination in Federally-Assisted programs of the Department of Transportation—Effectuation of Title VI of the Civil Rights Act of 1964);
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 USC

§ 4601) (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);

- Section 504 of the Rehabilitation Act of 1973 (29 USC § 794 *et seq.*), as amended (prohibits discrimination on the basis of disability); and 49 CFR part 27 (Nondiscrimination on the Basis of Disability in Programs or Activities Receiving Federal Financial Assistance);
- The Age Discrimination Act of 1975, as amended (42 USC § 6101 *et seq.*) (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982 (49 USC § 47123), as amended (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987 (PL 100-259) (broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, the Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms “programs or activities” to include all of the programs or activities of the Federal-aid recipients, sub- recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act of 1990 (42 USC § 12101, *et seq*) (prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities) as implemented by U.S. Department of Transportation regulations at 49 CFR parts 37 and 38;
- The Federal Aviation Administration’s Nondiscrimination statute (49 USC § 47123) (prohibits discrimination on the basis of race, color, national origin, and

- sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (ensures nondiscrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations);
 - Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs [70 Fed. Reg. 74087 (2005)];
 - Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 USC § 1681, et seq).

A6.4.2 Nondiscrimination Requirements / Title VI Clauses for Compliance

The Sponsor must include this contract clause in:

- 1) Every contract or agreement (unless the Sponsor has determined, and the FAA concurs, that the contract or agreement is not subject to the Nondiscrimination Acts and Authorities); and
- 2) Service contracts with utility companies that are not already subject to substantively identical nondiscrimination requirements.
- 3) Other types of contracts with utility companies involving property covered by A6.4.2, A6.4.3, or A6.4.4.

Compliance with Nondiscrimination Requirements:

During the performance of this contract, the Contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “Contractor”), agrees as follows:

1. **Compliance with Regulations:** The Contractor (hereinafter includes consultants) will comply with the Title VI List of Pertinent Nondiscrimination Acts and Authorities, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.
2. **Nondiscrimination:** The Contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, national origin (including limited English proficiency), creed, sex (including sexual orientation and gender identity), age, or disability in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The Contractor will not participate directly or indirectly in the discrimination prohibited by the Nondiscrimination Acts and Authorities, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21.
3. **Solicitations for Subcontracts, including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding or negotiation made by the Contractor for work to be

performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the Contractor of the contractor's obligations under this contract and the Nondiscrimination Acts and Authorities on the grounds of race, color, or national origin.

4. **Information and Reports:** The Contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Sponsor or the Federal Aviation Administration to be pertinent to ascertain compliance with such Nondiscrimination Acts and Authorities and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the Contractor will so certify to the Sponsor or the Federal Aviation Administration, as appropriate, and will set forth what efforts it has made to obtain the information.
5. **Sanctions for Noncompliance:** In the event of a Contractor's noncompliance with the non-discrimination provisions of this contract, the Sponsor will impose such contract sanctions as it or the Federal Aviation Administration may determine to be appropriate, including, but not limited to:
 - a. Withholding payments to the Contractor under the contract until the Contractor complies; and/or
 - b. Cancelling, terminating, or suspending a contract, in whole or in part.
6. **Incorporation of Provisions:** The Contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations, and directives issued pursuant thereto. The Contractor will take action with respect to any subcontract or procurement as the Sponsor or the Federal Aviation Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the Contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the Contractor may request the Sponsor to enter into any litigation to protect the interests of the Sponsor. In addition, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

A7 CLEAN AIR AND WATER POLLUTION CONTROL

Contractor agrees to comply with all applicable standards, orders, and regulations issued pursuant to the Clean Air Act (42 USC §§ 7401-7671q) and the Federal Water Pollution Control Act as amended (33 USC §§ 1251-1387). The Contractor agrees to report any violation to the Owner immediately upon discovery. The Owner assumes responsibility for notifying the Environmental Protection Agency (EPA) and the Federal Aviation Administration.

Contractor must include this requirement in all subcontracts that exceed \$150,000.

A8 CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS

1. Overtime Requirements.

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic, including watchmen and guards, in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; Liability for Unpaid Wages; Liquidated Damages.

In the event of any violation of the clause set forth in paragraph (1) of this clause, the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such 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 the clause set forth in paragraph (1) of this clause, in the sum of \$29 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 the clause set forth in paragraph (1) of this clause.

