Massachusetts Bay Transportation Authority

Technical Proposal

for
MBTA RFP No. CAP 27-10
New Orange and Red Line Vehicles

May 15, 2014

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1 TECHNICAL APPROACH

1.1 ORGANIZATION AND PROJECT STAFF

Below is the RFP requirement for the proposed Organization and Project Staff:

Tab I.1 (a) Organization Chart, Resume and Responsibilities of Key Staff
Provide a detailed organization chart (with names) of the project staff including, but not limited to Program Manager, Production Manager, Lead Electrical Engineer, Lead Mechanical Engineer, System Engineer (System Integration) Quality Engineer, Warranty and Reliability Engineers, Field Support Manager, Training and Manuals Manager. Include a detailed one-paragraph resume of each individual's experience, which directly applies to this project. A matrix of the responsibilities, location, and decision making authority, of the key staff shall be included.   *The proposed staff must be the staff which will actually fill each identified role and deliver the services defined in the contract and the proposal. Changes of key individuals require the prior approval of the Authority.*

China CNR Corporation Limited (CNR), one of the largest rail vehicle equipment manufacturers and its subsidiary, CNR Changchun Railway Vehicles Co., Ltd. (CNR CRC), have formed a joint venture, CNR MA Corporation, in Massachusetts, herein referred to as “CNR” to supply rail vehicles and equipment to North America and beyond. CNR has assembled a team of key staff members that will be dedicated to the MBTA Orange Line and Red Line project. CNR have made a long-term commitment to delivering new passenger rail equipment to the U.S. market and, as part of this long-term strategy, CNR is establishing its U.S. headquarters in Massachusetts. By establishing a permanent manufacturing facility in Massachusetts, CNR will be linked to the State of Massachusetts for many years to come. CNR will use these facilities on all future rail rolling stock equipment projects in North America and abroad. CNR's leadership capabilities and financial strength, and CRC's engineering and manufacturing experience, makes this team uniquely qualified to execute this project with unqualified success. The assigned staff members have extensive experience in the design, manufacture, quality assurance, testing and commissioning and delivery of rail vehicles, including modern stainless steel carbody construction.

1.1.1 Organization Charts by Facility

The project team consists of key individuals that are identified on the following organization chart, which identifies the staff by location. All the staff in these locations, Massachusetts, U.S. and Changchun, China, will report through the U.S. experienced Project Manager, whom CNR has appointed for this project, and who will be located in the Boston local office.

