



Camino Real Regional Mobility Authority

Addendum No. 2 to Request for Proposals

Rail Vehicle Procurement for the El Paso Streetcar Project

Addendum No. 2 Issue Date: **April 29, 2015**

Revised Addendum No. 1 Issue Date: April 6, 2015

Addendum No. 1 Issue Date: March 30, 2015

RFP Issue Date: February 17, 2015

Response Due: May 7, 2015 by 4:00 PM El Paso Time
Camino Real Regional Mobility Authority
300 N. Campbell, 2nd Floor
El Paso, Texas 79901

ADDENDUM 2 - INSTRUCTIONS TO PROPOSERS

The following items have been revised to the previously published documents and represent the changes to those documents in their entirety.

REVISIONS TO CONTRACT DOCUMENTS FROM THE CRRMA

The following Technical Specification Section has been revised to reflect a change to the OCS wire heights that the Vehicle Pantograph System shall interface with:

Section 2.3.2 Overhead Wire - Shall be revised and included in Appendix A – Technical Specifications attached.

REVISIONS TO CONTRACT DOCUMENTS IN RESPONSE TO SUBMITTED QUESTIONS

CP 1 - INSTRUCTIONS TO PROPOSERS:

- Cover sheet CP 1-i shall be replaced with the attached sheet.
- Page CP 1-7 shall be replaced with the attached sheet.

CP 3 - FORM OF CONTRACT:

- The Contract Form is attached.

CP 6 - WARRANTY:

- Section 6.5 TIME PERIODS OF WARRANTIES shall be replaced with the attached Section 6.5.
- Section 6.13 DELAYS AND DISRUPTIONS shall be replaced with the attached Section 6.13.

ATTACHMENT A - TECHNICAL SPECIFICATIONS:

The following Technical Specification sections have been revised and are attached: Sections 2, 3, 4, 5, 6, 8, and 11.



Camino Real Regional Mobility Authority

Addendum No. 42
to
Request for Proposals

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CP 1-i

Addendum No. 2

members of the El Paso City Counsel or staff, or members of the Sun Metro's Mass Transit Department Board or staff concerning the subject matter of this RFP from the date of issuance until the day after selection of the winning Proposer by the Board, except as otherwise provided in this RFP. Any Proposer judged to be in violation of this anti-lobbying prohibition shall be disqualified from being considered in this procurement at CRRMA's sole discretion. Proposers are responsible for reviewing the CRRMA's current Conflict of Interest Policy for Consultants and Conflict of Interest Policy – Financial Team Members as well as the current Key Personnel – Consultants and Key Financial Team Members. All four documents are posted on CRRMA's website at the following address: <http://www.crrma.org/policies.asp>

1.5.8 ANTICIPATED SOLICITATION SCHEDULE OF EVENTS

The following procurement schedule is anticipated, but not guaranteed:

- | | |
|--|--|
| • Request for Proposals Issued | February 17, 2015 |
| • Pre-Proposal Conference and PCC Vehicle Inspection | March 4, 2015 |
| • Deadline to Submit Written Questions to CRRMA | April 10, 2015 |
| • Proposals Due | May 7, 2015 |
| • Contract Award | May 13, June 10, 2015 |
| • Notice to Proceed | May 27, June 24, 2015 |

All dates set forth above and in this RFP are subject to change at CRRMA's sole discretion.

1.6 PROPOSAL FORMAT AND CONTENT

1.6.1 GENERAL

Proposals will be received and evaluated from firms or joint venture rail car builders who will serve as the sole or prime contractor. The prime contractor/rail car builder must propose to assume full responsibility for the execution of the work, including management of all subcontractor/supplier efforts.

The Proposer shall respond to all topics described below, maintaining the numbers, and repeating the direction with the response. The Proposer shall address each of the topics individually and completely, whether or not the same or similar descriptions are provided elsewhere in the Proposal. The Proposer should avoid, to the maximum extent practicable,

CP 1-7

[Addendum No. 2](#)

CP 3 - FORM OF CONTRACT

CRRMA and the Contractor will execute a Contract that shall be compiled and prepared by CRRMA and provided to the Contractor for execution.

CAMINO REAL REGIONAL MOBILITY AUTHORITY

CITY OF EL PASO STREETCAR PROJECT

**RAIL VEHICLE CONTRACT FOR
REMANUFACTURE OF PCC CARS**

THIS RAIL VEHICLE CONTRACT FOR THE REMANUFACTURE OF PCC CARS ("Contract"), is entered into and made as of this ____ day of _____, 2015, between the Camino Real Regional Mobility Authority, 300 N. Campbell, 2nd Floor, El Paso, TX 79901, hereinafter called the ("CRRMA") and _____, or its or their successors, executors, administrators and assigns, hereinafter called the "Contractor."

WITNESSETH, that the Contractor agrees with the CRRMA for the consideration herein mentioned, and at its or their own proper cost and expense, to do all the work and furnish all the materials, equipment, tools, labor, licenses, incidental work, overhead, insurance, bonds, transportation and delivery costs, taxes, charges, fees and assessments necessary to prosecute and complete the work under this Rail Vehicle Contract for the Remanufacture of PCC Cars, in the manner and to the full extent as set forth in the General Provisions, Special Provisions, Warranty Terms, Technical Specifications, Schedule of Prices Forms (together with the Contract, the "Contract Documents"), which are hereby adopted and made part of this Contract as completely as if incorporated herein, and to the satisfaction of the CRRMA or its duly authorized representative who shall have at all times full opportunity to inspect the materials to be furnished and the work to be done under the Contract Documents.

This Contract is awarded on the basis of the official total Schedule of Prices based on the unit prices bid of _____ dollars and _____ Cents (\$_____).

In consideration of the foregoing premise, the CRRMA agrees to pay the Contractor for all items of work performed and materials furnished at the amount of the unit prices bid therefore in the Schedule of Prices submitted for this Contract, subject to the conditions set forth in the Technical Specifications and other Contract Documents.

IN WITNESS WHEREOF, the parties hereto have duly executed this Agreement as of the day and year written above.

Sworn to and Subscribed
before me this _____ day of _____,
20__.

**CAMINO REAL REGIONAL MOBILITY
AUTHORITY**

By:_____

Raymond L. Telles
Executive Director

Notary Public

My commission expires: _____

Sworn to and Subscribed
before me this _____ day of _____,
20__.

CONTRACTOR:

Business Name

Notary Public

Address

My commission expires: _____

By:_____

Title

6.4 RELIABILITY WARRANTY

In addition to the other warranties provided by this Article, the Contractor further warrants the reliability of the PCCs, equipment, components, work and parts in accordance with all reliability requirements in the Contract Documents. In the event any Reliability Demonstration Test indicates a failure to comply with any of the specified requirements, or falls below any of the percentage requirements prescribed in the Contract Technical Specifications, the Contractor shall promptly notify CRRMA. CRRMA may at its option suspend further deliveries of cars and payments until the specified reliability is demonstrated. Failure to meet any reliability requirements in the Contract Documents shall constitute a Deficiency, and Contractor shall, at its sole cost and without cost or expense to CRRMA, take all actions required to correct the Deficiency as promptly as possible and to achieve the specified reliability. The Contractor shall incorporate at its sole cost such correction into all previously delivered PCCs, equipment, components, work and parts before it may resume deliveries of new PCCs or affected components. Such correction shall be incorporated into all undelivered PCCs, equipment, components, work and parts prior to delivery. Where the Deficiency in reliability constitutes a Fleet Defect, correction shall in addition be incorporated into all PCCs, equipment, components, work and parts for which the warranty has expired.

6.5 TIME PERIODS OF THE WARRANTIES

A. Basic Warranty

The warranty for each PCC, and each component that is separately delivered, shall commence on the date CRRMA provides to Contractor a Notice of Conditional Acceptance of the PCC or component, and shall be effective for a time period of two (2) years from the date (except as provided below in the paragraph herein titled Extended Warranty) of such Conditional Acceptance. The warranty for special tools and equipment, including, without limitation, portable test equipment, bench test equipment, diagnostic and test equipment shall be for a time period of ~~two~~one (21) ~~years~~year commencing on the date of their Conditional Acceptance by CRRMA.

B. Extended Warranty [None].

C. Limitation Related to Conditional Acceptance

If a component of a PCC has been Conditionally Accepted when the PCC is placed into revenue service, CRRMA may note on the Conditional Acceptance open item listing that the Warranty on that component shall commence after it has been unconditionally accepted (Final Accepted) by CRRMA on a pro-rated basis for the time the component has been in service.

6.12 USE OF CRRMA-OWNED SPARE PARTS

At the sole discretion of CRRMA, as determined on a case-by-case basis, CRRMA owned spare parts may be utilized by the Contractor for correction purposes. The Contractor must replace each borrowed part with a new unused part within thirty (30) calendar days. If the spare part utilized was not a new unused part, then the Contractor shall replace such with an equivalent part. All costs associated with replacing the spare parts shall be borne by the Contractor.

6.13 DELAYS AND DISRUPTION

To prevent delays and disruption to CRRMA's operations, CRRMA shall have the right to the continued use of any Deficient PCC, equipment, component, work or part, until it can be taken out of service and made available to Contractor to correct the Deficiency, provided that the CRRMA will not continue to operate a PCC that is unsafe or if such operation is likely to cause further harm to the PCC.

6.14 REPAIRS BY CRRMA

If the Contractor fails to correct any Deficiency as provided herein, CRRMA, at its sole discretion, may investigate, analyze, diagnose and correct the Deficiency at the Contractor's sole cost and expense.

Upon CRRMA's submittal of a Warranty claim, the Contractor shall timely reimburse CRRMA for, or replace, all parts required for the correction and for any equipment acquired by CRRMA for the investigation, analysis or diagnosis of the correction. The Contractor shall also timely reimburse CRRMA for all direct labor at a rate of \$65 per hour. This rate shall be escalated each CRRMA fiscal year by 3%.

6.15 WARRANTY PLAN

The Contractor shall submit a Warranty Plan that describes how the warranties required under this Section will be implemented and managed. The Plan shall address Contractor and Subcontractor staffing, parts provisioning, engineering support, warranty documentation and parts disposition.

- (1) The Contractor shall maintain a log of all defects and failures found in the equipment, and of any adjustments and changes made in order to repair such defects and failures. A weekly summary of the warranty logs signed by the Contractor's Project Manager, or other CRRMA approved designee, shall be submitted to CRRMA.
- (2) The Contractor and CRRMA shall meet on a monthly basis to review the warranty work.



PCC Vehicle Technical Specifications



Addendum 24

April 29~~March 30~~, 2015

EL PASO STREETCAR REMANUFACTURE OF PCC CARS

SECTION 2 – DESIGN PARAMETERS

2.0 CAR DESIGN PARAMETERS

2.1 GENERAL

This Section defines the operational and environmental parameters which must be taken into account as part of the vehicle remanufacturing and, by extension, to all subsystems and components. All modifications and remanufacturing performed to the PCC cars must adhere to Section 2.2 dimensional constraints, Section 2.3 infrastructure interfaces, and Section 2.4 clearances. Installation of roof mounted equipment must not reduce overhead clearance and overhead contact system (OCS) overhead and lateral swing clearances.

2.2 CAR DIMENSIONAL DATA

The dimensions given shall be interpreted as being either within normal good practice tolerances for nominal values, or absolute values for constraints and limits. The remanufactured PCC car under all operating conditions shall pass the as-built CRRMA infrastructure. The existing PCC car is approximately 46 feet 6 inches long, 8 feet 5 inches wide, and 11 feet 3 inches high above top of rail, and weighs approximately 36,000 pounds.

Unless specified otherwise, tolerances are:

- (a) Carbody width in any plane: + 0 inch, - 0.25 inch
- (b) Length over anti-climbers: ± 0.5 inch
- (c) Height (new wheels) top of rail to top of car: + 0 inch, - 0.5 inch. Contractor may propose alternate tolerances for vehicle height.
- (d) Passenger area height and width: ± 0.125 inch

2.3 TRACK, WAYSIDE, AND ENVIRONMENT

2.3.1 TRACK AND WAYSIDE

The CRRMA system will operate on all new constructed track serving new constructed passenger boarding locations. Typical boarding location arrangements, track turnout and track slab drawings are attached. All operation is in either mixed city street traffic or mixed reserved express bus lanes. The rail system has these characteristics:

- (a) Minimum centerline horizontal-curve radius 50 ft.
 - (b) Maximum corresponding super-elevation 0.5 in.
 - (c) Maximum track super-elevation 1.0 in.
 - (d) Track gauge 56.5 in.
 - (e) Running-rail maximum vertical wear 1/4 in.
- (51R1 girder rail, 115 RE "T" rail, or 112 TRAM block rail)

- (f) Maximum grade 10.5 %
- (g) Minimum carbody-ground clearance, including skirt 8 in.

2.3.2 OVERHEAD WIRE

- (a) Wire height above top of rail (nominal ~~maximum~~): 19 ft. 6 in.
- (b) ~~Wire height above top of rail (nominal minimum): 15 ft. 6 in.~~
- (c) Wire height above top of rail (maximum ~~for pantograph design~~) ~~230~~ ft. ~~60~~ in.
- (d) Wire height above top of rail (minimum ~~for pantograph design~~) 14 ft. 0 in.
- (e) Grooved 350 kcmil wire secured by clamp "ears"

2.3.3 POWER SUPPLY

Line voltage trolley wire feed ranges from 420 Volts dc to a maximum of 720 Volts dc based on a nominal 600 Volt system and a +20% -30% variation. Vehicle equipment shall be designed for operation at nominal 600 Volts dc power with these voltage variations, with intermittent power supply due to pantograph bounce and power isolation wire gaps.

All new, remanufactured and newly designed auxiliary electric equipment shall be able to function over the range 420 Volts dc to 720 Volts dc without faults, errors or failures. Sustained application of voltages up to 900 Volts shall not damage equipment. Auxiliary electric loads may be "load shed" under low line voltage conditions to reduce the line current draw. Such low line voltage conditions shall be proposed by the Contractor for CRRMA review and approval.

Propulsion equipment shall function normally (at rating) over the range 550 Volts to 720 Volts. Below 550 Volts the 265 Ampere maximum motor current shall decrease linearly to 165 motor Amperes at 350 Volts. Full control of power modulation shall be maintained.

The maximum propulsion equipment contribution to the line draw shall be approximately 530 Amperes above 550 Volts. It shall decrease at one Ampere per Volt line drop below 550 Volts to approximately 330 Amperes at 350 Volts. The auxiliary load contribution exclusive of any load shedding added to the propulsion load will determine the total line draw.

2.3.4 ENVIRONMENT

The CRRMA environment for design purposes shall be as defined by US Weather Bureau published data and ASHRAE design day data.

2.4 CLEARANCES

2.4.1 GENERAL

No parts of the car during car movement shall exceed the dynamic clearance envelope shown in the attached.

2.4.2 TRUCKS

Truck components which are modified from the original PCC car design, except for track brakes, shall clear the running rails by a minimum of 2.5 inches with fully worn wheels and

maximum suspension deflection. These limits shall apply with wheel wear and suspension system deflections at the dimension which is the worst case for the particular condition.

2.4.3 UNDERFLOOR EQUIPMENT

The carbody and attached equipment shall be designed to provide positive clearance under worst case operating conditions. Worst-case conditions will result from such factors as horizontal and vertical curves, track superelevation, worn wheels, maximum passenger load, sway, suspension system failures, etc., either singly or in combination.

During heavy storm conditions, the remanufactured PCCs operating in street service or in the yard must continue to be capable of successfully operating in water as defined below (all water depths are above top of rail):

- Up to 2 inches of water with no restrictions of any kind.
- Between 2 and 3 inches of water, subject to a 10 mph speed restriction.
- Between 3 and 4 inches of water, subject to a 5 mph speed restriction.
- Above 4 inches of water, no operation.

2.4.4 EQUIPMENT ACCESS

All newly-installed and remanufactured car equipment which requires inspection or maintenance must be readily accessible. Underfloor equipment shall be arranged to provide simple, easy access from maintenance pits. Any new roof mounted equipment shall be arranged to provide simple, easy access from car side elevated shop platforms. CRRMA will not permit personnel to access the car roof while in revenue service. The frequency of required inspection or service shall determine the degree of equipment accessibility.

2.5 WEIGHTS

The existing PCC car weight is approximately 36,000 pounds. The additional weight of a fully-seated passenger load may be assumed by the Contractor to be 6,500 pounds for structural calculations. It is desired that the weight of additional and/or new equipment added to the car by the Contractor be minimized. The Contractor shall weigh the first car which is placed in its possession at the beginning of the project, and shall create a weight matrix identifying the estimated weight of all changes being made to the car during the design period. This matrix shall be updated on a progressive basis as the actual weight for various items are received. Each car shall be weighed prior to shipment from the Contractor to CRRMA, using a certified scale which is kept in calibration during the time of this Project.

2.6 SHOCK AND VIBRATION

Equipment design and mounting for any new equipment being added to the cars by the Contractor shall consider the specific location of the equipment on the vehicle and shall comply with IEC 61373.

2.7 RIDE QUALITY

The vehicle shall be designed to provide a smooth, comfortable ride, free from objectionable vibration, shock, roll, pitch and lurching. This shall require the careful inspection, remanufacture

and repair of the truck suspension components. The ride quality as a minimum shall be comparable to that provided by the original PCC car design.

2.8 ELECTROMAGNETIC INTERFERENCE (EMI)

2.8.1 GENERAL

For all new components of an electronic nature, the Contractor shall develop and submit to CRRMA an electromagnetic compatibility control and test plan in accordance with APTA SS-E-010-98. The plan shall insure that proper emphasis will be placed on the control of interference and adequate attention given to interfaces and the U.S. Federal Communications Commission (FCC) requirements from the earliest stages of the vehicle design.

2.8.2 EMI CONTROL

The new and remanufactured electrical, electronic, and communications systems and subsystems being added to the cars shall operate without either suffering or causing interferences which may adversely affect any system operation and/or safety because of conducted, inducted and/or radiated emissions. The Contractor shall employ design techniques, construction methods, and whatever equipment is required to prevent interference caused by internal sources from affecting the proper operation of any car subsystem or any wayside system, such as the TWC system. In addition to coordinating frequencies, the Contractor shall provide necessary on-board balancing, filtering, shielding, modulating techniques, and isolation to maintain signal-to-noise (S/N) ratios to prevent interference.

Shielding, isolating, balancing, and grounding shall be used as required to reduce the undesirable effect of interference. Electrostatic and magnetic electrical shielding methods shall be employed to minimize the effect of stray signals and transient voltages on low-level interconnecting cables. Interconnecting power and signal cables shall be physically separated. Wiring shall be located and arranged such as to minimize electrical induction into circuits due to propulsion system, auxiliary power, power supply, or other currents, both static and transient.

