EXHIBIT 2

TROLLEY
TECHNICAL SPECIFICATIONS

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SCOPE

NOTICE: This specification is NOT intended to restrict competition. Manufacturers/Dealer's may bid their Trolley in accordance with their standard manufacturing process. In the case where that process varies for this specification, Deviations must be submitted on the provided Request for Specification Deviation Document Form and Specification Deviation Certification and Compliance Form. Any deviation documented shall be "brand name, equivalent, or equal in performance" and must meet or exceed all FTA requirements (for FTA compliant vehicles), and all Federal, State, and Local requirements. The state may, at any time during the evaluation and/or contract period, require the bidders to provide proof that the deviation meets the "brand name, equivalent or equal" in performance.

Technical Specifications define requirements for a Trolley for transit application which, by the selection of specifically identified alternative configurations, may be used for general service on urban arterial streets. It shall have a minimum expected life of 12 years/500,000 miles and is intended for the widest possible spectrum of passengers, including children, adults, the elderly, and persons with disabilities.

Base model technical specifications are offered in this document. In addition, vehicle optional features (options) may be requested by various Purchasing Entities but are not necessarily required for base vehicle operation. Proposers will have the opportunity to provide pricing as instructed in Attachment I.

SECTION 1. GENERAL REQUIREMENTS

1. The contractor shall ensure that the application and installation of major Trolley subcomponents and systems are compliant with all such subcomponent vendors' requirements and recommendations. Components used in the vehicle shall be proven in transit service.

2. The price quoted in any proposal submitted shall include all items of labor, material, tools, equipment, and other costs necessary to fully complete the manufacture and delivery of the vehicles here specified. The proposer shall not omit any part or detail which goes to make the vehicle ready for service, even if such part or detail is not addressed in this specification.

3. All parts, equipment, and accessories shall be new and completely installed, assembled, and/or adjusted as required. All exposed edges and surfaces shall be smooth, free from burrs and other projections and shall be neatly finished. Interior and exterior shall be washed and clean and vehicle shall arrive with a full tank of fuel. This specification is designed to require a complete vehicle of the class described that is constructed within agreed upon timeframes and ready for immediate operation upon delivery.

4. Whenever a specific trade or product name is used within this specification, the following statements apply: "… or approved equal with the same standards of quality, design and performance," and "…if available." All requests for approved equals must be submitted in accordance with the Request for Pre-Offer Change or Approved Equal or with the Form for Proposal Deviation.

SECTION 2. LEGAL REQUIREMENTS

1. The contractor shall comply with all applicable Federal, state and local regulations. Local regulations are defined as those below the state level. These shall include, but not be limited to, Federal ADA as well as state and local accessibility, safety and security requirements.

2. The Trolley shall meet all applicable FMVSS and shall accommodate all applicable FMCSR regulations in effect at the date of manufacture.

3. In the event of any conflict between the requirements of this specification and any applicable legal requirement, the legal requirement shall prevail.

SECTION 3. DEFINITIONS

The following are definitions of special terms used in Exhibit 2, Trolley Specifications.

(1) dBA. Decibels with reference to 0.0002 microbar as measured on the "A" scale.

(2) 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.

(3) 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 square feet shall be allocated for the feet of each seated passenger that protrudes into the standee area.

(4) 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 operator.

(5) Seated Load. One hundred fifty pounds for every designed passenger seating position and for the operator.

(6) Gross Load. One hundred fifty pounds for every designed passenger seating position, for the operator, and for each 1.5 square feet of free floor space.

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

(8) GVW (Gross Vehicle Weight). Curb weight plus gross load.

(9) 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.

(10) Mid-range Diesel Engine. Class 5 mid-range diesel engines are designed for extended service in transit vehicles and are generally used in vehicles up to 26,000 GVWR.

(11) Fireproof. Materials that will not burn or melt at temperatures less than 2,000°F.

(12) 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.

(13) Human Dimensions. The human dimensions used in Part 5: Technical Specifications are defined in Human scale 1/2/3, N. Different, A. R. Tilley, J. C. Bardagjy, MIT Press.

(14) HIC (Head Injury Criteria). The following equation presents the definition of head injury criteria:

$$\left[\frac{1}{t_1 - t_2}\int_{t_2}^{t_1}(a)dt\right]^{2.5}(t_2 - t_1)$$

Where:

a the resultant acceleration at the center of gravity of the head form expressed as a multiple of g, the acceleration of gravity.

t_1 and t_2 = any two points in time during the impact.

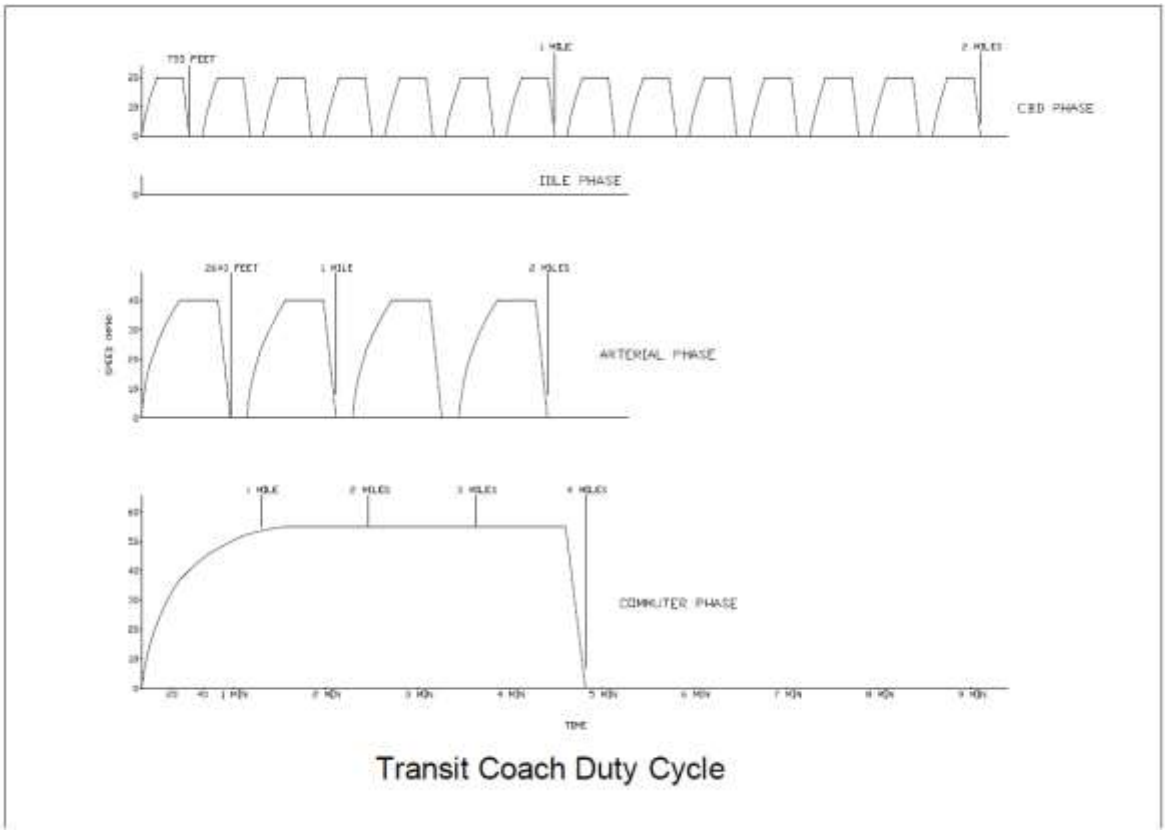
(15) Alternative. An alternative specification condition to the under thirty foot Trolley configuration. The Procuring Agency may define alternatives to the standard configuration to satisfy local operating requirements. Alternatives for the standard configuration will be clearly identified.

(16) Design Operating Profile. The operating profile for design purposes shall consist of simulated transit type service. The duty cycle consists of three phases to be repeated in sequence:

- A central business district (CBD) phase of 2 miles with 7 stops per mile and a top speed of 20 mph,
- An arterial route phase of 2 miles with 2 stops per mile and a top speed of 40 mph,
- A commuter phase of 4 miles with 1 stop and a maximum speed of 55 mph and a 5 minute idle phase.

Phase	Stops/ Mile	Top Speed (mph)	Miles	Accel. Dist. (ft.)	Accel. Time (s)	Cruise Dist. (ft.)	Cruise Time (s)	Decel. Rate (fpsps)	Decel. Dist. (ft.)	Decel. Time (s)	Dwell Time (s)	Cycle Time (min-s)	Total Stops
CBD	7	20	2	155	10	540	18.5	6.78	60	4.5	7	9-20	14
Idle	-	-	-	-	-	-	-	-	-	-	-	5-0	-
Arterial	2	40	2	1035	29	1350	22.5	6.78	255	9	7	4-30	4
CBD	7	20	2	155	10	510	18.5	6.78	60	4.5	7	9-20	14
Arterial	2	40	2	1035	35	1350	22.5	6.78	255	9	7	4-30	4
CBD	7	20	2	155	10	510	18.5	6.78	60	4.5	7	9-20	14
Commuter	1 stop for phase	Max. or 55	4	5500	90	2 miles + 4580 ft.	188	6.78	480	12	20	5-10	1
Total			14									47-10	51

Average Speed - 17.8 mph



Transit Coach Duty Cycle

The Trolley shall be loaded to SLW and shall average approximately 18 mph while operating on this duty cycle. Operation shall continue regardless of the ambient temperature or weather conditions. The passenger doors shall be opened and closed at each stop, and the Trolley shall be knelt at each stop during the CBD phase. The braking profile shall be:

16 percent of the stops at 3 ft/sec/sec
50 percent of the stops at 6 ft/sec/sec
26 percent of the stops at 9 ft/sec/sec
8 percent of the stops at 12 ft/sec/sec

These percentages of stops shall be evenly distributed over three phases of the duty cycle. For scheduling purchases, the average deceleration rate is assumed.

Alternative: High Density Operating Profile. Additional requirements for Procuring Agencies with more demanding operating profiles.

A High Density Urban (HDU) Operating Profile may be applicable to transit agencies operating in a highly populated urban area. In addition to the above requirements, this profile shall be taken into account during the design of subsystems such as charging, air, brakes and radiator/coolers. The HDU profile consists of mostly CBD type operating with some arterial and minimal commuter. The HDU profile is characterized by the following:

Average Speed	9 to 10 mph
Average Idle Time	50%
Percent Time at 0 to 19 mph	80% range
Percent Time at 20 mph & above	20%

Average speed is defined as the average engine hours versus miles traveled. Much of the “idle” time is due to stop and go nature of the service of the HDU operation. The majority of this idle time is while the Trolley is in gear and stopped in traffic or at Trolley stops as well as frequent brake applications per mile due to traffic congestion and traffic signals.

(17) Class of Failures. Classes of failures are described below.

a. Class 1: Physical Safety. A failure that could lead directly to passenger or operator injury or represents a severe crash situation.

b. Class 2: Road Call. A failure resulting in an en route interruption of revenue service. Service is discontinued until the Trolley is replaced or repaired at the point of failure.

c. Class 3: Trolley Change. A failure that requires removal of the Trolley from service during its assignments. The Trolley is operable to a rendezvous point with a replacement Trolley.

d. Class 4: Bad Order. A failure that does not require removal of the Trolley from service during its assignments but does degrade Trolley operation. The failure shall be reported by operating personnel.

(18) Maintenance Personnel Skill Levels. Defined below are maintenance personnel skill levels used in Part 5: Technical Specifications.

a. 5M: Specialist Mechanic or Class A Mechanic Leader
b. 4M: Journeyman or Class A Mechanic
c. 3M: Service Mechanic or Class B Servicer
d. 2M: Mechanic Helper or Servicer
e. 1M: Cleaner, Fueler, Oiler, Hostler, or Shifter

Note: Whenever a specific time is indicated to access components or complete a task, it is assumed the vehicle is in the location where the work is to be performed. All necessary equipment is in its correct position (tools, jacks, vehicle lifts, lighting, fluid recovery systems, etc.) and ready for use.

(19) Standards. Standards referenced are the latest revisions unless otherwise stated.

(20) 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 inches in width and 48 inches in length measured two inches above the ground and does not weigh more than 800 pounds when occupied.

(21) 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.

(22) Trolley Floor. A Trolley which, between at least the front (entrance) and rear (exit) doors, has a floor no higher than 34inches and level so as to remove the need for steps in the aisle.

SECTION 4. ABBREVIATIONS

The following is a list of abbreviations used Category 2, Trolley Technical Specifications.

(1)	ADA	Americans with Disabilities Act
(2)	ANSI	American National Standards Institute
(3)	ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
(4)	ASTM	American Society for Testing and Materials
(5)	EPA	Environmental Protection Agency
(6)	FTA	Federal Transit Administration
(7)	FMCSR	Federal Motor Carrier Safety Regulations
(8)	FMVSS	Federal Motor Vehicle Safety Standards
(9)	ISO	International Organization for Standardization
(10)	JIC	Joint Industrial Council
(11)	NHTSA	National Highway Traffic Safety Administration
(12)	OSHA	Occupational Safety and Health Administration
(13)	SAE	Society of Automotive Engineers
(14)	SPI	Society of the Plastics Industry
(15)	UL	Underwriters Laboratories
(16)	USDOT	United States Department of Transportation
(17)	NHTSA	National Highway Traffic Safety Administration
(18)	OSHA	Occupational Safety and Health Administration
(19)	SAE	Society of Automotive Engineers
(20)	SPI	Society of the Plastics Industry
(21)	UL	Underwriters Laboratories
(22)	USDOT	United States Department of Transportation

SECTION 5. VEHICLE SPECIFICATION REQUIREMENTS

5.1 DIMENSIONS

5.1.1 Physical Size

With the exceptions of exterior mirrors, marker and signal lights, bumpers, fender skirts, washers, wipers and rubrail, the Trolley shall have the following overall dimensions as shown in the figure "Transit Coach Exterior Dimensions" at static conditions and design height.

Baseline: Use for under 30-ft length Trolley

Baseline: Use for 102-inch width Trolley

- *Body Width: 102 inches (+0, -1 inch)*

- Maximum Overall Height: not to exceed 126 inches, for diesel and propane units and 135 inches for CNG units which includes all rigid roof mounted items such as A/C, exhaust, etc.

5.1.2 Underbody Clearance

The Trolley shall maintain the minimum clearance dimensions as shown in the figure "Transit Coach Minimum Road Clearance" and defined in SAE Standard J689, regardless of load up to the gross vehicle weight rating.

Ramp Clearances. Approach angle shall be no less than 10 degrees. Breakover angle shall be no less than 10 degrees. Departure angle shall be no less than 10 degrees.

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.

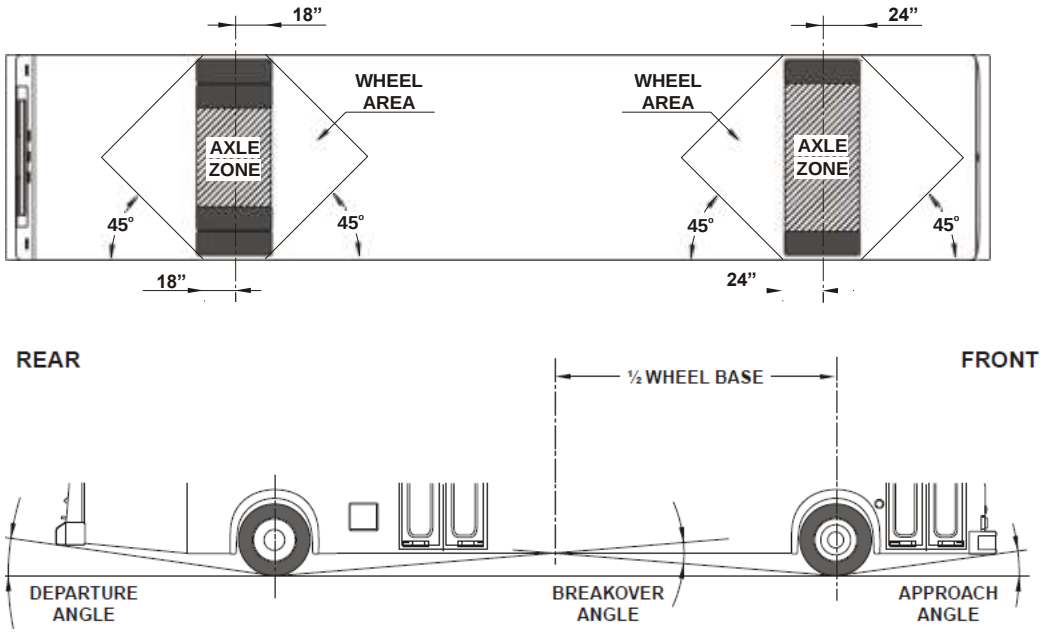
The breakover angle is the angle measured between two lines tangent to the front and rear tire static loaded radius and intersecting at a point on the underside of the vehicle that defines the largest ramp over which the vehicle can roll.

Ground Clearance. Ground clearance shall be no less than 11 inches, except within the axle zone and wheel area.

Axle Clearance. Axle zone clearance, which is the projected area between tires and wheels on the same axial centerline, shall be no less than 5½ inches.

Wheel Area Clearance. Wheel area clearance, shall be no less than 8 inches for

parts fixed to the Trolley body and 6 inches for parts that move vertically with the axles.



TRANSIT COACH MINIMUM ROAD CLEARANCE

5.1.3 Floor Height

Height of the floor above the street shall be no more than 34 inches measured at the centerline of the front doorway. First step from ground level shall be a maximum of 14 inches and the remaining two steps shall be a maximum of 10 inches each. The floor may be inclined along the longitudinal axis of the Trolley, and the incline shall be less than 3 ½ degrees off the horizontal except locally at the doors where 2 degrees slope toward the door is allowed. All floor measurements shall be with the Trolley at the design running height, on a level surface, and with the standard 255/70R x 22.5 tires.

5.1.4 Interior Headroom

Headroom above the centerline of the aisle shall be no less than 78 inches in the center of the Trolley and no less than 67 inches at the rear settee. At the centerline of the window seats, headroom shall be no lower than the required top of the side window. In any area of the Trolley directly over the head of a seated passenger and positioned where a passenger entering or leaving the seat is prone to strike his/her head, padding shall be provided on the overhead paneling.

5.2 WEIGHT

Curb weight of the Trolley, as defined in these Specifications, shall be minimized to the extent practical without compromising its integrity and durability and shall not exceed 21,000 pounds.

5.3 CAPACITY

The vehicle shall be designed to carry the Gross Vehicle Weight as defined in Section 5.1.2, which shall not exceed the Trolley GVWR.

5.4 SERVICE LIFE AND MAINTENANCE

5.4.1 SERVICE LIFE

The Trolley shall be designed to operate in transit service for at least 12 years or 500,000 miles. It shall be capable of operating at least 40,000 miles per year including the twelfth year. An Altoona Bus Test Report supporting 12years or 500,000 mile useful life will be supplied with the submission of a response to this RFP.

5.4.2 MAINTENANCE AND INSPECTION

Scheduled maintenance or inspection tasks as specified by the Contractor shall require a skill level of 3M or less. Scheduled maintenance tasks shall be related and shall be grouped in maximum mileage intervals. Based upon the Design Operating Profile defined in Section 5.1.2, routine scheduled maintenance actions, such as filter replacement and adjustments, shall not be required at intervals of less than 6,000 miles, except for engine oil/filter change intervals for severe duty shown below, or as indicated from a regular oil analysis program and routine daily service performed during the fueling operations. Higher levels of scheduled maintenance tasks shall occur at even multiples of mileage for lower level tasks.