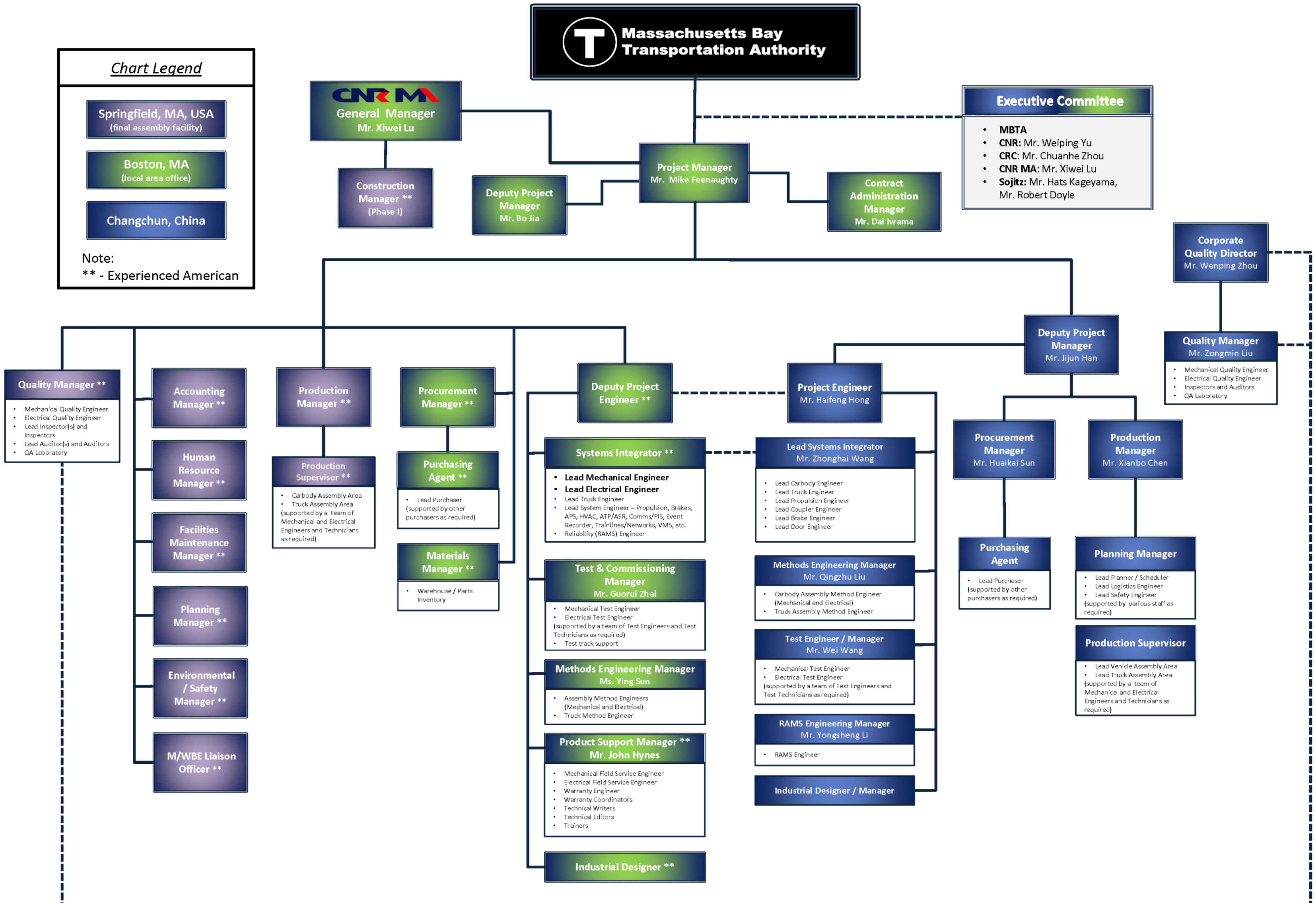
Chart Legend
Springfield, MA, USA (final assembly facility)
Boston, MA (local area office)
Changchun, China
Note:
** - Experienced American
Massachusetts Bay Transportation Authority
CNR MA General Manager Mr. Xiwei Lu
Construction Manager ** (Phase I)
Deputy Project Manager Mr. Bo Jia
Project Manager Mr. Mike Feenaughty
Contract Administration Manager Mr. Dai Iwama
Executive Committee
MBTA
CNR: Mr. Weiping Yu
CRC: Mr. Chuanhe Zhou
CNR MA: Mr. Xiwei Lu
Sojitz: Mr. Hats Kageyama, Mr. Robert Doyle
Corporate Quality Director Mr. Wenping Zhou
Quality Manager Mr. Zongmin Liu
Mechanical Quality Engineer
Electrical Quality Engineer
Inspectors and Auditors
QA Laboratory
Quality Manager **
Mechanical Quality Engineer
Electrical Quality Engineer
Lead Inspector(s) and Inspectors
Lead Auditor(s) and Auditors
QA Laboratory
Accounting Manager **
Human Resource Manager **
Facilities Maintenance Manager **
Planning Manager **
Environmental / Safety Manager **
M/WBE Liaison Officer **
Production Manager **
Production Supervisor **
Carbody Assembly Area
Truck Assembly Area
(supported by a team of Mechanical and Electrical Engineers and Technicians as required)
Procurement Manager **
Purchasing Agent **
Lead Purchaser
(supported by other purchasers as required)
Materials Manager **
Warehouse / Parts Inventory
Deputy Project Engineer **
Systems Integrator **
Lead Mechanical Engineer
Lead Electrical Engineer
Lead Truck Engineer
Lead System Engineer – Propulsion, Brakes, APS, HVAC, ATP/ASR, Comms/PIS, Event Recorder, Trainlines/Networks, VMS, etc.
Reliability (RAMS) Engineer
Test & Commissioning Manager Mr. Guorui Zhai
Mechanical Test Engineer
Electrical Test Engineer
(supported by a team of Test Engineers and Test Technicians as required)
Test track support
Methods Engineering Manager Ms. Ying Sun
Assembly Method Engineers (Mechanical and Electrical)
Truck Method Engineer
Product Support Manager ** Mr. John Hynes
Mechanical Field Service Engineer
Electrical Field Service Engineer
Warranty Engineer
Warranty Coordinators
Technical Writers
Technical Editors
Trainers
Industrial Designer **
Project Engineer Mr. Haifeng Hong
Lead Systems Integrator Mr. Zhonghai Wang
Lead Carbody Engineer
Lead Truck Engineer
Lead Propulsion Engineer
Lead Coupler Engineer
Lead Brake Engineer
Lead Door Engineer
Methods Engineering Manager Mr. Qingzhu Liu
Carbody Assembly Method Engineer (Mechanical and Electrical)
Truck Assembly Method Engineer
Test Engineer / Manager Mr. Wei Wang
Mechanical Test Engineer
Electrical Test Engineer
(supported by a team of Test Engineers and Test Technicians as required)
RAMS Engineering Manager Mr. Yongsheng Li
RAMS Engineer
Industrial Designer / Manager
Deputy Project Manager Mr. Jijun Han
Procurement Manager Mr. Huaikai Sun
Purchasing Agent
Lead Purchaser
(supported by other purchasers as required)
Production Manager Mr. Xianbo Chen
Planning Manager
Lead Planner / Scheduler
Lead Logistics Engineer
Lead Safety Engineer
(supported by various staff as required)
Production Supervisor
Lead Vehicle Assembly Area
Lead Truck Assembly Area
(supported by a team of Mechanical and Electrical Engineers and Technicians as required)

1.1.2 Roles, Responsibilities and Experience of Key Staff

The key individuals for this project are identified below, and are listed by facility location. Along with the role they will play for the MBTA project, their experience with the manufacturing of railcars is also identified.

Personnel at CNR Massachusetts, U.S. – Boston Local Office / Springfield Facility:

The project will be managed from the Boston local office. CNR has designated the following key people and responsibilities listed below, in addition to those positions that. CNR will hire experienced American workers to fill certain positions identified on the Organization Chart found in Section 1.1.1.

The General Manager, **Mr. Xiwei Lu**, will be the chief representative of CNR on site and responsible for the comprehensive management on the project site and the general work of the project; he will coordinate, dispose and resolve the problems occurring in the implementation of the project and report to the corporation. At the same time, Mr. Lu will also coordinate and deal with outstanding issues during project implementation, and report up to headquarters in China. It is noted that the General Manager will not be responsible for running the project, but to ensure that the Project Manager has all authority and dedicated resources and equipment necessary to run the project.

The Project Manager, **Mr. Mike Feenaughty,** will have a full authority to manage and oversee the overall project execution from the Boston office, and will be the single point of contact for all communications with the MBTA. Mr. Feenaughty has been working for several railcar manufacturers over the past 28 years and specifically in management roles for the past 19 years. His most recent role has been the U.S. Tender Director of Rolling Stock and Components at Alstom Transportation Inc., in which he successfully managed tenders valued at over $500 Million. As of January 2014, Mr. Feenaughty was responsible for a factory workforce increase from 30 to 300 personnel in a timeframe of a year and a half. His Project Management skills and responsibilities included the $330 Million WMATA 6000 Series project, the first WMATA project to achieve contract reliability goals and achieve final vehicle acceptance. Mr. Feenaughty also managed the design / build and delivery of 60 Amtrak Surfliner rail cars that were delivered on time and under budget.