2.8.3 EMI EMISSION LIMITS

The Contractor shall ensure that the cars and car equipment do not produce electromagnetic emissions that interfere with other systems on the car and do not interfere with electronic equipment that might be expected to be carried by passengers and crew. These include two-way radios, cell phones, pagers, portable computers, computer pads, hearing aids, pacemakers, and similar devices. Validation can be by sensor sweeps and/or tests using actual devices.
~~The Contractor shall ensure that the cars do not produce radiated emissions that violate FCC Rules and Regulations, Part 15.25.~~ In addition, for purposes of design validation, the cars shall not produce radiated emission levels above those permitted by Figure 10-2 (UM05), Curve 2 of MIL-STD-461B8 when measured 100 feet from the track centerline.

The radiated emissions of the first remanufactured car shall be measured. They shall not exceed the level permitted by the above standard at any frequency between 0.15 MHz and 6,000 MHz. Testing shall be based on the document "Radiated Interference in Rapid

Transit Systems, Volume 2 - Suggested Test Procedures" (UMTA-MA-05-0153-85-11) for guidance and shall be conducted to the satisfaction of CRRMA.

The Contractor shall submit EMC Test Procedures for all sensitive on-board systems that could be adversely impacted by the EMI generated by the new Chopper Propulsion and Inverter / Converter Auxiliary power systems. These sensitive systems include VETAG, TOMAC, CCTV, WiFi and Braking. After review and approval by CRRMA the Contractor shall implement these Test Procedures to verify that no objectionable EMI exists.

2.9 ELECTRICAL DESIGN CRITERIA

All new and/or remanufactured low voltage apparatus shall function satisfactorily for any duration at any continuous battery voltage within the battery operating voltage range. All low voltage apparatus shall not be damaged or operate in an unsafe manner by the continuous application of voltages between zero and minimum battery voltage.

All new and/or remanufactured hardware shall be protected against moisture, oxidation, and common airborne contaminants. A power source switch shall be conveniently located near any removable printed circuit board, or group of such boards, to make it possible to remove and replace such boards without injury to them. This switch may have multiple functions relating to troubleshooting and diagnostics as required.

The need for adjustments in new electronic assemblies shall be avoided wherever possible by the use of appropriate circuitry, stable components, and the use of high tolerance drift compensation and temperature compensation circuits. Where adjustments on printed circuit boards are necessary, they shall be accomplished without the use of specialized (i.e., non-catalog U.S. supplier) test equipment unless this special equipment is furnished by the Contractor in approved quantities as part of this procurement.

All car wiring shall have circuit breaker protection as specified. To as great an extent as possible, all returns for any one circuit shall return to a single terminal point, without any connections to returns from other circuits, and then have a single connection to the car return circuit (battery negative for low voltage dc circuits and traction ground for high voltage dc circuits).

2.10 INTERCHANGEABILITY

All similar parts, both as individual parts and as subassemblies, shall be physically and functionally identical within a car and from car-to-car within the fleet. Model numbers for identical components shall be identical. Replaceable components of any such apparatus shall be fully interchangeable, without adjustments being necessary. Approval shall be obtained from CRRMA for any new or remanufactured part whose replacement may require an adjustment. Such approval may be granted only where it can be shown to be absolutely necessary.

2.11 STANDARD KEY

CRRMA will require a key lock of the Operator console controls and rear controls on its PCC vehicles. The Contractor shall install an approved new cylindrical key interlock in the cab console area in a location approved by CRRMA, which would require activation in order to make the car auxiliary and propulsion controls functional. The console key shall have 3 positions: OFF, STANDBY and RUN. The key shall be inserted in the 12 o'clock position (OFF) and require a 90 degree turn to the right to reach the STANDBY position and a full 180 degree turn to the right to reach the RUN position for full car operation. The key shall be removable in the OFF and STANDBY locations, but shall be captive in the RUN position. The key used shall be functionally

equivalent to Chicago Lock Company ACE Key number xx5479. CompX is the present source of Chicago locks. The Contractor shall supply 30 keys to the CRRMA which shall be stamped "Do Not Duplicate" as well as "xx5479".

In the OFF position, no PCC systems except for the parking brake shall be functional or powered. In the STANDBY position with the pantograph up and functional OCS, the car shall have full HVAC, all interior lighting, all exterior lighting, all communications, doors, full capabilities of the wheelchair lift system and all other auxiliary circuits fully functional, but the propulsion and braking systems shall be arranged such that the car shall not be able to move regardless of the actions of the operator. In the RUN position, all functions of the car shall be available, including car movement. In the STANDBY position with the pantograph down, or with a non-functional OCS, the car shall operate on battery power as defined in Sections 5.2.2, 6.5 and 11.6.

Rear controls (see Section 10.3.6) shall be locked/unlocked using the Standard Key and hidden behind an approved hinged panel. The Contractor shall install an approved new cylindrical key interlock in the rear control area in a location approved by CRRMA, which would require activation in order to make the car auxiliary and propulsion controls functional from the rear controls. The key shall have 2 positions: OFF and RUN. The key shall be inserted in the 12 o'clock position (OFF) and require a 90 degree turn to the right to reach the RUN position for full car operation. The key shall be removable in the OFF location, but shall be captive in the RUN position.

Car directional controls (FWD, NEUTRAL and REV) in the cab area shall be by a separate reverser as described in Section 10.3.5. Movement of the reverser handle shall be possible only when the cab console key switch is in the RUN position. When the reverser handle is in the NEUTRAL position, the parking brake shall be applied. Car directional controls (FWD, NEUTRAL and REV) at the rear control area shall be by a separate 3 position switch as described in Section 10.3.6.

2.12 RELIABILITY

A vehicle fleet of 7 cars shall exhibit a vehicle Mean Time Between Service failures (MTBSF) of 700 operating hours or better for CRRMA operating conditions.

A vehicle fleet of 8 cars or 9 cars, shall exhibit a vehicle Mean Time Between Service Failures (MTBSF) of 800 operating hours or better for CRRMA street railway service conditions.

Allocation of the failure rates between major items of car equipment and subsystems shall consider the consequences of the failure to individual car operation and to overall CRRMA operation. Failures rendering a car not moveable shall be allocated the lowest rate. Allocated failure rates for doors and door controls shall be low and reflect the large number of door elements and the high frequency of door use expected. Allocated failure rates for HVAC shall be low to reflect the extreme discomfort to passengers caused by failures in the summer climate of El Paso.

A service failure is any equipment malfunction that forces a reduction in operating schedule, requires a car in service to be isolated, requires a major car portion of passenger accommodations to be isolated from passenger service, requires a car to be removed from service, prevents its being placed in service, or requires more than six minutes for the Operator to identify and correct before starting or resuming service.

Reliability shall be confirmed by joint CRRMA and Contractor monitoring of operations and maintenance during a portion of the basic warranty period or the optional period defined below. For initial reliability estimation purposes the following may be assumed:

- 7 car fleet size (6 operating cars, 1 shop spare). Monitoring shall also consider the option PCCs if such is exercised by CRRMA.
- 14 hours per day average car operating time. Total mileage of the streetcar system is 4.8 miles with anticipated total trip time being 50 minutes. Revenue service will take place between approximately 6:00 am and 8:00 pm.
- 80 miles per day average car operating distance.

The Contractor shall establish a database to monitor the reliability of the cars, measured as the Mean Time Between Service Failures (MTBSF). This taken from the car's operating elapsed time meter.

The term "unusual aspect or seventy" shall be understood to mean a condition that may occur on the CRRMA rail system less frequently than 10-year intervals. The time, place, or type of service operated by the car at the time of a failure shall not be of any consequence.

The above data collection shall be made during the selected data collection time interval, during which the Contractor shall conduct a reliability demonstration test. The purpose of this test is to establish a measure of new, reconfigured, remanufactured and repaired system reliability and to demonstrate that the cars are free of design problems which can interrupt revenue service or which can present hazards to CRRMA and/or COEP property, personnel and passengers.

Upon Conditional Acceptance of the last car by CRRMA, the fleet shall be monitored in revenue service for 12 months. CRRMA shall maintain and service the cars in accordance with maintenance schedules and procedures for all new, reconfigured, remanufactured and modified items that have been submitted by the Contractor and approved by the CRRMA. Time utilized for inspections and/or equipment maintenance and repair shall not be included in the test time. If any repairs or adjustments to the cars are required, beyond those required in the approved maintenance procedures, these shall be considered as failures. CRRMA reserves the right to make additional inspections to determine if failures have occurred.

Representatives of CRRMA, the Contractor and major subcontractors shall be present during the conduct of the reliability tests. CRRMA and the Contractor shall maintain separate logs which will be used to document individual observations. All defects, failures, improper operations of an assembly, subassembly or component and service interruption shall be recorded and the Contractor shall take immediate corrective action.

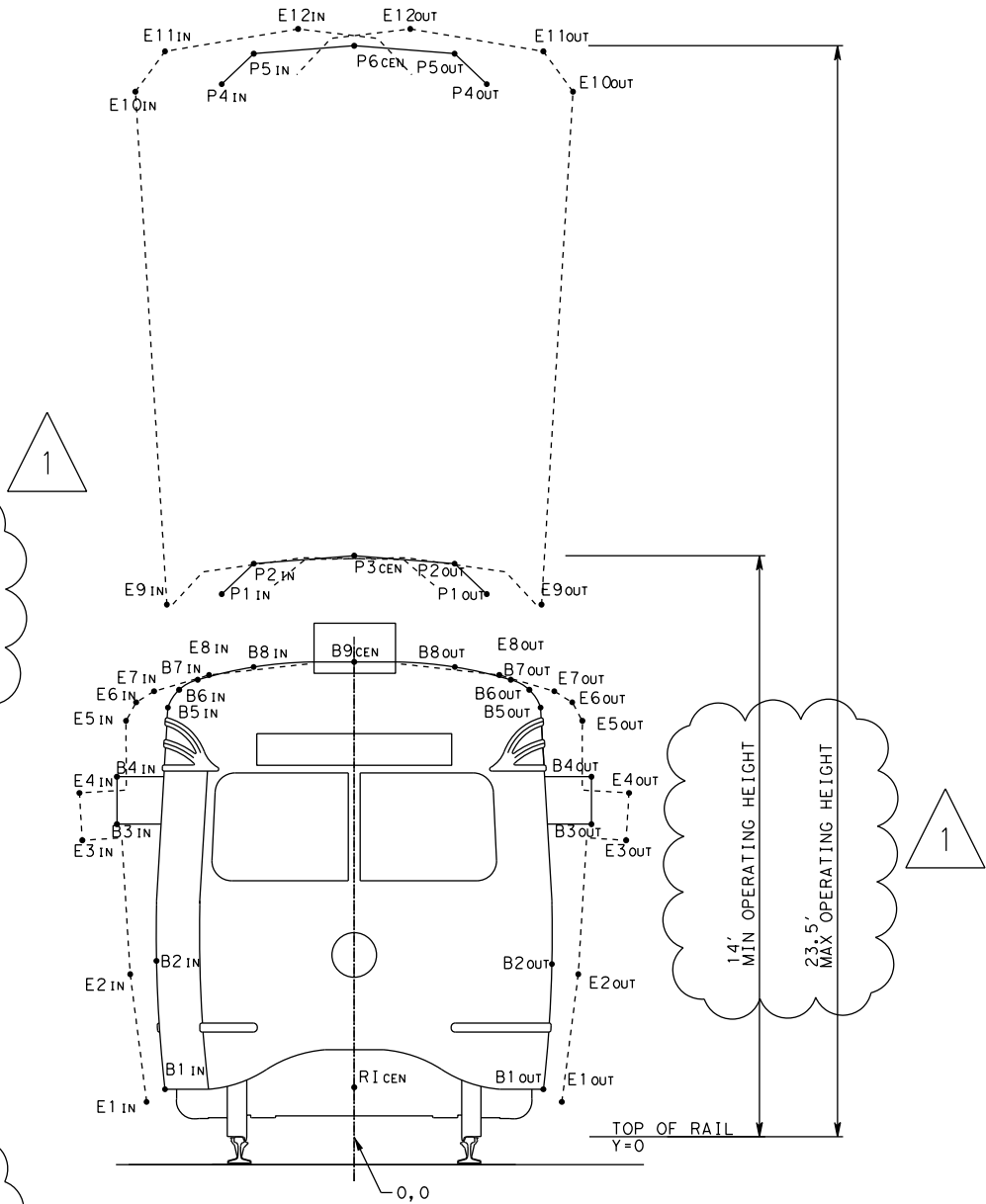
A separate report for each failure or malfunction of equipment shall be prepared by the Contractor indicating the reason for the failure, the repair required to correct the condition and, where applicable, corrective action required to prevent similar, subsequent abnormal operation and failures. These reports shall be reviewed and evaluated by CRRMA. Final acceptance of the repair or corrective actions taken and, in the case of disputes, the decisions as to what constitutes failure or interruption in this test shall be made by CRRMA. In the event that a failure occurs in one system under test, causing an interruption in the Reliability Test, it will not be considered an interruption for the other systems under test.

STATIC PCC ROLL CENTER					
	X	Y			
R1 CEN	0.000 ft	1.042 ft			

STATIC PCC BODY POINTS					
	X	Y		X	Y
B1 OUT	3.985 ft	1.000 ft	B1 IN	-3.985 ft	1.000 ft
B2 OUT	0.347 ft	3.708 ft	B2 IN	-0.347 ft	3.708 ft
B3 OUT	5.000 ft	6.589 ft	B3 IN	-5.000 ft	6.589 ft
B4 OUT	5.000 ft	7.589 ft	B4 IN	-5.000 ft	7.589 ft
B5 OUT	3.926 ft	9.046 ft	B5 IN	-3.926 ft	9.046 ft
B6 OUT	3.690 ft	9.422 ft	B6 IN	-3.690 ft	9.422 ft
B7 OUT	3.299 ft	9.633 ft	B7 IN	-3.299 ft	9.633 ft
B8 OUT	2.121 ft	9.903 ft	B8 IN	-2.121 ft	9.903 ft
B9 CEN	0.000 ft	10.000 ft			

STATIC PCC PANTOGRAPH POINTS					
	X	Y		X	Y
P1 OUT	2.792 ft	13.190 ft	P1 IN	-2.792 ft	13.190 ft
P2 OUT	2.116 ft	13.833 ft	P2 IN	-2.116 ft	13.833 ft
P3 CEN	0.000 ft	14.000 ft			
P4 OUT	2.792 ft	22.690 ft	P4 IN	-2.792 ft	22.690 ft
P5 OUT	2.116 ft	23.333 ft	P5 IN	-2.116 ft	23.333 ft
P6 CEN	0.000 ft	23.500 ft			

DYNAMIC VEHICLE ENVELOPE POINTS					
	X	Y		X	Y
E1 OUT	4.374 ft	0.733 ft	E1 IN	-4.374 ft	0.733 ft
E2 OUT	4.721 ft	3.425 ft	E2 IN	-4.721 ft	3.425 ft
E3 OUT	5.729 ft	6.250 ft	E3 IN	-5.729 ft	6.250 ft
E4 OUT	5.790 ft	7.248 ft	E4 IN	-5.790 ft	7.248 ft
E5 OUT	4.807 ft	8.768 ft	E5 IN	-4.807 ft	8.768 ft
E6 OUT	4.594 ft	9.158 ft	E6 IN	-4.594 ft	9.158 ft
E7 OUT	4.216 ft	9.392 ft	E7 IN	-4.216 ft	9.392 ft
E8 OUT	3.057 ft	9.784 ft	E8 IN	-3.057 ft	9.784 ft
E9 OUT	3.946 ft	12.719 ft	E9 IN	-3.946 ft	12.719 ft
E10 OUT	4.610 ft	22.532 ft	E10 IN	-4.610 ft	22.532 ft
E11 OUT	3.985 ft	23.382 ft	E11 IN	-3.985 ft	23.382 ft
E12 OUT	1.182 ft	23.854 ft	E12 IN	-1.182 ft	23.854 ft



DYNAMIC FACTORS	
Lateral Motion	in
Roll Angle 3° (with 0.5" cross level variation)	4.810
Suspension Lateral Travel (per side)	1.340
Wheel gauge construction tolerance (per side)	0.031
Lateral wheel wear (per side)	0.300
Rail gauge construction tolerance (per side)	0.125
Lateral rail wear (per side)	0.500
Wheel-to-rail side play (per side)	0.375
Pantograph lateral sway	1.500
Other wayside factors	
construction tolerance (paved track & pole)	1.500
maintenance tolerance (paved track)	0.500
Vertical Factors	
Pantograph Uplift	3.000
Pantograph carbon wear, contact wire wear & contact wire construction tolerance	1.250
Radial wheel wear	1.000

NO	DATE	REVISION	APPROVED
1	04/29/15	ADDENDUM 2	
2	/ /		
3	/ /		
4	/ /		


URS

2829 Montana Suite 206
El Paso, Texas 79903
(915) 493-6468

TBPE REGISTRATION NO. F-3162

COEP STREETCAR

PCC SIMPLIFIED
DVE ON TANGENT

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CONT	SECT	JOB	HIGHWAY
			VARIOUS
DIST	COUNTY	SHEET NO.	
EL PASO	EL PASO		

EL PASO STREETCAR REMANUFACTURE OF PCC CARS

SECTION 3 - CARBODY

3.0 CARBODY

3.1 GENERAL

The Contractor shall remanufacture each PCC carbody. Work shall consist of removing all roof, interior and undercar equipment, stripping each carbody down to the bare structure, inspecting for damage, repairing the structure, installation of structural modifications, remanufacture of equipment and reassembly of the carbody as defined by this Technical Specification and the Contract Documents. The Contractor shall be responsible for repair of any damage to the vehicle caused by any Contractor actions in cleaning, repairing, remanufacturing or installing equipment and/or materials, at no cost or other impact to CRRMA. There shall be no provision of Conditional or Extra Work during the remanufacture of the PCCs. All necessary work required by these Technical Specifications and other Contract Documents shall be performed by the Contractor as Base Work as part of the Contractor's bid price noted in CP2. No other costs or monies shall be paid to the Contractor to complete any work related to the carbody repair, truck repair or any other requirement of these Technical Specifications and other Contract Documents based on hidden conditions or similar situations, except as specifically authorized by CRRMA in accordance with the Contract Documents.

Floor and framing loads arising from any equipment added in or under the car shall be accommodated through appropriate additional structure. All such structural modifications shall be supported by stress analysis calculations in accordance with Section 3.16 to establish their suitability for the intended service.

3.2 DISASSEMBLY

Prior to the start of work, the Contractor shall provide an interior and exterior disassembly plan which shall be submitted to CRRMA for approval. This plan shall include each and every item to be removed from the car and methods for tracking and storing each removed item. The Contractor shall provide a preliminary stripping plan summary as part of its Technical Proposal.