3. Withholding for Unpaid Wages and Liquidated Damages.

The Federal Aviation Administration (FAA) or the Owner 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 the clause set forth in paragraph (2) of this clause.

4. Subcontractors.

The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs (1) through (4) and also a clause requiring the subcontractor 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 paragraphs (1) through (4) of this clause.

Contractor must comply with the requirements of the Copeland “Anti-Kickback” Act (18 USC 874 and 40 USC 3145), as supplemented by Department of Labor regulation 29 CFR part 3. Contractor and subcontractors are prohibited from inducing, by any means, any person employed on the project to give up any part of the compensation to which the employee is entitled. The Contractor and each Subcontractor must submit to the Owner, a weekly statement on the wages paid to each employee performing on covered work during the prior week. Owner must report any violations of the Act to the Federal Aviation Administration.

A10 DAVIS- BACON REQUIREMENTS

*See Wage Rates in Attachment 1 below.

1. Minimum Wages.

- (i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalent thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis- Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided*, that the employer’s payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can easily be seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination;
 - (2) The classification is utilized in the area by the construction industry; and
 - (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.
- (B) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.
- (C) In the event the Contractor, the laborers, or mechanics to be employed in the classification, or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.
- (D) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii) (B) or (C) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.
- (iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided*, that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding. The Federal Aviation Administration or the Sponsor 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 the Contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Federal Aviation Administration may, after written notice to the Contractor, Sponsor, Applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and Basic Records

(i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types

described in 1(b)(2)(B) of the Davis-Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records that show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs

anticipated or the actual costs incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit the payrolls to the applicant, Sponsor, or Owner, as the case may be, for transmission to the Federal Aviation Administration. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR § 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (*e.g.*, the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <https://www.dol.gov/agencies/whd/government-contracts/construction/payroll-certification> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker and shall provide them upon request to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit them to the applicant, Sponsor, or Owner, as the case may be, for transmission to the Federal Aviation Administration, the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, Sponsor, or Owner).

- (B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:
- (1) That the payroll for the payroll period contains the information required to be provided under 29 CFR § 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR § 5.5 (a)(3)(i), and that such information is correct and complete;
 - (2) That each laborer and mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either

directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR Part 3;

- (3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

- (C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance” required by paragraph (3)(ii)(B) of this section.

- (D) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

- (iii) The Contractor or subcontractor shall make the records required under paragraph (3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the Sponsor, the Federal Aviation Administration, or the Department of Labor and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the Contractor, Sponsor, applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR § 5.12.

4. Apprentices and Trainees.

- (i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage

determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

- (ii) Trainees. Except as provided in 29 CFR § 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination that provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate that is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the

Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

- (iii) Equal Employment Opportunity. The utilization of apprentices, trainees, and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. Compliance with Copeland Act Requirements.

The Contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.

6. 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 Federal Aviation Administration 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.

7. Contract Termination: Debarment.

A breach of the contract clauses in paragraph 1 through 10 of this section may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR § 5.12.

8. Compliance with Davis-Bacon and Related Act Requirements.

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes Concerning Labor Standards.

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. 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 USC § 1001.

A11 DEBARMENT AND SUSPENSION

CERTIFICATION OF OFFEROR/BIDDER REGARDING DEBARMENT

By submitting a bid/proposal under this solicitation, the bidder or offeror certifies that neither it nor its principals are presently debarred or suspended by any Federal department or agency from participation in this transaction.

A11.3.2 Lower Tier Contract Certification

CERTIFICATION OF LOWER TIER CONTRACTORS REGARDING DEBARMENT

The successful bidder, by administering each lower tier subcontract that exceeds \$25,000 as a “covered transaction”, must confirm each lower tier participant of a “covered transaction” under the project is not presently debarred or otherwise disqualified from participation in this federally-assisted project. The successful bidder 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 Offeror /Bidder Regarding Debarment, above.
3. Inserting a clause or condition in the covered transaction with the lower tier contract.

If the Federal Aviation Administration later determines that a lower tier participant failed to disclose to a higher tier participant that it was excluded or disqualified at the time it entered the covered transaction, the FAA may pursue any available remedies, including suspension and debarment of the non-compliant participant.