The Deputy Project Manager, **Mr. Bo Jia**, will work closely with the Project Manager to oversee the development of the project both in China and in the U.S. Currently, Mr. Jia is the General Manager Assistant of CNR Changchun Railway Vehicles Co. Ltd He joined CNR in 1993, and is currently one of the senior experts in the rail industry. From 2001 to 2007, he worked as director of Mass Transit Vehicles Design Dept., jointly led many design projects for large metro projects, such as Beijing metro, and Tianjin metro. In 2007, he was appointed as vice chief engineer. Since then, he has been participating and leading several metro projects such as Beijing metro, Shenzhen metro, Thailand metro, Hong Kong metro, Brazil metro, and Saudi Arabia metro.

The Contract Administration Manager, **Mr. Dai Iwama**, has over 18 years of professional experience in the area of Marketing and Sales, with 8 year specifically focused in the transportation industry. Mr. Iwama has worked as a contract administrator for the following projects: Propulsion System for Long Island Rail Road/Metro-North Railroad M-7 EMU; HVAC system for NJ Transit/AMT/Maryland MTA Multi Level Coaches; SEPTA Silverliner V EMU Project. He will directly support the Project Manager on the MBTA project.

The Deputy Project Engineer, an American with sound experience in the passenger transit industry, will be responsible for all engineering related activities that will take place in the Springfield facility. He will have the following direct reports: Lead Mechanical Engineer, Lead Electrical Engineer, other system engineers, and Systems Integrator. The Deputy Project Engineer will also oversee and be responsible for Testing & Commissioning activities, Methods Engineering, Product Support, and Industrial Design.

The Systems Integrator will be a locally-hired and skilled American with adequate experience in the passenger transportation industry. This person will be responsible for will controlling and monitoring the systems integration functions during the vehicle design process, including participation in the execution and acceptance of all vehicle, system, subsystem, and component qualification testing. At the top level, this includes the external interfaces of the electrical and mechanical systems with the railcars and existing MBTA systems, including wayside equipment, communications command centers, and maintenance facilities. This also includes the internal interfaces between the various onboard vehicle electrical and mechanical systems.

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The Production Manager will be a locally-hired and skilled American whose responsibilities will include the management and overall coordination of the production of the railcars at the Springfield facility.

The Quality Manager, who will be a locally-hired and skilled American, will be mainly responsible for the quality assurance, quality control planning and implementation of the electric system of the vehicle assembly, quality management and control planning and implementation of the purchased electric parts and participate in the building and routine maintenance of the quality system.

The Planning Manager will be responsible for the establishment, organization, planning and implementation of the general production plan to ensure the on-time delivery of the railcars to the MBTA; will develop, maintain, and update project schedule at the Springfield facility; assist the project manager and other key staff in communication and coordination of the relevant items of the project plan; provide the monthly progress report of the project. This position will also be filled by a highly skilled American.

The Methods Engineering Manager, **Ms. Ying Sun**, has been engaged in manufacturing engineering for passenger car projects since 2001, which included preparation of technical plans and documents, designation of production resource skills, facilities, and jigs, work sequencing, organization of tests and solving key problems, and provided ongoing technical support for manufacturing. Ms. Sun is the process director and process manager for Pakistan Project, Beijing

Line 5 Project, Tianjin Coastal Express Project, Hong Kong WIL Project, Brazil Rio Line 1A Project and Brazil Rio Line 4 Project. Ms. Sun's role as the Methods Engineering Manager for this MBTA project will include performing technical analysis and producing technical proposals and documents for the production configuration. She will also be responsible for organizing and planning of manufacturing work flow at the Springfield project site; and establishing process documents and process plans used in the production; be responsible for the process planning of the interfaces between assembly and commissioning and Trucks; and also cooperate with the training manager to carry out well the technical training of the on-site operators.

The Test & Commissioning Manager, **Mr. Guorui Zhai**, is a highly experienced electrical design engineer with knowledge of electrical schematic designs for many projects, and has extensive experience in commissioning. Mr. Zhai will be responsible for establishment of the test and commissioning process flow and organizing the verification of the test program; and for organizing the static and dynamic testing of the vehicles. He will also provide technical instruction and support during the commissioning phase.

The Procurement Manager will be responsible for the purchase of materials used in the production of the railcars. Purchasing Agents will assist the Procurement Manager in completing the purchase of materials and organize the arrival of goods and other relevant purchasing work. Both of these roles will be filled by locally-hired and skilled Americans.

The Materials Manager, also a locally-hired and skilled American, will be responsible for organization and coordination of all the materials allocation for production; Will be responsible for organization and coordination of planning, organization and control of warehousing, storage, keeping and issuing of some materials such as purchased parts and other parts; be responsible for organizing and reporting the logistic information of the purchased materials.

The Construction Manager will be responsible for the oversight and management of the construction of the Springfield facility. We intend to retain the construction manager after the construction work has been finished.

The Product Support Manager, **Mr. John Hynes**, is an accomplished manager with over twenty-five years of progressive experience and responsibility in transportation and project management. Highly developed administrative and management skills, Mr. Hynes has the ability to effectively communication, supervise staff, develop and manage budgets, and schedule labor and training of large workforce.

An M/WBE Liaison Officer will be appointed by CNR. This will be a dedicated long term position to ensure that M/WBE participation is maximized for all CNR projects. This person will be locally-hired and skilled American. Further information is provided in the M/WBE Plan.

Personnel at CNR China – Changchun Facility:

The Pilot phase will be led by CNR Changchun to draw on their experience and familiarity with CNR designs and practices.

The Deputy Project Manager, **Mr. Jijun Han**, has extensive experience in the design and associated technologies for mass transit rail vehicles. He also has on-site vehicle management experience. Since 2006, he has been working as a project manager for CRC. In addition to being familiar with the project management process in China and overseas, Mr. Han has successfully organized the implementation of multiple rolling stock projects. Mr. Han also has a Project Management (PMP) certification approved by the Project Management Institute (PMI). Specifically for the MBTA project, Mr. Han will be responsible for establishing, instructing, and monitoring the activities of the project team from the beginning to the end of the project.