SEVERE DUTY OIL/FILTER CHANGE INTERVAL

Average Vehicle Speed MPH	Oil/Filter Change Interval Miles
10 and higher	6000
8 – 10	5000
6 – 8	4000
4 – 6	3000
2 - 4	1500

5.4.3 ACCESSIBILITY

All systems or components subject to periodic maintenance or that are subject to periodic failures shall be readily accessible for service and inspection. To the extent practicable, removal or physical movement of components unrelated to the specific maintenance and/or repair tasks involved shall be unnecessary.

As a goal, relative accessibility of components, measured in time required to gain access, shall be inversely proportional to frequency of maintenance and repair of the components.

5.4.4 INTERCHANGEABILTY

Components with identical functions shall be interchangeable to the extent practicable. These components shall include 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 Trolleys shall be an exact duplicate in design, manufacture, and assembly for each Trolley in each order group in this Contract.

5.5 OPERATING ENVIRONMENT

The Trolley shall achieve normal operation in ambient temperature ranges of -10 degrees to 115° F, at relative humidity between 5 percent and 100 percent, and at altitudes up to 3,000 feet above sea level. Degradation of performance due to atmospheric conditions shall be minimized at temperatures below -10° F, above 115° F, or at altitudes above 3,000 feet.

Special equipment or procedures may be employed to start the Trolley after being exposed for more than four (4) hours to temperatures less than 30° F without the engine in operation. Speed, gradability, and acceleration performance requirements shall be met at, or corrected to 85° F, 29.61 inches Hg, and dry air.

5.6 NOISE

5.6.1 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 Trolley shall have a sound level of 83 dBA or less at any point inside the Trolley. These conditions shall prevail with all openings, including doors and windows, closed and with the engine and accessories switched off.

The Trolley-generated noise level experienced by a passenger at any seat location in the Trolley shall not exceed 83 dBA and the operator shall not experience a noise level of more than 83 dBA under the following test conditions. The Trolley shall be empty except for test personnel, not to exceed 4 persons, and the test equipment. All openings shall be closed, and all accessories shall be operating during the test. The Trolley shall accelerate at full throttle from a standstill to 35 mph on level commercial asphalt or concrete pavement in an area free of large reflecting surfaces within 50 feet of the Trolley path. During the test, the ambient noise level in the test area shall be at least 10 dBA lower than the Trolley under test. Instrumentation and other general requirements shall conform to SAE Standard J366. If the noise contains an audible discrete frequency as defined in Section 5.1.2, a penalty of 5 dBA shall be added to the sound level measured.

5.7 EXTERIOR NOISE

Airborne noise generated by the Trolley and measured from either side shall not exceed 83

dBA under full power acceleration when operated at or below 35 mph at curb weight and just prior to transmission upshift. The maximum noise level generated by the Trolley pulling away from a stop at full power shall not exceed 83 dBA. The Trolley-generated noise at curb idle shall not exceed 65 dBA. If the noise contains an audible discrete frequency as defined in Section 5.1.2, a penalty of 5 dBA shall be added to the sound level measured. All noise readings shall be taken 50 feet from and perpendicular to, the centerline of the Trolley with all accessories operating. Instrumentation, test sites, and other general requirements shall be in accordance with SAE Standard J366. The pull away test shall begin with the front bumper even with the microphone. The curb idle test shall be conducted with the rear bumper even with the microphone.

In addition, the Contractor shall comply with the exterior noise requirements defined in local laws and ordinances identified by the Procuring Agency.

5.8 FIRE SAFETY

The Trolley 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, firewalls, and facilitation of passenger evacuation.

All materials used in the construction of the Passenger Compartment of the Trolley shall be in accordance with the Recommended Fire Safety Practices defined in FMVSS 302.

5.9 EDERLY AND DISABLED PASSENGERS

The contractor shall comply with all applicable Federal requirements defined in the Americans with Disabilities Act, 49 CFR Part 38, and all state and local regulations regarding mobility-impaired persons. Local regulations are defined as those below the state level.

SECTION 6. PROPULSION SYSTEM

6.1 VEHICLE PERFORMANCE

6.1.1 POWER REQUIREMENTS

Propulsion system and drive train shall provide power to enable the Trolley to meet the defined acceleration, top speed, and gradability requirements, and operate all propulsion-driven accessories. Power requirements are based on medium duty diesel engines certified for use in all 50 states using actual road test results or computerized vehicle performance data.

6.1.2 TOP SPEED

The Trolley shall be capable of a top speed of _65_ M.P.H. (for emergency and passing maneuvers) on a straight, level road at GVWR with all accessories operating.

6.1.3 GRADABILITY

Gradability requirements shall be met on grades with a dry commercial asphalt or concrete pavement at GVWR with all accessories operating. The power plant shall enable the Trolley

to maintain a speed of 40 mph on a 2-1/2 percent grade and 7 mph on a 16 percent grade.

6.1.4 ACCERLATION

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 – (Idle Start.)

MAXIMUM IDLE START ACCELERATION TIMES ON A LEVEL SURFACE
(Vehicle weight = GVWR, 50-State Power Plant)

SPEED (MPH)	**TIME** (SEC)
10	5.0
20	10.8
30	20.0
40	31.0

6.1.5 OPERATING RANGE

The operating range of the coach run on the design operating profile shall be at least 350 miles with full fuel capacity for diesel Trolleys and 250 miles with CNG and Propane Trolleys.

SECTION 7. DRIVETRAIN

7.1 POWER PLANT

7.1.1 ENGINE

The front mounted medium duty; inline six-cylinder diesel engine shall be designed to operate for not less than 150,000 miles without major failure or significant deterioration. Components of the fuel injector and/or control system shall be designed to operate for not less than 150,000 miles without replacement or major service.

The engine shall meet all requirements of the Technical Specifications when operating on Ultra Low Sulfur diesel fuel, as certified by the engine manufacturer and specified by the Procuring Agency. Durability of the engine and its components shall not be seriously reduced and the requirement shall be met by operation on either of the commercially available diesel fuels.

The engine shall be equipped with an electronically controlled management system, compatible with 12-volt electrical systems. The engine control system shall be capable of receiving electronic inputs from the engine and other vehicle systems. Communication between these electronic systems shall be made using the SAE J1939 Recommended

Practice communication link. The engine's electronic management system shall monitor operating conditions and provide instantaneous adjustments to optimize both engine and Trolley performance. The system shall be programmable to allow optimization of engine performance.

Note: During the applicable warranty period, initial performance settings shall only be changed with authorization from the Trolley and engine manufacturers.

The engine shall have on-board diagnostic capabilities, able to monitor vital functions, store out-of- 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 operator's area and inside engine compartment. The on-board diagnostic system shall inform the operator via visual and/or audible alarms when out-of-parameter conditions exist for vital engine functions. Conditions that require an operator alarm are identified in Section 5.4.6.1.6.

The engine starter shall be protected by interlock that prevents its engagement when the engine is running. Special equipment or procedures may be employed to start the engine when exposed to temperatures less than 30° F for a minimum of four hours without the engine in operation. All cold weather starting aids, engine heating devices and procedures shall be of the type recommended by the engine manufacturer and approved by the Procuring Agency.

Baseline: 245hp, 660lb-ft torque diesel engine with B300 transmission
Optional: 245hp, 660lb-ft torque diesel engine with B300R transmission
Optional: 195hp, 420lb-ft torque diesel engine with B300 transmission
Optional: 195hp, 420lb-ft torque diesel engine with B300R transmission
Optional: 230hp, 420lb-ft torque CNG engine with B300 transmission
Optional: 230hp, 420lb-ft torque CNG engine with B300R transmission

Baseline: Standard requirements for a fast idle device.

The engine shall be equipped with an operator-controlled fast idle device. The fast idle control shall be a two-way toggle mounted on the dash or side console and shall activate only with the transmission in neutral and the parking brake applied. This device may be used to help meet the requirements of Trolley cool down in Section 5.4.8. The fast idle device shall be activated and regulated automatically by the engine control system when the two-way switch is in the proper location.

Baseline: No requirement for an auxiliary heater.
Optional: Auxiliary heater.

An auxiliary heater fired by diesel fuel shall be provided to supplement the heat supplied by the engine and shall have an output necessary to meet the performance criteria specified in 5.4.8.1. The heater shall be equipped with safety devices to prevent the following: over fueling, overheating due to loss of coolant or water pump failure, and operation during conditions of low battery voltage. The auxiliary heater shall be equipped with a self-priming fuel pump.

The engine control system shall protect the engine against progressive damage. The system shall monitor conditions critical for safe operation and automatically de-rate power and/or speed and initiate engine shutdown as needed. The on-board diagnostic system, as described in Section 5.4.6.1.6, shall trigger a visual and audible alarm to the operator when the engine control unit detects a malfunction, and the engine protection system is activated.

A control shall be available to the operator, to allow temporary override (30-45 seconds) of the engine protection/shutdown system if engine power is required to move the bus in emergency conditions.

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

Coolant Temperature
Oil Pressure

Baseline: Use for automatic engine protection/shutdown override feature.

A control shall be available to the operator, to allow temporary override (30-45 seconds) of the engine protection/ shutdown system if engine power is required to move the Trolley in emergency conditions.

7.1.2 COOLING SYSTEM

The cooling systems shall be of sufficient size to maintain all engine and transmission fluids and engine intake air at safe, continuous operating temperatures during the most severe operations possible and in accordance with engine and transmission manufacturers' cooling system requirements. The cooling system fan/fans viscous control should sense the temperatures of the operating fluids and if it is above safe operating conditions the cooling fan should be engaged. The fan control system shall be designed with a full-safe mode of "fan on". The cooling system in new condition, with 10% radiator blockage placed over the lower part of the radiator and with up to 280hp engine power output, shall have an ambient capacity of at least 115° F with a 50% water /glycol mix as coolant at sea level.

7.1.2.1 ENGINE COOLING

A water-based, pressure type, cooling system that does not permit boiling or coolant loss during the operations described above shall cool the engine. Engine thermostats shall be easily accessible for replacement. Shutoff valves shall allow filter replacement without coolant loss. Valves shall permit complete shutoff of lines for the heating and defroster units, and water booster pumps. All low points in the water-based cooling system shall be equipped with drain cocks. Air vent valves shall be fitted at high points in the cooling system unless it can be demonstrated that the system is self-purging.

A sight glass to determine satisfactory engine coolant level shall be provided in the

stainless steel overflow tank and shall be accessible by opening one of the engine compartment's access doors. A spring-loaded, push button type valve to safely release pressure or vacuum in the cooling system shall be provided with both it and the water filler no more than 64 inches above the ground and both shall be accessible through the same access door.

The radiator, with bolted stainless-steel top and bottom tanks and charge air cooler shall be of durable corrosion-resistant construction. The radiator shall be designed so a 2M mechanic can gain access to a substantial portion of the side facing the engine for the purpose of cleaning the radiator in five minutes or less.

No heat producing components or climate control system components shall be mounted between the engine cooling air intake aperture and the radiator.

The radiator and charge air cooler shall be designed to withstand thermal fatigue and vibration associated with the installed configuration.

The front air intake grill on the Trolley shall be designed to represent a vintage look incorporating 12 gauge heat treated alloy steel woven wire with a 3/4" clear open diamond pattern. This grill is to be finished with a gloss black powder coat and trimmed in 3/8 x 1-1/2" solid brass trim on the perimeter. Installed on the lower half of the grill assembly will be a 1/8" thick solid brass pennant with scrolled pinstripe edge and the coach numbers. The grill will be fastened to the front lower pantographed panel with oval head brass screws.

Optional: Optional requirement for coolant filtration.
The engine cooling system shall be equipped with a properly sized water filter with a spin-on element and an automatic system for releasing supplemental coolant additives (SCA's) as needed to replenish and maintain protection properties.

Baseline: Delete the requirement for coolant filtration.

The water filter and its plumbing shall not be provided.

Baseline: Standard requirements for cooling fan operation.

The cooling fan shall be temperature controlled, allowing the engine to reach operating temperature quickly. The temperature-controlled fan shall not be driven when the coolant temperature falls below the minimum level recommended by the engine manufacturer.

7.1.2.2 CHARGE AIR COOLING

The charge air cooling system, also referred to as after coolers or intercoolers shall provide maximum air intake temperature reduction with minimal pressure loss. The charge air radiator shall be sized and positioned to meet engine manufacturer's requirements. The charge air radiator shall be stacked ahead or behind the engine radiator and shall be positioned as close to the engine as possible unless integrated

with the radiator. Air ducting and fittings shall be protected against heat sources and shall be configured to minimize restrictions and maintain sealing integrity.

7.1.2.3 TRANSMISSION COOLING

The transmission shall be cooled by a heat exchanger located in the bottom of the radiator sized to maintain operating fluid within the transmission manufacturer's recommended parameters of flow, pressure and temperature. if a retarder is required a separate shell cooler is to be provided for the purpose of cooling the retarder. 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.

7.1.3 TRANSMISSION

The transmission shall be multiple speeds, automatic shift with torque converter, with optional retarder and electronic controls. Gross input power, gross input torque and rated input speed shall be compatible with the engine. A 3M mechanic, with optional assistance, shall be able to remove and replace the transmission assembly for service in less than 16 total combined man-hours. The transmission shall be designed to operate for not less than 300,000 miles on the design operating profile without replacement or major service.

The electronic controls shall be compatible with multiplex wiring systems, capable of receiving inputs from the throttle, shift selector, engine, and transmission. Communication between the transmission and other electronically controlled vehicle systems shall be made using the SAE J1939 Recommended Practice communication link. Electronic controls shall be compatible with either 12 or 24 volt systems, provide consistent shift quality, and compensate for changing conditions such as variations in vehicle weight and engine power. A brake pedal application of 15 to 20 psi shall be required by the operator to engage forward or reverse range from the neutral position with electronic transmissions only.

The electronically controlled transmission shall have on-board diagnostic capabilities, able to monitor functions, store out-of-parameter conditions in memory, and communicate faults and vital conditions to service personnel. A diagnostic reader device connector port, suitably protected against dirt and moisture, shall be provided in the operator’s area. The on-board diagnostic system shall trigger a visual alarm to the operator when the electronic control unit detects a malfunction. The transmission shall contain built-in protection software to guard against severe damage.

Baseline:	245hp diesel engine with B300 transmission
Optional:	245hp diesel engine with B300R transmission
Optional:	230hp propane engine with B300 transmission
Optional:	230hp propane engine with B300R transmission
Optional:	230hp CNG engine with B300 transmission
Optional:	230hp CNG engine with B300 transmission

Baseline: Use for requiring a transmission fluid level monitoring/protection system.

Only with electronic transmissions.

An electronic transmission fluid level monitoring and protection system shall be provided. This system shall allow a 2M or 3M mechanic to accurately determine transmission fluid levels during checking or oil change and shall be in addition to the manual dipstick. This system shall also provide protection against any damage resulting from improper fluid level conditions with electronic transmissions only.

7.1.4 RETARDER IF SELECTED

The transmission shall be equipped with an integral hydraulic retarder designed to extend brake lining service life. The application of the retarder shall cause a smooth blending of both retarder and service brake functions without exceeding jerk requirements as defined in section 5.2.2.1.5. Deceleration lights shall illuminate when the retarder is activated.

Baseline: Standard requirement for throttle activation of the retarder.

The retarder shall be activated when the throttle is released.

Optional: Brake activation of the retarder.

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

7.1.5 JERK

Jerk, the rate of change of acceleration measured at the centerline, floor level of the Trolley shall be minimized throughout the shifting of each transmission range and retarder application and shall be no greater than 0.3 g/sec. for duration of a quarter-second or more.

7.2 MOUNTING

All power plant mounting shall be mechanically isolated to minimize transfer of vibration to the body structure. Mounts shall control movement of the power plant so as not to affect performance of belt driven accessories or cause strain in piping and wiring connections to the power plant.

7.2.1 SERVICE

The power plant 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 power plant. Two 3M mechanics shall be able to remove and replace the engine and transmission assembly in less than 24 total combined man-hours. The muffler, exhaust system, air cleaner, air compressor, starter, alternator, radiator, all accessories, and any other component requiring service or replacement shall be easily removable and independent of the engine and transmission removal.

Baseline: Oil pressure and coolant temperature gauge will not be required; warning

lights will be provided with buzzer.

Optional: Oil pressure and coolant temperature gauge will be required in the driver's console.

Optional: Oil pressure and coolant temperature gauge will be required in the engine compartment.

Radiator filler cap shall be hinged to the filler neck and closed with spring pressure or positive locks. All fluid fill locations shall be properly labeled to help ensure correct fluid is added and all fillers shall be easily accessible with standard funnels, pour spouts, and automatic dispensing equipment. All lubricant sumps shall be fitted with magnetic-type, external, hex head, drain plugs.

Optional: An oil sampling provision shall be provided in the engine compartment to sample engine oil.

The engine and transmission shall be equipped with sufficient heavy-duty fuel and oil filters for efficient operation and to protect the engine and transmission between scheduled filter changes.

To the extent practicable, the filters shall be of the spin-on, disposable type or integral with the engine and transmission.

Optional: Use for additional bypass engine oil filters.
A centrifugal, non-disposable bypass engine oil filter shall be provided.

All filters shall be easily accessible and the filter bases shall be plumbed to assure correct reinstallation. The engine shall be equipped with a fuel-priming pump or a check valve fitted in the fuel suction line to aid restarting after fuel filter changes.

An air cleaner with a dry filter element shall be provided. The filter shall be removable by a 3M mechanic in 10 minutes or less. The location of the air intake system shall be designed to minimize the entry of dust and debris and maximize the life of the air filter. The engine air duct shall be designed to minimize the entry of water into the air intake system.

Optional: Graduated air filter restriction indicator will be provided.

7.2.2 ACCESSORIES

Engine-driven accessories shall be unit mounted for quick removal and repair. Accessory drive systems shall operate without unscheduled adjustment for not less than 50,000 miles on the design operating profile. These accessories shall be driven at speeds sufficient to assure adequate system performance during extended periods of idle operation and low route speed portion of the design operating profile. Belt guards shall be provided as required for safety and shall be sturdy in design and installation and readily removable.

7.2.3 HYDRAULIC SYSTEMS

Any accessory may be driven hydraulically. The hydraulic system shall demonstrate a mean time between repairs in excess of 50,000 miles. 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. A tamper-proof priority system shall prevent the loss of power steering during operation of the Trolley if other devices are also powered by the hydraulic system. All elements of the hydraulic system shall meet the accessibility loading requirements.

7.2.4 FLUID LINES, FITTINGS AND CLAMPS, AND CHARGE AIR PIPEWORK

All fluid lines and air pipework shall be rigidly supported to prevent chafing damage, fatigue failures, and tension strain.

Radiator piping shall be stainless steel or brass tubing and, if practicable, hoses shall be eliminated. Necessary hoses shall be premium, silicone rubber type that are impervious to all Trolley fluids. All hoses shall be as short as practicable. All hoses shall be secured with premium, stainless steel clamps that provide a complete 360-degree seal. The clamps shall maintain a constant tension at all times, expanding and contracting with the hose in response to temperature changes and aging of the hose material.

Fuel, oil, and hydraulic lines shall be compatible with the fluid they carry and the high temperature environment in the engine compartment. The lines shall also be compatible with potentially damaging elements of the surrounding environment including heat and salt. Lines shall be capable of withstanding maximum system pressures. Lines within the engine compartment shall be composed of steel tubing where practicable except in locations where flexible lines are specifically required by the Procuring Agency.