A12 DISADVANTAGED BUSINESS ENTERPRISE

(See DBE Section III of IFB, the DBE Goal, and the DBE Forms)

Bid Information Submitted as a matter of **responsiveness**:

The Owner's award of this contract is conditioned upon Bidder or Offeror satisfying the good faith effort requirements of 49 CFR § 26.53.

As a condition of responsiveness, the Bidder or Offeror must submit the following information with its proposal on the forms provided herein:

- 1) The names and addresses of Disadvantaged Business Enterprise (DBE) firms that will participate in the contract;
- 2) A description of the work that each DBE firm will perform;
- 3) The dollar amount of the participation of each DBE firm listed under (1);
- 4) Written statement from Bidder or Offeror that attests their commitment to use the DBE firm(s) listed under (1) to meet the Owner's project goal
- 5) Written confirmation from each listed DBE firm that it is participating in the contract in the kind and amount of work provided in the prime contractor's commitment; and
- 6) If Bidder or Offeror cannot meet the advertised project DBE goal, evidence of good faith efforts undertaken by the Bidder or Offeror as described in appendix A to 49 CFR part 26. The documentation of good faith efforts must include copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor was selected over a DBE for work on the contract.

Bid Information submitted as a matter of responsibility:

The Owner's award of this contract is conditioned upon Bidder or Offeror satisfying the good faith effort requirements of 49 CFR § 26.53.

As a condition of responsibility, every Bidder or Offeror must submit the following information on the forms provided herein within five days after bid opening.

- 1) The names and addresses of Disadvantaged Business Enterprise (DBE) firms that will participate in the contract;
- 2) A description of the work that each DBE firm will perform;
- 3) The dollar amount of the participation of each DBE firm listed under (1);
- 4) Written statement from Bidder or Offeror that attests their commitment to use the DBE firm(s) listed under (1) to meet the Owner's project goal;
- 5) Written confirmation from each listed DBE firm that it is participating in the contract in the kind and amount of work provided in the prime contractor's commitment; and
- 6) If Bidder or Offeror cannot meet the advertised project DBE goal, evidence of good faith efforts undertaken by the Bidder or Offeror as described in appendix A to 49 CFR part 26. The documentation of good faith efforts must include copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor was selected over a DBE for work on the contract.

A12 . 3 . 2 Solicitation Language (Race / Gender Neutral Means)

The requirements of 49 CFR part 26 apply to this contract. It is the policy of the Authority to practice nondiscrimination based on race, color, sex, or national origin in the award or performance of this contract. The Owner encourages participation by all firms qualifying under this solicitation regardless of business size or ownership.

A12 . 3 . 3 Prime Contracts (Contracts Covered by a DBE Program)

Contract Assurance (49 CFR § 26.13; mandatory text provided) –

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 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 recipient deems appropriate, which may include, but is not limited to:

- 1) Withholding monthly progress payments;
- 2) Assessing sanctions;
- 3) Liquidated damages; and/or
- 4) Disqualifying the Contractor from future bidding as non-responsible.

Prompt Payment (49 CFR § 26.29; acceptable/sample text provided) –

The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than 30 days from the receipt of each payment the prime contractor receives from the Authority. The prime contractor agrees further to return retainage payments to each subcontractor within 30 days after the subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the Authority. This clause applies to both DBE and non-DBE subcontractors.

Termination of DBE Subcontracts (49 CFR § 26.53(f); acceptable/sample text provided) – (See DBE Section III of IFB, the DBE Goal, and the DBE Forms)

A13 DISTRACTED DRIVING

TEXTING WHEN DRIVING

In accordance with Executive Order 13513, “Federal Leadership on Reducing Text Messaging While Driving”, (10/1/2009) and DOT Order 3902.10, “Text Messaging While Driving”, (12/30/2009), the Federal Aviation Administration encourages recipients of Federal grant funds to adopt and enforce safety policies that decrease crashes by distracted drivers, including policies to ban text messaging while driving when performing work related to a grant or subgrant.

In support of this initiative, the Owner encourages the Contractor to promote policies and initiatives for its employees and other work personnel that decrease crashes by distracted drivers, including policies that ban text messaging while driving motor vehicles while performing work activities associated with the project. The Contractor must include the substance of this clause in all sub-tier contracts exceeding \$10,000 that involve driving a motor vehicle in performance of work activities associated with the project.

A14 PROHIBITION ON CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT

Contractor and Subcontractor agree to comply with mandatory standards and policies relating to use and procurement of certain telecommunications and video surveillance services or equipment in compliance with the National Defense Authorization Act [Public Law 115-232 § 889(f)(1)].