Each car shall be completely disassembled by the Contractor to the bare, paint-free metallic carbody structure in accordance with the approved disassembly plan. The Contractor shall de-truck each car and remove all equipment, and both interior and exterior appointments. This shall include, but is not limited to, all propulsion equipment, auxiliary electrical equipment, all underfloor equipment boxes, all battery box items, trolley poles and bases, roof shrouds, roof mat, wooden roof ribbing, doors and door controls, all glazing, all window sash, interior and exterior accessories, electrical lockers and contents, lighting, seats, stanchions, rubber flooring, wooden flooring panels, ceiling panels, wall linings, all cab equipment, front interior dash, exterior lower belt rail and all skirting, and all other items as defined by this Technical Specification. All wiring, cable, connectors and all other items related to the wiring shall be removed and scrapped. All interior window sheet metal pressings shall be removed, as well as all electrical, door control, battery compartment and any other compartment doors or covers on the body. The carbody exterior sheathing (skin) and roof covering welded to structural members shall specifically NOT be removed at this time, as they are integral elements of the carbody structure and are required to maintain structural integrity stiffness. The intention is that the car be reduced to the most basic element of an integrally-welded structure, with all removable items stripped off.

Some of the items being removed from the car may be remanufactured and reinstalled by the Contractor as part of the remanufacturing process. Some items being removed will not be reinstalled, but will be disposed in accordance with the directions of CRRMA. The Contractor shall establish special procedures to remove all items to be remanufactured and later reused without damage, and to properly identify, handle, transport and store all such items without any damage. The Contractor shall create and maintain throughout the entire project duration a CRRMA disassembled material storage area. This area shall be separate from all other areas within the Contractor's facilities. The Contractor shall submit the plans and details of this area to CRRMA for approval. During the disassembly process, any and all components, items, systems, devices, panels, etc. that are removed shall be moved to this area for storage and kept in this area at all times until such items are either remanufactured and subsequently installed back on the car from which it was removed, discarded as approved by CRRMA, shipped back to CRRMA as defined in this Technical Specification, or otherwise disposed as approved by CRRMA. All items removed from any car shall be tagged with the car number, location on the car from which it was removed, visual condition of the item, and date of removal. Each tag shall remain attached to each item until such item is reinstalled on a car, returned to CRRMA or dispositioned as approved by CRRMA.

3.3 ASBESTOS ABATEMENT

The Contractor shall be responsible for the investigation, identification, and disposal of all asbestos containing materials on each remanufactured car in accordance with all applicable laws. Removal of all asbestos containing materials shall be performed by the Contractor as part of Base Work. The Contractor is advised for information that electrical lockers may be lined with "Transite" asbestos insulating board, and asbestos interior lighting wire harnesses may be used. Some parts of the existing propulsion control system may also contain asbestos. Asbestos paper may have been used to protect the front cab wiring from welding sparks if the front car sheathing needed to be replaced due to accident damage. CRRMA makes no guarantees that there is or is not asbestos on the cars, and emphasizes that it is solely the responsibility of the Contractor to investigate, identify and dispose of all asbestos on each PCC as part of Base Work.

EPA and OSHA regulations require third party air monitoring during and after Asbestos Abatement. Contractor will forward copies of all air monitoring results to CRRMA.

3.4 CLEANING

Prior to the start of work, the Contractor shall provide an interior and exterior carbody gritblast cleaning plan which shall be submitted to CRRMA for approval. This plan shall include methods, procedures, materials and application apparatus for each cleaning process. The Contractor shall provide a preliminary carbody gritblast cleaning plan summary as part of its Technical Proposal.

The stripped-down carbody shall be placed on jack stands to allow complete access to the underside of the body, and the complete carbody shall be thoroughly gritblasted to remove all paint and corrosion in accordance with a CRRMA approved procedure. The Contractor shall also clean non-accessible areas (tubing, channels, etc.) as best as possible. Care shall be taken during cleaning to prevent distortion of the side sheets, end sheets and roof. Air ducts, electrical raceways, and equipment boxes integral to the structure shall be cleaned both inside and outside. Once gritblasting is completed, the Contractor shall thoroughly clean and remove all residue, and then apply a chemical conversion coating in accordance with a CRRMA approved procedure to the exposed bare metal as quickly as possible to prevent flash rusting. The proposed coating shall not inhibit the inspection of the carbody.

3.5 INSPECTION

Prior to the start of work, the Contractor shall provide an inspection plan which shall be submitted to CRRMA for approval and shall include the methods and procedures for the inspection process of each car. A key part of this plan shall be a detailed listing of each and every critical weld and area on each carbody that shall be inspected. It shall include using a transit or other precision measuring technique to verify the alignment and tram of the 4 carbody lifting points and the king pins. CRRMA reserves the right to have the Contractor inspect additional areas if there is suspicion that hidden damage or corrosion exists. The Contractor shall provide a preliminary carbody inspection plan summary, including a preliminary list of all critical welds, as part of its Technical Proposal.

After cleaning and priming, the carbody shall be carefully inspected for wear, corrosion, and physical damage which may require remanufacture, repair or replacement. The Contractor is cautioned that inspection of closed section structural members may require the use of ultrasonic or other inspection techniques to determine the extent of hidden corrosion damage. Particular attention shall be given to the carbody bolsters, jacking pads, anticlimbers and the side sills and sheathing in the area of the bolsters. Particular attention shall be given to the final appearance of the side and end sheathing. The Contractor shall not use automotive plastic body filler materials as a repair technique, except for minor cosmetic items only as specifically approved by CRRMA.

Once the Contractor has submitted the inspection report to identify all items of work on each car, it shall arrange for a joint inspection of these items to be made with CRRMA and/or its representatives. The Contractor shall include all conditions observed which need to be corrected. It is emphasized that all repairs, regardless of whether hidden, noted during the pre-bid vehicle inspection, or other, shall be performed by the Contractor as part of its Total Base Contract Price as part of Base Work and that no Conditional Work or Extra Work shall apply to this contract. It is imperative that the report be well organized and the data presented in a consistent and orderly manner. Where applicable, the written report shall suggest each proposed corrective action. If any work requires the removal of either the carbody exterior sheathing (skin) or the roof covering welded to the structural members, the Contractor must first install the carbody into a structural jig fixture to maintain structural integrity stiffness and body camber during the repair, as the skin and roof elements are integral to the PCC carbody structure.

3.6 PASSENGER SIDE WINDOWS

Passenger side windows shall be new and replicate the original design, using the existing car body openings. See Section 3.13.

3.7 UNDERFRAME AND SUPERSTRUCTURE

3.7.1 GENERAL

Thorough cleaning and inspection may disclose damage to existing structural members or sheathing. Repair to damaged or corroded items shall be performed unless otherwise identified in this Technical Specification. Any structure, member, element or item whose thickness has been reduced by more than 20% of the original thickness due to corrosion or damage shall be remanufactured, repaired or replaced. Localized damage shall be repaired by welding, with more extensive damage replaced by cutting out the damaged area and welding in a replacement section. Welds visible to passengers shall be ground

flush, when appropriate to generally duplicate the original material, shape, and thickness. Weld filler metal shall be of the same strength and corrosion resistance as the original material. Brackets and fittings which are deformed shall be straightened and welded as required. Joints shall be welded unless a riveted joint was used in the original design; welding may also be proposed for such joints subject to CRRMA approval. All holes penetrating the roof or side skin shall be repaired. All new metal which is installed shall be paint primed using an approved procedure to prevent the occurrence of flash rusting. Special attention shall be given to the belt rail area and the roof area along the side seams. The side exterior rub rails shall be renewed using new fasteners.

The Contractor shall replace the wood/canvas roof center portion with metal sheets. The new metal sheets shall join the existing roof edge radius metal portion in a structurally sound and waterproof manner. The Contractor shall reinforce the joint between the roof edge radius metal and the side wall, at the top of the side wall, on all cars.

The drawbar attachment at each end of the car shall have a new drawbar pin installed, welded to a chain to keep it captive to the car.

The Contractor shall design and provide all necessary modifications (including but not limited to the carbody, ceiling structure and rear step well) to mount the replacement seats described in Section 4.3, and to accommodate the wheelchair lift as described in Section 4.5.

3.7.2 KING PIN

The bolster king pin and its attachment to the carbody shall be inspected using dye penetrant and/or magaflex for any cracks. Any cracks, wear or damage shall be repaired. The inspection report shall identify any defects and specific repair techniques including weld preparation, welding and stress relief.

3.7.3 ANTICLIMBERS

Anticlimbers shall be removed and restored to their original shape. One piece anticlimbers distorted beyond restoration shall be replaced. Replacement anticlimbers may be of double channel construction following later PCC practice.

Anticlimber structural support exhibiting deformation shall be remanufactured to its original shape. Deformation of the structure beyond 6 inches or deformation showing any tears or cracks shall be replaced by new material.

3.7.4 ANTIRCORROSION TREATMENT

Prior to reassembly of each stripped carbody, and in coordination with the painting of the car, all undercar structural members, including the interior of all enclosed sections and cavities and other non-accessible areas, shall be spray coated with Tectyl, Isoclad or approved equal long-life anti-corrosion preservatives from Tectyl Industrial Products, Marcus Corporation, or a CRRMA approved equal. The manufacturer's recommended product for each location shall be used. Spray wands with suitable extensions shall be used through access holes to completely coat all enclosed cavities. Particular attention shall be given to structural members at the ends of the cars and at the carbody bolsters.

3.7.5 LOUDSPEAKERS

Provide for mounting exterior loudspeakers at the front and center doorways per Section 5.4.3. The design shall place the loudspeaker, if possible, into the doorway header to avoid the need to project the loudspeaker assembly into the car; yet permit the speaker to be sufficiently elevated for good sound distribution. Provide for mounting eight interior loudspeakers in the ceiling. The design shall be submitted to CRRMA for approval.

3.8 EQUIPMENT BOXES AND COVERS

Any equipment boxes and covers which are to be reused shall be inspected for damage and water leaks. Water leaks due to problems other than seals shall be repaired by welding. All latches and hinges shall be cleaned and adjusted to ensure proper operation. The interior of all boxes shall be thoroughly cleaned and painted, and new door seals shall be applied. In order to mount revised equipment such as propulsion and auxiliary power supplies, the Contractor may need to modify existing equipment boxes and covers. The underfloor cooling air ducting for the traction motors shall be cleaned and inspected, and shall be suitably revised as required due to any changes in equipment to supply cooling air to the propulsion and auxiliary power systems. All fabric and elastomeric seals and components shall be renewed.

3.9 STEP WELLS

The rear step well center stanchion and handrail shall be removed to provide the maximum clear opening for wheelchair access, and its upper mounting shall be refinished to remove all signs of the original mounts. The existing front and rear step wells shall be removed from the cars, new stainless steel step wells shall be fabricated and installed, and the adjacent carbody structure shall be modified as necessary. The step treads and risers shall be covered with rubber flooring as described in Section 3.10.2, with the tread having a 3-inch deep yellow safety nosing. The design of the rear step well shall incorporate appropriate structure to support and accommodate the required wheelchair lift as defined in Section 4.5. The design, material, assembly techniques, installation method and finished aesthetic product shall be subject to CRRMA approval. The Contractor shall be solely responsible for integrating the required wheelchair ramp/lift system into the PCC cars in a manner that results in a fully ADA compliant system.

3.10 FLOOR

3.10.1 FLOOR PANELS

The existing flooring of the car shall be completely removed and replaced with new flooring. The floor panels shall be $\frac{3}{4}$ inch thick phenolic composite sandwich construction meeting the requirements of Section 15.

All exposed edges of the individual floor panels, including all penetrations and joints between panels, shall have a dense composite edge, machined smooth and free of sharp edges and burrs. The floor material shall be non-vermin supporting and shall not rot or corrode.

The floor panels shall be composed of pieces as large as possible and shall extend the full width of the PCC body. Transverse shiplap joints shall be located over structural members, but otherwise, there shall be no joints in the top or bottom faces of the panels.

Floors shall provide a smooth continuous surface for the floor lining. Installed panels shall have height variations at panel joints no greater than 0.03 inch. Floor flatness shall be better than 1/8 inch over any 36 inch span.

All panels shall be isolated from any metallic structure, including floor penetrations, and shall be mechanically attached and sealed, without use of adhesives, to the floor beams and sides. It shall be possible to remove, replace, and/or repair individual panels without damage to surrounding floor panels or structure. CRRMA will consider the use of adhesives for floor attachment subject to review of a Contractor prepared justification report that defines the benefits to CRRMA.

The Contractor shall provide a sheet metal panel below the floor structural beams to enhance the floor's fire penetration resistance. An inorganic material may be added to the top surface. All floor penetrations shall be sealed with an approved fireproof sealant.

The floor and mounting configuration shall not exhibit undesirable mechanical resonance, transmit underfloor equipment noise and vibrations, nor support other disagreeable noise generation.

For structural analyses, the floor panels shall not be considered part of the carbody structure.

3.10.2 FLOOR COVERING

Before applying the floor covering, all voids, fastener heads and cracks between the floor panels shall be filled and the floor made smooth and true with an approved leveling compound. The floor shall be cleaned immediately prior to floor covering installation.

The floor covering shall be Altro Rail Flooring or approved equal, in area specific colors as directed and approved by CRRMA. A darker covering is desired under the seats and a lighter color in the aisle area, and it is possible that car 1511 will incorporate a different floor rubber color scheme than that used on the rest of the fleet. The Contractor shall follow the Altro recommended practices for heat welding seams, solutions for moldings, step nosings, adhesives, tools, color matched sealants and weld rods.

Step tread and front operator's area floor coloring as approved by CRRMA shall also be provided.

3.11 ROOF

Each car shall have the roof and side frame structural members and sheathing modified and strengthened as required by the Contractor's design to install the pantograph and HVAC unit. All residual non-metallic portions of the roof shall be removed. The remaining metallic roof shall be inspected for corrosion damage. Special attention shall be given to the roof to sidewall joint area. Any areas showing evidence of corrosion shall be jointly inspected and any repairs shall be subject to CRRMA approval. The Contractor shall place high emphasis on integrating the HVAC, pantograph and roof structure and sheets in an aesthetically pleasing manner that results in an installation that is not dramatically noticeable and is integrated into the historical design of the PCC. Fairings shall be incorporated around the pantograph to hide the pantograph base and its attachments from passengers. These fairings shall be integrated with the HVAC unit enclosure to produce a seamless system of roof mounted components.

The Contractor shall remanufacture the curved roof sheet-to-gutter interface area at the eaves of each car in accordance with a CRRMA approved procedure. Each car shall have the roof and side frame structural framing members and sheathing modified and strengthened as required by the Contractor's design to install a new HVAC air comfort system and interior air ducts. The Contractor shall present to CRRMA prior to the start of any modifications a structural analysis regarding the additional loads and stresses being imposed by the new HVAC and pantograph systems, how the planned modifications by the Contractor shall properly resist these loads for the 20 year life of the carbody, and a complete set of drawings of the HVAC and pantograph mounting modifications, all for CRRMA approval.

Each car shall have the roof and side frame structural members and sheathing modified and strengthened as required by the Contractor's design to install the specified pantograph.

The original non-metallic roof shall be replaced with an all-metal roof. The design and interfacing shall be based on the evolution of PCC roofs to post-war all metal construction.

The roof area under and near the pantograph shall be provided with an insulating mat. See Section 3.13.3.

3.12 INSULATION

3.12.1 THERMAL INSULATION

The Contractor shall install thermal insulation during the reassembly of the car to reduce the heat losses on the HVAC system being installed. All insulation material shall comply with the smoke, flammability and toxicity requirements of this Technical Specification. The side wall below the passenger window sash, the front and rear wall areas and the roof areas shall have thermal insulation applied. Insulation of the floor shall utilize glass or mineral fiber insulation, and it shall be installed so that it will not shake down in long service under vibrating conditions. Maximum binder content should generally not exceed 6 percent. At floor heating areas, stainless steel or metal foil faced glass fiber or mineral fiber shall be applied to any heater guard area of the walls, with the metallic surface exposed toward the inside of the car. The insulation shall not support vermin or insects, be resistant to fungus, and not absorb water. The Contractor shall present a complete set of drawings of the insulation system to CRRMA for approval prior to the start of any work.

3.12.2 ACOUSTICAL

A vibration and sound damping material shall be applied to the inner surfaces of the carbody roof, metal floor skins, ends and side walls below the windows prior to thermal insulation application. The damping material shall have sufficient thickness to have a minimum vibration decay rate of 35 decibels per second (at a temperature of 70°F) as measured by the Geiger plate method. It shall be resistant to dilute acids, alkalis, greases, aliphatic oils, and vermin. It shall be unaffected by sunlight or ozone, and shall not become brittle with age. Application of damping compound and any recommended primer shall be in accordance with the supplier's recommendations.

3.12.3 UNDERCOATING

After floor panel and floor pan installation the underfloor of the carbody shall be coated with an approved heavy-duty automotive undercoating material. All materials shall be selected and applied in accordance with the manufacturer's recommendations for a 20 year life for a commercial motor vehicle.

3.13 WINDOWS

All glazing shall comply with FMVSS and ANSI Z26.1 motor vehicle glazing standards for buses (including appropriate "AS" glazing markings). All glazing material of laminated glass composition shall have all edges and radii ground smooth and sealed, and shall fit without binding. All elastomeric glazing strips shall fit tightly without buckling, and shall have rounded corners to facilitate car cleaning. The finished dimensions, layout, and the composition of all glazing shall be presented to CRRMA for approval. The ends of any glazing strip shall be joined together by the hot vulcanization process to form an endless glazing strip, gluing or other adhesives shall not be used unless the Contractor provides manufacturing processes and test data that demonstrates that the non-hot vulcanized joint will last for the design life of the car, considering the temperature conditions of El Paso and the understanding that window rubbers shrink over time placing stress on the joint. All tinting of each type of window shall be coordinated with CRRMA.

The car body has and will have the following window types:

- Front destination Sign (1)
- Windshield (2)
- Operator's left side (1) moveable/openable
- Passenger side fixed (see Section 4.8.7 for side window guard description)
- Passenger side openable (see Section 4.8.7 for side window guard description)
- Rear teardrop (2) fixed
- Rear (2) Emergency Exit
- Passenger door panels

The required work for each type is detailed below:

- The destination sign center vertical divider shall be removed and a single glazing piece installed. This will improve sign readability.
- The left and right windshields shall be of FMVSS compliant material, secured in fixed mounting that prevents being pushed in toward the operator. The size of each shall duplicate the original design. The orientation and slope of the original design may be retained.
- The Operator's left side sliding window shall be replaced with an identical function unit glazed with FMVSS compliant safety glass. The frame material and color shall match that provided for the passenger side windows.
- The passenger side windows shall be replaced in kind with glazing in bright metal frames. This shall replicate the original side window structure. Each side window unit shall be constructed as an identical self contained entity suitable for installation in the car body opening. Retention of the bright metal frame is desired. Unit removal and replacement for maintenance shall not require any car body metal disturbance.