The Corporate Quality Director, **Mr. Wenping Zhou**, has been engaged in vehicle design and manufacturing methods for many years. He has served as Director of the Mainline Engineering Department, and has a wealth of experience in vehicle design. Leading a team, Mr. Zhou has successfully completed the design of over 10 mainline passenger train projects and EMU projects, and has been directly responsible for quality management since 2009. As quality supervisor of the company, he is in charge of the preparation and implementation of the quality strategy, quality plan, quality guidelines, quality system and relevant systems under the leadership of the general manager. He takes full responsibility for: company quality management; improvement of product quality; the preparation of the overall quality strategy; the of review quality control policies, procedures, systems and operational regulations; supervision and review of the implementation of quality policies and systems; taking charge of the quality control of the supply chain; the organization of important quality issue analysis meetings; the direction of, and dealing with, major quality risk and accident work.

The Quality Manager, **Mr. Zongmin Liu**, has a significant amount of quality management exposure for several different types of projects. Mr. Liu has experienced being involved with the pipe assembly for a water supply and instructional work for the fitter technology. He was also engaged in some overseas projects by providing translation and assistance in the commercial inspection portions. He has continued to provide his services and skills to other projects which include Bangkok (BTS), HK WIL and SIL projects, and Brazil EMU. Specifically for the MBTA project, Mr. Liu will be in charge of managing and monitoring the project quality work and finding different ways of improving the quality. Mr. Liu reports directly to the Corporate Quality Director, Mr. Wenping Zou.

The Production Manager, **Mr. Xianbo Chen**, has been engaged in production management for many years, currently he is the director of Production Manager's Office, with a wealth of experience in production management, he is good at organization and coordination, and he is skilled at production system management software, such as SAP and P3E, he has production management experience for more than 10 domestic and overseas projects, all meet milestone and key dates requirement. He will serve as production manager for this MBTA project, take charge of establishment and improvement of production control system, prepare production plan, check production condition to ensure completion of production tasks. He will be in charge of inspecting and auditing the production schedule, as well as providing instructions to the US manufacturing facility in Massachusetts.

The Procurement Manager, **Mr. Huaikai Sun**, has previously managed CRC's procurement department for various urban railway projects, such as: Brazil EMU, Brazil 1A, Hong Kong (HK) WIL, HK SIL, and the Ethiopia project. Mr. Sun's role on the MBTA project will be to manage the procurement process, and will work closely with the Procurement Manager in the Springfield, Massachusetts facility.

The Project Engineer, **Mr. Haifeng Hong**, has been engaged in technical management for Beijing Line 15 and Beijing line 6 metro projects, Beijing Linear Motor Airport Express, Chongqing Monorail, and now he is Deputy Director in CRC technical design department. For MBTA project, he will be responsible for Technical & Design work.

The Systems Integrator, **Mr. Zhonghai Wang**, for MBTA project will be responsible for systems integration work. Overall charging and reviewing all interface between all subsystems, including interior and exterior systems. He has the experience of being interface manager for WIL & SIL project of HK. He also has been the design engineer of electrical system for many projects, such as Shen Yang Line 1, Shang Hai Line 6&8, Chong Qing Line 1.

The Method Engineer, **Mr. Qingzhu Liu**, has been part of the carbody manufacturing process as well as other technology developments for stainless steels. Since 2006, Mr. Liu has been in charge of organizing each professional technical team in order to further develop their technology and production services. He was the Technology Manager of the HK SIL, Beijing line #5, #10, #13 &#15, and Shenyang Metro projects. Mr.Liu's role as the Technology Manager for this MBTA project will include him developing technical analysis, producing technical proposals and documents for the production configuration, and fulfilling the design drawing specifications.

The Test Engineer, **Mr. Wei Wang**, has handled projects dealing with the application of new energies and equipment modifications. He was also engaged in designing the brakes and providing the optimal efficiency design for the brake system. Since 2008, Mr. Wang has been responsible for type testing, RAMS, and R&D management. For the MBTA project, he will be responsible for establishment of debugging process flow and organizing the verification of the experiment program; and for organizing the static and dynamic debugging of the vehicles.

The RAMS Management Engineer, **Mr. Yongsheng Li**, has acquired a variety of skills and knowledge that proved to be valuable on past projects. He was the RAMS manager for the BTS option car project, in which he was in charge of the design and management of RAMS-related tasks. He was also the RAMS manager for Beijing #15, Haerbing Line #1, and Chengdu Line #3 & #4 projects. For the MBTA project, Mr. Li will be responsible for providing the reliability analysis for the system, producing the reliability prediction reports, and organizing the reliability test and maintenance validation activities, formulating security design plan, organizing hazard identification and evaluation, and organizing the FMECA, Fault Tree Analysis, and System Safety Hazard Analysis (SSHA), and other related analyses.

1.1.3 Responsibilities Matrix

Name	Title	Responsibilities	Location	Decision Making Authority
Mr.Xiwei Lu	General Manager	Chief representative of the corporation; be responsible for the comprehensive management on the project site and the general work of the project.	USA	To make decisions for major issues on-site, and manage the leaders of each department.
Mr. Mike Feenaughty	Project Manager	Assist the general manager in completing the comprehensive management on the site; organizing all the meetings related to the project, supervise, inspect, coordinate and examine the implementation of the resolutions of the meetings; manage project cost, progress and quality.	USA	Solve the problems existing during project implementation, and report to general manager regularly.