Flexible fuel and oil lines shall be kept at a minimum and shall be as short as practicable. Flexible lines shall be routed or shielded so that failure of a line shall not allow fuel or oil to spray or drain onto any component operable above the auto ignition temperature of the fluid. Flexible lines shall be Teflon hoses with braided stainless steel jackets except in applications where premium hoses are required and shall have standard SAE or JIC brass or steel, factory crimped, swivel, end fittings. Flexible hoses and fluid lines shall not touch one another, or any part of the Trolley.

Lines shall have a maximum length of six (6) feet unless demonstrated inappropriate for a given application. Hoses/lines shall be secured with heavy-duty stainless steel, full silicone rubber clamps. Fuel lines shall be rated and sized to prevent freezing and plugging due to condensation and/or fuel gelling in extreme winter. Flexible hoses over 1 inch in diameter need not be Teflon with braided stainless steel jacket but shall be in conformance with SAE Standard J100R5.

The fuel lines forward of the engine bulkhead shall be in conformance to SAE Standard J1149 Type 1 for copper tubing, SAE Standard J526 for welded steel tubing, or SAE

Standard J844 for nylon tubing color coded orange.

Charge air pipework and fittings shall be designed to minimize air restrictions and leaks. Pipework shall be as short as possible, and the number of bends minimized. The bend radii should be maximized to meet the pressure drop and temperature rise requirements of the engine manufacturers. The cross section of all charge air pipework shall not be less than the cross section of the intake manifold inlet. Any changes in pipework diameter shall be gradual to ensure a smooth passage of air and to minimize restrictions. Pipework shall be routed away from exhaust manifolds and other heat sources, and insulated or shielded as required to meet the pressure drop and temperature rise requirements of the engine, transmission or other component manufacturer.

Charge air pipework shall be constructed of either stainless steel, anodized aluminum or aluminized steel. Pipework between the air filter and turbocharger inlet may be constructed of fiberglass.

Connections between all charge air pipework sections shall be sealed with a short section of reinforced hose and stainless steel, constant tension clamps that provide a complete 360° seal.

SECTION 8. FUEL SYSTEM

8.1 . FUEL TANK(S)

The fuel tank shall be made of corrosion resistant coated steel. The fuel tank shall be securely mounted to the Trolley to prevent movement during Trolley maneuvers but shall be capable of being removed and reinstalled by a 2M mechanic for cleaning or replacement in 1.5 hours or less.

Baseline: 75-gallon minimum capacity diesel fuel tank.

Optional: 60-gallon minimum capacity diesel fuel tank.

Optional: Roof mounted CNG fuel tanks with a minimum capacity of 8000 cubic feet of gas at 3600 psi.

Optional: Under floor mounted propane fuel tanks with a minimum capacity of 111 gallons.

The fuel tank shall be equipped with an external, hex head, brass drain plug. It shall be at least a 3/8-inch size and shall be located at the lowest point of the tank. The fuel tank shall have an inspection plate or easily removable filler neck to permit cleaning and inspection of the tank. The tank shall be baffled internally to prevent fuel-sloshing noise regardless of fill level. The baffles or fuel pickup location shall assure continuous full power operation on a 6 percent upgrade for 15 minutes starting with no more than 25 gallons of fuel over the unusable amount in the tank(s). The Trolley shall operate at idle on a 6 percent downgrade for 30 minutes starting with no more than 10 gallons of fuel over the unusable amount in the

tank(s).

The capacity, date of manufacture, manufacturer name, location of manufacture, and certification of compliance to Federal Motor Carrier Safety Regulation shall be permanently marked on the fuel tank(s). The markings shall be readily visible from the fuel filler access door and shall not be covered with an undercoating material.

OPTIONAL: CNG FUEL TANKS:

The tanks will consist of twelve (12) FMVSS 304 hoop wrapped design tanks consisting of an aluminum liner reinforced with epoxy impregnated E-glass continuous filaments. With a total capacity of 8844cu. ft. at a rated service pressure of 3,600 psig @ 70 degrees Fahrenheit. The fuel tanks will be roof mounted and concealed in the lantern roof area.

Access to the tanks will be through two (2) hinged roof sections that when open will allow complete access to all tanks and lines. The roof sections will be supported in the open position by two (2) gas springs for each section. Each section will be held in the closed position by three-
(3) fixed threaded studs with flex lock nuts.

Each fuel tank will be equipped with an integral manual shut off valve and two temperature pressure relief devices. A pressure relief device will be located at each end of each tank.

All natural gas pressure lines will be made of stainless steel tubing routed in such a manner to prevent chafing. All pressure line fittings will be stainless steel "o-ring face seal" style for positive seal and easy repair.

Each pressure relief device will be vented using copper tubing and 45° flair fittings. The vent lines will be routed in such a manner as to prevent chafing. All vent lines will vent to atmosphere on the roadside of the lantern roof. The fuel fill door will be mounted on the curbside skirt of the coach just ahead of the entrance door. The door will be hinged and secured in a closed position by an over center spring and two bolts. The door will be equipped with a switch to automatically shut down the engine when the door is open for fueling.

An automatic shut off valve will be provided in the fuel system to automatically shut off fuel flow to the engine in the event of a loss of engine oil pressure, high engine temperature, fire detection or fuel door open.

A primary pressure regulator will be provided between the fuel tanks and the secondary regulator on the engine to reduce system pressure from tank pressure to 100 PSI.

The complete fuel system will meet all National Fire Protection Association (NFPA) 52 standards, the Texas Railroad Commission regulations for natural gas and Federal Motor Vehicle Safety Standards.

OPTIONAL: PROPANE FUEL TANKS

The propane fuel system shall consist of a minimum of two under floor mounted fuel tanks with a capacity of not less than 111 gallons of propane and shall provide a minimum of 250 mile range.

Each tank shall be located behind an access panel that allows complete access for easy removal and installation of the tanks. Each access panel shall have an access door to allow immediate access to the manual shut off valve and tank mounted fuel gauges.

Each tank shall be fitted with a pressure relief valve to allow excess pressure to be vented from the tanks. Each fuel tank shall be vented to atmosphere above roof level and each vent shall be protected with a pressure relief type rain cap to prevent the entrance of water into the vent.

Each tank shall be fitted with a manual shut off valve that is conveniently located behind an access door that will not require more than ten (10) seconds to access.

The fuel system shall be fitted with Stainless Steel braided hose from the tanks to the engine that meets all requirements of the Canadian Gas Association (GSA Type III). The system shall be fitted with solenoid shut off valves for each tank that shall provide complete fuel shut off from the tank when the engine is switched off. Two inline five (5) micron magnetic fuel filters shall be provided, one at each tank with a twenty-five (25) micron spin on fuel filter at the engine.

Each fuel line shall be fitted with a manual shut off valve between the tank and the fuel filter to allow the replacement of the inline fuel filter without fuel loss. An additional relief valve shall be located in the fuel line between the solenoid valve and the fuel filter to relieve line pressure.

8.2 DIESEL FUEL FILLER

The fuel filler shall be located behind the centerline of the front door on the curbside of the Trolley. The filler cap shall be retained to prevent loss and shall be recessed into the body so that spilled fuel will not run onto the outside surface of the Trolley.

The fuel lines forward of the engine bulkhead shall be in conformance to the SAE Standards.

Baseline: Standard requirement for accommodating a diesel fuel filler nozzle.
The filler shall accommodate a 1-1/2-inch diameter nozzle and fille rate of not less than 40 gallons per minute of foam-free fuel without spitting back or causing the nozzle to shut off before the tank is full. An audible signal shall indicate when the tank is essentially full.

Optional: Dry-break diesel fuel filler
The fuel filler shall accommodate a nozzle that forms a locked and sealed connection during the refueling process to eliminate spills. Fuel shall not be allowed to flow into the tank unless the nozzle has been properly coupled, locked and sealed to the filler. With the nozzle open, fuel shall enter the tank at a fill rate of not less than 40 gallons per minute of foam-free fuel without causing the nozzle to shut off before the tank is full. The

nozzle shall automatically shut off when the tank is essentially full. Once disconnected, fuel shall not be allowed to flow through the nozzle at any time. Any pressure over 3 psi shall be relieved from the fuel tank automatically. An audible signal shall indicate when the tank is essentially fuel. The dry break system shall be compatible with the Procuring Agency's system. The cap shall be retained to prevent loss.

Optional: CNG Fuel Filler
Behind the fuel door will be a slow and fast fill fuel valve that meets NGV 1 requirements with a dust cover and a 0 to 5000 lb. oil filled pressure gauge. The door shall be equipped with interlock (micro switch) that shall not allow the engine to be started or shall shut down the engine if it is running during the fueling operation. The fast fill system will be capable of filling all tanks to capacity in less than ten (10) minutes. A manual vent valve will be provided near the fuel fill valve behind an access cover to manually vent the line pressure for engine or system service. This valve will be capped to prevent dirt intrusion.

Optional: Propane Fuel Filler
The tanks shall be filled through individual fills for each tank and the fill locations will be remote. The remote fill locations shall be conveniently located on the curbside of the coach, close together and in close proximity to the propane tanks. Each remote fill location shall be located behind a spring closed and mechanically latched door. These remote fill locations shall consist of a liquid propane fill valve as well as an eighty percent (80%) valve. The doors shall be equipped with interlock (micro switch) that shall not allow the engine to be started or shall shut down the engine if it is running during fueling operation.

8.3 FINAL DRIVE

A single heavy-duty axle shall drive the Trolley at the rear with a load rating sufficient for the Trolley loaded to GVWR. Transfer of gear noise to the Trolley interior shall be minimized. The rear axle shall be designed to operate for not less than 150,000 miles on the design operating profile without repairs. The lubricant drain plug shall be magnetic type, external hex head. If a planetary gear design is employed, the oil level in the planetary gears shall be easily checked through the plug or sight gauge. The drive shaft shall be guarded to prevent it striking the floor of the Trolley or the ground in the event of a tube or universal joint failure.

SECTION 9. EMMISSIONS

9.1 EXHAUST EMISSIONS

The engine shall meet all applicable emission standards.

9.2 CATALYTIC CONVERTER PROTECTION SYSTEM

Provide a protection system preventing the theft of the Catalytic Convertor.

9.3 EXHAUST LOCATION

Exhaust gases and waste heat shall be discharged from the roadside rear near ground level. The exhaust pipe shall be of sufficient length to prevent exhaust gases and waste heat from discoloring or causing heat deformation to the Trolley body. The exhaust system shall be

stainless steel from the engine to the muffler or catalytic converter and aluminized steel from the muffler or catalytic converter to the rear of the Trolley. The exhaust system to include the muffler or catalytic converter shall be mounted on rubber isolators to minimize transmission of noise, vibration, and heat. The entire exhaust system shall be adequately shielded to prevent heat damage to any Trolley component. The exhaust outlet shall be designed to prevent rain, snow or water generated from high-pressure washing systems from entering into the exhaust pipe and causing damage.

SECTION 10. CHASSIS

10.1 SUSPENSION

10.1.1 GENERAL REQUIREMENTS

The chassis shall be purpose built for transit applications of structural steel tubing and formed channel welded to form a base to support the transit quality suspension system and body structure. All welded joints shall be properly ground, beveled, and prepared prior to welding. The completed chassis shall be sand blasted, primed and painted with acrylic urethane enamel prior to final assembly.

10.1.2 CORROSION

Baseline: Chassis exterior shall be sand blasted then primed and painted with acrylic urethane enamel prior to assembly

Optional: For coastal areas or northern climates. Chassis exterior shall be primed and painted with acrylic urethane enamel prior to assembly and the interior of all structural steel tubing shall be treated with an undercoat process.

Both the front and rear suspensions shall be a four air spring pneumatic type. The basic suspension system shall last the service life of the Trolley without major overhaul or replacement. Normal replacement items, such as one suspension bushing, shock absorbers, or air spring shall be replaceable by a 3M mechanic in 30 minutes or less. Adjustment points shall be minimized and shall not be subject to a loss of adjustment in service. Necessary adjustments shall be easily accomplished without removing or disconnecting the components.

10.1.3 SPRINGS AND SHOCK ABSORBERS

10.1.3.1 TRAVEL

The suspension system shall permit a minimum wheel travel of 3 inches jounce-upward travel of a wheel when the Trolley hits a bump (higher than street surface), and 3 inches rebound-downward travel when the Trolley 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 Trolley height relative to the centerline of the wheels does not change more than +/- 1/2 inch at any point from the

height required.

10.1.3.2 **DAMPING**

Vertical damping of the suspension system shall be accomplished by five position adjustable hydraulic shock absorbers with a minimum warranted life of three years or 300,000 miles 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 3 cycles or less after hitting road perturbations. Shock absorbers shall maintain their effectiveness for at least 300,000 miles of the service life of the Trolley. Each unit shall be replaceable by a 2M mechanic in less than 15 minutes. The shock absorber bushing shall be made of elastomeric material that shall be easily replaced to extend the shock life.

10.1.3.3 **LUBRICATION**

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 without flexible hose end from a pit or with the Trolley on a hoist. Each element requiring lubrication shall have its own grease fitting with a relief path. Lubricant specified shall be standard for all elements on the Trolley serviced by standard fittings.

10.1.3.4 **KNEELING**

Baseline: Kneeling will not be required.

Optional: Kneeling feature shall be supplied.

A kneeling system shall lower the entrance of the Trolley a minimum of 3 inches during loading or unloading operations regardless of load up to GVWR, measured at the longitudinal centerline of the entrance door, by the driver using a two position switch. Turning the switch to the on position will lower the Trolley. Turning the switch to the off position will allow the system to go to floor height without the driver having to hold the switch up.

Brake and Throttle interlock shall prevent movement when the Trolley is kneeled. The kneel control shall be disabled when the Trolley is in motion. The Trolley shall kneel at a maximum rate of 1.25 inches per second at essentially a constant rate. After kneeling, the Trolley shall rise within 2 seconds to a height permitting the Trolley to resume service and shall rise to the correct operating height within 7 seconds regardless of load up to GVWR.

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, minimum 2.5" diameter, amber lens shall be provided that will light when kneel feature activated and throughout operation. Kneeling shall not be operational while the wheelchair lift is deployed or in operation.

10.1.4 WHEELS AND TIRES

10.1.4.1 WHEELS

Wheels and rims shall be stud-piloted steel and shall be integral formed drop center construction and should resist rim flange wear. All wheels shall be interchangeable and shall be removable without a puller. Wheels shall be compatible with tires in size and load-carrying capacity. Front wheels and tires shall be balanced as an assembly per SAE J1986.

10.1.4.2 TIRES

Tires shall be suitable for the conditions of transit service and sustained operation at the maximum speed capability of the Trolley. Load on any tire at GVWR shall not exceed the tire supplier's rating. The tires shall be supplied by the Contractor.

Baseline: Use for low profile 255/70R x 22.5 tires to be furnished by the Manufacturer.
The Trolleys shall be equipped with low profile (255/70R x 22.5) tires and wheels Load range H as appropriate for the Trolley design.

Optional: Use of customer furnished low profile 255/70R x 22.5 tires.
The Trolleys shall be equipped with Customer Furnished low profile (255/70R x 22.5) tire and wheels, Load range H as appropriate for the Trolley design.

Optional: Use for one (1) spare tire and wheel to be furnished by the manufacturer, The Trolley shall be equipped with one (1) low profile (255/70R x 22.5) spare tire and wheel, Load range H as appropriate for the Trolley design.

10.2 STEERING

10.2.1 FRONT AXLE

Baseline: Use for solid beam axle and oiled-type front bearings and seals.
The front axle shall be solid beam, non-driving with a load rating sufficient for the Trolley loaded to GVWR and shall be equipped with oiled type front wheel bearings and seals.

Optional: Use for grease-type front bearings.
The front axle shall be non-driving with a load rating sufficient for the Trolley loaded to GVWR and shall be equipped with sealed, grease type front wheel bearings.
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.

10.2.2 STRENGTH

Fatigue life of all steering components shall exceed 1,000,000 miles. No element of the steering system shall sustain a Class I failure when one of the tires hits a curb or strikes a severe road hazard.

10.2.3 **TURNING RADIUS**

Outside body corner-turning radius for a standard configuration under 30-foot long Trolley shall not exceed 31 feet.

10.2.4 **TURNING EFFORT**

The steering wheel shall be no less than 18 inches in diameter and shall be shaped for firm grip with comfort for long periods of time. The steering wheel shall be removable with a standard or universal puller. The steering column shall have full tilt and telescoping capability allowing the operator to easily adjust the location of the steering wheel.

Hydraulically assisted power steering shall be provided. The steering gear shall be an integral type with flexible lines eliminated or the number and length minimized. Steering torque applied by the driver shall not exceed 10 foot-pounds with the front wheels straight ahead to turned 10 degrees.

Steering torque may increase to 70 foot-pounds when the wheels are approaching the steering stops. Steering effort shall be measured with the Trolley 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. Power steering failure shall not result in loss of steering control. With the Trolley in operation the steering effort shall not exceed 55 pounds 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.

SECTION 11 BRAKES

11.1 SERVICE BRAKE

11.1.1 ACTUATION

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 Trolley deceleration rate and shall not exceed 50 pounds at a point 7 inches above the heel point of the pedal to achieve maximum braking. The heel point is the location of the driver's heel when foot is rested flat on the pedal and the heel is touching the floor or heel pad of the pedal. A microprocessor controlled Automatic Braking System (ABS) shall be provided. The microprocessor 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

Baseline: No Automatic Traction Control required.

Optional: Automatic traction control

Microprocessor controlled Automatic Traction Control (ATC) shall be provided.

Baseline: Use of Meritor slack adjusters.
Optional: Use of Haldex slack adjusters.

Actuation of ABS and/or ATC shall override the operation of the brake retarder.

11.1.2 FRICTIONAL MATERIAL

The entire service brake system, including friction material, shall have a minimum overhaul or replacement life of 30,000 miles with a brake retarder on operating profile or 20,000 miles without a brake retarder. Brakes shall be self-adjusting throughout this period. Visible stroke indicators shall be provided to allow service personnel to easily identify when the brakes are not in correct adjustment. The brake linings shall be made of non-asbestos material. In order to aid maintenance personnel in determining extent of wear, a scribe line indicating the thickness at which replacement becomes necessary, shall be provided on each brake lining.

11.1.3 HUBS AND DRUMS

Replaceable wheel bearing seals shall be provided. Wheel bearing and hub seals shall not leak or weep lubricant for 100,000 miles when running on the design operating profile. Brake drums shall allow machining to ¼ inch oversize. The brake drum material and design shall be selected to absorb and dissipate heat quickly so the heat generated during braking operation does not glaze brake linings. The drum heat shall not increase the temperature of tire beads and wheel contact area to more than that allowed by the tire manufacturer.

11.2 PARKING/EMERGENCY BRAKE

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. An emergency brake release shall be provided to release the brakes in the event of automatic emergency brake application. The parking brake valve button will pop out when air pressure drops below requirements of FMVSS 121. The driver shall be able to manually depress and hold down the emergency brake release valve to release the brakes and maneuver the Trolley to safety. Once the operator releases the emergency brake release valve, the brakes shall engage to hold the Trolley in place.

The rear brake system will be interlocked with the doors. The system will use a zero motion detector connected to the doors, which will not allow the door to open until the coach is brought to a complete stop. When the doors are open, the rear brakes will apply and stay applied until the doors are closed. The brake system will meet all standard FMVSS-121 regulations.

11.2.1 PNEUMATIC SYSTEM

11.2.1.1 GENERAL

The Trolley air system shall operate the air-powered accessories and the braking

system with reserve capacity. New Trolleys shall not leak down more than 5 psi as indicted on the instrument panel mounted air gauges, within 15 minutes from the point of governor cut-off.