- Openable side windows, two left side and two right side at the car front, and two left side and two right side at the car rear shall slide in the car body vertical channels as with the original design. Lockable latches, using the standard key, shall be provided to hold these windows in the opened position and the closed position.
- Fixed side windows shall be mounted in the body vertical channels as with the original design, but secured in the fully closed position.
- The two rear teardrop windows shall be replaced with identical size and shape units in fixed framing. The color and finish of the framing shall match the passenger side windows.
- The two rear widows shall be replaced with identical size and shape units with provision for emergency removal. Removal provisions shall follow a series of simple steps (no more than three) that shall be proposed by the Contractor for CRRMA consideration, review and approval. The Contractor shall propose the emergency window design, usage methods, and instructions to CRRMA for review and approval. All instructional signage shall be bilingual and approved by CRRMA. The color and finish of the framing shall match the passenger side windows.
- Passenger door panels shall include appropriate glazing as approved by CRRMA and described below.

Window installation in the existing car body shall involve no removal or alteration of the basic body metal. Window units shall include a metal frame suitable for zip strip or gasket mounting. The metal of all unit frames shall be provided with a bright finish that is uniform for the whole car. The finish may be brushed stainless steel (bright metal) or a black powder coating, as proposed to and approved by CRRMA.

New polycarbonate windows for the folding passenger doors shall be used. The installation shall be water tight to prevent deterioration of the door. The front door windows shall not be tinted and shall meet the requirements of ANSI Z26.1, latest issue, for bus glazing to the immediate right of the driver at levels requisite for driving visibility. The center door windows shall be tinted to match the passenger side windows shall meet the requirements of ANSI Z26.1, latest issue, for bus glazing to the immediate right of the driver at levels not requisite for driving visibility.

3.14 ROOF EQUIPMENT

3.14.1 PANTOGRAPH MOUNTING

The new pantograph shall be mounted so that the contact point to the OCS is directly above the rear truck center. For the single arm type pantograph, the arms shall point toward the rear to afford maximum roof area clearance for the HVAC equipment. The area under the pantograph shall be provided with an insulating mat described in Section 3.14.3.

3.14.2 PANTOGRAPH

The existing trolley poles shall be replaced by a single pantograph. The pantograph hold-down hook shall be installed on the car using an insulator base, so that the pantograph can be energized with 600 volts dc for shop testing while in the lowered position.

3.14.3 ROOF MAT

After finish painting of the car roof, a new insulating roof mat shall be installed. The roof mat shall be a black non-slip elastomer approximately 0.25 inch thick, or a spray on material developed for this type of application, installed to provide a minimum of 1,000 volts dc resistance to carbody ground. The mat material shall have prior application experience in an identical or approved equivalent use and shall have a service life of no less than 20 years. The size of the mat shall consider the pantograph size and potential for failed items to contact the roof. The mat shall be bonded to the roof with a waterproof adhesive, and ~~—All~~ edges shall be both mechanically fastened and sealed with a non-hardening, polyurethane sealant/adhesive equal to Sikaflex 221, unless a spray on material is used. The provided roof mat shall meet the service proven, durability and electrical protection requirements of this section. The type, size and installation method shall be subject to CRRMA approval.

3.14.4 SHROUD

The roof shroud shall be removed from the car and discarded.

3.15 PAINTING

The entire carbody shell interior, the car exterior and undercar surfaces shall be primed and finished painted, as well as painted areas of the completed interior such as linings and doors as specified herein. All areas shall be prepared, sanded and painted in accordance with the paint manufacturer's recommendations and as approved by CRRMA. A rust preventative primer which is compatible with the finish paint shall first be applied to all areas. The underfloor of the car (as well as all underfloor equipment boxes) shall have a finish coat of a rust resistant black paint applied prior to the installation of any wiring or equipment. The interior of all equipment boxes and electrical lockers shall be primed and painted with a white insulating paint. The exposed areas of the car exterior and painted areas of the car interior shall be painted using an automotive line of polyurethane paint similar to the application to a COEP Sunmetro transit bus. The finish paint colors shall be as identified in the color schedule in Section 1.15. The Contractor shall provide color chip samples of all colors for approval by CRRMA prior to the ordering of any painting material.

The paint schemes are defined in Section 1.15, and the Contractor shall use the included photos of the three required schemes to prepare new paint drawings defining the paint dimensions and details of the PCCs. In general, the exterior shall have one color for the roof, a second color for area above and around the side windows, and a third color below the belt rail (window sill) to and through the lower body rub rails. The belt rail may be painted a contrasting color or finished by an adhesive band. The lower body rub rail shall be painted the same color as the lower body side.

The El Paso PCC cars will incorporate 3 different exterior paint schemes as noted in Section 1.15.

3.16 STRUCTURAL ANALYSIS

When required by these Technical Specifications (i.e., wheelchair lift installation, pantograph installation, HVAC installation and for any new equipment weighing 200 pounds or more), the Contractor shall provide a structural analysis to demonstrate that the static and fatigue strength (as defined herein and elsewhere in these Technical Specifications) of the carbody and supporting

structure are adequate for the application. Each structural analysis shall be divided into sections as defined below:

- Complete description;
- A structural sketch (layout) of the carbody (including skin or sheathing) showing all member locations and shapes with dimensions, and indicating the material and thickness of each. Methods of joining shall be completely defined;
- Diagrams displaying externally applied loads and boundary conditions; and
- Complete analysis demonstrating adequate static and fatigue strength.

The margins of safety (MS) shall be positive and as close to zero as possible. MS is defined as the allowable stress divided by the calculated stress less 1.00 for each loading condition. The calculated stress shall include the applicable load factors. Each analysis shall be submitted for review and approval by CRRMA prior to any remanufacturing taking place.

EL PASO STREETCAR REMANUFACTURE OF PCC CARS

SECTION 4 – CARBODY ITEMS

4.0 CARBODY ITEMS

4.1 GENERAL

Two different car interiors configurations are involved. The basic base fleet shall follow the post-war PCC arrangement and seating as found on the San Francisco MUNI cars in service on the “F” line. Car 1511 shall be restored to the perimeter seating arrangement that was used in service between El Paso and Juarez.

The aesthetic PCC appearance of the interior shall be maintained as much as possible. The car interior shall be a harmonious, attractive design presenting clean and neat surfaces. Any new interior linings shall be designed and mounted to avoid vibration and noise when the car is operation. The car interior shall be designed to minimize the time and cost required for repair work by using common components wherever possible.

All exterior access doors, vents, handholds, folding steps, mirrors, and other accessories shall be removed, inspected for proper operation, cleaned, remanufactured and reinstalled in accordance with this Technical Specification. New seals shall be installed on all vents and doors.

4.2 INSIDE FINISH

4.2.1 GENERAL

The present interior finish panels of the car are missing or damaged beyond use. They are to be renewed by a combination of embossed stainless steel, painted metal stampings, and painted sheet metal ceiling panels. The side window interiors are to be removed and discarded. The inside surfaces of the exposed exterior skin shall be suitably finished for use as an interior painted finish surface. The painted ceiling panels are to be designed to accommodate the installation of the new HVAC system. All interior surfaces shall be smoothly finished and in accordance with the color schedule in Section 1.15.

4.2.2 CEILING PANELS

All of the side ceiling panels shall be removed from the carbody, carefully labeled to identify their original car and mounting location, remanufactured as required by this Technical Specification and reinstalled in their original car and location. Modifications shall be made as required to incorporate the HVAC air ducts, lights, CCTV cameras, interior loudspeakers and all other items as required. If a panel is too badly damaged to permit its remanufacture, the Contractor shall replace it with a new panel. Reused panels shall be remanufactured to a smooth appearance free of paint sags, runs, and other surface defects. Any moldings and trim strips to be reused shall be painted to match the adjacent material. If desired by the Contractor, in lieu of painting the ceiling panels, they shall be covered with a CRRMA approved adhesive-backed Tedlar composite laminate. New mounting fasteners shall be used. Anti-squeak tape at least 1 inch wide shall be applied to all framing members before application of the finish panels to inhibit squeaks.

4.2.3 SIDE PANELS

The Contractor shall install side wall structure, if and as required, on both sides of the interior to permit installation of the seats described in Section 4.3. New interior side panels below the windows shall be installed, using a CRRMA approved Tedlar composite laminate over a backing of aluminum sheet or fiberglass reinforced plastic. The material shall have a high-gloss green color finish. Two color samples shall be presented to the CRRMA for approval prior to ordering of material. The side panel material shall be designed for ease of removal of paint and ink from felt-tip pens. Panels shall be installed so that they are easily replaceable, and shall resist buckling, flexing and "oil-canning" while in service. New mounting fasteners shall be used. Anti-squeak tape at least 1 inch wide shall be applied to all framing members before application of the finish panels to inhibit squeaks.

4.2.4 ADVERTISING PANELS

The existing interior advertising card panels shall be reused after they are remanufactured by repairing all deformities and preparing the surface for repainting. The color shall match the ceiling panel color. Surface shall be free of runs from the old paint. Alternatively, the Contractor may choose to furnish new panels subject to CRRMA approval. In any case, after NTP, CRRMA will furnish the Contractor a sample of the COEP advertising media insert that will be used within the car card advertising panels. The Contractor shall ensure that the car card panels accommodate the COEP media. Media is landscape orientation: 17" x 11" (Tabloid) or 24" x 11". Live area: 15.5" x 10" or 23" x 10" (margins: 1/2" top + bottom; 3/4" sides). More information can be found at http://sunmetro.net/howto_advertising.html

4.2.5 FASTENING

Interior panels shall be attached so that there are no exposed edges or rough surfaces to snag passenger clothing. Panels and fasteners shall not be easily removable by passengers. Exposed interior trim fasteners shall be rivets or cross-recessed head screws.

4.2.6 WINDSCREEN PARTITIONS

The front (quantity of one) and center door (quantity of two) windscreen partitions shall be replaced with new. They shall be painted in accordance with the color schedule in Section 1.15. The rear door partition shall be taller than that used on the original El Paso PCCs in order to better conceal the new wheelchair lift. However, the curves and aesthetic design of the new taller rear door, and new front door, partitions shall mimic that of the original El Paso PCC design. The Operator's fabric night screen and ceiling mounting bar shall be removed and discarded, and all ceiling holes filled by welding and ground smooth.

A new Operator's partition shall be installed, similar to the bus Operator's partition found on COEP Sunmetro 60-foot articulated buses. Although this partition shall be similar to the Sunmetro bus configuration, the Contractor shall include aesthetic alterations to the partition so that it aesthetically matches the interior concept of the original PCC and is consistent with the front and rear door partitions. The Contractor shall not simply install a Sunmetro bus partition in kind. It shall be a solid panel with a window, with translucence characteristics as approved by CRRMA, and a shade or curtain that can be deployed by the Operator when desired. The shade or curtain shall be approved by CRRMA and shall

block all light coming from the passenger compartment to reduce windshield glare. The shade or curtain shall be stowable in a method approved by CRRMA. If necessary to incorporate all of the required systems (communications, CCTV, etc.), the Contractor may incorporate an electric locker into the lower portion of the new Operator's partition, but such locker shall not interfere with the window and shade operation. Details on the proposed Operator's partition shall be presented to CRRMA for approval.

4.3 SEATS

4.3.1 PASSENGER SEATS

Any existing passenger seats shall be removed from the car and discarded. They shall be replaced with CRRMA approved passenger seats in two separate configurations. The base fleet (7 cars plus any optional cars) shall incorporate the basic forward facing arrangement, and as previously noted, the seats in Car 1511 shall be of a separate configuration, replicating the final El Paso in-service perimeter seat arrangement.

The basic seating layout (for all cars except 1511) shall follow the post-war San Francisco Muni arrangement. Attachments to this section (total of 4) illustrate the San Francisco Muni arrangement. Drawing TRC 3-7-c1 shows the basic dimensions of the PCC seat, and shall be used by the Contractor as a guide to provide an equivalent design that will provide the same function and aesthetics, but is not required to provide the exact seat that is identified in the drawing. The upper hand-hold shall follow the San Francisco Muni approach providing a grab loop or a stanchion attachment as appropriate at each location.

The Contractor shall suggest variations to improve internal passenger circulation or to ensure compliance with ADA. The seat modules shall be arranged as required to supply passenger seats in a knee to back forward facing seating arrangement on the PCC car. The rear bench seat shall be a row of as many seat modules as possible. The ADA required wheelchair parking locations shall use wall mounted flip seats, but the bike storage area shall not. Seat installation shall be coordinated with the stanchion arrangement described below so as to provide sufficient stanchion attachment points. All seats shall be smoothly finished to prevent snagging passenger clothing or causing injury.

Seats at the sandboxes shall be hinged to permit sandbox access without tools.

The exterior seat backs of the basic seat arrangement (forward facing) shall be of embossed textured stainless steel for vandal resistance and easy cleaning. Shells and frames shall be of a color approved by CRRMA. The seat backs and shells shall use a texture that shall be approved by CRRMA. Seat cushions shall be covered with a CRRMA approved vinyl material that meets the requirements of these Technical Specifications and is of a color approved by CRRMA. The Contractor shall propose various types and thicknesses of cushion foams for CRRMA evaluation and approval.

Car 1511 seats shall incorporate a tubular steel perimeter frame attached to the car side wall, and include appropriate flip seats as necessary and as approved by CRRMA. Seat cushions and backs shall be of uniform height and thickness but segmented for easy repair and passenger comfort. Stanchions shall be provided at the segment divisions. Materials shall be as specified above.

4.3.2 FOLD-UP SEATS

Two wheelchair berthing areas sufficient in size to park two wheelchairs, one in each area, in accordance with ADA requirements, shall be located across the aisle from each other adjacent to the center doors. To provide maximum seating space when wheelchairs are not being berthed, the Contractor shall provide longitudinal sidewall seats and their required carbody mountings in the wheelchair berthing area facing the aisle. These seats shall match the appearance of and use the same colors and textures of the other passenger seats and have similar cushions. The quantity supplied shall be sufficient to make most efficient use of the wheelchair berthing areas. These seats shall feature theater style seat bottoms, which will allow the seats to be folded up whenever a wheelchair berthing space is required. There shall not be any lock that a passenger needs to operate to allow seat movement, but seats should remain in the raised or lowered position as selected.

The wheelchair parking areas shall have attachment provisions for Q'STRAIT, or approved equal, wheelchair securement devices. The actual securement devices shall not be installed, just all provisions necessary to install such devices in the future. Complete details and arrangement drawings shall be presented to CRRMA for approval prior to the start of any seat construction.

No fold-up seats shall be provided at the bicycle storage rack area of the basic seating layout. In addition to the upper securement device for the upper wheel, the Contractor shall develop a securement system for the lower bicycle wheel to prevent uncontrolled swinging. The arrangement shall be coordinated with the requirement of Section 4.6.7.

4.3.3 OPERATOR'S SEAT

The Contractor shall remove any remaining Operator's seats and remanufacture the existing Operator's seat in-kind. As an alternative, a new Operator's seat may be proposed for CRRMA consideration. It shall be as selected by CRRMA based on a minimum of 2 seat design proposals prepared by the Contractor, and shall include swivel provisions. Any new seats shall be included as Base Work. In any case, the Operator seat cushion(s) covering shall be as approved by CRRMA.

4.4 HANDRAILS AND STANCHIONS

The Contractor shall investigate and submit to CRRMA for approval suitable methods to provide vertical stanchions generally similar in arrangement to those on the San Francisco Muni PCC cars. In all cases, new fasteners and new elastomeric mounting cup liners shall be used. All stanchions shall be one piece without splices, and shall not have exposed holes. Stanchions shall not vibrate or produce noise while in service. All locations where stanchion ceiling mounts are relocated shall have the existing mounting holes through the ceiling lining filled and ground flush as part of the ceiling panel remanufacture. Suitable stanchion mounting tapping plate reinforcements shall be installed in the ceiling structure in all new stanchion mounting locations. The existing "grab handles" that are suspended from the existing stanchions shall be removed, cleaned, repaired, remanufactured and reused. The Contractor shall provide CRRMA with an inventory of all remanufactured grab handles and a recommendation of how many and in what sections of the vehicle they should be reinstalled over the fleet of cars. Final quantity and location of all grab handles shall be approved by CRRMA.

The center stanchion and hand rail located in the middle of the center door shall be removed to provide sufficient operating width for the wheelchair lift and to provide ADA compliance. New passenger assist diagonal hand rails which comply with ADA requirements shall be installed in each car, fabricated of stainless steel-clad tubing. One handrail shall be located in the middle of the front door entranceway to permit use by passengers boarding from the front door. The other two hand rails shall be located at the windscreens flanking the center door steps, in coordination with the wheelchair lift storage location. The hand rails shall be attached to the vertical stanchion at the windscreen and run diagonally down and attach to the windscreen. The design, arrangement of all stanchions and hand rails, for both seating arrangements, used on the car shall be submitted to CRRMA for approval.

4.5 WHEELCHAIR LIFT

The Contractor shall install a CRRMA approved wheelchair lift, with a capacity of no less than 660 pounds, at the center door area of each car. It is desirable that the intrusion into the rear stepwell area be minimized, and that the minimum number of seats be removed to accommodate the lift. The Contractor's carbody modifications necessary to accommodate the 660 pound capacity wheelchair lift shall be designed to support a future wheelchair lift that will have a capacity of 1,000 pounds.

It is solely the responsibility of the Contractor to propose, design, integrate and provide a fully ADA compliant and Technical Specification compliant wheelchair lift system. The below wheelchair system data is provided as information only, and CRRMA does not warrant that the noted models will or will not comply:

- A type of wheelchair lift system that appears to not require major car structural modifications may be available for consideration by the Contractor. The Ricon Mirage Model F9T is a horizontally extending unit that fits in the lowest center step riser. It requires approximately 7 feet of clear under car space behind the center steps. The Contractor shall present to CRRMA for approval, prior to the start of any modifications or integration efforts, a complete set of drawings and complete supplier information of the proposed method for installing the proposed wheelchair lift. As part of this process, the Contractor shall create a stress analysis (as defined in Section 3.16) demonstrating that the step well, carbody and ceiling structure modifications are sufficient to adequately support the approved wheelchair lift. All assumptions, load factors, material property values, all other stress analysis input data, and the results that demonstrate the structure is adequate and in compliance with these Technical Specifications, shall be submitted to CRRMA for approval.

As prescribed in ADA legislation, no width dimension shall be less than 34 inches; areas requiring 90 degree turns by wheelchairs shall have a clearance arc dimension of no less than 45 inches. In the parking area, where 180 degree turns are expected, space shall be clear within a full 60 inch diameter circle. Wheelchair footrest clearance of 12 inches above the floor surface shall be provided on the outside of turning areas. It shall be the Contractor's responsibility to ensure that the wheelchair lift, its installation, traverse areas and aisles from the wheelchair lift to the wheelchair parking areas, the wheelchair parking areas, and all other items associated with it comply with the requirements of ADA.

4.6 INTERIOR ACCESSORIES

4.6.1 DESTINATION SIGNS

The existing front roller curtain destination signs shall be removed and the existing front destination sign roller curtain boxes shall be discarded. The center divider shall be removed and connection points finished in a manner approved by CRRMA.

Any dash mounted run number sign shall be discarded and shall be replaced with the required new sign systems after being suitably modified to mount in the PCC car.