Name	Title	Responsibilities	Location	Decision Making Authority
Mr. Bo Jia	Deputy Project Manager	Assist the project manager to implement on-site management work; collect, sort, statistics, analyze, conclude, and report information during project, and to prepare and update the communication information between each relevant departments.	USA	Focusing on the project plan, production progress management, and temporarily deal with the project's issues entrusted by the project manager.
Mr. Jijun Han	Deputy Project Manager	Assist the project manager in completing the comprehensive management in China; organizing all the meetings related to the project, supervise, inspect, coordinate and examine the implementation of the resolutions of the meetings; manage project cost, progress and quality for activities in China.	China	Solve the problems existing during project implementation, and report to the project manager regularly.
Mr. Dai Iwama	Contract Administration Manager	Support the Project Manager on the MBTA project with regards to Contract Administration tasks, such as manage communications with subcontractors, maintain contract records and logs, and use standard contract principles by establishing internal policies and procedures.	USA	Make decisions directly related to Contract Administration related issues.
TBD	Quality Manager	Responsible for planning, organizing and implementing the project quality management work; in charge of establishing quality management system, quality inspection before using, FAI and products' quality at the Springfield facility.	USA	Be responsible for produce the quality standard, and delivery inspection.
Mr. Zongmin Liu	Quality Manager	Responsible for planning, organizing and implementing the project quality management work; in charge of establishing quality management system, quality inspection before using, FAI and products' quality.	China	Be responsible for produce the quality standard, and delivery inspection.
TBD	Deputy Project Engineer	Be responsible for the management of the technical team for the design process, testing and commissioning, methods engineering, and product support after-sale service in the implementation of the project.	USA	Decision-making in technical issues of this project; be responsible for instructing, monitoring, assessing the technical management.

Name	Title	Responsibilities	Location	Decision Making Authority
Mr. Haifeng Hong	Project Engineer	Be responsible for the technical support in the whole process on-site design changes, purchase, manufacturing, experiment and after-sale service in the implementation of the project; be responsible for management of the on-site technical team.	China	Decision-making in technical issues of this project; be responsible for instructing, monitoring, assessing the technical management.
TBD	Systems Integrator	Be responsible for the technical guidance and support of the systems integration of the vehicles in the U.S.	USA	In charge of the system integration and standard clarification, and report the major issues to Deputy Project Engineer.
Mr. Zhonghai Wang	Lead Systems Integrator	Be generally responsible for the technical guidance and support, etc. of the systems integration of the vehicles on the site.	China	In charge of the system integration and standard clarification, and report the major issues to Project Engineer.
Mr. Qingzhu Liu	Method Engineering Manager	Be responsible for organizing establishment of the process documents and process plans used in the production; be responsible for organizing the technical guidance and support of the production process in the manufacturing process; organize the planning of some relevant work of adjustment of the process layout on the project site, expansion and reconstruction of the plant building.	China	In charge of the assembly facility and equipment sources, and examination of production capability human rescues, and organizing the instruction, supporting, and inspection work for technology.
Ms. Ying Sun	Methods Engineering Manager	Be responsible for establishment of process documents and guidance of the process methods of vehicle assembly; assist training manager in assembly technical training.	USA	Clarify the process standard, and instruct assembly processes.
Mr. Yongsheng Li	RAMS Management Engineer	Be responsible for overall RAMS management; analyze the RAMS demands, collect the RAMS original data and provide the data analysis report.	China	To provide the data for improving the stability and reliability.

Name	Title	Responsibilities	Location	Decision Making Authority
Mr. Huaikai Sun	Procurement Manager	Be responsible for purchase, of purchase contract signing, material preparation as per demand, and claims for compensation to the suppliers under the on-site project.	China	To implement material purchasing work based on overall schedule, and coordinate material delivery based on production demand.
Mr. John Hynes	Field Support Engineer	Be responsible for organization and coordination of the relevant work during the quality assurance service after sales of the vehicles; be responsible for solve the problem existing during servicing; be responsible for summary, analysis and feedback of the after-sale service information and presenting the product rectification proposal.	USA	To supervise and control the vehicle after-sale warranty service, make the vehicle operation security proposal, guarantee vehicle safety and reliable operation.
TBD	Production Manager	Responsible for the assignment of all skilled labor and issuing of required tools to perform all manual work on the vehicles. Manage the overall production activities with close attention to the delivery schedule to ensure on-time delivery of the vehicles.	USA	In charge of general production organization and holding regular production meeting , and implementation of production schedule
Mr. Xianbo Chen	Production Manager	Produce, organize, plan, and implement daily manufacturing plan, to ensure on-time delivery.	China	In charge of general production organization and holding regular production meeting , and implementation of production schedule
Mr. Guorui Zhai	Test & Commissioning Manager	Be responsible for all testing and commissioning activities necessary to achieve vehicle acceptance by the MBTA	USA	Decision making that affect testing & commissioning
Mr. Wei Wang	Test Engineer	Be responsible for establishment of commissioning process flow in CRC; be responsible for organizing the static and dynamic commissioning.	China	Be responsible for commissioning

Name	Title	Responsibilities	Location	Decision Making Authority
TBD	M/WBE Liaison Officer	As the single point liaison, responsible for all interfaces with the minority firms and the transit authority. Activities include but not limited to the following: prepare reports for payment to minority firms; review purchase orders; establish and maintain contract and subcontract award records; attend business opportunity workshops, seminars and trade fares related to minority involvement	USA	In charge of decisions directly related to M/WBE activities at all levels.

1.2 STATEMENT OF UNDERSTANDING

Below is the RFP requirement for the Statement of Understanding, and CNR's commitment of compliance.

Tab I.1 (b) Statement of Understanding
Provide a statement that confirms that the Offeror fully understands and will adhere to the requirements of the technical specification and all design and manufacturing standards referenced or otherwise applicable.

CNR confirms that it fully understands and will adhere to the requirements of the technical specification and all design and manufacturing standards referenced or otherwise applicable.