Provision shall be made to apply shop air to the Trolley air systems using a standard quick disconnect type valve. The disconnect fitting shall be easily accessible and located in the engine compartment and near the front bumper area for towing. Retained caps shall be installed to protect fitting against dirt and moisture when not in use. Air for the compressor shall be filtered through the main engine air cleaner system. The air system shall be protected by a pressure relief valve set at 150 psi and shall be equipped with check valve and pressure protection valves to assure partial operation in case of line failures.

11.2.1.2 AIR COMPRESSOR

The engine-driven air compressor shall be sized to charge the air system from 40 psi to the governor cutoff pressure in less than 3 minutes while not exceeding the fast idle speed setting of the engine.

11.2.1.3 AIR LINES AND FITTINGS

Air lines, except necessary flexible lines, shall conform to the installation and material requirements of SAE Standard J1149 for copper tubing with standard, brass, flared or ball sleeve fittings, or SAE Standard J844 for nylon tubing if not subject to temperatures over 200 degrees F. 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 Trolley. 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-foot intervals. Nylon lines may be grouped and shall be supported at 2-foot intervals or less.

The compressor discharge line between power plant 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 Trolley except for the supporting grommets. Flexible lines shall be supported at 2-foot intervals or less.

Airlines shall be clean before installation and shall be installed to minimize air leaks. All airlines shall be sloped toward a reservoir and routed to prevent water traps. Grommets or insulated clamps shall protect the airlines at all points where they pass through understructure components.

11.2.1.4 AIR RESERVOIRS

All air reservoirs shall meet the requirements of FMVSS Standard 121 and SAE Standard J10 and shall be equipped with clean-out 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 brass drain valves which discharge below floor level with lines routed to eliminate the possibility of water traps and/or freezing in the drain line.

11.2.1.5 AIR SYSTEM DRYER

An air dryer shall prevent accumulation of moisture and oil in the air system. The air dryer system shall include a replaceable desiccant bed, electrically heated drain, and activation device. A 2M/3M mechanic shall replace the desiccant in less than 15 minutes.

SECTION 12. BODY

12.1 GENERAL

12.1.1 DESIGN

The coach shall present an early 20th. Century style Trolley. The exterior and body features, including grilles and louvers, shall be shaped to facilitate cleaning and repair. Water and dirt shall not be retained in or on any body feature to freeze or bleed out onto the Trolley after washing. The body and windows shall be sealed to prevent leaking of air, dust, or water under normal operating conditions and during cleaning for the service life of the Trolley. Exterior panels shall be sufficiently stiff to minimize vibration, drumming or flexing while the Trolley is in service. When panels are lapped, the upper and forward panels shall act as a watershed. The windows, hatches, and doors shall be able to be sealed. Accumulation on any window of the Trolley of spray and splash generated by the Trolley' wheels on a wet road shall be minimized.

12.1.2 CRASHWORTHINESS

The Trolley 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-inch reduction in any interior dimension. Windows shall remain in place and shall not open under such a load.

Exterior panels below 35 inches from ground level shall withstand a static load of 2,000 pounds applied perpendicular to the Trolley by a pad no larger than 5 inches square. This load shall not result in deformation that prevents installation of new exterior panels to restore the original appearance of the Trolley utilizing minor repair methods.

12.1.3 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 Trolley

Baseline: No requirement for protection against graffiti/vandalism for body material surfaces

12.1.4 CORROSION

The Trolley flooring, sides, roof, understructure, axle suspension components shall resist corrosion or deterioration from atmospheric conditions and road salts for a period of 6 years or 300,000 miles by use of undercoating the interior walls of all structural members. The exterior of all structural members will be sand blasted primed and painted prior to installation of body skin. An adhesive sealant shall be used between the body structure and the body skin to protect the coach against galvanic corrosion. It shall maintain structural integrity and nearly maintain original appearance throughout its service life, provided that it is maintained by the Procuring Agency in accordance with the procedures specified in the Contractor's service manual. With the exception of periodically inspecting the visible coatings applied to prevent corrosion and reapplying these coatings in limited spots, the Contractor shall not require the complete reapplication of corrosion compounds over the life of the Trolley.

Baseline: Body structure exterior shall be sand blasted then primed and painted with acrylic urethane enamel prior to assembly.

Optional: For coastal areas or northern climates. Body exterior shall be sand blasted then primed and painted with acrylic urethane enamel prior to assembly and the interior of all structural steel tubing shall be treated with an undercoat process.

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 2-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.

12.1.5 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.

12.1.6 FIRE PROTECTION

The passenger and engine compartments shall be separated by a bulkhead(s) that shall, by incorporation of fireproof materials in its construction, be a firewall. The engine compartment shall include areas where the engine and exhaust system is housed including the muffler, if mounted above the horizontal shelf. This firewall shall preclude or retard propagation of an engine compartment fire into the passenger compartment and shall be in accordance with the Recommended Fire Safety Practices defined in FMVSS 302. Only necessary openings shall be allowed in the firewall. Any passageways for the climate control system air shall be separated from the engine compartment by fireproof material. Piping through the bulkhead shall have copper, brass, or fireproof fittings sealed at the firewall with copper or steel piping on the forward side. Wiring may pass through the bulkhead only if connectors or other means are provided to prevent or retard fire propagation through the firewall. Engine access panels in the firewall shall be fabricated of fireproof material and secured with fireproof fasteners. These panels, their fasteners, and the firewall shall be constructed and reinforced to minimize warping of the panels during a fire that will compromise the integrity of the firewall.

12.1.7 DISTORTION

The Trolley, 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 and service doors. Static conditions shall 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.

12.2 STRUCTURE

12.2.1 GENERAL

The structure of the Trolley shall be designed to withstand the transit service conditions typical of an urban duty cycle throughout its service life. The Design Operating Profile shall be considered for this purpose.

The Structure of the Trolley shall have undergone appropriate structural testing and/or analysis, including Altoona testing, to ensure adequacy of design for the urban transit service. Any items that require repeated repairs or replacement must undergo the corrective action with supporting test and analysis. A report clearly describing and explaining the failures and repairs performed shall be submitted to the Procuring Agency.

12.2.2 TOWING

Towing devices shall be provided on each end of the Trolley. Each towing device shall withstand, without permanent deformation, tension loads up to 1.2 times the curb weight of the Trolley within 20 degrees of the longitudinal axis of the Trolley. The rear towing device(s) shall not provide a toehold for unauthorized riders.

Baseline: Front lift and tow of Trolley not required.

The front towing devices shall allow attachment of adapters for a rigid tow bar and shall permit lifting of Trolley until the front wheels are clear off the ground in order to position the Trolley on the towing equipment by the front wheels.

Alternative: Front lift and tow of Trolley is required.

The front towing devices shall allow attachment of adapters for a rigid tow bar and shall permit lifting and towing of the Trolley, at curb weight, until the front wheels are clear off the ground.

Towing device should accommodate flat bedding. The rear tow eyes shall permit lifting and towing of the Trolley for a short distance, such as in cases of an emergency. The method of attaching the tow bar or adapter shall require the specific approval of the Procuring Agency. Each towing device shall accommodate a crane hook with a 1-inch throat.

12.2.3 JACKING

It shall be possible to safely jack up the Trolley, 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 Trolley is on a level, hard surface, without crawling under any portion of the Trolley. Jacking from a single point shall permit raising the Trolley 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-inch-high run-up block not wider than a single tire. Jacking and changing any one tire shall be completed by a 2M mechanic helper in less than 30 minutes from the time the Trolley is approached. The Trolley shall withstand such jacking at any one or any combination of wheel locations without permanent deformation or damage.

12.2.4 HOISTING

The Trolley axles or jacking plates shall accommodate the lifting pads of a 2-post hoist system. Jacking plates, if used as hoisting pads, shall be designed to prevent the Trolley from falling off the hoist. Other pads or the Trolley structure shall support the Trolley on jack stands independent of the hoist.

12.2.5 FLOOR

12.2.5.1 DESIGN

The floor shall be essentially a continuous flat plane, except at the wheel housings and platforms.

Where the floor meets the walls of the Trolley, the surface edges shall be blended with a circular section of radius not less than 1 inch. Similarly, a molding or cove shall prevent debris accumulation between the floor and wheel housings.

12.2.5.2 STRENGTH

The floor deck may be integral with the basic structure or mounted on the structure securely to prevent chafing or horizontal movement designed to last the life of the vehicle. Sheet metal screws shall not be used to retain the floor and all floor fasteners shall be serviceable from one side only. The use of adhesives to secure the floor to the structure shall be allowed only in combination with the use of bolt, stainless steel rivets or screw fasteners and its effectiveness shall last throughout 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 Trolley. 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 inches from the normal plane. The floor shall withstand the application of 2.5 times gross load weight without permanent detrimental deformation. Floor, with coverings applied, shall withstand a static load of at least 150 pounds applied through the flat end of a 2-inch-diameter rod, with 1/32-inch radius, without permanent visible deformation.

12.2.5.3 CONSTRUCTION

The floor shall consist of Space Age Thermo Lite Board (or approved equal) all composite sub-floor and the floor covering. The floor, as assembled, including the sealer, attachments and covering shall be waterproof, non-hygroscopic, and resistant to mold growth. The sub-floor shall be resistant to the effects of moisture, including decay (dry rot) and impervious to wood destroying insects such as termites. Plywood, if used, shall be of a thickness adequate to support the design loads, manufactured with exterior glue of Group I Western panels as defined in PS 1-95 (Voluntary Product Standard PS 1-95, Construction and Industrial Plywood) and of a grade that is manufactured with a solid face and back. Plywood shall be installed with the highest-grade veneer up and with all edges sealed. Preservative treated plywood shall utilize a chemical that contains no EPA listed hazardous compounds and have moisture content at or below fifteen percent. Plywood prior to any preservative treating shall be certified at the time of manufacturing by an industry approved third-party inspection agency such as APA- the Engineered Wood Association (formerly the American Plywood Association).

12.3 PLATFORMS

12.3.1 GENERAL

Platform height shall not exceed twelve (12) inches. Trim shall be provided along top edges of platforms unless integral nosing is provided. Except where otherwise indicated, covering of platform surfaces and risers shall be same material as specified for floor covering.

Other raised areas such as for providing space for underfloor installation of components shall be limited. Such raised areas shall be constructed in accordance

to these specifications.

12.3.2 OPERATOR'S PLATFORM

The operator's platform shall be of a height to render the position of the operator with respect to the road surface the same as on standard floor Trolley. If the height of the operator's platform exceeds twelve (12) inches, a step shall be provided to allow for ease in boarding.

12.3.3 FAREBOX

If the driver's platform is higher than twelve (12) inches, then the farebox is to be mounted on platform of suitable height to provide this accessibility for operator without compromising passenger's access.

12.4 WHEEL HOUSING

12.4.1 DESIGN

Sufficient clearance and air circulation shall be provided around the tires, wheels, and brakes to preclude overheating when the Trolley is operating on the design operating profile.

Interference between the tires and any portion of the Trolley 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 requirements of Section 5.6, Noise.

Design and construction of front wheel housings shall allow for the installation of radio/electronic equipment storage compartment on interior top surface.

The interior of the front wheel housings will be covered with a sound deadening material and covered with smooth floor covering to match the interior of the coach. Panels and Finishes and complement interior finishes of the Trolley 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 12 inches above floor shall be equipped with additional mar-resistant coating or stainless-steel trim.

12.4.2 CONSTRUCTION

Wheel housings shall be constructed of corrosion-resistant, fire-resistant stainless steel. Wheel housings, as installed and trimmed, shall withstand impacts of a 2-inch steel ball with at least 200 foot-pounds of energy without penetration.

SECTION 13 EXTERIOR PANELS AND FINISHES

13.1 PEDESTRIAN SAFETY

Exterior protrusions greater than 2 inch and within 80 inches of the ground shall have a radius no less than the amount of the protrusion. The exterior rearview mirrors and

required lights and reflectors are exempt from the protrusion requirement. Advertising frames if required shall protrude no more than 7/8 inch from the body surface and shall have the exposed edges and corners rounded to the extent practicable. Grilles, doors, bumpers and other features on the sides and rear of the Trolley shall be designed to minimize the ability of unauthorized riders to secure toeholds or handholds.

13.2 REPAIR AND REPLACEMENT

Exterior panels below the floor level shall be divided into sections, installed with quarter turn fasteners for quick access and that are repairable or replaceable by a 3M mechanic in less than 30 minutes for a section up to 5 feet long (excludes painting).

Baseline: No requirement for anti-graffiti/vandalism surface treatments.

Alternative: Additional requirements for anti-graffiti/vandalism treatments for exterior surfaces.

13.3 RAIN GUTTERS OR ROOF OVERHANG

Rain gutters or roof over hang shall be provided to prevent water flowing from the roof onto the passenger doors and operator's side window. When the Trolley is decelerated the gutters or roof over hang shall not drain onto the windshield, or operator's side window, or into the door boarding area. Cross sections of the gutters shall be adequate for proper operation.

13.4 LICENSE PLATE PROVISIONS

Baseline: Requirement for rear license plate only.

Optional: Provisions shall be made to mount standard size U.S. license plates per SAE J686 on the front and rear of the Trolley. These provisions shall direct mount or recess the license plates so that they can be easily cleaned. License plates shall be mounted at the lower center or lower street side of the Trolley and shall not allow a toehold or handhold for unauthorized riders.

13.5 RUBRAILS

Optional: Rubber rubrails without skirt wood.

Rubber rubrails composed of flexible, resilient material shall be provided to protect both sides of the Trolley body from damage caused by minor sideswipe accidents with automobiles.

Rubrails shall have vertical dimensions of no less than 2 inches or 50 mm with the centerline no higher than 35 inches above the ground between the wheel wells. The rubrails shall 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, wider than the rubrail, and with 1/4-inch end radii, with no visible Damage to the rubrail, retainer, or supporting structure. The rubrail may be discontinued at doorways and wheel wells. A damaged

portion of the rubrail shall be replaceable without requiring removal or replacement of the entire rubrail.

The above specification does not apply to coaches provided with solid heart wood skirt wood rub rails.

Standard: Solid heart wood skirt wood rub rails
Three (3) separate rub rail sections will be installed on the outside of the skirt panel assemblies. The top rub rail will be 1-1/2" thick x 5-1/2" solid Philippine mahogany. The second rub rail section will be 3/4" thick x 4" wide solid Philippine mahogany. The third and lower rub rail section will be 3/4" thick x 5-1/2" wide solid Philippine mahogany.

Optional: Use of composite material in lieu of natural wood.

13.6 FENDER SKIRTS

Features to minimize water spray from the Trolley in wet conditions shall be included in wheel housing design. Any fender skirts shall be easily replaceable. Wheels and tires shall be removable with the fender skirts in place.

13.7 SPLASH APRONS

Splash aprons, composed of 1/4-inch-minimum composition or rubberized fabric, shall be installed behind of wheels as needed to reduce road splash and protect underfloor components. The splash aprons shall extend downward to within 4 inches of the road surface at static conditions. Apron widths shall be no less than tire widths. Splash aprons shall be bolted to the Trolley 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. Other splash aprons shall be installed where necessary to protect Trolley equipment.

13.8 SERVICE COMPARTMENTS AND ACCESS DOORS

13.8.1 ACCESS DOORS

Conventional or pantograph hinged doors shall be used for the engine compartment and for all auxiliary equipment compartments including doors for checking the quantity and adding to the engine coolant, engine lubricant and transmission fluid. Access openings shall be sized for easy performance of tasks within the compartment including tool-operating space. Access doors shall be of rugged construction and shall maintain mechanical integrity and function under normal operations throughout the service life of the Trolley. They shall close flush with the body surface. All doors shall be hinged at the top, bottom or on the forward edge and shall be prevented from coming loose or opening during transit service or in Trolley washing operations. Doors with top hinges shall have safety props stored behind the door or on the doorframe. All access doors shall be retained in the open position by props or counterbalancing with over-center or gas-filled springs 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.

The battery compartment or enclosure shall be vented and self-draining. It shall be accessible only from outside the Trolley. All components within the battery compartment, and the compartment itself, shall be protected from damage or corrosion from the electrolyte and gases emitted by the battery.

13.8.2 SERVICE AREA LIGHTING

Lights 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. Sealed lamp assemblies shall be provided in the engine compartment and shall be controlled by a switch located on the light in the engine compartment. Necessary lights, located in other service compartments, shall be provided with switches on the light fixture or convenient to the light.

13.9 BUMPERS

13.9.1 LOCATION

Bumpers shall provide impact protection for the front and rear of the Trolley and will present an early 20th. Century appearance.

13.9.2 FRONT BUMPER

Front bumper will be one-piece steel fabricated assembly. The front bumper shall be a minimum of 5-1/2" high, incorporating heavy cast steel tow eyes on the face. The front bumper shall be designed with a constant 3" curvature from side to side. The bumper will be finished in gloss black powder coat.

An authentic vintage, designed, framed heavy gauge woven wire cowcatcher will be mounted on the underneath side of the front bumper. This cowcatcher will have the same contour from side to side as the bumper and wraps around the corners of both sides of the trolley. The cowcatcher is to be finished in gloss black powder coat. The cowcatcher will be made of 12 gauge x 1-1/4" 0.D. steel tubing frame covered with 7 gauge heat treated alloy steel woven wire with a 1-1/2" clear open diamond pattern.

13.9.3 REAR BUMPER

The rear bumper will be a 12 inch high one piece steel fabricated assembly. The rear bumper will be designed to match the rear wall contour and will incorporate heavy cast steel tow eyes on the face. The bumper will be black powder coated.

13.10 FINISH AND COLOR

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 Trolley. Drilled holes and cutouts in exterior surfaces shall be made prior to cleaning, priming and painting to prevent corrosion. The Trolley shall be completely painted prior to installation of exterior lights,

windows, mirrors and other items, which are applied to the exterior of the Trolley. Body filler materials may be used for surface dressing, but not for repair of damaged or improperly fitted panels.

Paint shall be applied smoothly and evenly with the finished surface free of dirt and the following other imperfections:

A. Blisters or bubbles appearing in the topcoat film
B. Chips, scratches, or gouges of the surface finish
C. Cracks in the paint film
D. Craters where paint failed to cover due to surface contamination
E. Overspray
F. Peeling
G. Runs or sags from excessive flow and failure to adhere uniformly to the surface
H. Chemical stains and water spots

To the degree consistent with industry standards for commercial vehicle finishes, painted surfaces shall have gloss and orange peel shall be minimized. 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.

All wood trim in the trolley shall be solid heartwood. Veneers will not be accepted. All edges of the wood trim shall be chamfered to accent seams and joints to facilitate a vintage appearance.
All solid heartwood trim except the rub rail if specified on the side skirt panels shall be installed with 3/16" diameter aluminum pull rivets and capped with brass plated aluminum rivet caps.

The rub rail mahogany shall be installed with wood screws from the backside of the skirt panels. Wood trim is to be installed over the steel structural framing and is in no way required to support loads.

The trolley shall have accenting on selected panels with applied graphic vinyl pin-striping and number pennants. Lettering, signage and pin striping shall be designed and applied with applied graphic 2-mil 5-year vinyl. All letters shall be in the letter style of Tiffany heavy and gold in color, outlined with a silk-screened 1/8" wide black border. Coach numbers shall be 4" high.

Panel pin striping shall be a combination of 1/8" with 1/4" wide dual striping in gold color. Seat end pin striping shall be 1/8" wide thermo-die-cut, gold vinyl applied on a common mask.