The side roller curtain destination signs shall be removed from the cars and discarded.

Replacement destination signs shall be Luminator SMT signs, or approved equal. The front sign shall be 16 x 120 Gen 4 with 1,920 LEDs. The right side sign shall be 8 x 64 Horizon with 512 LEDs (there shall be no left side sign). The front sign shall fit the existing opening within the PCC. The side sign shall each fit a single side window opening. These signs, their controls and displays shall be ADA compliant. The Contractor may propose for CRRMA consideration larger signs if such will still effectively interface with the PCC car dimensional constraints. See Sections 5.2.6, 5.3 and 5.3.33 for interior sign requirements.

4.6.2 PASSENGER STOP REQUEST

Passenger stop request pull cords shall be provided. They shall be of vinyl coated stainless steel cord, with an exterior bright yellow color. The cord switches and cab chime shall be similar to those used on COEP Sunmetro buses. Additional switches and pull cords shall be installed on each car located below the side windows in the wheelchair berthing areas across the aisle from the rear doorway. Each car shall have a CRRMA approved "Stop Requested" sign in accordance with Section 5.3.9.

4.6.3 SAND BOXES

The sanding system shall be converted to electric operation. The two sand boxes shall be dismantled, cleaned, inspected, remanufactured and new cover screens and covers shall be installed. The Contractor shall design and submit for CRRMA approval a new sanding hose arrangement which will permit rail on curves, in addition to tangent track, to be properly sanded. The sanding hoses shall be connected to a new attachment point located on the front truck. The sand traps shall be cleaned, inspected, remanufactured and tested for proper operation.

The sander solenoid valves shall be thoroughly cleaned, remanufactured and inspected for major external damage and corrosion that would prevent the valve from being successfully remanufactured and reused. The valve shall be tested for 1 megohm resistance to ground with a megohm meter at 500 volts. If the valve does not pass the ground resistance test, the coil as well as associated wiring and terminals shall be replaced with new. The valve shall be disassembled for inspection. If the internal wear is such that remanufacture can be successfully accomplished, then all seals, diaphragms, and springs shall be renewed. As part of the remanufacturing process, all corrosion shall be removed from the valve bodies. The valve body shall be primed and painted black per the requirements of Section 15. Upon installation on the car, new elastomeric flap "mudguards" shall be installed under the car both fore and aft of the sander assembly to

protect it from road splash. Any sander solenoid valves that cannot be remanufactured shall be replaced with a new valve of the same type or approved equal.

4.6.4 INTERIOR MIRRORS

New interior mirrors shall be provided at the front and center doors. Design, shape and location shall be as approved by CRRMA.

4.6.5 SCHEDULE BOXES

The Contractor shall provide and install new schedule boxes to be located near each doorway and on the rear face of the new Operator's partition. They shall be dimensioned to retain COEP and Sunmetro timetables and notices. The bottom center of each box shall be left open to prevent the collection of any debris. The top one-third of the timetable or notice shall be visible while in the box.

4.6.6 CAB ACCESSORIES

A new COEP approved Adams & Westlake, or approved equal, locking roller curtain sunshade with neutral gray mesh fabric shall be installed on both windshields. A new switch iron holder and a new farebox mounting plate shall be installed.

4.6.7 BICYCLE RACKS

- A. Bicycle storage racks of stainless steel or finished to match the car interior as supplied by Sportworks or approved equal shall be installed in all cars except 1511. They shall be installed across the aisle from the center doors and shall not share space with the wheel chair parking areas. Maintenance and parts shall be included in the maintenance manuals. The following components are required:
 - a. Tapping plate attached to the lower body frame.
 - b. Rack prism manufactured to include:
 - i. Wheel barrel roller;
 - ii. Wheel support;
 - iii. Two bushings per frame;
 - iv. One-way bearing for wheel retention; and
 - v. Top railer.
 - c. Mounting bracket.
- B. The bike racks shall accommodate three (3) bikes with two (2) wheels each.
- C. Load capacity shall be a minimum of fifty five (55) pounds in a central location of the bike rack. All hinges and pivot pins shall be stainless steel. There shall be no sharp corners to pose a safety problem for passengers.
- D. The bike rack shall be able to be deployed by a passenger with one hand, without additional assistance.

- E. Any support arms or locking device to hold the bike rack shall be constructed such that when the bike is being stored in the upright position it will not be necessary for the passenger to orient it beforehand.
- F. The bike rack shall accommodate all bicycles with a wheel size equal to or greater than sixteen (16) inches. This includes children's and mountain bikes.
- G. The bike rack components shall be easily stored out of the way when not in use to allow the area to be utilized by standee passengers.
- H. The bike racks shall not cause aisle interference when a bike is stowed.
- I. The system shall include a CRRMA approved method for securing the bottom wheel of the bike to eliminate swing.

4.7 CCTV

Each vehicle shall be equipped with a Closed Circuit Television (CCTV) system consisting of at least 5 exterior and 5 interior color cameras, digital video recorder (DVR), CCTV controller, cab displays and other ancillary equipment, as required. The video from all cameras shall be recorded at all times. The digital surveillance equipment shall be connected using an Ethernet network, independent of the Vehicle Control Network. The CCTV network shall use a mesh topology, where a single point network failure shall not cause any component within the system to fail. All cameras shall be color, and all video recorded shall be in color. All cameras shall be connected to the DVR using the CCTV Ethernet network. No switches are permitted between each camera and the DVR unless their use is verified by a network traffic analysis that demonstrates that CCTV data does not adversely affect the network, and vice versa.

~~The CCTV system shall provide automatic and manual, software adjustable, data transfer between the vehicle and wayside storage installations using a wireless data link; the wireless data link may be external to the CCTV system.~~

CCTV Workstation software shall be provided for installation on standard PC computers for uploading operating parameters (such as sampling rates), downloading of video data from the DVR, verification of authenticity, image and video enhancement, and similar processes. The interface connections to the DVR shall be Ethernet, arranged as a TCP/IP network connection. The software shall be Web-browser based, and compatible with common internet Web browsers, such as Internet Explorer or Mozilla Firefox.

The Contractor shall submit a CCTV Design Package to CRRMA for review and approval.

The camera locations, coverage, capacity, control software and arrangement shall be subject to approval by CRRMA.

4.7.1 EXTERIOR CAMERAS – TOTAL OF NO LESS THAN FIVE

In addition to the manual side-view mirrors for the train operator, CCTV shall enable the Operator to supervise the loading and unloading of passengers at all doorways of the car when the doors are open, and to verify that the doors on the car are clear of passengers.

In addition to the rearward facing cameras, the rear corners of the PCC shall include cameras that face forward looking along the sides of the cars.

(1) SIDE VIEW CAMERAS – TOTAL OF FOUR

Total of two cameras shall be placed on the front exterior corners of the PCC; one above the cab side window and one over or adjacent to the front doors to provide a clear view looking back along both the sides of the car. Cameras shall be enclosed in waterproof enclosures. Each of the rearward facing front exterior cameras shall be wired to a pair of color, LCD-based display screens located within the cab in CRRMA approved locations.

In addition to the rearward facing cameras (as defined above), a total of two cameras shall be placed on the rear corners of the PCC that face forward looking along both the sides of the cars.

(2) FRONT VIEW CAMERA(S) – TOTAL OF 1 OR 2

A single camera shall be placed near, below, above or behind the cab windshield (as approved by CRRMA) to provide a clear 180 degree view out of the front of the PCC to record video mimicking what the Operator would see. Camera shall be enclosed in a waterproof enclosure. If two cameras are required to provide the 180 degree coverage, then the Contractor shall provide two cameras to meet this requirement.

(3) CAB DISPLAYS – TOTAL OF 2

Color LCD monitors shall be placed on each side of the cab console in CRRMA approved locations, connected to the camera for the matching side. Displays shall be backlit for night-time use and shrouded to prevent wash-out during bright conditions. Display screens shall be a minimum of 8 in (200 mm), diagonally, with pushbutton controls for contrast and brightness.

4.7.2 INTERIOR CAMERAS – TOTAL OF NO LESS THAN FIVE

Each vehicle shall be equipped with enough interior color surveillance cameras, but no less than 5, mounted to provide complete coverage of all passenger areas, including all door openings looking out to the platform. One camera shall be installed in the ceiling near the front door looking backward within the passenger compartment, one camera shall be installed in the ceiling near the rearmost portion of the vehicle looking forward within the passenger compartment, one camera shall be installed in the ceiling near the right side destination sign looking towards the Operator, one camera shall be installed in the ceiling across the aisle from the center door facing the center door, and one camera shall be installed in the ceiling near the Operator facing the front door. If necessary, the Contractor shall install additional cameras to ensure full video coverage of the interior.

4.7.3 CCTV CAMERAS – INTERIOR AND EXTERIOR

Each camera shall record High Definition video, having a minimum resolution of 1.1 megapixels (1280x800), 16.7 million colors, and use MPEG-4/MJPEG compression, or better, such as H.264 compression. The cameras shall have a maximum frame rate of 30 fps using MPEG-4, 15 fps using MJPEG compression. The frame rate and bandwidth for each camera shall be controllable, using the CCTV controller.

4.7.4 DIGITAL VIDEO RECORDER

The following events shall trigger high resolution recording at an increased frame rate, the resolution and frame rate shall be software adjustable, using a PTU.

- Distress Signal over the radio
- Emergency brake application
- Passenger door emergency release activation
- Incident Alarm switch activation

The DVR shall be able to store no less than ~~1421~~ days worth of CCTV recorded video, computed using a minimum: 16 hours per day, image resolution 1280x1024, 15 fps, and high quality compression; the DVR shall have a minimum capacity of ~~24~~ terabytes (TB). Sunmetro currently uses Radio Engineering Inc. (REI) for the provision of CCTV systems on their bus fleet.

The used/unused capacity of the DVR shall be viewable, using the CCTV controller, by maintenance personnel.

The recording method shall include an approved authentication process to detect any alteration of the data after recording.

The DVR shall have hot-swappable non-volatile memory storage (hard-disk), with a simple, standard (Ethernet) plug-in arrangement for playback on a standard laptop PC. Recording shall be active whenever the vehicle auxiliaries are turned on.

It shall be possible for CRRMA to remove the hot-swappable memory storage device, replace it with a new memory storage device and return the vehicle to full operation without the need for reprogramming. The removed storage device shall be easily connected via Contractor provided cables or an interface unit to standard desktop or laptop computers to allow seamless interface with a Contractor provided software application. Once connected to the computer and the software application is opened, it shall be possible for CRRMA to easily view, stop, pause, and edit any and all video files from the memory device. The PCC car number from which the memory device was removed shall be imprinted on the video and displayed within the software application. It shall be possible for CRRMA to cut and otherwise edit any video file down to smaller video files with specific start and stop times and allow conversion to standard video formats so as to allow viewing on standard desktops or laptops via the use of standard video viewing applications such as RealPlayer, QuickTime, MediaPlayer or similar.

4.8 EXTERIOR ACCESSORIES

4.8.1 WINDSHIELD WIPERS AND WASHERS

The air windshield wiper motor and gearing shall be discarded. It shall be replaced by a new linear motion electric unit carrying two vertical wiper blades at each windshield panel. The geometry shall replicate the original installation. A windshield washer system shall be installed as detailed in Section 12.8. The design shall be approved by CRRMA.

4.8.2 HEADLIGHT WINGS

The existing bright metal headlight wings shall be cleaned, remanufactured and restored for reinstallation. Alternatively, new stainless steel "wings" similar in styling to those used on the cars as-delivered shall be provided as ornamental trim surrounding the headlight if such is approved by CRRMA. The "wings" shall be installed using stainless steel tamper proof fasteners.

4.8.3 EXTERIOR MIRRORS

A new left side exterior mirror of a CRRMA approved design shall be added to each car, which shall be foldable to allow the Operator to reach through the sliding sash window and manually pull the mirror to within the body clearance envelope when required.

A new right side mirror of a CRRMA approved design shall be located to allow the Operator to view along the right side of the car through the right windshield shall be installed.

4.8.4 GONG

The gong shall be cleaned and inspected for obvious defects and damage. The gong shall be functionally tested to assure that it works properly and produces the proper sound. All defects that impair the operation of the gong shall be remanufactured by replacing the defective part. Dented gongs shall be straightened. New gongs shall be provided as necessary to equip the complete fleet as part of Base Work. New gongs shall be as approved by CRRMA.

4.8.5 HORN

A horn suitable for El Paso city traffic conditions shall be added to each car and shall be of a "railroad or transit" type. It shall have a pleasing yet authoritative sound, and such sound shall be proposed to CRRMA for approval. The horn shall be located under the cab floor and oriented to project its sound forward from the car. The horn shall be electronic and its controls shall accommodate software modifications to sound intensity, tone, and sequence.

4.8.6 LIFE GUARD

The existing front life guard shall be reconditioned, restored and remanufactured. Any missing guards, parts, or badly worn assemblies shall be replaced with new items matching the original form fit and function.

The front life guard hinged panel serves to sense something being at risk of being run over by the PCC. When deflected back, it releases the rear panel to drop and slide on the rail head and/or pavement to prevent the item from getting under the car wheels. In addition to the front panel release, an Operator initiated drop release shall be added. It may be a simple pull handle on the Operator's area floor or other Contractor proposed means.

The original PCC specification requirement for Operator capability to prevent the rear panel dropping as an aid in operation with deep snow shall not be provided.

4.8.7 SIDE WINDOW GUARDS

The six bar horizontal side window guards shall be replaced in-kind with stainless steel units of similar design. Car body attachment shall replicate the original installation, and shall not include any hinges or similar hardware, but be securely mechanically fastened to the carbody in a CRRMA approved manner.

4.9 SIGNS AND MARKINGS

The Contractor shall be responsible for providing bilingual (English and Spanish) vinyl color striping, lettering, instructions, warnings and all other signs for each car. Signs and markings shall be in accordance with CRRMA and Sunmetro standards for transit bus signage. The signs are of great importance, and a complete signage drawing and bill of material for the interior and exterior of the car identifying all details shall be submitted to CRRMA for approval prior to the ordering of any material. All vinyl signs and markings shall be suitable for use in transit vehicle service. Unless otherwise specified, all metal signs and identification plates shall be engraved and black paint-filled stainless steel plates attached by stainless steel rivets. CRRMA does not allow any exterior advertising for the manufacturer; therefore, no nameplate or logos will be permitted on the car exterior.

The cab console switch nameplate shall be revised and updated as necessary to reflect any changes in switch functions to integrate with new switches and devices as required by these Technical Specifications. Labeling material shall be equal in durability to that of the original design. All added equipment in the cab shall have a permanent nameplate attached. All circuit breakers, switches, fuses, cutouts and the like shall have permanent nameplates included in their respective electrical lockers. A complete switch nameplate and label drawing of the car identifying all details shall be submitted to CRRMA for approval.

4.10 TOWBAR

The towbar shall be removed from each car, cleaned and inspected for cracks or any other damage and remanufactured. If any towbar is either missing or too badly damaged to permit its remanufacture, the Contractor shall replace it with an identical new unit. Each towbar shall be primed and painted a safety yellow color, or other color as approved by CRRMA. Each PCC shall be delivered with one towbar installed within the storage tube.

A new towbar storage tube shall be added on the rear underside of the car. A new securement pin to store the towbar shall be installed on each car, and shall include a new chain welded to the securement pin to keep it captive to the car.

EL PASO STREETCAR REMANUFACTURE OF PCC CARS

SECTION 5 - COMMUNICATIONS

5.0 COMMUNICATIONS

5.1 GENERAL

The PCC cars do not include any electronic communications devices, nor are there any provisions (enclosures, electrical connections, etc.) to facilitate their introduction into the car.

The Contractor shall install within each remanufactured PCC car a vehicle communication system which shall include:

- On Board Transit Operations Management and Communications System (TOMAC)
- Next Stop Passenger Information System
- Public Address System (PA)
- Train to Wayside (TWC): VETAG - Remote track switch selection system
- CCTV Monitoring (see Section 4.7)
- WiFi

All communication systems specified shall be energized from battery voltage through appropriately sized circuit breakers, one for each system or more than one for each system as appropriate. They shall function satisfactorily for any duration at any continuous voltage between the range defined in IEEE STD 1476 for a 24 volt dc system, measured at the battery, and shall not be damaged or operate in an unsafe manner by the continuous application of voltages between 0 and the minimum voltage of the range defined in IEEE STD 1476 for a 24 volt dc system. Their installation shall be designed to provide sufficient capacity to meet all peak power requirements.

Switches and relays shall be conveniently located and identified as approved by CRRMA. They shall be service proven, ruggedly constructed, with contacts which provide ample wiping contact. Transient filter protection shall be an integral part of the equipment and shall provide adequate protection from transients. All terminals and wires shall be properly identified.

The Contractor shall provide power, all wiring, connectors, enclosures and suitable installation hardware for all communications equipment.

5.2 ON BOARD TRANSIT OPERATIONS MANAGEMENT AND COMMUNICATIONS SYSTEM (TOMAC)

5.2.1 GENERAL

- (1) An on-board TOMAC system shall be furnished, installed, and tested in each vehicle. The on-board TOMAC system shall be provided as a complete integrated system including the mobile radio subsystem, mobile data terminal (MDT), integrated vehicle logic unit (IVLU), automatic passenger counters (APC), annunciation system, interior information signs, destination signs, speakers, ambient noise microphone(s), local control microphone that are required for an on-board Intelligent Transportation System (ITS). The CRRMA and COEP currently use the Trapeze System, and the Contractor shall provide a similar system or approved equal.

- (2) The Contractor shall be responsible for providing all wiring, cabling, conduits, connections, power circuits, and structural mounting necessary for a complete and fully operational TOMAC system. The TOMAC manufacturer shall certify the installation of all equipment within all PCCs and provide written compliance of installation and operation before the first car is shipped to CRRMA. This certification shall be included with the request for shipping release.
- (3) The vehicle wiring and infrastructure that supports the ITS hardware and software infrastructure shall comply with the National Transportation Communication for ITS Protocol (NTCIP) COBRA and TCIP compatibility.
- (4) The communications between system components shall be via the PCC Vehicle Area Network (VAN) that shall be based on the latest SAE J1939 and J1708 protocols and other applicable standards for physical, data and software interconnects.
- (5) The system components shall operate in the vehicle without degradation due to shock and vibration encountered during normal service.
- (6) The system components shall operate reliably within an ambient temperature range of -22 °F to +128 °F.

5.2.2 MOBILE RADIO SUBSYSTEM

- (1) The mobile radio subsystem shall be designed to function with the existing COEP transit bus radio system that is presently employed by COEP and Sunmetro to control and coordinate bus operations.
- (2) In the event of a failure of the auxiliary power supply or of the 600 volt dc trolley wire power, the radio shall continue to function with full capabilities under emergency battery power for a minimum of 1 hour. See Section 11.6.