1.3 CNR'S STAINLESS STEEL CARBODY EXPERINECE AND EXPERIENCE OF SUBCONTRACTORS

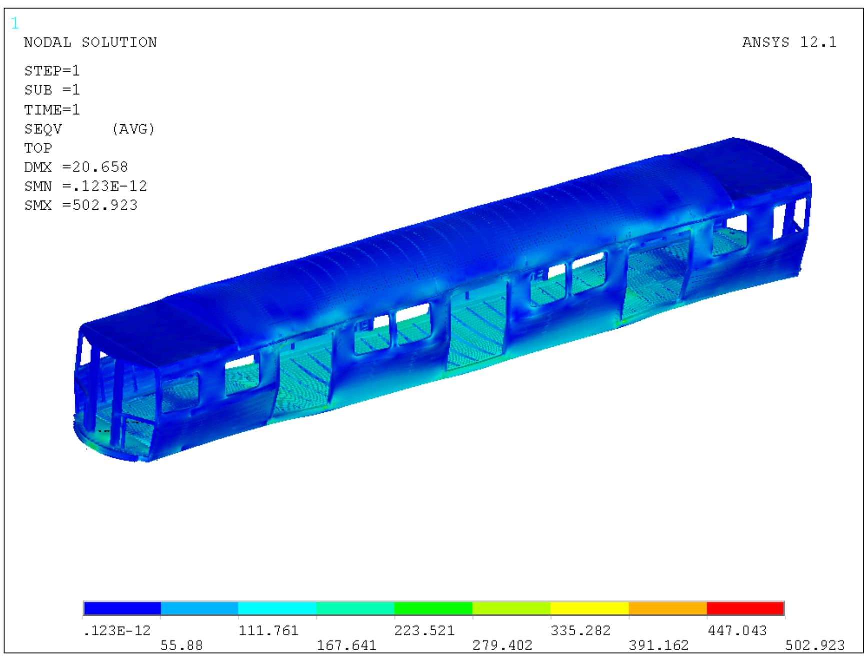
Below is the RFP requirement for the experience with stainless steel carbody manufacturing, and subcontractor history information:

Tab I.1 (c) Experience with Design and Manufacturing of Stainless Steel Carbodies for Heavy Rail Transit Vehicles
Indicate the Offeror's experience with the design and manufacture of stainless steel carbodies for heavy rail transit vehicles, with emphasis on North American projects. To do this, provide a matrix that includes: the transit property; number of cars; date of contract; and carbody manufacturer (in-house or sub-contractor). *Identify the potential subcontractor(s) for the Propulsion, Trucks and Major Truck Components, Auxiliary Power, Low Voltage DC Power, HVAC, Carbody, Couplers / Draft Gear, Wheel Sets, Air Brake Equipment and Controls, Cab Signal Equipment, Door Systems, Seats, Vehicle Monitoring System, Network Equipment and Integrator, Communications Equipment including LED and LCD Signage, Lighting. Identify the type of equipment being considered and where and in what quantities similar equipment is in use. Indicate where this equipment will be manufactured and assembled. The Authority places special emphasis on the use of equipment that is service proven in a similar application in the North American market.*

1.3.1 Experience with stainless steel carbody

The stainless steel carbodies to be provided by CNR will be manufactured in Changchun, China. CNR began developing stainless steel transit vehicle designs in 1987. With the delivery of 116 stainless steel vehicles to Tianjin Binhai Metro in 2002, CNR became the first Chinese manufacturer to successfully deliver lightweight stainless steel heavy rail vehicles. CNR then went on to deliver 192 stainless steel vehicles for Beijing Metro Line 5 in 2005, a project that proved the maturity of CNR's research, design and manufacturing processes. Since 2005, CNR's manufacturing processes have been developed and refined even further, allowing CNR to become a world-class rail vehicle manufacturer able to compete in the world marketplace. In the past 10 years, CNR has produced over 3000 stainless steel carbodies, as shown in "Stainless Steel Projects" table located at the end of this section.

CNR has continued to advance stainless steel vehicle manufacturing techniques and designs by setting up a dedicated stainless steel carbody research and development platform and manufacturing base. Currently, more than 200 experienced CNR engineers specialize in heavy rail transit design development. CNR uses advanced software, such as Catia 3-D design software, an integrated Virtual Product Management (VPM)/SAP system and ANSYS for Finite Element Analysis (FEA), to provide the best and most efficient designs to their customers. CNR has successfully performed FEA analyses on past projects having similar requirements as in Section T 3.05.03 I of the technical specification.



Finite Element Analysis of Complete Car

Following FEA, the complete carbody structure is physically tested to validate the finite element model of the car and the FEA, and to confirm that the structural strength of the carbody fully meets the customer's requirements.

Static Testing of Carbody structure

CNR spot welds 90% of the stainless steel components on the carbody in order to provide lightweight vehicles. To ensure that the spot welds transfer operating and emergency loads, CNR has created exacting stainless steel spot welding procedures and has performed FEAs on the carbody structures and has validated the analyses via physical tests. The low heat generated during the spot welding process reduces carbody deformation and ensures that the skin panels remain flat and aesthetically pleasing.

Spot Welding Jig for Stainless Steel Sideframe Panels

Spot Welded Stainless Steel Carbody

Laser welding has recently been incorporated into many heavy rail carbody designs. CNR has thoroughly researched laser welding designs and processes, and has substituted laser welding for spot welding on carbody kin panels. CNR has used FEA to compare the strength of spot welded structures with laser welded structures, and the results of the analysis show that laser welding provides superior structural and fatigue strength, and preserves skin flatness while eliminating spot welding discoloration on the exterior of the vehicle.

Laser Welded Stainless Steel Carbody

The table below shows CNR's previous contracts for stainless steel heavy rail vehicles, for which CNR has specifically manufactured the carbody structure.