Optional: Allow for graphic wrap on top of paint

13.11 NUMBERING AND SIGNING

Monograms, numbers and other special signing specified by the Procuring Agency shall be applied to the inside and outside of the Trolley as required. Signs shall be durable and fade-, chip-, and peel-resistant; they may be painted signs, decals, or pressure-sensitive appliqués. All decals shall be sealed with clear, waterproof sealant around all exposed edges if required by the decal supplier. Signs shall be provided in compliance with the ADA requirements defined in 49 CFR Part, Subpart B, 38.27.

13.12 EXTERIOR LIGHTING

All exterior lights shall be designed to prevent entry and accumulation of moisture or dust, and each lamp shall be replaceable in less than 5 minutes by a 2M mechanic helper. Commercially available Incandescent or LED (Light Emitting Diode)-type lamps shall be used wherever possible, excluding applications where white lights are used, such as for headlights. Lights mounted on the engine compartment doors shall be protected from the impact shock of door opening and closing. Lamps, lenses and fixtures shall be interchangeable to the extent practicable. Two hazard lamps at the rear of the Trolley shall be visible from behind. Light lenses shall be designed and located to prevent damage when the Trolley is being washed. Lights located on the roof and sides (directional) of the Trolley shall have protective shields or be of the flush mount type to protect the lens against minor impacts.

Baseline: No DRLs (Daytime Running Lights)

Optional: Daytime Running Lights

Baseline: **Four (4) inch diameter incandescent exterior lighting.**
Side clearance lights will be of the slimline design incandescent with amber front and red rear installed on the outside edge of the roof assembly. Front directional lights will be incandescent mounted under the bumper behind the woven wire cowcatcher. Front side incandescent directional lights will be mounted on the left and right forward skirt above the cowcatcher. The incandescent rear stop, tail, and directional lights and back-up light will be mounted in the rear bumper, recessed for easy maintainability and aesthetics.

Optional: **Four (4) inch diameter LED exterior lighting.**
Side clearance lights will be of the slim line design Dialight LED with amber front and red rear installed on the outside edge of the roof assembly. Front directional lights will be Dialight LED mounted under the bumper behind the woven wire cowcatcher. Front side Dialight LED directional lights will be mounted on the left and right forward skirt above the cowcatcher. The 4” Dialight LED rear stop, tail, and directional lights and back-up light will be mounted in the rear bumper, recessed for easy maintainability and aesthetics.

Optional: **Seven (7) inch diameter Led exterior lighting.**
Side clearance lights will be of the slim line design Dialight LED with amber front and red rear installed on the outside edge of the roof assembly. Front directional lights will be Dialight LED mounted under the bumper behind the woven wire cowcatcher. Front

side Dialight LED directional lights will be mounted on the left and right forward skirt above the cowcatcher. The 7” Dialight LED rear stop, tail, and directional lights and 4” Dialight LED back-up light will be mounted in the rear bumper, recessed for easy maintainability and aesthetics.

Optional: **Deceleration Lights:**
Deceleration lights will be 4 inch incandescent lights, two amber and 1 red mounted on outside rear of the coach centered above the engine access door. The amber light will activate when the throttle is released then extinguish when the brakes are applied. The center brake light will activate with the other brakes lights.

Optional: **DECELERATION LIGHTS:** Deceleration lights will be 7 inch Dialite LED, two amber and 1 red mounted on outside rear of the coach centered above the engine access door. The amber light will activate when the throttle is released then extinguish when the brakes are applied. The center brake light will activate with the other brakes lights.

A non-functioning authentic vintage-design single headlight assembly shall be mounted in the center of the front panel. The headlight housing shall be a 9" minimum diameter standoff design, made of cast aluminum finished in gloss black powder coat. The polished brass headlight bezel with protective lens bars shall be made of one-piece cast solid brass, a minimum of 9" diameter, and hinged on the headlight housing. Within the light shall be mounted a bulb that appears to be vintage that is single element.

Visible and audible warning 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.

Lamps at the front and rear passenger doorways shall comply with ADA requirements and shall activate only when the doors open. These lamps shall illuminate the street surface to a level of no less than 1 foot-candle for a distance of 3 feet outward from the outboard edge of the door threshold equipped with the loading system. The lights may be positioned above or below the lower daylight opening of the windows and shall be shielded to protect passengers' eyes from glare.

Turn-signal lights shall be provided on both sides of the Trolley.

SECTION 14 – INTERIOR PANELS AND FINISHES

14.1 GENERAL

Materials shall be selected on the basis of maintenance, durability, appearance, safety, flammability, and tactile qualities. Trim and attachment details shall be kept simple and unobtrusive. Materials shall be strong enough to resist everyday use and vandalism; they shall be resistant to scratches and markings. Interior trim shall be secured to avoid resonant vibrations under normal operational conditions.

Interior surfaces more than 10 inches 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. Water and soap should not normally be sprayed directly on the instrument and switch panels.

Baseline: No requirement for anti-graffiti/vandalism surface treatments.

Alternative: Additional requirements for anti-graffiti/vandalism treatments for interior surfaces.

14.2 FRONT END

The entire front end of the Trolley shall present an early 20th.Century appearance and be sealed to prevent debris accumulation behind the dash and to prevent the operator's feet from kicking or fouling wiring and other equipment. The front end shall be free of protrusions that are hazardous to passengers standing or walking in the front of the Trolley during rapid decelerations. Paneling across the front of the Trolley and any trim around the operator's compartment shall be formed metal or plastic material. Formed fiberglass dash panels shall be painted and finished to the quality described in Section 16.1 Operator's Area. Plastic dash panels shall be reinforced, as necessary, vandal-resistant, and replaceable. All colored, painted, and plated parts forward of the operator's barrier shall be finished with a dull matte surface to reduce glare.

14.3 REAR END

The rear bulkhead and rear interior surfaces shall be material suitable for exterior skin, painted and finished to exterior quality trimmed with aluminum.

14.4 INTERIOR PANELS

14.4.1 General

Interior side trim panels and operator's barrier shall be textured stainless steel, painted aluminum, fiberglass reinforced plastic, melamine-type material, or carpeting. Panels shall be easily replaceable and tamper-resistant. They shall be reinforced, as necessary, to resist vandalism and other rigors of transit Trolley service. Individual trim panels and parts shall be interchangeable to the extent practicable. Untrimmed areas shall be painted and finished. All materials shall comply with the Recommended Fire Safety Practices defined in FMVSS 302.

14.4.2 Operator Barrier

A barrier or bulkhead between the operator 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.

A driver's coat hook and strap will be provided behind the driver allowing adequate space for all sizes of coats.

Baseline: Full-height configuration of operator's barrier.

The barrier shall extend from the floor or wheel housing to the ceiling and shall fit the Trolley side windows, wall, and ceiling panels to effectively close off driver's area and prevent passengers from reaching the operator or the operator's personal effects.

14.4.3 MODESTY PANELS

Sturdy divider panels constructed of durable, painted, corrosion-resistant material complementing the interior trim shall be provided to act as both a physical and visual barrier for seated passengers. Modesty panels shall be located at doorways to protect passengers on adjacent seats, and along front edge of rear upper level. Design and installation of modesty panels located in front of forward facing seats shall include a handhold/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 no higher than the lower daylight opening of the side windows and those forward of transverse seats shall extend downward to a level between 1-1/2 and 1 inches above the floor. Panel's 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 2-1/2- inch clearance between the modesty panel and the opened door to protect passengers from being pinched. Modesty panels installed at doorways shall be equipped with grab rails. The modesty panel and its mounting shall withstand a static force of 250 pounds applied to a four-inch by four-inch area in the center of the panel without permanent visible deformation

14.4.4 REAR BULKHEAD

The rear bulkhead paneling shall be contoured to fit the ceiling, side walls, and seat backs so that any litter, such as a cigarette package or newspaper, will tend to fall to the floor or seating surface when the Trolley 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 removed and replaced by a 3M mechanic in 5 minutes. Grilles where access to or adjustment of equipment is required shall be heavy duty and designed to minimize damage.

14.4.5 HEADLINING

Ceiling panels shall be textured stainless steel, anodized aluminum, melamine-type material, fiberglass-reinforced plastic, carpeting, or material suitable for exterior skin painted and finished to exterior quality. 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 edge 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.

14.4.6 FASTENING

Interior panels shall be attached so that there are no exposed unfinished or rough edges or rough surfaces. Panels and fasteners shall not be easily removable by passengers. Interior trim fasteners, where required, shall be rivets or cross-recessed head screws.

14.4.7 INSULATION

Any insulation material used between the inner and outer panels shall be sealed or self-sealing to minimize entry and/or retention of moisture. Insulation properties shall be unimpaired during the service life of the Trolley. 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. All insulation materials shall comply with the Recommended Fire Safety Practices defined in FMVSS 302.

The combination of inner and outer panels on the sides, roof, wheelwells and ends of the Trolley, and any material used between these panels shall provide a thermal insulation sufficient to meet the interior temperature requirements. The Trolley body shall be thoroughly sealed so that the operator or passengers cannot feel drafts during normal operation s with the passenger doors closed.

14.5 FLOOR COVERING

The floor covering shall have a non-skid-walking surface that remains effective in all weather conditions and complies with all ADA requirements. The floor covering, as well as transitions of flooring material to the main floor and to the entrance and exit area, shall be smooth and present no tripping hazards. Color shall be consistent throughout the floor covering.

Baseline: Rubber transit floor, ribbed in the aisle and smooth under seat.

Optional: Vinyl transit floor.

Any areas on floor, which are not intended for standees, such as areas “swept” during passenger door operation, shall be clearly and permanently marked.

The floor in the operator's compartment shall be easily cleaned and shall be arranged to minimize debris accumulation.

For Trolleys with rubber floors, a ribbed one-piece center strip shall extend from the rear of the back door between the aisle sides of transverse seats to the front riser. The ribbed area will have forty five degree cuts that will allow the ribs to change direction to allow for a smooth sweep out (all ribs will line up) at the front and rear doors. The covering between the center strip and the wheel housings may be separate pieces. At the rear door, however, 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 under the seats shall be covered with smooth surface flooring material. The floor covering shall closely fit the sidewall cove or extend to the top of the cove.

For Trolleys with vinyl floors, the floor will be essentially smooth with a single vinyl welded seam located under the curbside seats. Any other joints will be vinyl welded to preclude the possibility of water intrusion. The floor covering shall closely fit the sidewall cove or extend to the top of the cove.

14.6 PASSENGER INTERIOR LIGHTING

Dome lights will be brass powder coated assemblies with clear defused lenses. Twelve (12) light fixtures will be evenly located throughout the passenger compartment, presenting the appearance of vintage-type lighting. Step well, driver, and engine compartment lights are to be mounted overhead, utilizing the same type lights as used for dome lights.

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

Lens material shall be clear defused polycarbonate. Lens shall be sealed to inhibit incursion of dust and insects yet are easily removable for service. Access panels shall be provided to allow servicing of components located behind light panels

Baseline: Use for first light modules extinguishes when front door closes.

The lights above the front and rear doors will extinguish when the doors close. There are no lights forward of the front entrance door on the curbside and the driver’s light is driver controlled.

14.7 FARE COLLECTION

Space, as far forward as practicable and structural provisions shall be made for installation of currently available fare collection device(s). Location of the fare collection device shall not restrict traffic in the vestibule, including wheelchairs if a front door loading device is used, and shall allow the operator to easily reach the remote farebox controls and to view the fare register. The fare box shall not restrict access to the operator area, shall not restrict operation of remote operator controls and shall not restrict operator’s field of view per SAE Recommended Practice J1050. Location and mounting of fare collection device shall allow use, without restriction, by passengers. Fare box location shall permit accessibility to the vault for easy manual removal or attachment of suction devices. Meters and counters on the fare box shall be readable on a daily basis. A 15-amp minimum, 12 or 24 -volt, DC, protected circuit shall be available to power the fare box. This power service shall include a grounded lead with both wires enclosed in a flexible conduit. The floor under the fare box shall be reinforced, as necessary, to provide a sturdy- mounting platform and to prevent shaking of the fare box.

Transfer mounting, cutting, and punching equipment shall be located in a position convenient to the operator.

Optional: Install customer furnished GFI farebox and dash mounted key pad

14.8 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. When necessary access doors shall be hinged with gas props or over-center springs, where practical, to hold the doors out of the mechanic's way. Panel fasteners shall be standardized so that no tools are required or only one tool is required to service all special fasteners within the Trolley.

Baseline: Door actuator access doors do not require keys to open.

Access doors for the door actuator compartments shall be secured with hand screws or latches, and shall prevent entry of mechanism lubricant into the Trolley interior. All fasteners that retain access panels shall be captive in the cover.

Access openings in the floor shall be sealed to prevent entry of fumes and water into the Trolley interior. Flooring material shall be flush with the floor and shall be edge-bound with stainless steel, or other material that is acceptable to the Procuring Agency, to prevent the edges from coming loose. Access openings shall be asymmetrical so that reinstalled flooring shall be properly aligned. Fasteners shall tighten flush with the floor.

SECTION 15 PASSENGER ACCOMMODATIONS

15.1 PASSENGER SEATING

15.1.1 ARRANGEMENTS AND SEAT STYLE

The passenger seating arrangement in the Trolley shall be such that seating capacity is maximized and in compliance to the following requirements. The Procuring Agency recognizes that foot room, hip-to-knee room, doorway type and width, seat construction, floor level type, seat spacing requirements, etc. ultimately affect seating capacity and layout.

Optional: Combination forward facing and perimeter seating arrangement.

The passenger compartment will accommodate 28 seated passengers, utilizing seven (7) two- passenger seats mounted transversely, one (1) three (3) passenger seat mounted longitudinally over the curbside rear wheel housing, two (2) three (3) passenger flip-up seats mounted longitudinally on the roadside, and one (1) five (5) passenger forward facing contoured seat to match the shape of the rear of the coach. The roadside seats will flip up allowing space for two forward facing wheelchair.

Seating capacity with this arrangement shall be no less than 28 seated passengers with 19 standees, not including the operator, with the specified seating arrangement.

Optional: Perimeter seating arrangement.
Passenger seats shall be arranged in longitudinal rows facing the centerline of the Trolley. One row of transverse, forward facing seats shall be provided at the rear of

the Trolley. Longitudinal seating shall meet the requirements in Section 15.1 Passenger Seating, except that armrest shall be provided between every other seating position at the same location as vertical passenger assists defined in Section 15.2 Passenger Assists. Each seat shall have a minimum width of 17 inches, not including the armrest.

Seating capacity with this arrangement shall be no less than 26 seated passengers, not including the operator, with the specified seating arrangement.

Baseline: Forward facing seat configuration

The passenger compartment will accommodate 27 seated passengers, utilizing seven (5 two- passenger seats mounted transversely, one (1) three (3) passenger seat mounted longitudinally over the curbside rear wheel housing, one (1) three (3) passenger seat mounted longitudinally over the roadside rear wheel housing, (2) three (3) passenger flip-up seats mounted longitudinally on the roadside, and one (1) five (5) passenger forward facing contoured seat to match the shape of the rear of the coach. The roadside seats will flip up allowing space for two forward facing wheelchairs.

Passenger seating capacity with this arrangement shall be no less than 27 not including the operator, with the specified seating arrangement.

Note: This minimum capacity may be reduced when accommodations for more than two wheelchairs are required

Passenger seating in the trolley will present the authentic vintage design of a wood slat seat. Standard passenger seats will be 34" in width, representing two passengers and is to be arranged in a 28 passenger-seating plan with accommodations for two forward facing wheelchair locations.

The wheelchair or mobility and securement device will be two (2) four (4) point belt systems with flush mounted floor pockets for each belt. The systems will incorporate a lap and shoulder belt for passenger restraint. The systems will be installed for maximum flexibility to install a wide variety of wheelchairs. An additional flush mounted floor pocket will be installed between the two rear pockets to accommodate three (3) wheeled mobility aids. The securement devices will conform to ADA Part 38.

Baseline: Two (2) four (4) point mobility securement belt systems with flush mounted floor pockets for each belt. With both lap and shoulder belts.

Optional: Two (2) sets of telescoping arm mobility securement systems without loose belts. With both lap and shoulder belts.

Priority seating and securement location signs will be provided per Americans With

Disability Act Part 38-27.

Baseline: Non-padded seats

The passenger seats shall not be equipped with-padded inserts throughout the Trolley.

Optional: Padded seat inserts

The passenger seats shall be equipped with padded cover throughout the Trolley on the lower portion of the seat only. Note that all applicable seat dimensions specified below shall be measured with pad fully depressed

Baseline: Hip-to-knee room.

Hip-to-knee room measured from the front of one seat back horizontally across the highest part of the seat to the seat or panel immediately in front, shall be no less than 26 inches. 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.
Alternative: Increased hip-to-knee room.

Hip-to-knee room measured from the front of one seat back horizontally across the highest part of the seat to the seat or panel immediately in front, shall be no less than 28 inches. At all seating positions in paired transverse seats immediately behind other seating positions hip-to-knee room shall be no less than 28 inches.

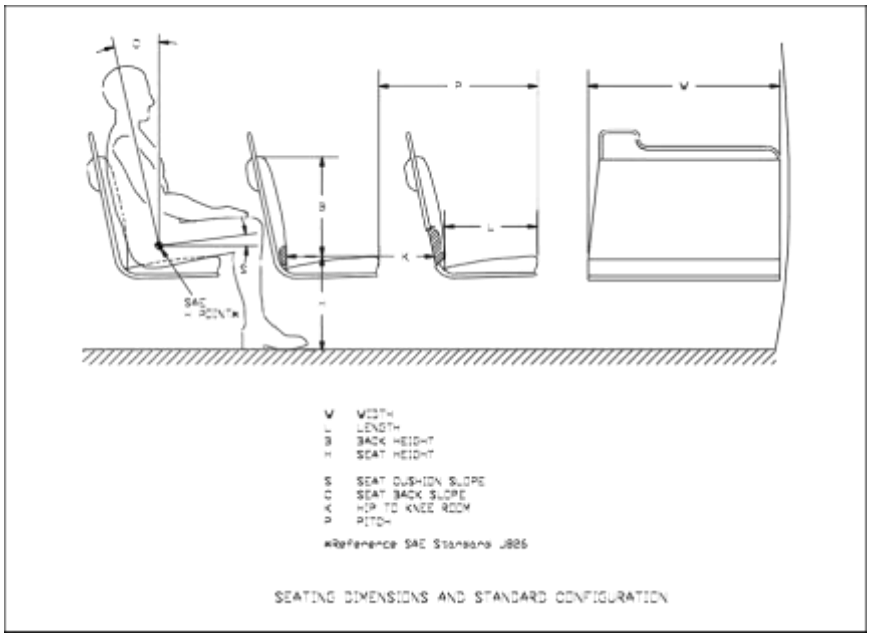
Thickness of the transverse seat backs shall be minimized at the bottom to increase passenger knee room and passenger capacity. The area between the longitudinal seat backs and the attachment to the Trolley sidewalks shall be designed to prevent debris accumulation.

The aisle between the seats shall be no less than 20 inches wide at seated passenger hip height

Raised platforms for passenger seats shall not be allowed without Procuring Agency's approval.

All Offeror's shall submit a copy of the proposed seat layout consistent with these specifications showing hip-to-knee and foot room dimensions, stanchion layout and wheelchair maneuverability layout for Procuring Agency review and approval. The bidders shall also indicate on this layout the Free Floor Space available to standees.

15.1.2 DIMENSIONS



SEATING DIMENSIONS AND STANDARD CONFIGURATION

Seat dimensions for the various seating arrangements shall have the dimensions as follows (refer to the figure above):

The width, W, of the seat shall be 34 inches. The length, L, shall be 15 ±1 inches.