5.2.3 INTEGRATED VEHICLE LOGIC UNIT (IVLU)

- (1) The IVLU in conjunction with the MDT shall be the core component of the on-board TOMAC system that shall be designed based on an open architecture and design of industry-standard SAE interfaces integrated within the unit.
- (2) The IVLU shall be ITS ready providing real-time over-the-air full fleet management including advanced ADA annunciation, APC and fare collection.
- (3) The embedded and integral functions of the IVLU shall include, but not be limited to, Automatic Vehicle Locator (AVL) system, Transit Signal Priority (TSP) system, Schedule and Route Performance Monitoring, Vehicle Maintenance Monitoring, and built-in interfaces for peripheral devices including destination sign, automatic passenger counters, and fare collection units.
- (4) The IVLU shall also include a built-in Global Positioning Satellite (GPS) receiver, wireless LAN (WLAN) interface, radio antenna, and Public Address amplifiers.
- (5) All associated control and management software applications shall be provided. Memory for the system shall be contained in a credit card sized, non-volatile memory device in the PCMCIA format. The system shall not require the use of

batteries or other voltage sources for memory retention. The system shall be capable of storing up to 60 megabytes of memory data without hardware modification.

- (6) On-vehicle reprogramming shall be accomplished in a single step process by plugging a "master" memory card into a slot allowing automatic transfer of data to the system.
- (7) The IVLU shall be Continental ITS Controller or approved equal.

5.2.4 ON-BOARD AUTOMATIC VEHICLE LOCATOR (AVL) SYSTEM

- (1) The navigational GPS system embedded within the IVLU shall be capable to provide the precise vehicle position, time, and heading as part of the AVL system of the IVLU. It shall be compatible with, and seamlessly integrated with the COEP and Sunmetro existing Continental TransitMaster CAD/AVL system located at the COEP Central Control Facility.

5.2.5 ON-BOARD TRANSIT SIGNAL PRIORITY (TSP) SYSTEM

- (1) The on-board TSP system emitter shall be wired and mounted on the roof of the PCC with the capability to automatically initiate requests for priority at properly signalized intersections. The provided system on the PCC shall be fully compatible with the CRRMA and COEP existing system and infrastructure.
- (2) Contractor shall follow the emitter Original Equipment Manufacturer (OEM) instructions for wiring and mounting.

5.2.6 ON-BOARD ANNUNCIATION SYSTEM

- (1) The on-board annunciation system shall be an audible and visual transit messaging system designed to comply with ADA requirements for the communication of essential information to passengers.
- (2) The system shall be capable to use prerecorded route and stop messages for automatic playback over the interior information signs and PCC speakers when vehicles reach specified stops or intersections.
- (3) The interior information sign shall also function as a "Stop Requested" sign. This stop requested message is automatically mixed with other active messages. The stop requested message shall clear when the vehicle door opens.
- (4) The interior information sign shall also function as a "Please Exit Through Rear Doors" sign. The stop requested message shall be displayed first, then the interior information sign shall scroll to "Please exit through rear doors." The "Exit" message shall clear when the vehicle doors open.
- (5) The interior speakers shall also announce "{CHIME} Stop Requested" the first time a passenger activates the system, if such is programmed by CRRMA.
- (6) The Operator shall have the capability to repeat the last announcement when desired.

- (7) The Operator shall have the capability to select a message for immediate announcement and/or display via pre-defined announcement buttons. This function shall not interfere with the normal next stop functions.
- (8) The Operator shall have the capability to display Public Relations messages that are automatically mixed with normal messages.
- (9) Control of the signs and audio shall be integrated into the IVLU that shall be easy to operate, maintain, and modify for future route expansion and modification.
- (10) The microphone and controls shall be provided and located in the driver's compartment. A minimum of eight (8) interior surface mounted high quality speakers with mesh grilles, shall be provided, staggered in the PCC ceiling from the front to rear. Two (2) weatherproof, surface mounted speakers shall be located outside the vehicle at the front and center doors (one per doorway). The outside speakers shall be operated ~~separately through a foot-operated control switch mounted at a location approved by CRRMA~~ via the Mobile Data Terminal (MDT) described in TS Section 5.2.1.
- (11) The interior information sign shall be Trapeze Next Stop Announcement Sign or approved equal.

5.2.7 ELECTRONIC DESTINATION SIGN SYSTEM

- (1) Refer to Sections 4.6.1 and 5.3 for the provision of the Electronic Destination Sign System.

5.2.8 ON-BOARD AUTOMATIC PASSENGER COUNTERS

- (1) Three PCCs, selected by CRRMA, shall be equipped with on-board Automatic Passenger Counters (APC) to improve operational efficiencies by providing highly accurate passenger counts that shall support standard J1708 interface with the IVLU. The remaining vehicles shall be wired to accommodate future installation of the APC equipment.
- (2) The APC shall be by TransitMaster or approved equal.

5.3 NEXT STOP PASSENGER INFORMATION SYSTEM

- 5.3.1 The Contractor shall provide a Trapeze Service utilizing Next Stop and Next Stop Manager, semi-automatic next stop passenger information system, or approved equal, providing audio and visual destination and next stop information to the passengers on the vehicle as well as those waiting to board curbside; and integrate with the vehicle's intelligent transportation system.
- 5.3.2 Control of the signs and audio shall be integrated into a single, multi-function system that is easy to operate, maintain, and modify for future route expansion and modification. Included in the integration shall be the control of the destination signs and interior next stop information sign. Additionally, this integration shall allow for the CRRMA and COEP ITS system to operate the signs and audio as required.

- 5.3.3 The integrated system shall operate automatically once the Operator initializes the system by selecting the desired destination code.
- 5.3.4 The system shall allow the vehicle to comply with the Americans with Disabilities Act.
- 5.3.5 The system shall sequence through preprogrammed announcements when the operator pushes the announce button.
- 5.3.6 The system shall announce and display inside the vehicle, information regarding upcoming stops, major intersections, and transfer points, to adequately orient hearing or visually impaired passengers as to their progress along the route. The system shall be adequate to project messages as needed in addition to any ADA requirements. It must be able to handle longer messages, music, and voice inflection without audio distortion.
- 5.3.7 The system shall display the route and destination information on the outside of the vehicle and announce this information outside near the entrance door when the door opens.
- 5.3.8 Announcements shall be automatically directed to the interior and/or exterior speakers. The announcement volume shall be automatically adjusted to compensate for both internal and external ambient noise levels.
- 5.3.9 The interior information sign shall also function as a "Stop Requested" sign. This stop requested message is automatically mixed with other active messages. The stop requested message shall clear when the vehicle door opens.
- 5.3.10 The interior information sign shall also function as a "Please Exit Through Rear Doors" sign. The stop requested message shall be displayed first, then the interior information sign shall scroll to "Please exit through rear doors." The "Exit" message shall clear when the vehicle doors open.
- 5.3.11 The interior speakers shall also announce "{CHIME} Stop Requested" the first time a passenger activates the system, if programmed by CRRMA.
- 5.3.12 The Operator shall have the capability to repeat the last announcement when desired.
- 5.3.13 The Operator shall have the capability to select a message for immediate announcement and/or display via pre-defined announcement buttons. This function shall not interfere with the normal next stop functions.
- 5.3.14 The Operator shall have the capability to display Public Relation messages that are automatically mixed with normal messages.
- 5.3.15 The system shall control all interior and exterior displays. The system shall be capable of adding additional signs to the communications network without rewiring existing equipment.
- 5.3.16 The Integrated System Control Unit (ISCU) shall contain all critical system logic:
 - (1) Integrated voice annunciation

- (2) Ambient noise sensing
 - (3) Sign control
 - (4) System memory
 - (5) Integrated public address sub-system
 - (6) Additional asynchronous serial interfaces
- 5.3.17 The ISCU shall use plug-in circuit cards to reduce the on-vehicle Mean-Time-To-Repair. Each card (other than GPS Receiver) shall use ejectors or other devices to facilitate easy removal. Each card shall use LED indicators or other aids to simplify system troubleshooting.
- 5.3.18 The system logic unit shall be modular such that additional interfaces, additional memory beyond 20 megabytes, or other features may be added in the future.
- 5.3.19 Memory for the system shall be contained in a credit card sized, non-volatile memory device in the PCMCIA format. The system shall not require the use of batteries or other voltage sources for memory retention.
- 5.3.20 The system shall be capable of storing up to 20 megabytes of memory data without hardware modification.
- 5.3.21 On-vehicle reprogramming shall be accomplished in a single step process by plugging a "master" memory card into a slot allowing automatic transfer of data to the system.
- 5.3.22 Audio announcements shall be initiated at any point along the route as directed by the Operator. Each announcement shall be designated as interior and/or exterior.
- 5.3.23 The volume for each announcement shall be automatically set, based upon analysis of the ambient noise level.
- 5.3.24 All volume settings shall be digitally set to guarantee consistent volume throughout the fleet. Each announcement shall be capable of being set to a unique volume setting.
- 5.3.25 The Audio Announcement Sub-system shall use the vehicle Interior Public Address (IPA) speakers. Weatherproof exterior speakers in an all-metal housings shall be supplied. The IPA shall provide the following features:
- (1) Two audio amplifiers, one for the interior speakers and one for the exterior speakers.
 - (2) An Operator's microphone that overrides any ongoing announcement when activated.
- 5.3.26 The vehicle's volume control and speaker select switch shall only affect PA operation when the PTT (Push-to-Talk) button is pushed.
- 5.3.27 An additional vehicle PA system is not required; this facilitates the Operator's override function that may not be available if more than one PA system is used.

- 5.3.28 The Contractor shall provide all of the necessary hardware and software to record announcements and program signs for the Next Stop System.
- 5.3.29 Initial system programming shall be provided by the Contractor.
- 5.3.30 A programming software package shall be provided to generate message lists for the vehicle interior and exterior signs. The programming software shall operate on an IBM PC compatible computer that allows the programming of PCMCIA memory cards.
- 5.3.31 The system shall operate reliably within an ambient temperature range of -22 °F to +128 °F (excluding fluorescent lamps, if applicable, that must start when the vehicle interior temperature reaches 32° F or higher).
- 5.3.32 The equipment shall operate in the vehicle without degradation due to shock and vibration encountered during normal service.
- 5.3.33 The Contractor shall provide an additional double sided, ceiling mounted scrolling electronic sign that is integrated into the system. This sign shall be capable of being programmed with text-based messages to inform passengers of CRRMA information. The sign shall be installed in a location that affords passengers from all areas of the car to see the sign. The Contractor shall propose the method of creating, changing and uploading the messages.

5.4 PUBLIC ADDRESS SYSTEM

5.4.1 GENERAL

The public address (PA) system shall allow one-way voice announcements from the Operator to passengers in the car, and to boarding passengers outside the car. The Contractor shall supply and install all equipment necessary to meet this requirement. The system shall be muted when not in use. The public address system shall measure ambient noise level and compensate accordingly. The peak sound level shall be easily adjustable.

5.4.2 AMPLIFIERS

The public address system amplifier and associated components shall be mounted together in a dust proof enclosure behind an access cover. The unit shall be completely transistorized with modular construction. Provisions shall be made for securing the unit with the Standard Key of Section 2.11.

The amplifier shall be mounted so that it can be removed from the front of the enclosure without requiring access to the rear of the enclosure. The gain controls shall be adjustable from a well indicated location, and in a restricted access in the amplifier enclosure. Complete test and adjustment procedures shall be provided in the appropriate maintenance publication. The amplifiers and their mounting shall be approved by CRRMA.

The pre-amplifier shall contain a compressor-limiter section which shall produce a minimum compression range of 18 dB with a maximum output level variation of 2 dB and a maximum total harmonic distortion of 3 percent at the compressor output. The output shall be at a minimum 14 dBm for a nominal 600 ohms impedance.

The power amplifier shall be capable of delivering 35 watts at not more than 1 percent total harmonic distortion in the range of 100 to 8,000 Hz within the voltage operating range specified in Section 5.1.

The amplifier unit shall have transient voltage spike protection for up to 3.0 kV peak pulse with total energy of 90 joules. With speech input, the amplifier shall operate continuously with full output, at rated voltage, without damage to any components.

5.4.3 SPEAKERS

A minimum of ten (10) public address speakers shall be installed on each car. Minimum of eight (8) internal speakers shall be located in the ceiling of the passenger area, evenly spaced longitudinally and alternately mounted on opposite sides of the car. Two (2) weather-resistant exterior speakers shall be located on the right exterior side of the car, one at each side doorway.

The speakers shall be transportation grade, direct radiating, and permanent magnet field type capable of handling the required audio power. The frequency response with proper enclosure shall be plus or minus 5 dB from 100 to 8,000 Hz. The nominal axial sensitivity shall be at least 87 dB at 4 feet with 1 watt input, and the speakers shall have a wide dispersion characteristic.

All loudspeaker assemblies shall have a low profile speaker and a 70 volt line matching transformer rated at 10 watts. Power taps shall be 10, 5, 2, 1, and 0.5 watt. The secondary of the transformer shall properly match the voice coil of the speaker. The primary of the matching transformer shall be connected to the audio distribution network by means of a two conductor cable. The transformer end of the cable shall be arranged to permit connection or reconnection of the conductors to any two of the taps. The entire loudspeaker shall be designed and constructed to tolerate frequent exposure to moisture. Alternate approaches can be utilized so long as the proposed system has the ability to adjust the balance of the audio within the car, and such systems do not adversely affect maintenance efforts.

The speakers shall be phased so that when the primary is connected to the distribution network, all speaker cones shall move in the same direction at the same time. During public address announcements the speakers shall be properly balanced for equal sound level distribution throughout the car interior and eliminate feedback noise to the Operator microphone.

Each interior speaker shall be protected by a stainless steel or plastic enclosure designed to adequately protect the speaker from the effects of dust, moisture, ferrous materials or other foreign objects. The enclosure shall include knockouts and gaskets for the dust-tight entrance of the speaker connection leads and shall prevent mechanical resonances or vibrations from occurring. The speakers shall be mounted behind an approved flush baffle of stainless steel satin finished metal or integrally colored plastic material, matching the decorative treatment of the car. Tamper-resistant stainless steel mounting hardware shall be used. The mounting of the interior speakers shall be aesthetically pleasing and allow easy removal of the speaker for repair or replacement.

The exterior speakers shall be mounted behind a robust stainless steel grille resistant to thrown objects. They shall be a waterproof, dynamic reflex horn

designed for extreme outdoor environmental conditions, and the front surface of the horn shall have a gasketed flange for flush mounting into the carbody.

The mounting of the external speakers shall not allow water to leak into the carbody, shall be aesthetically pleasing and allow easy removal of the speaker for repair or replacement. The speaker locations and grilles shall not violate the outline limits defined in this Technical Specification. The exterior speakers shall be immune to the chemicals and detergents normally used during vehicle washing and shall not interfere with or damage the mechanical car wash components.

5.5 VETAG

The Contractor shall supply and install the Vapor Corporation/Phillips Telecommunications Industries/VECOM USA VETAG system components, or approved equal, for the remote selection of track switches and other possible future applications. The console mounted controls shall include the programming and functions to enter the maintenance area, any storage tracks, and the two revenue service loops. Additional interfacing to traffic control apparatus shall be provided for signal coordination.

The equipment for each car shall include a variable code transponder, a code control box, and a multiconductor connecting cable. A VECOM USA HP-2T transponder, transponder, Vapor Corporation Part No. V2883621928536042, or approved equal, weighing approximately 4.41-5 pounds and measuring approximately 8 inches by 5 inches by 5 inches, shall be mounted according to the manufacturer's instructions underneath the Operator's cab of each car, and shall be accessible and removable from under the car. The transponder shall be connected via multiconductor cable to the code control box, Vapor Corporation Part No. 288X6134, or approved equal, weighing approximately 3 pounds and measuring approximately 8 inches by 3 inches by 6 inches, mounted on the Operator's console in a location approved by CRRMA. The receiver coil shall be mounted from the car body approximately 10 inches above the rail on the center-line of the car and in front of the leading (front) truck. The Contractor shall coordinate with CRRMA and its wayside installer to locate and adjust the PCC installed transponder to properly interface with the track installed elements of the system.

Power for the VETAG equipment shall be taken from the low voltage dc power supply and shall be protected by its own circuit breaker. Power shall be supplied whenever the car is in an operational mode and shall be unpowered when the car is in a storage mode.

5.6 WIFI

Each PCC shall include a fully functional WiFi system to provide internet access to passengers. Coverage shall be sufficient to provide WiFi access to all seating and standing areas of the vehicle. The Contractor shall be responsible for providing all wiring, cabling, conduits, connections, power circuits, and structural mounting necessary for a complete and operational WiFi system and shall fully integrate all necessary components into the PCC to facilitate the provision of WiFi as defined. The Contractor shall work closely with the subcontractor of the WiFi system during design, integration and test, and shall provide a written letter prepared by the WiFi subcontractor confirming that all installations and integration methods meet their requirements. This letter of written compliance shall be provided before the first car is shipped to CRRMA. This certification shall be included with the request for shipping release. The WiFi system shall be In Motion or approved equal and shall include the following components and elements or approved equal:

- On Board Mobile Gateway 2040 - with GPS, 802.11b/g AP, 802.11a/b/g/n Client, 4-Port Switch, Sunmetro Package
- Hardware Upgrade: Verizon LTE radio (installed at factory)
- Network Security: On Board Connection Manager Software License (per Additional Unit)
- On Board Mobility Manager Enterprise Core Software License (per Additional Unit)
- oMG Platinum Extended Support (Appliance) - 2 Years
- Web Protection Service - McAfee SaaS (per oMG) - Years 1 and 2
- Antenna: Bolt Mount, White, GPS, 3G/LTE dual MIMO, 802.11a/b/g/n dual MIMO, 15' Detachable Cables
- Antenna: Screw-on, White, Wi-Fi 2.4GHz patch (SM20W-R0)

EL PASO STREETCAR REMANUFACTURE OF PCC CARS

SECTION 6 - LIGHTING

6.0 LIGHTING

6.1 GENERAL

The existing interior and exterior lighting fixtures shall be removed from the cars. They shall be replaced with new fixtures as indicated. All existing wiring and terminations shall be removed and discarded, and replaced with new wiring. Existing 600 volt dc lighting circuits shall be revised to operate from either 120 volt ac or 24 volt dc as indicated. In all cases for new fixtures or lights, each fixture shall be designed to provide ease of installation, cleaning, lens, lamp or LED change-out, adjustments, and housing removal. Lamp access shall be by gasketed enclosure covers secured by captive stainless steel fasteners. Fixtures installed on the car exterior shall be watertight. All fixtures shall be dust proof to minimize the accumulation of dirt within the fixture.

6.2 INTERIOR LIGHTING

All interior light fixtures shall be removed. They shall be replaced with new fixtures replicating the original in external appearance. Each ceiling light assembly shall be located as the original. Each shall contain an LED array and suitable reflectors, reflective spectrum modifiers and hardware to replicate the original "bulls eye" look. The bezels shall be chrome plated to match the original appearance. The interior lighting fixtures shall be installed on the cars using new lamps, new heat-resistant fiber seals, new gaskets and new stainless steel fasteners. Lighting shall be controlled as detailed in Section 6.4.