Stainless Steel Projects

No	Transit Agency	Contract Award	Car Quantity
1	Beijing Metro Line 5	2005	192
2	Shenyang Metro Line 1#	2006	138
3	Australia Double-Deck Stainless Steel EMU Project	2006	624
4	Bangkok BTS Metro Project	2007	48
5	Hong Kong Metro West Island Line	2008	120
6	Shenzhen Metro Line 3, New Procurement	2009	114
7	Brazil Rio de Janeiro Metro 1A	2009	114
8	Beijing Metro Line 9	2009	144
9	Beijing Metro Line 10 Phase II	2009	258
10	Beijing Metro 15#	2009	180
11	Beijing Yizhuang Line	2009	138
12	Chongqing Rail Transit Line 1	2009	174
13	Brazil EMU Project	2009	120
14	Chongqing Rail Transit Line 6	2010	126
15	Beijing Metro 6#	2011	384
16	Beijing Metro Line 5 New Procurement	2011	132
17	Hong Kong MTR South Island Project	2011	30
18	Beijing Metro 14#	2012	228
		Total	3264

1.3.2 Potential Suppliers and Experience Matrix

System / Equipment	Type of Equipment	Supplier	Facility Location	Where Used	Quantity
Auxiliary Power Supply System	Auxiliary Power Supply; Low Voltage DC Power	Mitsubishi Electric Power Products, Inc.	Freedom, PA, USA	SEPTA	120 cars
				NYCT	300 cars
				BART	410 cars
		TOYO DENKI USA, Inc.	Freedom, PA, USA	WMATA	364
				MNR	162
				NYCT	2
	Battery	Saft America Inc.	Valdosta, GA, USA	NYCT	15
				HRT	13
				SFMTA	151
				NYCT	618
				NYCT	460
Cab Signaling Equipment	Automatic Train Protection; Automatic Station Identification	Alstom Signaling, Inc.	Rochester, NY, USA	MNR	190
				SEPTA	118
				UTA	20
				PATCO	60
				Seoul, South Korea	14
		ANSALDO STS USA, Inc.	Batesburg, SC, USA	NJT	99
				NJT	33

System / Equipment	Type of Equipment	Supplier	Facility Location	Where Used	Quantity
				LACMTA	52
				LIRR	418
				PAAC	83
				LACMTA	50
				Sound Transit	31
				NJT	42
				CATS	20
				ARRC	68
				NJT	10
				STM	144
				LACMTA	78
				WMATA	32
				Montreal STM	104
				HART	68
Carbody		CNR Changchun Railway Vehicles Co., Ltd.	Changchun, China	Chongqing, China	126
				Beijing, China	384
				Beijing, China	132
				Hong Kong MTR	30
				Beijing, China	228
Communication Equipment	PIS, PA, PEI, CCTV (Option V)	RL Control LLC / ISC Applied Systems	Eden Prairie, Minnesota, USA	DART	2
	PIS,PA, PEI, CCTV (Option V), WiFi, Infotainment, Network			MDT	138
	ICCU for VHF and UHF radio systems			GO Transit	157
	Communication System including interoperability with existing Amtrak fleet			Caltrans	130
	Analog PA/IC + PEI equipment including new equipment designs			GO Transit	60
	Analog PA/IC + PEI equipment			GO Transit	25
	Digital Passenger Information System (PIS) & video surveillance,			SACRT	21
	Digital Passenger Information System (PIS)			TRIMET	18
				VRE	8
				METRO	19
Communication Equipment	Digital Passenger Information System (PIS) & video surveillance, wireless communications	RL Control LLC / ISC Applied Systems	Eden Prairie, Minnesota, USA	METROLINX	18
				SMART	12
	Digital Passenger Information System (PIS) & video			PATCO	120

System / Equipment	Type of Equipment	Supplier	Facility Location	Where Used	Quantity
	surveillance, infotainment, wireless communications				
	Upgrade of the communications control panel in support of UHF radio upgrade			WMATA	1000
	Digital Passenger Information System (PIS) for new and existing LRV fleet			SDMTS	109
	Control Amplifier	TOA Communication Systems	NJ, USA	MBTA	80+
	Control Amplifier with GPS function		NJ, USA and Japan	SCRRA and SFRTA	141+
	LED sign		NJ, NY, and Japan	MBTA, SCRRA and SFRTA	800+
	Automatic Announcement System Unit		Japan	India, Hong Kong MTR, Singapore, Turkey, Greece, China, Japan	900+
	Passenger Emergency Intercom		Japan and NJ, USA	MBTA, SCRRA, NYCT, India, Hong Kong MTR, Singapore, Turkey, Greece, China, Japan	4500+
	LCD Monitor (Option VIII)		Japan	India and Greece	1000 +
	Main Communication Unit		NJ, USA	NYCT	50+
	Interior Speaker		Japan, Indonesia, USA	USA, India, Hong Kong MTR, Singapore, Turkey, Greece, China, Japan	10000+
Communication Equipment	Interior Camera (Option V)		Japan and USA	NYCT, SCRRA, India	250+
Composite Flooring	Abrastop/Foam Lite	Baultar Concept, Inc.	Windsor, Quebec, Canada	Montreal STM	468
	Abrastop/Foam			CSX	200+
	Abrastop/Foam			METRA	104
	Abrastop/Foam & Abrastop/Fibre			Amtrak	21
	Abrastop/Foam			RTD Denver	12+
	Abrastop/Foam			SNCF	344
Coupler and Draft Gear		Wabtec Passenger Transit	Duncan, SC, USA	BART	80
				CTA	706
				LACMTA	74
				MARTA	100
				NYCT	1030
				NYCT	600
				NYCT	212