The seat back height, B, shall be a minimum of 15 inches.

The seat height, H, shall be 17 ± 1 inches. For the rear lounge (or settee) and longitudinal seats, and seats located above raised areas for storage of under floor components, a cushion height of up to 18 ±2 inches will be allowed. This shall also be allowed for limited transverse seats, but only with expressed approval of the Procuring Agency.

The seat cushion slope, S, shall be between 5° to 11°. The seat back slope, C, shall be between 8° to 17°.

The pitch, P, is shown as reference only.

15.1.3 STRUCTURE AND DESIGN

The passenger seats will be contour designed using cast aluminum seat ends with molded design scrollwork. The passenger seat ends will be pinstriped to accent all scrollwork.

The seat slats are to be 3/4" solid heartwood, fastened to the seat ends over 1/32" rubber insulator with Phillips head countersunk brass machine screws. Seat slats will be installed so that each slat interfaces with the adjacent slat within 1/16". The top or shelf slat will accommodate the brass stanchion flange fittings.

The passenger seat frame and its supporting structure shall be constructed and

mounted so that space under the seat is maximized to increase wheelchair maneuvering room.

15.2 PASSENGER ASSISTS

15.2.1 GENERAL

All interior grab rails and stanchions will be 1-1/4" 0.D. x .032" clear powder coated spiraled brass tubing. A horizontal passenger assist will be located across the front of the vehicle and will prevent passengers from sustaining injuries on the fare collection device or windshield in the event of a sudden deceleration. Without restricting the space, the assist will provide support for a boarding passenger from the front door through the boarding procedure. Passengers will be able to lean against the assist for security while paying fares.

Overhead grab rails will be suspended from the ceiling by ornamental vintage cast aluminum grab rail brackets, finished in flat black polyurethane enamel paint.

Stanchions will extend from the overhead grab rail to the top of every forward facing seat and from the overhead grab rail to the floor at longitudinal seats at every third passenger location. At the entrance and exit step well and modesty panel a stanchion will extend from the overhead grab rail to the top of the entrance areas forward, rear modesty panels, and one floor to ceiling behind the driver. All stanchions will terminate at turned flange solid clear coated brass fittings with anti-rattle "O" ring inserts.

Authentic vintage leather grab straps of the loop design will be installed around the overhead grab rails located one between each grab rail mounting bracket, which will provide additional assist for standee passengers. Grab straps will be minimum 3/16" thick x 1-1/2" wide and extend 9" from the overhead grab rails.

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 Trolley 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. The forward-most vertical stanchions on either side of the aisle immediately behind the driver’s area shall be 1 ¼” polished spiral brass.

Excluding those mounted on the seats and doors; the assists shall have a cross-sectional diameter of 1-1/4” or shall provide an equivalent gripping surface with no corner radii less than 1/4 inch. All passenger assists shall permit a full handgrip with no less than 1-1/2 inches 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.

Passenger assists shall be designed to minimize glare in the Operator's area to the extent possible. With the exception of entrance handholds, all areas of the passenger assists that are handled by passengers including functional components used as passenger assists shall be of clear powder coated spiral brass. Door mounted passenger assists shall be of clear powder coated spiral brass. Connecting tees, angles, and bases shall be clear powder coated brass. All brass tees and bases will contain a rubber o-ring to element rattles. Assists shall withstand a force of 300 pounds applied over a 12-inch 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 flush with the surface and free from burrs or rough edges.

15.2.2 FRONT DOORWAY

Front doorways or the entry area, shall be fitted with assists no less than 3/4-inch in width. Assists shall be as far outward as practicable, but shall be no farther than 6 inches from the outside edge of the entrance door 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, the vertical assist, and the assists on the wheel housing or on the front modesty panel.

15.2.3 VESTIBULE

The aisle side of the operator'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 inches 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 Trolley and shall prevent passengers from sustaining injuries on the fare collection device or windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the fare collection procedure. Passengers shall be able to lean against the assist for security while paying fares. The assist shall be no less than 36 inches above the floor. The assists at the front of the Trolley 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 operator's barrier, wheel housings, or front modesty panel.

15.2.4 REAR DOORWAY

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 no less than 3/4 inch in width and shall provide at least 1-1/2 inches of knuckle clearance between the assists and their mounting. The assists shall be designed to permit a 5^{th}-percentile female to easily move from one assist to another during the entire exiting process. The assists shall be located a minimum of 6 inches from the outside edge of the rear doorway.

15.2.5 OVERHEAD

Except forward of the driver's platform and at the rear door, a continuous, full grip, overhead assist shall be provided. This assist shall be convenient to standees anywhere in the Trolley and shall be located over the center of the aisle seating position of the transverse seats. The assist shall be no less than 70 inches above the floor.

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

15.2.6 LONGITUDINAL SEATS

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 or functionally continuous for a 5^{th} percentile female passenger.

15.2.7 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.

15.3 PASSENGER DOORS

15.3.1 GENERAL

Two doorways shall be provided in the curbside of the Trolley for passenger ingress and egress. The front doorway shall be behind the front wheels. Passenger doors and doorways shall comply with ADA requirements.

Baseline: Use for rear door located behind the rear axle.

The rear doorway shall be located behind the rear axle. A stepwell shall be provided as required.

15.3.2 MATERIALS AND CONSTRUCTION

Structure of the doors, their attachments, inside and outside trim panels, and any mechanism exposed to the elements shall be corrosion-resistant. The doors, when fully opened, shall provide a firm support and shall not be damaged if used as an assist by passengers during ingress or egress. The front leaves of the passenger doors shall overlap the rear leaves.

The entrance and exit door will be a two piece assembly installed flush with the bottom step and will be of a closed type, which fills the door opening. The door is fabricated of steel square tubing, finished with a black powder coat crinkle finish and

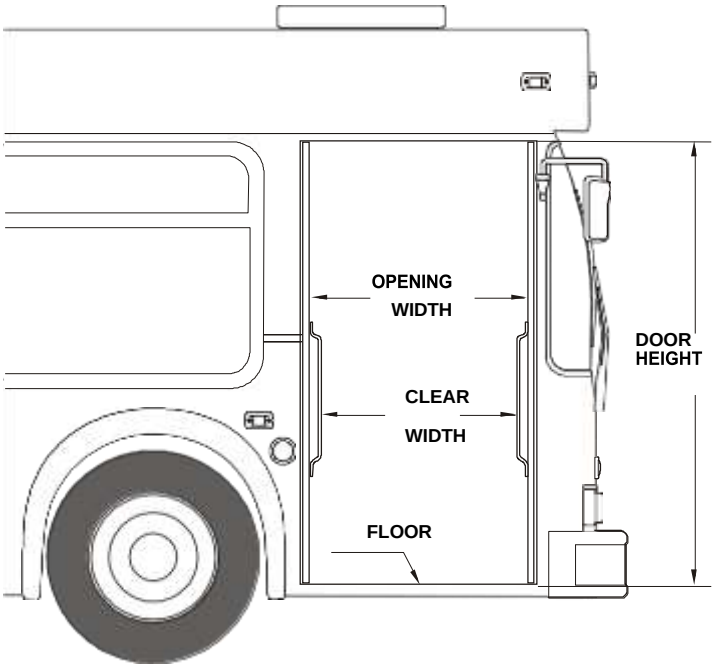
trimmed with five (5) 7/8" diameter clear powder coated spiral brass tube assemblies, running horizontally in the lower half and the exterior perimeter trimmed in solid heartwood, covered with a clear polycarbonate panel.

The entrance and exit door opens out from the first step, and is to be actuated electropneumatically from the driver's console by a five-position door controller. The door actuator cylinder will be of an air differential style. The front and rear door operators are mounted overhead in the stepwell and meet or exceed all Federal and State Regulations.

The leading edge of each door will be equipped with extruded rubber safety sensitive edge to reverse the door closing cycle when obstructed.

The door system will be interlocked with the brake and accelerator to stop the coach when doors open or prevent the coach from being operated while the door is open. A zero (0) motion detector will be provided that will prevent the doors from opening prior to the vehicle coming to a complete stop.

15.3.3 DIMENSIONS



TRANSIT COACH MINIMUM DOOR OPENING

Baseline: Front door 38.00-inch doorway clear width.
Front door clear width shall be no less than 38.00 inches with the doors fully opened.

Baseline: Rear door 26-inch doorway clear width.
Rear door opening clear width shall be no less than 26 inches with the doors fully opened. If a rear door ramp is provided, then the clear door opening width shall be no less than 31.75 inches with door fully opened.

When open, the doors shall leave an opening no less than 81 inches in height.

15.3.4 DOOR GLAZING

The upper section of both front and rear doors shall be glazed for no less than 45 percent of the respective door opening area of each section. The lower section of the front door shall be glazed for no less than 25 percent of the door opening area of the section. The edge of a 6-inch high curb shall be visible to the seated operator through the closed front door when the Trolley is more than 12 inches from the curb.

The front door panel glazing material shall have a nominal 1/8-inch thick polycarbonate.

Glazing material in the rear doorway door panels shall be the same material, thickness and color as the front door.

15.3.5 DOOR PROJECTION

Exterior projection of the doors shall be minimized and shall not exceed 13 inches during the opening or closing cycles or when doors are fully opened. Projection inside the Trolley shall not exceed 21 inches. The closing edge of each door panel shall have no less than 2 inches of soft weather stripping. The doors, when closed, shall be effectively sealed and the hard surfaces of the doors shall be at least 4 inches apart.

15.3.6 DOOR HEIGHT ABOVE PAVEMENT

It shall be possible to open and close either passenger door when the Trolley loaded to GVWR is not knelt and parked with the tires touching an 8-inch-high curb on a street sloping toward the curb so that the street side wheels are 5 inches higher than the right side wheels.

15.3.7 CLOSING FORCE

Closing door edge speed shall not exceed 19 inches per second. Power close rear doors shall be equipped with a sensitive edge or other obstruction sensing system such that if an obstruction is struck by a closing door edge, the doors will stop and/or reverse direction prior to imparting a 10- pound force on 1 square inch of that obstruction. Doors closed by return spring or counterweight- type device need not be equipped with an obstruction sensing device but shall be capable of being pushed to the point where the door starts to open with a force not to exceed 20 pounds applied to the center edge of the forward door panel. Whether or not the obstruction sensing system is present or functional it shall be possible to withdraw a 1-1/2 inch diameter cylinder from between the center edges of a closed and locked door with an outward force not greater than 35 pounds.

15.3.8 ACTUATORS

Door actuators shall be adjustable so that the door opening and closing speeds can be independently adjustable to satisfy the requirements of Section 5.4.6.1.4. Actuators and the complex door mechanism shall be concealed from passengers but shall be easily accessible for servicing. The door actuators shall be rebuild-able.

15.3.9 EMERGENCY OPERATON

In the event of an emergency, it shall be possible to open the doors manually from inside the Trolley using a force of no more than 25 pounds after actuating an unlocking device at each door. The unlocking devices 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 entrance and exit areas. When this emergency device is actuated, the door interlock throttle system shall return the engine to idle and the door interlock brake system shall apply to stop the Trolley.

Locked doors shall require a force of more than 100 pounds 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, engines, and complex mechanism.

15.4 ACCESSIBILITY PROVISIONS

15.4.1 GENERAL

The design and construction of the Trolley shall be in accordance with all requirements defined in 49 CFR, Part 38, Subpart B: ADA Accessibility Specifications for Transportation Vehicles - Trolleys, Vans and Systems. Space and body structural provisions shall be provided at the front or rear door of the Trolley to accommodate the wheelchair loading system. Prior to submission of bid, the Contractor shall provide a plan, including layout drawings for entry, maneuvering, parking, and exiting of wheelchair passengers, to show compliance with ADA regulations.

15.4.2 LOADING SYSTEM

A driver-controlled, power-operated passive step lift system compliant to requirements defined in 49 CFR Part 38, Subpart B, §38.23c shall provide ingress and egress quickly, safely, comfortably, and in a forward direction for a passenger in a wheelchair from the street level or curb.

Baseline: Front door location of loading system.

The wheelchair loading system shall be located at the front door and accommodate a weight of 800 pounds, which includes mobility aid when occupied.

Alternative: Rear door location of loading system.

The wheelchair loading system shall be located at the rear door.

When the system is not in use, the passageway shall appear normal. In the stored position of the ramp, no tripping hazards shall be presented and any resulting gaps shall be minimized. The controls shall be simple to operate with no complex phasing operations required, and the loading operation shall be under the surveillance and complete control of the operator. If the loading system and controls are at the rear doors, a switch shall be provided in the operator's area to disable the loading system.

The Trolley shall be prevented from moving during the loading or unloading cycle by a throttle and brake interlock system. The wheelchair loading system shall not present a hazard, nor inconvenience any passenger. The loading system shall be inhibited from retracting or folding when a passenger is on the ramp/platform. A passenger departing or boarding via the passive step lift shall be able to easily obtain support by grasping the passenger assist located on the doors or other assists provided for this purpose. The platform shall be designed to protect the passive step lift from damage and persons on the sidewalk from injury during the extension/retraction or lowering/raising phases of operation. The loading platform shall be covered with a replaceable or renewable, nonskid material and shall be fitted with devices to prevent the wheelchair from rolling off the ends or sides during loading or unloading. Deployment or storage of the passive step lift shall require no more than 15 seconds. The device shall function without failure or adjustment for 500 cycles or 5,000 miles in all weather conditions on the design operating profile when activated once during the idle phase. A manual override system shall permit unloading a wheelchair and storing the device in the event of a primary power failure. The manual operation of the passive step lift shall not require more than 20 lbs. of force. Hydraulic systems incorporated in the loading system mechanism shall comply with the requirements defined in Section 7.2.3 Hydraulic Systems. The passive step lift assembly components shall be replaceable within 30 minutes by 3M mechanic. An audible warning alarm will sound simultaneously with the operation of the wheelchair lift to alert passengers and bystanders. A warning light mounted near the curbside of the front door, minimum 2.5" diameter, amber lens shall be provided that will light when wheelchair lift is activated and throughout operation

15.4.3 WHEELCHAIR ACCOMMODATIONS

Baseline: Two forward facing wheelchair securement locations

Two forward-facing locations, as close to the wheelchair loading system as practical, shall provide parking space and securement system compliant with ADA requirements for a passenger in a wheelchair.

Alternative: Greater number of wheelchair securement locations

Additional equipment, including passenger restraint seat belts, shoulder harnesses and wheelchair securement devices shall be provided for each wheelchair passenger. All belt assemblies must stow up and out of the way when not in use.

15.4.4 INTERIOR CIRCULATION

Maneuvering room inside the Trolley shall accommodate easy travel for a passenger in a wheelchair from the loading device through the Trolley to the designated parking area, and back out. No portion of the wheelchair or its occupant shall protrude into the normal aisle of the Trolley when parked in the designated parking space(s). As a guide, no width dimension should be less than 34 inches. Areas requiring 90-degree turns of wheelchairs should have a clearance arc dimension no less than 45 inches and in the parking area where 180-degree turns are expected, space should be clear in a full 60-inch-diameter circle. A vertical clearance of 12 inches above the floor

surface should be provided on the outside of turning areas for wheelchair.

15.4.5 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 as required in Section 5.4.9.5 of Part 5: Technical Specifications.

Requirements for a stop-request passenger signal in accordance with 49 CFR, Part 38.37 shall be provided as required in Section 5.4.9.3 of Part 5: Technical Specifications.

Requirements for exterior destination signs in accordance with 49 CFR, Part 38.39 shall be provided as required in Section 5.4.9.1 of Part 5: Technical Specifications.

SECTION 16 OPERATOR PROVISIONS

16.1 OPERATOR'S AREA

16.1.1 GENERAL

The operator'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 operator's area shall be avoided. Such objects include dash panels, switches and controls, cowlings, windshield wipers and arms, barriers and modesty panels, fare stanchions, access panels and doors, fasteners, flooring, ventilation and heating ducting, window and door frames, and visors. The operator shall control interior lighting located ahead of the standee line.

16.1.2 VISORS

Adjustable sun visor(s) shall be provided for the windshield and the operator's side window. Visors shall be shaped to minimize light leakage between the visor and windshield pillars. Visors shall store out of the way and shall not obstruct airflow from the climate control system or interfere with other equipment such as the radio handset or the destination control. Deployment of the visors shall not restrict vision of the rearview mirrors. Visor adjustments shall be made easily by hand with positive locking and releasing devices and shall not be subject to damage by over-tightening. Sun visor construction and materials shall be strong enough to resist breakage during adjustments.

Visors may be transparent but shall not allow a visible light transmittance in excess of 10 percent. Visors, when deployed, shall be effective in the operator's field of view at angles more than 5 degrees above the horizontal.

Optional: Use for operator's window sunscreens

An adjustable roller type sunscreen shall be provided over the side window. The sunscreen shall be capable of being lowered to the midpoint of the operator's window. To secure and stabilize the screen, it shall be attached to thin metal rods on each side of the window. Once lowered, the screen shall remain in the lowered position until returned to the stowed position by the operator.

16.1.3 OPERATOR'S CONTROLS

All switches and controls necessary for the operation of the Trolley shall be conveniently located in the operator's area and shall provide for ease of operation. Switches and controls shall be essentially within the hand reach envelope described in SAE Recommended Practice, J287, Driver Hand Control Reach. Controls shall be located so that boarding passengers may not easily tamper with control settings.

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

Controls for engine operation shall be closely grouped within the operator's compartment. These controls shall include separate master run switch and start switch or button. The run switch shall be a four-position rotary switch with the following functions:

OFF	-	All electrical systems off, except power available for the passenger interior lighting, hazard lights, silent alarm, fire detection equipment, engine compartment lights, auxiliary heater, if provided and electronic equipment that require continuous energizing. If the Trolley is not operated for a period of two weeks, the total electric load due to devices that require continuous energizing shall not cause the battery to be discharged below the level necessary to start the engine. The electrical load resulting from the Procuring Agency's devices, such as, farebox, GPS, radio, etc., shall not exceed ____ amps with master run switch in OFF position.
Cl/ID	-	All electrical systems off, except those listed in OFF and power to marker lights.
RUN	-	All electrical systems and engine on, except the headlights, parking lights and marker lights. Daytime running lights (DRL), if provided, shall be on.
NITE/RUN	-	All electrical systems and engine on.

The door control, windshield wiper/washer controls, and run switch shall be in the most convenient operator locations. They shall be identifiable by shape, touch, and permanent markings. Doors shall be operated by a single control, conveniently located

and operable in a horizontal plane by the operator's left hand. The setting of this control shall be easily determined by position and touch.

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

All panel-mounted switches and controls shall be marked with easily read identifiers and shall be replaceable, and the wiring at these controls shall be serviceable from the vestibule or the operator's seat. Switches, controls, and instruments shall be dust- and water-resistant consistent with the Trolley washing practice.

16.1.4 DOOR CONTROL

Doors shall open or close completely in not more than 3.5 seconds from the time of control actuation and shall be subject to the closing force requirements of Section 5.4.5.3.7 and the adjustment requirements of Section 5.4.5.3.8. The door control shall be a lever that rotates around a vertical staff. The lever shall be located on the street side of the operator’s area approximately 16 inches to the street side of the operator’s seat centerline, forward of the seat, and approximately 23 inches above the floor in the operator’s area. Front door shall remain in commanded state position even if power is removed or lost.

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

Baseline: Use for operator- controlled front and rear doors.

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

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 Trolley shut down. A master door switch which is not within reach of the seated operator when set in the "Off" position shall close the doors, deactivate the door control system, release the interlocks, and permit only manual operation of the doors.