A15 DRUG FREE WORKPLACE REQUIREMENTS

The Drug-Free Workplace Act of 1988 requires some Federal contractors and *all* Federal grantees to agree that they will provide drug-free workplaces as a condition of receiving a contract or grant from a Federal agency. The Act does *not* apply to contractors, subcontractors, or subgrantees, although the Federal grantees workplace may be where the contractors, subcontractors, or subgrantees are working.

A16 EQUAL EMPLOYMENT OPPORTUNITY (EEO)

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 identify, 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 it has a collective bargaining agreement or other contract or understanding, a notice to be provided by the agency contracting officer, advising the labor union or workers' representative of the Contractor's commitments under this section 202 of Executive Order 11246 of September 24, 1965, 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 the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the

contracting 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 such 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 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 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 may be directed by the Secretary of Labor as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

EEO Specifications

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS

1. As used in these specifications:
 - a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
 - b. "Director" means Director, Office of Federal Contract Compliance Programs (OFCCP), U.S. Department of Labor, or any person to whom the Director delegates authority;
 - c. "Employer identification number" means the Federal social security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941;
 - d. "Minority" includes:
 - (1) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 - (2) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South

American, or other Spanish culture or origin, regardless of race);

- (3) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
 - (4) American Indian or Alaskan native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).
2. Whenever the Contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.
 3. If the Contractor is participating (pursuant to 41 CFR part 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved plan is individually required to comply with its obligations under the EEO clause and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other contractors or subcontractors toward a goal in an approved Plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.
 4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through 7p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction contractors performing construction work in a geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.
6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.
7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:
 - a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
 - b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.
 - c. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source, or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.
 - d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the

Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

- e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.
- f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
- g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decisions including specific review of these items with onsite supervisory personnel such as superintendents, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
- h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other contractors and subcontractors with whom the Contractor does or anticipates doing business.
- i. Direct its recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
- j. Encourage present minority and female employees to recruit other minority persons

and women and, where reasonable, provide after school, summer, and vacation employment to minority and female youth both on the site and in other areas of a contractor's work force.

- k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR part 60- 3.
 - l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel, for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
 - m. Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.
 - n. Ensure that all facilities and company activities are nonsegregated except that separate or single- user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
 - o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
 - p. Conduct a review, at least annually, of all supervisor's adherence to and performance under the Contractor's EEO policies and affirmative action obligations.
8. Contractors are encouraged to participate in voluntary associations, which assist in fulfilling one or more of their affirmative action obligations (7a through 7p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the Contractor is a member and participant may be asserted as fulfilling any one or more of its obligations under 7a through 7p of these specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.
9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take

affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, sexual orientation, gender identity, or national origin.
11. The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.
12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination, and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.
13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR part 60-4.8.
14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government, and to keep records. Records shall at least include for each employee, the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.
15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g. those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

A17 FEDERAL FAIR LABOR STANDARDS ACT (FEDERAL MINIMUM WAGE)

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 CFR part 201, et seq, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part-time workers.

The Contractor has full responsibility to monitor compliance to the referenced statute or regulation. The Contractor must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division.

A18 LOBBYING AND INFLUENCING FEDERAL EMPLOYEES

CERTIFICATION REGARDING LOBBYING

The Bidder or Offeror certifies by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the Bidder or Offeror, to any person for influencing or attempting to influence an officer or employee of an agency, 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 influencing or attempting to influence an officer or employee of any agency, 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, subgrants, 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 section 1352, title 31, U.S. Code. 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.

A19 PROHIBITION OF SEGREGATED FACILITIES

- (a) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Employment Opportunity clause in this contract.
- (b) “Segregated facilities,” as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.
- (c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Employment Opportunity clause of this contract.

A20 OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 CFR Part 1910 with the same force and effect as if given in full text. The employer must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The employer retains full responsibility to monitor its compliance and their subcontractor’s compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (29 CFR Part 1910). The employer must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

A21 PROCUREMENT OF RECOVERED MATERIALS

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.

A22 RIGHT TO INVENTIONS

Contracts or agreements that include the performance of experimental, developmental, or research work must provide for the rights of the Federal Government and the Owner in any resulting invention as established by 37 CFR part 401, Rights to Inventions Made by Non-profit Organizations and Small Business Firms under Government Grants, Contracts, and Cooperative Agreements. This contract incorporates by reference the patent and inventions rights as specified within 37 CFR § 401.14. Contractor must include this requirement in all sub-tier contracts involving experimental, developmental, or research work.