6.2.1 REVISION OF SUPPLY VOLTAGE

The PCC cars currently operate the interior lighting incandescent fixtures from a 600 volt dc series circuit switched directly at the cab console, and the lamp socket for each bulb contains a shorting bar. The Contractor shall revise each car's lighting system by discarding the equipment associated with the 600 volt dc lighting circuit.

Eight of the interior light fixtures (four center ceiling fixtures, and two each at the front doorway ceiling and the center doorway ceiling) shall be revised to serve as emergency lights. They shall be independently powered from the 24 volt dc low voltage power supply and battery.

All other interior light fixtures shall be revised to use 120 volt ac supplied from the new auxiliary power inverter. These interior lights shall be relay switched controlled by an Operator cab console switch.

All lamp fixtures following remanufacture shall pass a megger test to verify electrical integrity at 1,000 volts for a minimum of 1 megohm resistance to ground.

6.2.2 OPERATOR'S CAB LIGHT

Two new ceiling mounted focused beam reading light fixtures, operating from the 24 volt dc low voltage power supply, shall be installed in the Operator's cab. Both fixtures shall use a single lamp. One fixture shall be used as an Operator's reading light (Cab Light),

and the second fixture shall have a red glass color filter for use to illuminate the Operator's console (Panel Lights). These lights shall not reflect onto the windshield when in use.

6.2.3 DESTINATION SIGN LIGHTS

The existing incandescent lighting system for the destination signs and run number sign shall be rewired and converted for operation ~~using 120-volt ac, similar to the interior lighting fixtures,~~ as required to interface with the new destination and run number signs.

6.3 EXTERIOR LIGHTS

The exterior of each car shall have its lighting system upgraded, remanufactured and modernized as described below to meet the requirements of current USDOT Federal Motor Vehicle Safety Standard number 108, except as described otherwise. New exterior lighting fixtures shall be installed on each car. All exterior lights shall be incandescent or LED and shall operate from 24 volts dc, except the headlight which shall operate from 12 volts dc or 24 volts dc. All fixtures shall be installed using new lamps, new gaskets and seals, and new stainless steel fasteners. Lighting shall be controlled as detailed in Section 6.4. The location, LED or incandescent lamp types, and installation method shall be subject to approval by CRRMA.

6.3.1 HEADLIGHT

The existing headlight on the car shall be modernized and remanufactured to use an automotive high/low sealed beam lamp. The fixture assembly shall be remanufactured and reused. The headlight assembly shall be carefully removed, cleaned and inspected. Any headlight assembly which is defective shall be replaced. The headlight assembly shall be reinstalled on the car using a new lamp, and new stainless-steel fasteners. The headlight shall be adjusted so that the high beam intersects the running rails 400 feet from the vehicle on level track.

6.3.2 TAIL LIGHTS

Two new red LED tail lights meeting SAE J585e requirements intended for streetcar or bus service shall be installed below the stop lights and directional lights, in a location outboard of the battery box, and mounted with new fasteners. The tail lights shall emit a red light that is plainly visible in clear weather from a distance of at least 500 feet to the rear of the vehicle.

6.3.3 MARKER LIGHTS

New front and new rear 20 watt equivalent LED type amber and red marker lights meeting SAE J592e requirements shall be located as follows:

- 2 amber lights on front, 2 red lights on rear, to indicate the overall width of the vehicle, outboard of the location of the existing marker lights;
- 1 amber light on each side sheet, above side rub rail just inboard of front anticlimber flush mounted;
- 1 red light on each side sheet, above side rub rail just inboard of rear anticlimber flush mounted;

- 1 amber light on each side, at the approximate midpoint of the vehicle, above roof gutter.

6.3.4 STOP LIGHTS

The existing stop light assemblies shall be removed. They shall be replaced in the same location with two new red LED stop lights meeting SAE J1398 requirements intended for streetcar or bus service and mounted with new fasteners. The stop lights shall be capable of producing at least 150 percent of the intensity of the taillights.

In addition to the two stop lights described above, a rear "Stop LED Strip" shall be added at the back of the car. It shall be consistent with the Sun Metro bus fleet installation.

6.3.5 DIRECTIONAL INDICATOR LIGHTS

Two directional indicator lights (turn signals) using new amber LED lamps shall be installed on the front and rear of each car. They shall be located as far apart as practical and below the window belt rail. Additional new amber LED "beehive" lamps shall be located aft of the center door opening on the right car side and correspondingly on the left car side.

6.3.6 DOOR STATUS LIGHT

A pair of new 20 watt equivalent LED "beehive" red door status lights shall be located on the right car side to the rear of the center door opening. They shall be located so as to be visible to automotive traffic as a warning when any door is open.

6.3.7 BACK UP LIGHTS

Two new white back-up incandescent warning lights shall be installed on the rear of the car, located below the tail lights.

6.3.8 REFLECTORS

New reflex reflectors meeting SAE J594f requirements shall be flush mounted on each car as follows:

- 2 red reflectors on the rear, as far apart as possible, mounted below the back-up lights;
- 1 amber reflector on each side sheet, mounted inboard of the amber side marker light;
- 1 red reflector on each side sheet, mounted inboard of the red side light;
- 1 amber reflector on each side sheet at the approximate midpoint of the vehicle, mounted below the belt rail.

6.4 LIGHTING CONTROL

New switches shall be provided on the cab console (unless otherwise indicated) for lighting control as follows:

- A. Headlight: a new 3-position switch identified as HEADLIGHT shall be provided. In the HIGH (top) position the headlight shall be on high beam, and in the LOW (middle) position the headlight shall be in the dipped beam, with the tail lights and marker lights being illuminated whenever the switch is in either of these two positions. The third (bottom) position shall be OFF which shall extinguish the headlight, tail lights and marker lights. A cab console green LED indicator shall indicate when high beam is in use. The switch shall be functional whenever the car is in the STANDBY or RUN position.
- B. Interior Lights: a new 2-position switch (OFF, ON) shall control the interior lighting, including the four center ceiling lights, lights over the front doorway, the lights over the center doorway, the destination sign lighting, and the run number box lighting by means of relay switching, whenever the car is in the STANDBY or RUN position. In addition, when either front door is opened, the two front doorway lights shall illuminate.
- C. Front Door Lights: a new 2-position switch (OFF, ON) shall control the two front doorway lights to allow them to illuminate if the front doors are open, whenever the car is in the STANDBY or RUN position.
- D. Turn Signal: a new 3-position horizontal switch (LEFT, OFF, RIGHT) shall control the directional indicator lights and respective winker lights, whenever the car is in the STANDBY or RUN position. A green LED cab console indicator shall indicate when the switch is in use. In addition, a cab beeper, as approved by the CRRMA, shall sound when this switch is in use.
- E. Hazard Lights: a new 2-position switch (OFF, ON) shall, when ON, flash all car turn signals on both sides, whenever the car is in the STANDBY or RUN position. In addition, the turn signal LED cab console indicator and cab beeper shall function when this switch is in use.
- F. Cab/Panel Light: a new 3-position switch (CAB LIGHT, PANEL LIGHTS, OFF) shall control the Operator's white cab reading light or red cab console illumination lights, whenever the car is in the STANDBY or RUN position.

The stoplights shall be illuminated whenever the car is in the STANDBY or RUN position and any braking system is engaged. The stoplights shall be independent of any directional indicator lights or tail lights.

The back-up lights shall automatically illuminate whenever the car is in the STANDBY or RUN position and is in reverse direction of propulsion.

The two exterior "beehive" red door status lights shall flash alternatively whenever the car is in the STANDBY or RUN position and any one of the four side doors are open.

Suitable circuit breaker protection shall be provided for all lighting circuits and shall be located in an organized manner in a location within the interior of the car, as approved by CRRMA.

6.5 EMERGENCY LIGHTING

Whenever the interior ceiling lights are turned on in an activated car (in the STANDBY or RUN position), the eight lights which have been configured to directly use 24 volt dc power shall be connected to the battery (with the front doorway lights being controlled by their respective doorways) while the remaining ceiling lights shall be supplied 120 volts ac from the auxiliary power supply. See Section 11.6 for emergency battery requirements.

In the event of a failure of the auxiliary power supply or of the 600 volt dc trolley wire power, the following lights shall continue to function with full brilliance under emergency battery power for a minimum of 1 hour. The 1 hour time of operation shall also include the communication systems that shall also be fully functional, see Section 5:

- (a) Eight interior emergency lights as described above;
- (b) Headlight (Dim position only);
- (c) Tail lights;
- (d) Marker lights;
- (e) Turn Signals/Hazard Lights;
- (f) Stop Lights; and
- (g) Operator's white cab light.

EL PASO STREETCAR REMANUFACTURE OF PCC CARS

SECTION 8 - DOORS

8.0 DOORS AND DOOR OPERATORS

8.1 GENERAL

The existing PCC cars have two right side doorways, referred to as front and center doors, which have two blinker doors each. A new wheelchair lift shall be installed at the center door location. The center door shall be converted to use two new opposed bi-fold doors to obtain the clear opening needed for ADA lift installation and ADA compliance. The front blinker doors shall be remanufactured as described herein.

8.2 DISASSEMBLY

The Contractor shall remove and disassemble all door and door operator equipment, and inspect all door body interfaces. This door operator equipment shall include door engines, cam assemblies, door shaft assembly, guide assemblies, door stop fittings, and all other door related items. All parts shall be tagged, inventoried, packaged and handled in accordance with the marking system established in the Management Plan. Door engines, cam assemblies, door shaft assemblies, and related material shall all be set aside for CRRMA disposition.

8.3 DOOR PANELS

The existing door panels shall be discarded. New replacement door panels, complete with new stainless steel hinges, glazing, edge nosing, weather-stripping, reinforcements, seals and end caps, shall be furnished and installed. The door panels shall be aesthetically similar to the original doors. The Contractor shall determine the final dimensions for each door panel. The size of door panels must not vary from car to car. The Contractor shall submit detail door panel drawings for approval by CRRMA.

Door panels shall be constructed from a composite material similar to the flooring material as manufactured by Milwaukee Composites, Inc., or approved equal, or a twin sheet fused or bonded pressure molded ABS/Polycarbonate panel assembly, as approved by CRRMA. As a minimum, the strength of the door panels must equal that of the original 0.75 inch thick, 7-ply construction marine grade plywood door assembly. Glazing shall conform to the requirements of Section 3.13 and shall be glazed directly into the doors using new elastomer zipper strips.

The center doors shall be provided with new pressure-wave type sensitive-edge door switches. These shall be Vapor Corporation Part Number 57410099-02, or approved equal. New sensitive edge door nosing assemblies, Vapor Corporation Part Number 57926408, or approved equal, shall be installed on the center door panels. The new nosing assemblies shall include top and bottom air seals and a minimum of 6 feet of tubing, with a diameter matching the sensitive-edge switch, bonded into the nosing near to the top of the door assembly. The tubing shall be routed to insure it is not cut, pinched, or pulled from place during operation. When installed, the sensitive edge shall be effective from 1 inch above the top of the bottom step to 3 inches below the top of the door panel. The sensitive-edge door nosing assemblies shall be attached to the door panel in an approved manner. Door edge nosings for the front door panels shall be Vapor Corporation Part Number 57422047, or approved equal. All door edge nosing shall be of material in accordance with Section 15.

Door panels shall be sealed, sanded, primed, and painted with a finish coat of paint on both the interior and the exterior sides to match the car color schemes.

8.4 OBSTRUCTION DETECTION

Upon detection of an obstruction, the door panels in the affected doorway shall recycle immediately fully open and remain open for a preset 5-second period then attempt to close again. The preset period shall be controlled by a 0 to 10 seconds adjustable time delay logic. If the obstruction is still detected, the obstruction detection system shall cause the door panels to recycle until the preset number of recycles is reached. The number of recycles shall be adjustable from 1 to 5, and initially preset to 4. If an obstruction is detected on the closing stroke of the last recycle the door shall fully open and remain open, illuminate an indicator on the cab console, and announce the Door Emergency Buzzer in the cab.

A door close command shall reset the obstruction detection system and close all doors not closed and locked with the obstruction detection system active. If an open command is issued at any time, it shall reset the obstruction detection system.

Door obstruction detection shall be in accordance with APTA PR-CS-S-012-02.

8.5 DOOR TRACK

All existing door tracks shall be replaced with new door tracks, which shall be fabricated from ASTM A606 steel, or other CRRMA approved material, and function like the original door tracks. All door tracks shall be primed and finish painted in a CRRMA approved color. The existing spacer/close-off blocks adjacent to the track shall be replaced with new blocks made of phenolic or equivalent material, and shall also be primed and finished painted in a CRRMA approved color. New stainless steel fasteners shall be used with stainless steel self-locking nuts.

8.6 MECHANICAL LINKAGES

The door shaft assemblies, connecting rods, guide assemblies, and all other door mechanical linkages, levers, rod ends, pins, etc., shall be cleaned and remanufactured. These parts shall be inspected for excessive wear, failures, damage, and corrosion. All of the PCCs shall be provided with new connecting rods. Those original rods which pass inspection and have been remanufactured shall be packaged, marked, and shipped to CRRMA as spares. Door track rollers in the guide assemblies shall be replaced with new rollers. All bushings and sleeve bearings shall be replaced with new components. Pins fitted into bushings or sleeve bearings shall be replaced with new if they show any signs of scoring, grooving, corrosion or diametrical wear greater than 0.005 inch. New rubber door stops shall be provided. All moving parts such as bearings, bushings and rod ends shall be lubricated with an approved lubricant and adjusted as required for proper door operation.

8.7 DOOR ENGINE

8.7.1 MOTORS

All new door engine electric motors shall be provided. These shall replace the pneumatic door drives.

8.7.2 GEAR ASSEMBLIES

If remanufactured, the gear assembly portion of the door engines shall be inspected for oil leaks, rough or noisy operation, excessive free play, wear, and broken, cracked or failed parts. The gear assembly shall be dismantled, cleaned, remanufactured and overhauled. All oil seals, gaskets, bushings, and bearings shall be replaced with new parts. If any gear set shows indications of failed lubrication, overheating, scuffing, wear, spalling, or has chipped or broken teeth, it shall be renewed.

8.7.3 ASSEMBLY AND TESTING

The new replacement motor and remanufactured or new gear assembly shall be reassembled, lubricated, tested, and inspected for satisfactory operation, including free play, freedom from oil leaks, excessive or unusual noise, binding, and vibration. Each door engine shall be tested for proper smooth and uniform operation over a voltage range of 20 to 34 volts dc.

8.8 CONTROL EQUIPMENT

Completely new door controls shall be provided. The system shall provide all the capabilities of modern transit practice including obstruction detection, diagnostics, ease of adjustment, and reliability.

8.9 DOOR CONTROL MODIFICATIONS

The door system shall be modified to incorporate an Emergency Door Release Switch for each set of doors. The front and center door controls shall include propulsion/friction brake and line switch interlocks. A no-motion and speed interlock shall be added on the front door No. 2 door engine (see Section 8.9.2) and both center door engines to prevent these doors from opening when the car speed is above 0 miles per hour, or as close to zero as possible, but no higher than 1 mile per hour. A Sonalert warning beeper, emitting an approved audible alert, and flashing amber beehive-type light shall be added to the door header for both the front and center doors to provide the required ADA warning annunciation for door closing. Both devices shall function during the door closing cycle, including any time delay.

The Contractor shall submit drawings detailing the new, modified and added circuitry and the installation of the door control modifications for approval by CRRMA.

An emergency door-release mechanism shall be provided for each doorway opening. The purpose of this mechanism is to provide an emergency means to manually open the doors. The emergency door release shall be activated by a switch for each doorway opening (i.e., one switch for the front doors and one switch for the center doors). The switch shall be located near the door it controls, behind a frangible or tear-away panel, as approved by CRRMA, shall be accessible to passengers, and installed at a height and orientation that complies with ADA. When the switch is activated, power shall be removed from the adjacent door engine motors and the car shall initiate an irretrievable emergency brake application. Once the car has reached a stop, the doors shall be capable of being manually opened by a passenger or crewmember.

The Emergency Door-Release Switch mounting shall incorporate a printed legend clearly indicating the switch position for emergency stop and door release by labeling that position as "OPEN" with accompanying graphics. Adjacent to the Emergency Door-Release Switch locations, a sign shall be provided with the appropriate wording similar to "Car Stop and Door Release - In An Emergency Break Panel, Turn Switch, Wait for Car to Stop, Push Door Open" at the center doors; and "Car Stop and Door Release - In An Emergency Break Panel, Turn Switch, Wait for Car to Stop, Pull Door Open" at the front doors. Exact text and details shall be subject

to design review. These emergency instructional signs shall be bilingual including both English and Spanish, conform to the standards as outline in Section 4.9, and shall be approved by CRRMA.

8.9.1 DOOR BALANCE CONTROL

The door control wiring shall be arranged so that the door balance relay is activated when emergency brakes are applied. This is to prevent the door from not opening when an emergency stop brake application is made.

8.9.2 NO MOTION AND SPEED INTERLOCK

The door controls shall be no motion and zero speed interlocked such that the doors will not respond to an "open door" command at speeds above 0 miles per hour, or as close to zero as possible, but no higher than 1 mile per hour. This system shall be of minimal complexity. It shall be fail safe for single point failures. The failure mode of the zero speed equipment shall be such that in the event of a failure, all doors will remain closed.

The front No. 1 door engine shall not have zero speed interlocking. This permits the operator to have full control of car motion when inching past and observing a wayside obstruction.

A sealed speed interlock bypass switch shall be provided to disconnect the zero speed equipment from the door control circuits. This switch shall be labeled and sealed in the "Normal" position. In the bypass position a LED indicator labeled "INTERLOCK BYPASS" on the Operator's console shall illuminate.

8.9.3 CENTER DOOR EXIT LIGHT

A prominent, CRRMA approved, green Center Door Exit Light and sign shall be added above the center doors.

8.9.4 CREW SWITCH

The Contractor shall propose a means for CRRMA review and approval to allow an Operator to open and close the front doors from the exterior of the PCC. This system shall interface and use all necessary and appropriate safety systems and be installed in a covert or hidden manner to preclude unapproved use.

8.10 TESTING

Following completion of all required engineering of new equipment, remanufacturing, overhaul, repair and modification work, the door equipment shall be reinstalled on the vehicle. As part of the final setup of the completed car, the door systems shall be set up, adjusted, and tested.

8.10.1 PERFORMANCE TEST

As part of the acceptance testing performed at the Contractor's facility, the door system on each car shall be given a comprehensive performance test to verify proper operation of the doors in each and every mode of operation, and to verify each and every safety system operates properly. The Contractor shall make all adjustments necessary to obtain the specified performance. It shall be the Contractor's responsibility to provide a safe and reliable door system consistent with the original design or to recommend changes

necessary for safe and reliable operation. Testing shall include the following controls and devices:

8.10.2 TOGGLE SWITCHES

The Operator's console toggle switches related to door operation to be tested are:

- Open and Close #1 Front Door
- Open and Close #2 Front Door
- Open and Close Center Doors

8.10.3 NO MOTION AND SPEED INTERLOCK

The center doors and the front door rear leaf shall be no motion and speed interlocked. With the car speed above 0 miles per hour, or as close to zero as possible, but no higher than 1 mile per hour, it shall not be possible to open these doors using the Operator's console switches. The speed interlock bypass shall disable this feature. See Section 8.9.2.