To preclude movement of the Trolley, accelerator interlock shall lock the accelerator in the closed position and brake interlock shall engage the service brake system when the front or rear door control is activated. The braking effort shall be adjustable with hand tools.

Baseline: Use for requiring accelerator interlock whenever front or rear doors are open.
An accelerator interlock shall lock the accelerator in the closed position whenever front doors are open.

Alternative: No requirements for accelerator interlock whenever front doors are open.

16.1.5 INSTRUMENTATION

The speedometer, air pressure gauge(s), and certain indicator lights shall be located on the front cowl immediately ahead of the steering wheel. The steering wheel spokes or rim shall not obstruct the operator's vision of the instruments when the steering wheel is in the straight-ahead position.

Illumination of the instruments shall be simultaneous with the marker lamps. Glare or reflection in the windshield, side window, or front door windows from the instruments, indicators, or other controls shall be minimized. Instruments and indicators shall be easily readable in direct sunlight. Indicator lights immediately in front of the operator are identified in the following table.

Visual Indicator	Audible Alarm	Condition
Back-Up	Backup Alarm	Reverse gear is selected
Hazard	Click	Four-way flashers activated
DRL	None	Daytime Running Lights
High Beam	None	Headlamp high beams activated
Kneel	Kneel Horn	Suspension kneeling system activated
Left Turn Signal	Click	Left turn signal activated
Parking Brake	None	Parking brake is activated
Front Door	None	Front passenger door is not closed and locked
Rear Door	None	Rear passenger door is not closed and locked
Right Turn Signal	Click	Right turn signal activated
Stop Request	Chime	Passenger stop request has been activated
Wheelchair Request	Chime	Passenger wheelchair stop request has been activated

A reproduction of the original trolley bell manufactured in the 1800's will be installed on the exterior front portion of the roof and is to be rung by the driver through a momentary rocker switch located within easy reach of the driver in the center dash console panel just to the right of the steering column. The bell base will be of cast steel finished in black powder coat. The bell will be a brass plated steel contoured bell, minimum of 14" diameter.

The instrument panel shall include an electronic speedometer indicating no more than 80 mph and calibrated in maximum increments of 5 mph. The speedometer shall be a rotating pointer type, with a dial deflection of 220 to 270 degrees and 40 mph near the top of the dial. The speedometer shall be sized and accurate in accordance with SAE Recommended Practice J678.

Baseline: Use for speedometer with integrated odometer.

The speedometer shall equipped with an odometer with a capacity reading no less than 999,999 miles.

Optional: Use for hubodometer.

The Trolley shall be equipped with a hubodometer mounted at the curbside of the rear axle. The hubodometer shall have a capacity reading no less than 999,999 miles.

The instrument panel shall also include air brake reservoir pressure gauge(s) with indicators for front and rear air tanks and voltmeter(s) to indicate the operating voltage across the Trolley batteries. The instrument panel and wiring shall be easily accessible for service from the operator's seat or top of the panel. Wiring shall have sufficient length and be routed to permit service without stretching or chafing the wires.

16.1.6 ON-BOARD DIAGNOSTICS

The Trolley shall be equipped with an on-board diagnostic system that will indicate conditions that require immediate action by the operator to avoid an unsafe condition or prevent further damage to the Trolley. This diagnostic system shall have visual and audible indicators. The diagnostic indicator lamp panel shall be located in clear sight of the operator but need not be immediately in front of him. The intensity of indicator lamps 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 have a method of momentarily testing the operation of the lamp. 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. Malfunction and other indicators listed in the following table shall be supplied on all Trolleys.

Visual Indicator	Audible Alarm	Condition or Malfunction
ABS	None	ABS System Malfunction
A/C Inop.	None	Compressor stopped due to high/low pressure or loss of refrigerant
Check Engine	None	Engine Electronic Control Unit detects a malfunction
Check Transmission	None	Transmission Electronic Control Unit detects a malfunction
Fire	Buzzer	Over-temperature condition in engine compartment
Charge Inop.	None	Loss of generator output
Coolant Temp.	Buzzer	Excessive engine coolant temperature

Low Air	Buzzer	Insufficient air pressure in either primary or secondary reservoirs
Low Oil	Buzzer	Insufficient engine oil pressure
Low Coolant	Buzzer	Insufficient engine coolant level

Optional: Wheelchair Lift Beeper with flashing light forward of the front entrance/wheelchair lift door.

16.2 WINDSHIELD WIPERS

The Trolley shall be equipped with a variable speed windshield wiper for each of the three windshields, with separate controls for each. If powered by compressed air, exhaust from the wiper motors shall be muffled or piped under the floor of the Trolley. No part of the windshield wiper mechanism shall be damaged by manual manipulation of the arms. At 60 mph, no more than 10 percent of the wiped area shall be lost due to windshield wiper lift. Both wipers shall park along the edges of the windshield glass. Windshield wiper motors and mechanisms shall be easily accessible for repairs or service from inside or outside the Trolley and shall be removable as complete units. The fastener that secures the wiper arm to the drive mechanism shall be corrosion resistant

Optional: A variable intermittent feature shall be provided to allow adjustment of wiper speed for the two roadside windshields. The adjustment will allow speeds between approximately 5 to 25 cycles per minute.

16.3 WINDSHIELD WASHERS

The windshield washer system shall deposit washing fluid on the windshield and, when used with the wipers, shall evenly and completely wet the entire wiped area. If powered by compressed air, all fluid shall be purged from the lines after each use of the washers.

The windshield washer system shall have a minimum three-quart reservoir, located for easy refilling from outside of the Trolley and protected from freezing. Reservoir pumps, lines, and fittings shall be corrosion-resistant, and the reservoir itself shall be translucent for easy determination of fluid level.

16.4 OPERATOR'S LIGHTING

The operator's area shall have a brass powder coated light that match the other interior lights to provide general illumination and it shall illuminate the half of the steering wheel nearest the operator. The operator through a switch on the front or side console shall control this light.

16.5 OPERATOR'S SEAT

16.5.1 DIMENSIONS

The operator's seat shall be comfortable and adjustable so that persons ranging in size from the 95th-percentile male to the 5th-percentile female may operate the Trolley. The operator's seat cushion shall have a minimum width of 18 inches, a

length of 16 to 18 inches, and rearward slope of 0 to 10 degrees (non-adjustable.) The operator's seat back height, measured from the point of intersection of the uncompressed seat cushion with the seat back to the top of the back, shall be 20 plus or minus 2 inches. The angle formed between the seat back and the seat cushion shall be adjustable in the range of 95 to 110 degrees. Height of the seat shall be adjustable so that the distance between the top of the uncompressed seat cushion and the floor may vary between 17 and 21 inches. The seat shall be adjustable forward and rearward for a minimum travel of 7.5 inches. While seated, the operator shall be able to make all of these adjustments by hand without complexity, excessive effort, or being pinched. Adjustment mechanisms shall hold the adjustments and shall not be subject to inadvertent changes.

16.5.2 STRUCTURE AND MATERIALS

The operator's seat shall be contoured to provide maximum comfort for extended period of time. Cushions shall be fully padded with at least 3 inches of neoprene foam, or material with equal properties, in the seating areas at the bottom and back. Upholstery shall be ventilated, transportation grade vinyl.

Baseline: Standard (air cushion) seat.

The operator's seat shall be cushioned supplementally by an air cylinder or air diaphragm. These devices may also provide the seat height adjustments. Damping shall be provided as required.

Alternative: Fixed or static seat.

All visually exposed metal on the operator's seat, including the pedestal, shall be unpainted aluminum or stainless steel.

Baseline: Use for standard (may be lap only) seat belt.

Required Type I seat belts shall be fastened to the seat so that the operator may adjust the seat without resetting the seat belt. Seat belts shall be stored in automatic retractors.

Optional: Use for three-point (lap and shoulder) seat belt.

Seat belts shall be provided across the operator's lap and diagonally across the operator's chest. The operator shall be able to use both belts by connecting a single buckle on the right side of the seat cushion. The belts shall be fastened to the seat and/or the Trolley structure so that the operator may adjust the seat without resetting the seat belt. Seat belts shall be stored in automatic retractors.

Optional: Tour guide seat;
A tour guide seat shall be provided and located opposite the driver on the driver riser.

The seat and seatbelt assemblies as installed in the Trolley shall withstand static horizontal forces as required in FMVSS 207 and 210. The seat shall withstand 10,000 impacts of a 40-pound sandbags dropped from a height of 12 inches without visible deterioration. The seat shall be tested in the lowest vertical position and repeated with the seat in the top vertical position.
Two 40-pound sandbags shall be suspended on a 36-inch pendulum and shall strike the seat back 10,000 times each from distances of 6, 8, 10, and 12 inches. Seat cushions shall withstand 100,000 randomly positioned 3-1/2-inch drops of a squirming, 150-pound, smooth-surfaced, buttocks-shape striker with only minimal wear on the seat covering.

At the request of the Procuring Agency, the Contractor shall provide a certified test report fully documenting compliance with all the requirements defined above upon request. The test report shall contain a record of all testing activities, test diagrams, testing equipment, as well as test data related to loads, deflections and permanent deformation of the seat assembly. The report shall include a statement of compliance with the requirements of this section.

16.6 MIRRORS

16.6.1 EXTERIOR MIRRORS

Baseline: Use for mirrors on both sides.

The Trolley shall be equipped with a corrosion-resistant, outside rearview mirror on each side of the Trolley. Mirrors shall permit the operator to view the highway along both sides of the Trolley, including the rear wheels. Each mirror will contain both flat and convex mirrors with the adjustable flat mirror containing a minimum of 50 square inches of mirror area and the convex containing a minimum of 20 square inches of mirror area. The curbside rearview mirror shall be mounted so that its lower edge is no less than 80 inches above the street surface.

Baseline: Standard curb and roadside mirror without remote adjustment and non-heated exterior mirrors.

Optional: Use for remote adjustment and heated curb and roadside mirrors.

The operator shall be able to adjust the curb and roadside mirror remotely while seated in the driving position. The control for remote positioning of the mirror shall be a single switch or device. All exterior mirrors shall be electrically heated. The heaters shall be energized whenever the operator's heater and/or defroster are activated.

Mirrors shall be firmly attached to the Trolley to prevent vibration and loss of adjustment, but not so firmly attached that the Trolley or its structure is damaged when the mirror is struck in an accident. Mirrors shall retract or fold sufficiently to allow Trolley washing operations.

16.6.2 INTERIOR MIRRORS

Mirrors shall be provided for the operator to observe passengers throughout the Trolley without leaving his seat and without shoulder movement. With a full standee-load, including standees in the vestibule, he shall be able to observe passengers in the front/entrance and rear/exit areas, anywhere in the aisle, and in the rear seats. Inside mirrors shall not be in the line of sight to the right outside mirror.

SECTION 17 WINDOWS

17.1 GENERAL

Shall be designed to allow maximum serviceability with minimum maintenance. Frames will be made from high strength aluminum extrusions and assembled with top quality fasteners and hardware. Windshields and side windows will be glazed with distortion free tempered side windows and laminated windshields, which will be, cushioned in resilient vinyl or nitrile channels. Movable windows will be fitted with easily operated latches and where necessary drain slots and weather-seals will keep wind and water outside. All windows will be in accordance with Federal Motor Vehicle Safety Standard 571.205.

17.2 WINDSHIELD

Windshields - The Trolley shall present an early Twentieth Century design and incorporate three (3) individual windshield assemblies, installed right and left and at the center of the front section. The center windshield shall be 90 degrees (perpendicular) to the horizontal center line of the coach with the left and right windshields slanting back (to create a bay window effect) from the center windshield at 18 degrees. Windshields will be glazed with distortion free AS1, 1/4" thick, 73% laminated safety glass. All windows meet FMVSS 571.205 Lantern windows, one front, one rear and seven on each side will be glazed with 1/8" Black Acrylic. The exterior of the coach will depict the turn of the century lantern roof appearance while the interior of the coach will present a smooth interior ceiling paneled with .070" textured fiberglass reinforced plastic sheet.

The windshield shall be easily replaceable by removing zip-locks from the windshield retaining moldings. Bonded-in-place windshield shall not be used. The windshield glazing material shall have a 1/4-inch or 6-mm nominal thickness laminated safety. The glazing material shall have single density tint.

17.3 OPERATOR’S SIDE WINDOW

Side windows (roadside and curbside) adjacent and forward of the driver. The driver's side window (roadside) forward of the driver and opposite (curbside) will be fixed non-opening windows. The window opposite the driver (curbside) will be a top vertical drop sash design. These windows will be AS2, 7/32" thick, 73% density; light green tint laminated glass. The vertical drop sash portion of the window will be approximately 12" with a two-latch system. The window immediately adjacent to the driver (roadside) will be a bottom full slider horizontal slider design with AS2, 7/32" thick, 73% density, light green tint laminated glass.

17.4 SIDE AND REAR WINDOWS

17.4.1 DIMENSIONS

Baseline: Use for drop sash side windows.

Windows, Side - both road and curbside windows will be a top vertical drop sash design with AS3, 1/4" thick, 14% density, gray tint tempered glass. The vertical drop sash portion of the window will be approximately 12" with a two-latch system. The lower portion of the window will be fixed. The windows will exhibit the vintage trolley appearance. The side destination sign window will be AS2, 1/4" thick, 73% light green tint, tempered glass at the top with the lower portion of AS3 1/4" thick, 14% density, gray tint, tempered glass.

Emergency exit windows will be a horizontal hinge type design whereas the top vertical drop sash portion will be fixed and the lower portion hinges out away from the vehicle. Two egress windows will be equally spaced on the streetside of the vehicle and one egress window will be centered in the rear wall of the vehicle. The windows will be glazed with AS3, 1/4" thick, 14% density, gray tint tempered glass. These windows will conform to FMVSS 571.205.

Windows, rear - the rear of the trolley will incorporate one (1) emergency exit window at the center and two fixed glass assemblies at the right and left of the rear section. Rear window assemblies will be glazed with AS3 1/4" thick, 14% density, gray tint tempered glass. All window sashes will be extruded black finished aluminum.

Optional: Use for all openable (full slider) side window configurations.

Each openable side window shall consist of two full-height horizontally sliding panels. All side windows shall be easily replaceable without disturbing adjacent windows and shall be mounted so that flexing or vibration from engine operation or normal road excitation is not apparent.

17.4.2 MATERIALS

Baseline: Use for safety glass glazing panels.

Side windows glazing material shall have a 1/4-inch nominal thickness tempered safety glass. The material shall conform to the requirements of ANSI Z26.1 Test Grouping 2 and the Recommended Practices defined in SAE J673

Alternative: Use for polycarbonate glazing panels

Side window glazing material shall have a 1/4-inch nominal thickness. The material shall conform with the requirements of ANSI Z26.1-1977 Standard for Type AS-5 Safety Glazing Materials except for Test Number 17 which shall subject the specimens to 1000 cycles and the arithmetic mean of the percentages of light

scattered shall not exceed 5 percent. Windows shall be polycarbonate sheet with an abrasion resistant coating on both sides of the window.

Windows on the Trolley sides and in the rear door shall be tinted a neutral color, complementary to the Trolley 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. Windows over the destination signs shall not be tinted.

SECTION 18 HEATING VENTILATING AND AIR CONDITIONING

18.1 CAPACITY AND PERFORMANCE

The Heating, Ventilation and Air Conditioning (HVAC) climate control system shall be capable of maintaining the interior of the Trolley at the temperature and humidity levels defined in the following paragraphs.

Alternative: No requirements for cooling. All requirements relevant to the HVAC cooling mode contained in this section as well as throughout this Specification need not apply.

With the Trolley running at the design operating profile with corresponding door opening cycle, and carrying a number of passengers equal to 150 percent of the seated load, the HVAC system shall maintain an average passenger compartment temperature within a range between 65^{o} and 80^{o}F, while controlling the relative humidity to a value of 50 percent or less. The system shall maintain these conditions while subjected to any outside ambient temperatures within a range of 10^{o} to 95^{o} F and at any ambient relative humidity levels between 5 and 50 percent.

When the Trolley is operated in outside ambient temperatures of 95^{o} to 115^{o} F, the interior temperature of the Trolley shall be permitted to rise one degree for each degree of exterior temperature in excess of 95^{o}.

When Trolley is operated in outside ambient temperatures in the range of -10^{o} to $+10^{o}$ F, the interior temperature of the Trolley shall not fall below 55^{o} F while Trolley is running on the Design Operating Profile.

Testing shall be conducted in accordance to the APTA Recommended Instrumentation and Performance Testing for Transit Trolley Air Conditioning System. Temperature measurements shall be made in accordance to this document with the following modifications:

The three primary locations used for temperature probes are (1) 6 inches aft of front wheelhousing, (2) centered between the two axles and (3) 6 inches aft of rear wheelhousing. At each primary location, the nine- (9) temperature sensing devices shall be (A) 72" above floor level, (B) 6 inches above top surface of seat cushion and (C) 6" above floor.

The recommended locations of temperature probes are only guidelines and may require

slight modifications to address actual Trolley design. Care must be taken to avoid placement of sensing devices in immediate path of air duct outlet. In general, the locations are intended to accurately represent the interior passenger area.

An air conditioning system will be furnished utilizing two evaporators one mounted rear facing above the drivers platform and one mounted forward facing above the rear contoured seat and two (2) condensers mounted behind removable skirts on the roadside of the coach along with an electronic controls mounted on the dash. The air conditioner compressors will be two 12.6 cu. in. 6-cylinder type that will be belt driven from the coach engine. The system capacity will be 66,000 BTU's with two speed fans, low speed providing 900 CFM and high speed providing 1,750 CFM. The system is thermostatically controlled to provide a comfortable climate. R-134- A refrigerant will be used.

Baseline: Capacity and performance requirements

The air conditioning portion of the HVAC system shall be capable of reducing the passenger compartment temperature from 100 ^{o} to 90 ^{o} F in less than 20 minutes after engine start-up. Engine temperature shall be within the normal operating range at the time of start-up of the cool-down test and the engine speed shall be limited to fast idle that may be activated by an operator-controlled device. During the cool-down period the refrigerant pressure shall not exceed safe high-side pressures and the condenser discharge air temperature, measured 6 inches from the surface of the coil, shall be less than 45 ^{o} F above the condenser inlet air temperature. The Trolley shall be parked in direct sunlight with ambient temperature at 100 ^{o} F and humidity less than 20 percent. There shall be no passengers on board, and the doors shall be closed.

Optional: For hotter ambients

The test procedure as described in Section 8 of the APTA document, “Recommended Instrumentation and Performance Testing for Transit Trolley Air Conditioning System” shall be used for the purposes of the following pull-down requirements. The air conditioning portion of the HVAC system shall be capable of reducing the passenger compartment temperature from 110^{o}to 70^{o}F ± 3^{o} F in less than 30 minutes after start-up of A/C system.

During the cool-down period the refrigerant pressure shall not exceed safe high-side pressures and the condenser discharge air temperature, measured 6 inches from the surface of the coil, shall be less than 45^{o} F above the condenser inlet air temperature. No simulated solar load shall be used. There shall be no passengers on board, and the doors shall be closed.

Optional: For cold ambients

The pull-up requirements for the heating system shall be in accordance with Section 9 of APTA’s “Recommended Instrumentation and Performance Testing for Transit Trolley Air Conditioning.” With ambient temperature at -20^{o} F, and vehicle cold soaked at that

temperature, the Trolley heating system shall warm the interior passenger compartment to an average temperature of 70^{o} ±2^{o} F within 70 minutes. The refrigerant for the Air Conditioning system will be R134a.