SEISMIC SAFETY

In the performance of design services, the Consultant agrees to furnish a building design and associated construction specification that conform to a building code standard that provides a level of seismic safety substantially equivalent to standards as established by the National Earthquake Hazards Reduction Program (NEHRP). Local building codes that model their building code after the current version of the International Building Code (IBC) meet the NEHRP equivalency level for seismic safety. At the conclusion of the design services, the Consultant agrees to furnish the Owner a “certification of compliance” that attests conformance

of the building design and the construction specifications with the seismic standards of NEHRP or an equivalent building code.

A23 .3.2 Construction Contracts

SEISMIC SAFETY

The Contractor agrees to ensure that all work performed under this contract, including work performed by subcontractors, conforms to a building code standard that provides a level of seismic safety substantially equivalent to standards established by the National Earthquake Hazards Reduction Program (NEHRP). Local building codes that model their code after the current version of the International Building Code (IBC) meet the NEHRP equivalency level for seismic safety.

A24 TAX DELINQUENCY AND FELONY CONVICTIONS

CERTIFICATION OF OFFEROR/BIDDER REGARDING TAX DELINQUENCY AND FELONY CONVICTIONS

The applicant must complete the following two certification statements. The applicant must indicate its current status as it relates to tax delinquency and felony conviction by inserting a checkmark (✓) in the space following the applicable response. The applicant agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification in all lower tier subcontracts.

Certifications

- 1) The applicant represents that it is () is not () a corporation that has 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.
- 2) The applicant represents that it is () is not () a corporation that was convicted of a criminal violation under any Federal law within the preceding 24 months.

Note

If an applicant responds in the affirmative to either of the above representations, the applicant is ineligible to receive an award unless the Sponsor has received notification from the agency suspension and debarment official (SDO) that the SDO has considered suspension or debarment and determined that further action is not required to protect the Government's interests. The applicant therefore must provide information to the owner about its tax liability or conviction to the Owner, who will then notify the FAA Airports District Office, which will then notify the agency's SDO to facilitate completion of the

required considerations before award decisions are made.

Term Definitions

Felony conviction: Felony conviction means a conviction within the preceding twenty four (24) months of a felony criminal violation under any Federal law and includes conviction of an offense defined in a section of the U.S. Code that specifically classifies the offense as a felony and conviction of an offense that is classified as a felony under 18 USC § 3559.

Tax Delinquency: A tax delinquency is 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.

A25 TERMINATION OF CONTRACT

A25.3.1 Termination for Convenience

TERMINATION FOR CONVENIENCE (CONSTRUCTION & EQUIPMENT CONTRACTS)

The Owner may terminate this contract in whole or in part at any time by providing written notice to the Contractor. Such action may be without cause and without prejudice to any other right or remedy of Owner. Upon receipt of a written notice of termination, except as explicitly directed by the Owner, the Contractor shall immediately proceed with the following obligations regardless of any delay in determining or adjusting amounts due under this clause:

1. Contractor must immediately discontinue work as specified in the written notice.
2. Terminate all subcontracts to the extent they relate to the work terminated under the notice.
3. Discontinue orders for materials and services except as directed by the written notice.
4. Deliver to the Owner all fabricated and partially fabricated parts, completed and partially completed work, supplies, equipment and materials acquired prior to termination of the work, and as directed in the written notice.
5. Complete performance of the work not terminated by the notice.
6. Take action as directed by the Owner to protect and preserve property and work related to this contract that Owner will take possession.

Owner agrees to pay Contractor for:

1. Completed and acceptable work executed in accordance with the contract documents prior to the effective date of termination;
2. Documented expenses sustained prior to the effective date of termination in performing work and furnishing labor, materials, or equipment as required by

- the contract documents in connection with uncompleted work;
3. Reasonable and substantiated claims, costs, and damages incurred in settlement of terminated contracts with Subcontractors and Suppliers; and
 4. Reasonable and substantiated expenses to the Contractor directly attributable to Owner's termination action.

Owner will not pay Contractor for loss of anticipated profits or revenue or other economic loss arising out of or resulting from the Owner's termination action.

The rights and remedies this clause provides are in addition to any other rights and remedies provided by law or under this contract.