8.10.4 SENSITIVE EDGES

Per Section 8.4 and in accordance with APTA PR-CS-S-012-02.

8.10.5 MAIN DOOR RELAYS

The main door relay for the front doors and the main door relay for the center doors shall be energized by the front door cam switch and the center door cam switch, respectively, when any controlled door is not fully closed. When a main door relay is energized, it shall prevent application of power to the traction motors. When all doors are fully closed, the main door relays shall be de-energized. Energizing the main door relay for the front or center doors shall also energize the brake interlock relay.

8.10.6 BRAKE INTERLOCK RELAY

The brake interlock relay shall be energized when any controlled door is not fully closed. When the brake interlock relay is energized, the circuit to the friction brake actuator coils shall be opened, thereby applying the brakes to the vehicle.

8.10.7 DOOR LIGHTS

When either front doors are open ~~and~~ the switch defined in Section 6.4 is in the ON position, the front door ceiling lights shall illuminate, and shall extinguish when both doors are closed.

8.10.8 DOOR TIMING

- a. Opening Time. From the fully closed position, the time for a door to fully open from the initiation of the opening command to the closing of the Cam Switch on the door engine, shall be between 1.0 second and 2.0 seconds. The Contractor shall strive to have the door opening time closer to 1.0 second than the upper limit of 2.0 seconds.

- b. Closing Time. From the fully open position, the time for a door to fully close from the initiation of the closing command to the closing of Cam Switch on the door engine, shall be between 2.0 seconds and 3.0 seconds. For the center doors, the closing time shall include the time delay of the Closing Time Delay Relay, with its time delay set at 0.5 second. The Contractor shall strive to have the door closing time closer to 2.5 seconds than the upper limit of 3.0 seconds.

EL PASO STREETCAR REMANUFACTURE OF PCC CARS

SECTION 11 – AUXILIARY ELECTRICAL

11.0 AUXILIARY ELECTRIC

11.1 GENERAL

Auxiliary electrical equipment covers primary current collection, electrical fault protection, electrical conversions necessary for the HVAC system, the lighting system, the low voltage controls, all newly added systems, electrical conversions, and battery storage for emergency systems.

The original auxiliary electrical equipment included the high voltage (600 volt dc), medium voltage ac and low voltage (37.5 volt dc) distribution equipment, the trolley pole, the motor-generator set blowers, storage batteries and any other equipment. This equipment shall be replaced or remanufactured as specified herein. In order to accomplish this work, disassembly is required for cleaning and inspection of those items that remain. The 37.5 volt battery system shall be replaced with a new 24 volt battery system. This will allow the use of available automotive (bus/truck) apparatus.

Reinstallation of equipment shall be performed using new mounting and connecting hardware that meets the requirements of this Technical Specification. A conductive no-ox compound shall be applied between wiring lugs and mating surfaces for all connections of wire size 2 AWG and larger. When indicated, equipment shall be tested with a megohm meter at 500 volts for 24 volt dc rated equipment, or 1,000 volts for both ac and 600 volt dc rated equipment. Resistance to ground shall be a minimum of 1 megohm resistance for low voltage dc circuits and equipment and 4 megohms for ac and 600 volt dc circuits.

11.2 PANTOGRAPH

The Contractor shall integrate a new pantograph onto the PCC. The pantograph shall be electrically lowered and spring raised and be of a design that has a minimal visual and aesthetic impact on the PCC car, and shall include roof fairings to hide the base and roof mountings. Such fairings shall be integrated into the HVAC unit fairings to present a unified and aesthetic appearance. Current collection shall accommodate the wire height range of Section 2.3.2. A typical pantograph design that may be considered for use by the Contractor is the Portland streetcar Schunk pantograph, SBE 922HC. The pantograph shall be mounted such that the collector shoe(s) are above the rear truck pivot point. The lower arm shall be oriented rearward when mounted on the car to provide maximum roof area for HVAC equipment. CRRMA clarifies that it will consider alternatives to the noted pantograph concept, so long as the overall “feel” of the pantograph is minimized and it fits aesthetically with the PCC car. The pantograph shall be painted a color that minimizes its impact to the overall PCC aesthetics, and shall be approved by CRRMA.

A new insulated hold-down hook shall be provided to secure the pantograph in a lowered position. The hook base shall be mounted in a CRRMA approved manner with insulating stand-offs. Pantograph orientation when lowered shall not foul an adjacent car, roof equipment, or overhead wire. In the hooked-down position the pantograph shall be capable of energization by a shop “stinger” cable and clamp.

11.3 GROUND RETURN AND BRUSHES

Ground brushes in the axle drive assemblies acting on the present ground ring shall be replaced with new components at each axle per Section 9. Primary power ground plate(s) shall be installed and isolated from carbody ground. These plates shall be insulated for 3,000 volts minimum, and shall be located for accessibility. The plates shall have studs for connection of ground brush cables, propulsion return cables, and miscellaneous equipment return wires. Only one wire or cable shall be connected per stud. Three spare studs shall be provided on each plate.

11.4 FAULT PROTECTION

11.4.1 MAIN FUSE

A new enclosure for a new main fuse on the roof shall be provided. The enclosure shall be Horn Products No. 19012 fuse box or approved equal. The new fuse box shall be oriented so that the fuse opening is towards the center of the car. A set of brackets, bolted to the roof, shall be supplied for mounting the fuse box. In its final configuration, the fuse box shall be mounted at least 3 inches above the roof, roof shroud, or from any nearby grounded metal parts. Clearance directly in front of the fuse opening shall be a minimum of 10 inches.

11.4.2 HIGH SPEED CIRCUIT BREAKER

A new high speed circuit breaker, Secheron UR-6 or approved equal, shall be provided for propulsion system protection. It shall be capable of initiating contact tip opening within 10 milliseconds of sensing a fault and extinguishing the arc within 25 milliseconds of sensing the fault for all supply inductance conditions. Tripped status of the circuit breaker shall be indicated in a CRRMA approved means on the Operator's control console. Reset capabilities directly from the Operator's console shall be provided.

11.4.3 LIGHTNING ARRESTER

A new pantograph lead to the car shall be provided with a new service proven lightning arrester. These cars were originally equipped with a General Electric 4 microfarad, PCB filled lightning arrester. Any original units remaining shall be disposed of in accordance with all legal requirements and replaced by a new thyrite-type lightning arrester designed for traction applications. Lightning arrester type and service history shall be provided in the Technical Proposal.

11.4.4 GROUND FAULT PROTECTION

The total car primary supply current and the total car return current shall be accurately sensed and compared. When the two are not essentially equal, a ground fault condition shall be indicated on the Operator's console and all primary supply circuit breakers automatically opened.

11.5 POWER CONVERSIONS

The existing motor-generator set shall be replaced with a new static inverter/converter source for medium voltage three-phase alternating current and a separate low voltage direct current converter.

11.5.1 PRIMARY TO MEDIUM VOLTAGE

A new electrical power converter of suitable characteristics and rating shall be provided as required for the HVAC system and all other systems defined in this Technical Specification. This converter shall provide galvanic isolation from the primary supply for the equipment supplied. The converter shall be fault protected and provided with remote status indication and reset capability to enhance car operability. For auxiliary electric system loads where a single point converter failure would render a car totally inoperable, redundant converters shall be supplied along with the necessary critical load transfer capability to afford a single car a "limp home" capability.

A new static inverter using IGBT switching devices shall be provided. The rating of the inverter shall be at least 5 kW in excess of the maximum load presented by the HVAC, blower motor(s), main interior lights, convenience outlets and low voltage dc loads. The low voltage dc loads include all controls, low voltage devices, battery charging and the track brakes. For inverter sizing purposes, the convenience outlet loads shall be assumed to be the associated circuit breaker rating (15 amps at 120 volts with a power factor of 0.8). The inverter shall provide an output of ~~240~~208 or 230 volts 3 phase, 60 Hz. The output voltage shall be that which most simplifies the car design including that of the inverter. The frequency shall be regulated to 60 Hz \pm 1 Hz, except during initial ramp up when it shall maintain a constant volts-per-Hertz relationship. The inverter shall be able to provide rated output parameters at any input voltage from 420 to 800 volts dc. Sustained application of voltages up to 900 Volts shall not damage any equipment.

The inverter shall be provided by an internationally recognized manufacturer and of a design family having at least three years of revenue experience on more than 300 units in rail service operating from the traction supply, unless otherwise approved by CRRMA.

11.5.2 120 VOLT STEP DOWN TRANSFORMER

A new 3 phase step down transformer shall be installed to provide 120 volts per phase, with output to be a wye connect, grounded neutral. The three phases shall be connected as follows; one for right side overhead lighting, one for left side overhead lighting and the third for the convenience outlets. Connections to the lamp sockets and convenience outlets shall adhere to commercial codes with the lamp socket outer shells and convenience outlet neutrals connected to the transformer neutral. The convenience outlet grounds shall be electrically connected to the carbody.

11.5.3 LOW VOLTAGE DC POWER SUPPLY

A new low voltage dc power supply shall be provided separate from the auxiliary inverter. It shall be a stand-alone dc-dc converter. As an alternative, the Contractor may provide the LVPS within the Auxiliary Power Unit container. It shall have an output of at least 3 kW (5 kW if an inverter ballast lighting system is used) at a presettable voltage within the range defined by IEEE STD 1476 for a 24 volt system in steps of not less than 0.1 volt. Regulation shall be within ± 0.2 volts for all line and load variations. The low voltage supply shall have a current limited output. The voltage shall be initially set at 24 volts.

Non-critical low voltage loads may be load-shed to minimize battery drain when the converter is not operating. The time interval for load shed shall be selected to minimize light interruptions due to intermittent power collection. Critical low voltage loads are the emergency battery system of Section 11.6, the lighting system of Section 6.5, and the radio of Section 5.2. Characteristics for battery charging shall be coordinated with the NiCd battery for proper charging with minimum water use.

11.5.4 OTHER POWER SUPPLIES

The car shall be provided with all new necessary isolating and protective power supplies to energize the TOMAC, next stop, radio, public address system, train-to-wayside equipment, farebox, CCTV, WiFi and all other similar loads from the low voltage supply. Each subsystem requiring special electrical supply different from the low voltage system shall be provided with a dedicated, galvanically-isolated power supply.

A new 46-ampere (minimum rated capacity), 12 volt dc protected power supply (or larger if such is required) shall be provided to power the farebox and two-way radio, and any other 12 volt equipment. The 12 volt dc power supply shall be powered from the low voltage bus; it shall operate when the low voltage power supply operates, and shall have automatic battery backup.

All 12 volt dc power supplies, unless approved otherwise by CRRMA, shall regulate the voltage to 13.6 ± 0.5 volts dc over the rated capacity of the power supply with an input voltage variation provided by the LVPS as defined in TS Section 11.5.3 of 26 to 42 volts dc. The protected power supply shall provide 13.6 ± 2.0 volts dc over an input voltage range provided by the LVPS as defined in TS Section 11.5.2 of 22 to 44 volts dc.

Each power supply shall provide overcurrent, over/under input voltage, and reverse polarity protection. Both the input and the output shall be protected against electrical spikes and transients. Electrical spikes and short duration transients (characteristic of relay coil transients) of up to plus or minus 1,000 volts can be expected on the input to the power supply.

Each 12 volt dc power supply shall be located either in its own underfloor enclosure or under a front passenger seat; in the latter case, the passenger seat will also have to be modified (similar to passenger seats with sand boxes). Wiring to and from the power supplies shall be contained in conduit complying with the requirements of Section 15. The enclosures shall be steel meeting NEMA 4 requirements, with a hinged full-size door. The enclosures, if underfloor, shall be painted black on the outside and an approved white enamel on the inside. The enclosures, if underseat, shall be coordinated with the interior color scheme and design and shall be approved by CRRMA.

All wiring connections to and from the power supplies shall be from one or more terminal strips. All wiring connections shall be clearly labeled. A wiring connection diagram, laminated in plastic, shall be affixed to the inside of each door as appropriate.

11.6 EMERGENCY BATTERY ELECTRICAL SYSTEM

A new 24 volt dc NiCd (Nickel Cadmium) storage battery of sufficient capacity as a direct current supply for battery charging and for battery voltage car loads shall be provided on each car. Critical control loads such as doors, radio, brakes, communications equipment loads, and emergency lighting loads shall be supplied through this system. The exact list of all systems and subsystems

that will function off of the battery system shall be developed and proposed by the Contractor, closely coordinated with CRRMA, and shall be as approved by CRRMA.

The battery shall be capable of supplying all car loads for the load shed relay interval and then all essential loads for a period of 1 hour or more without battery charging and converter load support over the full car temperature range. The battery initial state shall be equivalent to that of normal car operation (80 percent charged for a float charge system). During that hour, the car may be operated as in normal service including use of the magnetic track brakes for an aggregate time of 90 seconds. Voltage range for the battery system shall be as defined in IEEE STD 1476 for a 24 volt dc system. These requirements shall determine the battery type and rating.

When primary power output is lost for more than 30 seconds, nonemergency low voltage loads shall be disconnected. They shall be reconnected after primary power output is restored. Emergency power shall be provided by the NiCd battery system. The battery shall be sized to provide at least the following loads, with associated duty cycles:

- Emergency Lighting (continuous), see Section 6.5.
- Door Control (cycle doors open for 20 seconds every 2 minutes).
- Communications (operate PA and radio for 20 seconds every 2 minutes).
- Braking Control (continuous).
- Wheelchair Lift Control (deploy and stow twice).
- Operator's Console Indicators and Interlocks (continuous).
- Gong and Horn (on for 5 seconds every 2 minutes).
- Track Brakes (on for 30 seconds at end of each 20 minute period).
- Pantograph Control (raise and lower once).
- Windshield Wiper (continuous).
- CCTV (continuous).

All loads, except emergency lighting and its control and the train radio, may be shed after 60 minutes. Emergency lighting shall comply with the requirements of Section 6.5.

The Contractor shall provide to CRRMA a battery sizing analysis that demonstrates that the battery capacity is sufficient to meet these requirements. This shall include details of the load shedding philosophy and battery protection circuits.

The battery shall be a service proven railway or transit quality battery with reserve electrolyte capacity appropriate for transit vehicle service. The battery compartment arrangement and case material shall provide for easy visual checking of electrolyte level. The battery compartment shall be external to any passenger space. Battery compartment arrangement and size shall accommodate batteries from at least two independent suppliers. Battery arrangement and selection shall be submitted for CRRMA review.

11.7 AUXILIARY ELECTRICAL DISTRIBUTION

Power distribution (primary, intermediate, low voltage, and emergency battery) shall be through logically structured branching circuits with appropriate branch fault protection. Branch organization shall facilitate fault isolation and shall minimize any operational impacts on other unfaulted systems.

The Technical Proposal shall include a conceptual auxiliary distribution plan (one line diagram) and protection scheme. It shall provide for voltage level segregation, branch circuits within voltage levels, branch circuit protection, and auxiliary electrical load segregation.

11.7.1 LOW VOLTAGE CIRCUIT BREAKERS

All existing low voltage circuit breakers shall be replaced. The Contractor shall provide all new circuit breakers and panels, and all shall comply with the requirements of these Technical Specifications. A list of all breakers to be replaced and corresponding manufacturer catalog cut sheets for the replacement circuit breakers shall be submitted to CRRMA for approval before the replacement breakers are purchased. Each breaker shall be identified with an engraved label.

11.7.2 HIGH VOLTAGE CIRCUIT BREAKERS

All existing high voltage branch circuit breakers shall be replaced with new breakers and panels, and each breaker shall be identified with an engraved label. Circuit breakers and panels shall comply with the requirements of these Technical Specifications. A list of breakers and corresponding manufacturer catalog cut-sheets for the replacement circuit breakers shall be submitted to CRRMA for approval before the replacement breakers are purchased.

11.7.3 HIGH VOLTAGE FUSES

The high voltage fuse compartment behind the rear door in the passenger area shall be vacated and any asbestos shall be removed and properly disposed of in accordance with Section 3. This area may be utilized for equipment supporting the wheelchair lift. Fuses that are not replaced by circuit breakers shall be renewed and relocated to an accessible compartment outside the passenger area. All remanufactured terminals shall be cleaned and restored to like-new condition. Remanufactured fuse clips shall be checked for tension and replaced if tension is low. New fuses shall comply with the requirements of these Technical Specifications.

11.7.4 HIGH VOLTAGE WIRING

New wire meeting the requirements of Section 15 of the same gauge and 2,000 volt insulation rating shall be used to replace all existing wiring and for circuits. All terminations shall be cleaned and inspected for tightness and signs of heating or arcing. Any damage found shall be remanufactured to like new condition.

During installation, the new wiring shall be temporarily disconnected from equipment (i.e., motors, contactor coils, relay coils, etc.), electrically connected together into convenient groupings, and tested for a minimum resistance to ground of 4 megohms with a megohm meter at 1,000 volts dc. Any wiring group that does not pass this test shall be isolated to identify individual wire segments that are defective. Once the problem is found, it shall be corrected and retested. Following the megohm meter test, the wiring shall be reconnected and given a continuity test to verify proper reconnection of the wiring.

11.7.5 ALTERNATING CURRENT WIRING

All new alternating current wiring shall be provided and shall meet the requirements of Section 11.7.4 except that circuits operating at 240 volts or below may use 600 volt rated wiring.

11.7.6 CONVENIENCE OUTLETS

Four new convenience outlets shall be provided inside the car and shall use covered and protected outlets as approved by CRRMA. The locations of these outlets shall be presented to CRRMA for approval.

11.7.7 LOW VOLTAGE WIRING

New wire meeting the requirements of Section 15 of the same gauge and 600 volt insulation rating shall be used to replace all low voltage wiring and for new circuits. All terminations shall be cleaned and inspected for tightness and signs of heating or arcing. Any damage found shall be remanufactured to like-new condition.

Wiring shall be temporarily disconnected from equipment (i.e., motors, contactor coils, relay coils, etc.), electrically connected together into convenient groupings and tested for a minimum resistance to ground of 1 megohm with a megohm meter at 500 volts. Any wiring group that does not pass this test shall be isolated to identify individual wire segments that are defective. Once the problem is found, it shall be corrected and retested. Following the megohm meter test, the wiring shall be reconnected and given a continuity test to verify proper reconnection of the wiring.

11.8 REPLACEMENT BLOWERS

Only if specifically approved by CRRMA, any existing equipment requiring forced ventilation shall be provided with a new dedicated blower and duct arrangement. All new equipment shall be naturally ventilated and no cooling blowers shall be added to these cars.