18.2 CONTROLS AND TEMPERATURE UNIFORMITY

After manual selection and/or activation of air conditioner system operation mode, all interior climate control system requirements for the selected mode shall be attained automatically.

Baseline: Use for single air conditioner thermostat control set point at 70^{o} F

The temperature control set-point for the system shall be 70^{o}F.

Alternative: Manually adjustable temperature control set-point

The air conditioner system shall have the provision to allow driver to adjust the temperature. The controls contain an on/off switch, thermostat control, three speed fan control and diagnostic indicator lights. After the thermostat is set all interior air conditioner system requirements shall be attained automatically, unless re-adjusted by driver.

The operator shall have full control over the defroster and operator's heater. The driver shall be able to adjust the temperature in his area through air distribution and fans. The interior climate control system shall be manually switched 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. The temperatures between any two points in the passenger compartment, 6 inches above the floor to 72 inches above the floor, shall not vary by more than 5^{o} F with doors closed. The interior temperature, from the front to rear of the Trolley, shall not vary more than ± 5° F from average temperature determined by measurement made in accordance to APTA Recommended Instrumentation and Performance Testing for Transit Trolley Air Conditioning System.

18.3 AIRFLOW

18.3.1 OPERATOR'S AREA

The Trolley interior climate control system shall deliver at least 100 cfm of air to the operator'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 operator's feet and legs. The defroster or interior climate control system shall maintain visibility through the operator's side window.

18.4 MAINTAINABILITY

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. The condenser shall be located to efficiently transfer heat to the atmosphere and shall not ingest air warmed above the ambient temperature by the Trolley mechanical equipment, or to discharge air into any other system of the Trolley. The location of the condenser shall preclude its obstruction by wheel splash, road dirt or debris. HVAC components located within 6 inches of floor level shall be constructed to resist damage and corrosion.

Note: Procuring Agency may include the following sections if Alternative for colder ambient performance is specified above.

Optional: Entrance area heating

18.5 ENTRANCE AREA HEATING

Heat shall be supplied to the entrance area to prevent accumulation of snow, ice, or slush with Trolley operating under design operating profile and corresponding door opening cycle.

18.6 FLOOR LEVEL HEATING

Sufficient floor level heaters shall be provided to evenly supply heated forced air through floor mounted under seat heaters. Floor mounted under seat heaters will be located to ensure temperature uniformity. Control of the floor level heating shall be through the main heating system electronic control.

Baseline: Floor level heating.

SECTION 19 SIGNAGE AND COMMUNICATION

19.1 EXTERIOR ROUTE DISPLAYS

19.1.1 DESTINATION SIGNS

Front destination sign will be a single roller type installed in the upper curbside windshield with a glass exposure of 5-3/4" x 21".

Side destination sign will be a single roller type installed in the upper curbside window immediately behind the entrance door with a glass exposure of 5-3/4" x 21".

Destination signs will be electrically operated, single curtain, with provisions for 25 readings of 4" high characters. Control switch is to be located on the left hand of the driver's console.

Destination signs will conform to the Americans With Disabilities Act Part 38. Characters on these signs will have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10. Generally the space between letters will be 1/16 the height of upper case letters and will contrast with the background either light on dark or dark-on-light.

Baseline: Use for roller curtain destination sign system.

Front destination sign will be a single roller type installed in the upper curbside windshield with a glass exposure of 5-3/4" x 21".
Side destination sign will be a single roller type installed in the upper curbside window immediately behind the entrance door with a glass exposure of 5-3/4" x 21".
Destination signs will be electrically operated, single curtain, with provisions for 25 readings of 4" high characters. Control switch is to be located on the left hand of the driver's console.

Optional: Electronic destination sign system.

The front and side destination sign will be two electronic destination signs, both the same size. The signs will be controlled by a driver's rubber sensitive keypad control console and display with all cables. The sign will have the capability to display a minimum of 4,000 single line, 15 single stroke alphanumeric character messages in 75 columns, each character will be a minimum of 2.7 inches high. The signs will meet all current ADA requirements.

If an automatic electronic destination sign system is selected it shall be furnished on the front and on the right side near the front door. Display areas of destination signs shall be clearly visible in direct sunlight and/or at night. The sign system shall provide optimum visibility of the message display units for passengers and shall meet applicable ADA requirements defined in 49 CFR, Part 38.39. Destination signs shall be installed in such a manner as to facilitate easy access for replacement of the entire sign assembly, or components such as fluorescent lamps/LED’s and electronic control modules, from inside the Trolley within 30 minutes by a 3M mechanic.

Lamps and associated parts shall be commercially available.

Destination messages, route designations, and public relations messages shall be independently selectable via a single Operator's Control Panel (OCP) which shall include a display monitor. The rear route number sign shall be controlled by the same OCP that operates the destination signs. The OCP display monitor readout shall show the exact information displayed on the destination signs and route number sign. The OCP shall be conveniently located for the Trolley operator and mounted in such a manner that will not pose any safety hazard. The OCP shall utilize a durable weatherproof keypad with tactile feel for destination message control functions.

The destination sign system shall be capable of programming 10,000 message lines. The number of public relations messages shall be limited only by the remaining number of message lines not used for destination purposes. Sign displays shall have alternating message capability with programmable blanking time between message lines as may be required. Variable blanking times shall be programmable between 0.5 to 25 seconds in duration. Each line message or

blanking time for each message shall be individually programmable. The message display units shall incorporate an automatic blanking feature that will cause the display area to blank within 30 seconds of the Trolley master power switch being turned off.

Destination Sign Programming: The electronic sign system shall be programmable via an integral connector located in the front destination sign area. Software shall be furnished for programming the sign system via an IBM-compatible, laptop computer. Software shall be capable of providing a high degree of flexibility to create, or select preprogrammed, fonts and graphic displays. The sign shall have the capability of being programmed in the field using a PC or field programmer. Message program information shall be transferable to and/or from the field programmer device as specified by the Procuring Agency.

The Trolley “Master Run” switch shall control power to the sign system. The sign system shall be operable in all switch positions except "Off" or “CL/ID”.

The destination sign compartments shall be designed to prevent condensation and entry of moisture and dirt. Additional provisions shall be included, if necessary, to prevent fogging of both destination sign compartment window and glazing on unit itself. Access shall be provided to allow cleaning of inside of destination sign compartment window and unit glazing.

19.1.2 TROLLEY BLOCK NUMBERS

Baseline: Use if no Trolley block number sign is required by Procuring Agency.

No Trolley block number sign shall be provided. Any and all references to this sign shall not apply.

Optional: Manual Block Number Sign.

An illuminated block number sign box with four characters, 4 inches high, shall be mounted on the dash panel to the right of center of the Trolley. The sign shall be mounted with a built-in appearance to eliminate glare and reflections in the windshield and shall minimize obstruction of the operator's view. Manual adjustment of the block number sign entry shall be provided from inside the Trolley with provision for reading the sign during the adjustment operation.

Illumination of the sign shall be concurrent with the marker lights.

Optional: If electronic destination sign is selected, specify electronic block number sign.

The front Trolley block number sign shall be electronic and capable of Displaying 4 alphanumeric characters (1 through 9 and A through Z) with a display area of not less than 4 inches high by 13 inches wide (or 7 rows by 23 columns). The block numbers to be displayed shall be input directly into the destination sign system’s

OCP and shall be independent of any destination sign message code. This sign shall be mounted on the front dash panel toward the curbside and shall not obstruct driver's view. Lighting of the block number sign shall be as specified above.

19.2 PASSENGER INFORMATION AND ADVERTISING

19.2.1 INTERIOR DISPLAYS

Optional: Provisions shall be made on the rear of the operator's barrier for a frame to retain information that is 18 inches X 24 inches and large enough to hold all route information.

19.3 PASSENGER EXIT SIGNAL

The signal system will have two (2) chimes switches mounted overhead in the passenger compartment and painted flat black. The switches will be activated by rope pull cords on each side of the coach above the side windows. The chime will be mounted overhead in the driver's compartment. The cord guides will be brass plated and installed with brass screws. A touch strip activation mechanism will be provided at each of the wheelchair securement areas mounted no higher than 48" and no lower than 15" above the floor. It will be operable with one hand and will not require tight grasping, pinching or twisting of the wrist. The force to activate the control will be no greater than 5 lbs.

When the chimes sounds, a light indicating passenger "STOP REQUESTED" will also light. This stop requested light shall be located in the upper forward portion of the coach visible to all passengers and will remain lit until passenger(s) alights and the door is closed. Two "STOP REQUESTED" lights will be installed in the TellTale module to alert the driver when the chime sounds. One light labeled "STOP REQUESTED" will notify the driver of a stop requested from the standard seating area and one labeled with the international handicapped symbol will notify the driver of a stop requested from the handicapped seating area. All passenger signal systems will conform with the American With Disabilities Act Part 35.

19.4 RADIO COMMUNICATION SYSTEM

Optional: Radio location & lock box

A location convenient to the operator shall be provided for the radio control head, speaker, handset, and cradle. The location shall conform to SAE Recommended Practice J287 "Driver Hand Control Reach." Provisions for attaching an antenna to the roof and routing an antenna lead to the radio compartment shall include a 3/4-inch inside diameter conduit with a pull wire. The antenna mounting and lead termination shall be accessible from the Trolley interior. A compartment shall be provided to accommodate a communication system. It shall be located within 8 feet of the operator's seat. The radio compartment shall be supplied with a 30-amp, 12-volt, DC, protected service with positive and negative leads.

The compartment shall include a clear space 8 inches deep, 12 inches wide, and 20

inches long for location of the radio. The Trolley manufacturer shall provide and install any special brackets, reinforcements and/or other hardware necessary to install the radio equipment in the Trolley.

The compartment may be located under the floor but shall not be located in an area where it is directly subject to road spray from tires and shall not reduce the ground clearances stated elsewhere in this specification. The compartment shall be fabricated in a durable fashion and all seams of the compartment shall be sealed. It shall be accessible from either inside or outside the Trolley and shall be splash proof when the service door is secured. If the compartment is located inside the Trolley it shall not provide any encumbrance to the operator or passengers. If located at floor level, it shall be sealed against moisture from washing equipment including but not limited to power washers, garden hoses, etc.

Optional: Radio antenna conduit and pull wire.
A radio antenna conduit and pull wire shall be provided. The conduit will start at the upper center of the roof or procuring agency determined antenna location and terminate at the radio lock box or other location determined by the procuring agency at or near the driver compartment.

19.5 PUBLIC ADDRESS SYSTEM

A public address system that complies with the ADA requirements of 49 CFR, Part 38.35 and enables the operator to address passengers inside the Trolley. Inside speakers shall broadcast, in a clear tone, announcements that are clearly perceived from all seat positions at approximately the same volume level. The system shall be muted when not in use. The microphone shall be hand held. A provision shall be provided to secure the microphone in a stored position when not in use.

Baseline: Public address system only with hand held mic.
Optional: Public address system with AM/FM radio and cassette player
Optional: Public address system with AM/FM radio and CD player
Optional: Exterior speaker located near the front entrance door with and operator controlled switch for interior only, exterior only or both
Optional: Gooseneck microphone only
Optional: Gooseneck microphone and hand held microphone.
Optional: Head set microphone.
Optional: Extra hand held microphone with six foot cord for a narrator

19.6 SECURITY CAMERAS

Run conduit for a 5 camera system. DART will supply information on locations.
Manufacturer: DRI, 975-0001-105 MDVR 5 Cam System w/LAN

Communication link: J1939 is to be installed.

SECTION 20 ELECTRICAL SYSTEM

20.1 GENERAL REQUIREMENTS

The liquid tight vehicle electrical junction box will be located on the left side of the vehicle and will provide access from the vehicle exterior. The exterior junction box access door will be liquid tight and latches will be easily opened without special tools. All wiring, including cables, will be primary type with stake-on terminals, sleeved with loom. Circuits will be 12-volt DC negative ground. All wiring will be color-coded too meet SAE color coding recommendations, and all harnesses will have 10% excess wire. The electrical system will be designed and installed as sectional harnesses with quick-disconnect, multi-pin connectors, properly supported with insulated clamps. All interior-wiring harnesses will be installed in the interior body in removable, molded covers located along each of the lower roof edges. The engine and chassis harness will be mounted along the inside edge of the chassis rail, supported by rubber insulated clamps and will be protected by Flex-Guard loom. All multi-pin connectors with twelve (12) or fewer circuits will be environmentally sealed high impact plastic, pull apart with locking tabs.

All multi-pin connectors with more than twelve (12) circuits will be environmentally sealed, metal, circular twist lock style.

The electrical system shall provide and distribute power to ensure satisfactory performance of all electrical components. The system shall supply nominal 12 volts of direct current (DC). Electrical power provided for the fare collection device and the radio compartment shall be 12 volts DC. Precautions shall be taken to minimize hazards to service personnel. The power generating system shall be rated sufficiently higher than the total possible electrical load except the wheelchair lift to maintain the charge on the batteries at all operating conditions including the engine at fast idle. All circuits, except for those involved in propulsion system start-up, shall be protected by circuit breakers or fuses. Fuses shall be used only where it can be demonstrated that circuit breakers are not practicable, and they shall be easily accessible for replacement.

Grounds shall not be carried through hinges, bolted joints (except those specifically designed as electrical connectors), or power plant mountings. One ground may be the Trolley body and framing. Electrical equipment shall not be located in an environment that will reduce the performance or shorten the life of the component or electrical system. To the extent practicable, wiring shall not be located under the Trolley floor. Wiring and electrical equipment necessarily located under the Trolley shall be insulated from water, heat, corrosion, and mechanical damage.

20.2 MODULAR DESIGN

Design of the electrical system shall be modular so that each major component, apparatus panel, or wiring bundle is easily separable with standard hand tools or by means of connectors. Each module, except the main body wiring harness, shall be removable and replaceable in less than 1 hour by a 3M mechanic. Power plant wiring shall be an independent wiring module. Replacement of the engine compartment wiring module(s) shall not require pulling wires through any bulkhead or removing any terminals from the wires.

20.3 WIRING AND TERMINALS

All wiring between electrical components and terminations, shall have double electrical insulation, shall be waterproof, and shall conform to specification requirements of SAE Recommended Practice J1127 and J1128. Except as interrupted by the master battery disconnect switch, battery and starter wiring shall be continuous cables, grouped, color-coded with connections secured by bolted terminals; and shall conform to specification requirements of SAE Standard J1127-Type SGT or SGX and SAE Recommended Practice J541. Wiring harnesses shall not contain wires of different voltages unless all wires within the harness are sized to carry the current and insulated for the highest voltage wire in the harness.

Double insulation shall be maintained as close to the terminals as possible. The requirement for double insulation shall be met by wrapping harnesses with plastic electrical tape or by sheathing all wires and harnesses with non-conductive, rigid or flexible conduit. Strain-relief fittings shall be provided at points where wiring enters all electrical J Boxes. Grommets of elastomeric material shall be provided 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.

All wiring harnesses over 5 feet long and containing at least 5 wires shall include 10 percent excess wires for spares that are the same size as the largest wire in the harness excluding the battery cables. This requirement for spare wires does not apply to data links and/or communication cables. Wiring length shall allow end terminals to be replaced twice without pulling, stretching, or replacing the wire. Except for large wires such as battery cables, terminals shall be crimped to the wiring and may be soldered only if the wire is not stiffened above the terminal and no flux residue remains on the terminal. Terminals shall be corrosion-resistant and full ring type or interlocking lugs with insulating ferrules. T splices may be used when there is less than 25,000 circular mills of copper in the cross section and a mechanical clamp is used in addition to solder on the splice; the wire supports no mechanical load in the area of the splice; and the wire is supported to prevent flexing.

All cable connectors shall be locking type, keyed, and watertight, unless enclosed in watertight cabinets. 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.

20.4 JUNCTION BOXES

All relays, controllers, flashers, circuit breakers, and other electrical components shall be grouped according to voltage; and mounted in easily accessible exterior junction boxes. The boxes shall be sealed to prevent moisture from normal sources, including engine compartment cleaning, from reaching the electrical components and shall prevent fire that may occur inside the box from propagating outside the box. The components and circuits in each box shall be identified and their location permanently recorded on the printed circuit board. The drawing shall be protected from oil, grease, fuel, and abrasion. The front junction box shall be completely serviceable from the exterior adjacent to the driver's seat.

20.5 ELECTRICAL COMPONENTS

All electrical components, including switches, relays, flashers, and circuit breakers, shall be heavy- duty designs. These components shall be longest lasting, commercially available, and shall be replaceable in less than 5 minutes by a 3M mechanic. Sockets of plug-in components shall be polarized where required for proper function and the components shall be positively retained. Any manually resettable circuit breakers critical to the operation of the Trolley shall be mounted in a location convenient to the driver and provide visible indication of open circuits. Electric motors shall be located for easy replacement and except for the cranking motor shall be replaceable in less than 15 minutes by a 3M mechanic. Electronic circuit protection for the cranking motor shall be provided to prevent engaging of the motor for more than 30 seconds at a time.

20.6 BATTERIES

Batteries shall be easily accessible for inspection and service from only the outside of the Trolley. The batteries shall be securely mounted on a stainless steel 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. A positive lock shall retain the battery tray in the stowed position.

Baseline: Two 8D Battery Units

Two 8D-battery units conforming to SAE Standard J537 shall be provided. Each battery shall be fitted with post type terminals and have a minimum of 1150 cold cranking amps. Each battery shall have a purchase date no more that 60 days from date of release for shipment to the Procuring Agency.

Optional: Four Group 31 Maintenance Free Batteries

Four Group 31 Series deep cycling maintenance free battery units shall be provided. Each battery shall be fitted with threaded stud terminals and have a minimum of 700 cold cranking amps.
Each battery shall have a purchase date no more that 60 days from date of release for shipment to the Procuring Agency.

Positive and negative terminal ends shall have different size studs to prevent incorrect installation. 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. Battery terminals shall be located for access in less than 30 seconds with jumper cables. Battery cables shall be flexible and sufficiently long to reach the batteries with tray in the extended position without stretching or pulling on any connection and shall not lie directly on top of the batteries. Battery cables must be of sufficient size to carry the load required by the starting motor.

Baseline: No requirements for jump-start connector.

Optional: Use for requirements for jump-start connector.

Jump-start connector shall be provided in the engine compartment equipped with dust cap and adequately protected from moisture, dirt and debris.

20.7 MASTER BATTERY SWITCH

A master switch on the battery positive (+) shall be provided in the battery compartment near the batteries for complete disconnecting from all Trolley electrical systems except for safety devices such as fire suppression system and other systems as specified. The location of the master battery switch shall be clearly identified on the access panel and be accessible in less than 10 seconds for activation. The master switch shall be capable of carrying and interrupting the total circuit load. Opening the master switch with the power plant operating shall not damage any component of the electrical system. The location of the master battery switch shall prevent corrosion from fumes and battery acid when the batteries are washed off.

At least 2 temperature-sensitive sensors shall be provided. They shall be located in the engine compartment under all horizontal bulkheads, above and downwind of the major heat sources, and in areas likely to be wetted by leaking flammable fluids. The sensors shall detect over-temperature in the critical areas and shall activate the fire alarm bell and warning light in the driver's compartment. The sensors shall return to normal setting and deactivate alarms when the temperature returns to normal.

20.8 FIRE DETECTORS

A ten (10) pound, UL approved, ABC fire extinguisher will be mounted so as to provide easy access to the operator and will be in an anti-rattle bracket. A 16 unit UL approved, first-aid kit will be provided and mounted adjacent to the fire extinguisher. A DOT approved highway hazard warning kit will be provided and mounted adjacent to the fire extinguisher and first aid kit.