TERMINATION FOR CONVENIENCE (PROFESSIONAL SERVICES)

The Owner may, by written notice to the Consultant, terminate this Agreement for its convenience and without cause or default on the part of Consultant. Upon receipt of the notice of termination, except as explicitly directed by the Owner, the Contractor must immediately discontinue all services affected.

Upon termination of the Agreement, the Consultant must deliver to the Owner all data, surveys, models, drawings, specifications, reports, maps, photographs, estimates, summaries, and other documents and materials prepared by the Engineer under this contract, whether complete or partially complete.

Owner agrees to make just and equitable compensation to the Consultant for satisfactory work completed up through the date the Consultant receives the termination notice. Compensation will not include anticipated profit on non-performed services.

Owner further agrees to hold Consultant harmless for errors or omissions in documents that are incomplete as a result of the termination action under this clause.

Termination for Default

TERMINATION FOR CAUSE (CONSTRUCTION)

Section 80-09 of FAA Advisory Circular 150/5370-10 establishes standard language for conditions, rights, and remedies associated with Owner termination of this contract for cause due to default of the Contractor.

TERMINATION FOR CAUSE (EQUIPMENT)

The Owner may, by written notice of default to the Contractor, terminate all or part of this Contract for cause if the Contractor:

1. Fails to begin the Work under the Contract within the time specified in the Notice- to- Proceed;
2. Fails to make adequate progress as to endanger performance of this Contract in accordance with its terms;
3. Fails to make delivery of the equipment within the time specified in the Contract, including any Owner approved extensions;
4. Fails to comply with material provisions of the Contract;
5. Submits certifications made under the Contract and as part of their proposal that include false or fraudulent statements; or
6. Becomes insolvent or declares bankruptcy.

If one or more of the stated events occur, the Owner will give notice in writing to the Contractor and Surety of its intent to terminate the contract for cause. At the Owner's discretion, the notice may allow the Contractor and Surety an opportunity to cure the breach or default.

If within [10] days of the receipt of notice, the Contractor or Surety fails to remedy the breach or default to the satisfaction of the Owner, the Owner has authority to acquire equipment by other procurement action. The Contractor will be liable to the Owner for any excess costs the Owner incurs for acquiring such similar equipment.

Payment for completed equipment delivered to and accepted by the Owner shall be at the Contract price. The Owner may withhold from amounts otherwise due the Contractor for such completed equipment, such sum as the Owner determines to be necessary to protect the Owner against loss because of Contractor default.

Owner will not terminate the Contractor's right to proceed with the work under this clause if the delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such acceptable causes include: acts of God, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, and severe weather events that substantially exceed normal conditions for the location.

If, after termination of the Contractor's right to proceed, the Owner determines that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the Owner issued the termination for the convenience the Owner.

The rights and remedies of the Owner in this clause are in addition to any other rights and remedies provided by law or under this contract.

TERMINATION FOR CAUSE (PROFESSIONAL SERVICES)

Either party may terminate this Agreement for cause if the other party fails to fulfill its

obligations that are essential to the completion of the work per the terms and conditions of the Agreement. The party initiating the termination action must allow the breaching party an opportunity to dispute or cure the breach.

The terminating party must provide the breaching party [7] days advance written notice of its intent to terminate the Agreement. The notice must specify the nature and extent of the breach, the conditions necessary to cure the breach, and the effective date of the termination action. The rights and remedies in this clause are in addition to any other rights and remedies provided by law or under this agreement.

- a) **Termination by Owner:** The Owner may terminate this Agreement for cause in whole or in part, for the failure of the Consultant to:
1. Perform the services within the time specified in this contract or by Owner approved extension;
 2. Make adequate progress so as to endanger satisfactory performance of the Project; or
 3. Fulfill the obligations of the Agreement that are essential to the completion of the Project.

Upon receipt of the notice of termination, the Consultant must immediately discontinue all services affected unless the notice directs otherwise. Upon termination of the Agreement, the Consultant must deliver to the Owner all data, surveys, models, drawings, specifications, reports, maps, photographs, estimates, summaries, and other documents and materials prepared by the Engineer under this contract, whether complete or partially complete.

Owner agrees to make just and equitable compensation to the Consultant for satisfactory work completed up through the date the Consultant receives the termination notice. Compensation will not include anticipated profit on non-performed services.

Owner further agrees to hold Consultant harmless for errors or omissions in documents that are incomplete as a result of the termination action under this clause.

If, after finalization of the termination action, the Owner determines the Consultant was not in default of the Agreement, the rights and obligations of the parties shall be the same as if the Owner issued the termination for the convenience of the Owner.

- b) **Termination by Consultant:** The Consultant may terminate this Agreement for cause in whole or in part, if the Owner:
1. Defaults on its obligations under this Agreement;
 2. Fails to make payment to the Consultant in accordance with the terms of this Agreement;
 3. Suspends the project for more than [180] days due to reasons beyond the control of the Consultant.

Upon receipt of a notice of termination from the Consultant, Owner agrees to cooperate with Consultant for the purpose of terminating the agreement or portion thereof, by mutual consent. If Owner and Consultant cannot reach mutual agreement on the termination

settlement, the Consultant may, without prejudice to any rights and remedies it may have, proceed with terminating all or parts of this Agreement based upon the Owner's breach of the contract.

In the event of termination due to Owner breach, the Consultant is entitled to invoice Owner and to receive full payment for all services performed or furnished in accordance with this Agreement and all justified reimbursable expenses incurred by the Consultant through the effective date of termination action. Owner agrees to hold Consultant harmless for errors or omissions in documents that are incomplete as a result of the termination action under this clause.

A26 TRADE RESTRICTION CERTIFICATION

By submission of an offer, the Offeror certifies that with respect to this solicitation and any resultant contract, the Offeror –

- 1) is not owned or controlled by one or more citizens of a foreign country included in the list of countries that discriminate against U.S. firms as published by the Office of the United States Trade Representative (USTR);
- 2) has not knowingly entered into any contract or subcontract for this project with a person that is a citizen or national of a foreign country included on the list of countries that discriminate against U.S. firms as published by the USTR; and
- 3) has not entered into any subcontract for any product to be used on the Federal project that is produced in a foreign country included on the list of countries that discriminate against U.S. firms published by the USTR.

This certification concerns a matter within the jurisdiction of an agency of the United States of America and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18 USC § 1001.

The Offeror/Contractor must provide immediate written notice to the Owner if the Offeror/Contractor learns that its certification or that of a subcontractor was erroneous when submitted or has become erroneous by reason of changed circumstances. The Contractor must require subcontractors provide immediate written notice to the Contractor if at any time it learns that its certification was erroneous by reason of changed circumstances.

Unless the restrictions of this clause are waived by the Secretary of Transportation in accordance with 49 CFR § 30.17, no contract shall be awarded to an Offeror or subcontractor:

- 1) who is owned or controlled by one or more citizens or nationals of a foreign country included on the list of countries that discriminate against U.S. firms

- published by the USTR; or
- 2) whose subcontractors are owned or controlled by one or more citizens or nationals of a foreign country on such USTR list; or
- 3) who incorporates in the public works project any product of a foreign country on such USTR list.

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by this provision. The knowledge and information of a contractor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

The Offeror agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification without modification in all lower tier subcontracts. The Contractor may rely on the certification of a prospective subcontractor that it is not a firm from a foreign country included on the list of countries that discriminate against U.S. firms as published by USTR, unless the Offeror has knowledge that the certification is erroneous.

This certification is a material representation of fact upon which reliance was placed when making an award. If it is later determined that the Contractor or subcontractor knowingly rendered an erroneous certification, the Federal Aviation Administration (FAA) may direct through the Owner cancellation of the contract or subcontract for default at no cost to the Owner or the FAA.

A27 VETERAN' SPREFERENCE

In the employment of labor (excluding executive, administrative, and supervisory positions), the Contractor and all sub-tier contractors must give preference to covered veterans as defined within Title 49 United States Code Section 47112. Covered veterans include Vietnam-era veterans, Persian Gulf veterans, Afghanistan-Iraq war veterans, disabled veterans, and small business concerns (as defined by 15 USC § 632) owned and controlled by disabled veterans. This preference only applies when there are covered veterans readily available and qualified to perform the work to which the employment relates.

A28 DOMESTICPREFERENCES FOR PROCUREMENTS

CERTIFICATION REGARDING DOMESTIC PREFERENCES FOR ROCUREMENTS

The Bidder or Offeror certifies by signing and submitting this bid or proposal that, to the greatest extent practicable, the Bidder or Offeror has provided 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) in compliance with 2 CFR § 200.322.