System / Equipment	Type of Equipment	Supplier	Facility Location	Where Used	Quantity
				NYCT	1662
				NJT/NYCT	350+
				Toronto TTC	216
				Toronto TTC	156
Door System	Includes Door Open Pushbuttons int/ext (Option VII)	Ellcon National Inc. (Faiveley Transport)	Greenville, SC, USA	Montreal STM	2808
				NJT	800
				SEPTA	720
				AMT	1200
				NJT	770
				NJT	3000
				NJT	1800
				SEPTA	2600
				WMATA	8000
		Vapor Stone Rail Systems	Duncan, SC, USA	NYCT	12,360
				NYCT	7,200
				NYCT	3,392
				NCYT	16,032
				LIRR	2,824
				PATH	4,200
				CTA	706
				MNR	405
	Gap Mitigation Device (Option VI)		Plattsburgh, NY, USA	MBTA	200
	Door Open Pushbuttons int/ext (Option VII)			NYCT	46,000+
Friction Brake System		Wabtec Passenger Transit	Duncan, SC, USA	CTA	80
				CTA	706
				LACMTA	74
				MARTA	100
				NYCT	1030
				NYCT	600
				NYCT	212
		Ellcon National Inc. (Faiveley Transport)	Greenville, SC, USA	NYCT	6
				SNCF	150
				NS (Netherlands)	130
				Grenoble, France	100
HVAC		Ellcon National Inc. (Faiveley Transport)	Greenville, SC, USA	MARTA	58
				NYCT	28
				SFMTA	64
				RTCSNV	32
		Mitsubishi Electric Power Products, Inc.	Freedom, PA, USA	MNR	405 cars
				NJT	95 cars
				Montreal AMT	160 cars
				NYCT	126 cars

System / Equipment	Type of Equipment	Supplier	Facility Location	Where Used	Quantity
				NJT	100 cars
				Maryland MTA	54 cars
				NYCT	600
				NYCT	212
Lighting		LECIP Inc.	Hornell, NY, USA	Caltrans	Unavail.
				SEPTA	Unavail.
				Amtrak	Unavail.
		TDG Transit Design Group, Inc.	Niagara Falls, NY, USA	Sound Transit	9 cars
				SunRail	22 cars
				SEPTA	250 cars
				Mn/DOT	18 cars
				UTA	18 cars
				Amtrak	36 cars
Propulsion System	Traction Motor, Propulsion Inverter Box, Gear Unit, Switch Box	Mitsubishi Electric Power Products, Inc.	Itami, Japan And Freedom, PA, USA	LIRR	836
				MNR	336
				MNR/CDOT	380
				SEPTA	120
				MDT	28
				WMATA	29
	Traction Motor, Propulsion Inverter Box, Gear Unit, Switch Box	Toyo Denki USA, Inc.	Freedom, PA, USA	DART	20
				DART	48
Seating		Freedman Seating Company	Augusta Blvd, Chicago, IL 60651.	Rocky Mountaineer	2 trains
				Amtrak	140 trains
				Sun Tran	8 trains
				ODOT	2 trains
				TriMet	6 trains
				SEPTA	26 trains
				GCRTA	34 trains
				MVTA	27 trains
				METRA	298 trains
				STA	33 trains
				WMATA	50 trains
				TriMet	27 trains
				Port Authority	82 trains
		Kustom Seating	Bellwood, IL, USA	DART	259 car sets
				WMATA	428 car sets
				METRO	38 car sets
				MVTA	59 car sets
				TriMet	18 car sets
				CATS	26 car sets
Training		FAAC, Incorporated	Royal Oak, MI	NYCT	1

System / Equipment	Type of Equipment	Supplier	Facility Location	Where Used	Quantity
Simulator (Option XI)				Metropolitan Transit Authority - Houston Rail	1
		SIMUTECH INTERNATIONAL CO., LTD	Beijing, China	Beijing Metro ; China DaLian MTRC; Dalian Modern Rail Transit Co. China Beijing Vocational College of Transportation; CNR Changchun Railway Vehicles Co., Ltd	30
Trucks	Gallary Car Truck	Bradken, Inc.	Atchison , Kansas, USA	Metra	554
				Metra	26
				Metra	600
				VRE	20+
				BART	500
				BART	160
				WMATA	600
				WMATA	384
				WMATA	368
				MARTA	200
				MARTA	10
	Bi-level			Go Transit, Tri-Rail	1098
				SCRRA, Coaster, West Cost Express, ACE, Sounder, Trinity Railway Express, Caltran	1082
				UTA	322
	TTC H-Series			TorontoTTC	932
	TTC Workcar			TorontoTTC	18
	EMD Loco			Unavail.	77,381
	GE Loco			Unavail.	16,561
	MPI Loco			METRA	142
	Brookville			Unavail.	20
Vehicle Monitoring System	Includes Network Equipment and Integrator	Mitsubishi Electric Power Products, Inc.	Freedom, PA, USA	MNR	405
	Includes Network Equipment and Integrator	Toyo Denki Seizo K.K.	Yokohama, Japan	Beijing, China	100+
Wheelsets	Wheels, Axles, Journal Bearings and Housing	UTCRAS, Inc	Morton, PA, USA	SCRRA	644
				SEPTA	500
				RTD Denver	200
				Amtrak	520
				AMARTA	960

1.4 PROPOSED TRUCKS

Below is the RFP requirement for the proposed trucks:

Tab I.1 (d) Proposed Trucks
Describe the proposed trucks for this contract. Include such information as, but not limited to, structural material description, suspension (primary or secondary) description, allowable static and dynamic movement, and fully assembled weight. Provide a listing of the past experience of the basic design of the proposed trucks. Indicate where the major truck structural components will be manufactured (cast or fabricated) and where the trucks will be assembled.

1.4.1 Technical Approach

CNR, along with Bradken (formerly Atchison Castings) are proposing a cast truck design utilizing the expertise and service proven history of Bradken trucks within North America. After a thorough evaluation of capable North American truck suppliers, CNR selected Bradken as the strongest partner. Bradken as a company can both design and manufacture trucks for their clients. They aren't dependent upon an inflexible design being used to satisfy a service proven design instead they can focus on the needs of current vehicle designs to provide the best solution utilizing the experience they have gained as a leading North American truck supplier.

Bradken has designed and manufactured over 5,000 railway passenger trucks since 1961 and more than 90,000 locomotive trucks since 1936. These trucks have provided millions of miles of safe and highly reliable service for the many long distance and commuter rail passengers in North America.

Bi-Level trucks have been provided for Metrolink (SCRRA), Sounder (Seattle), Coaster (San Diego), Trinity Railway Express (Dallas Fort Worth), Altamount Commuter Express (ACE), SFRTA (formerly Tri-Rail), GO Transit, and several others.

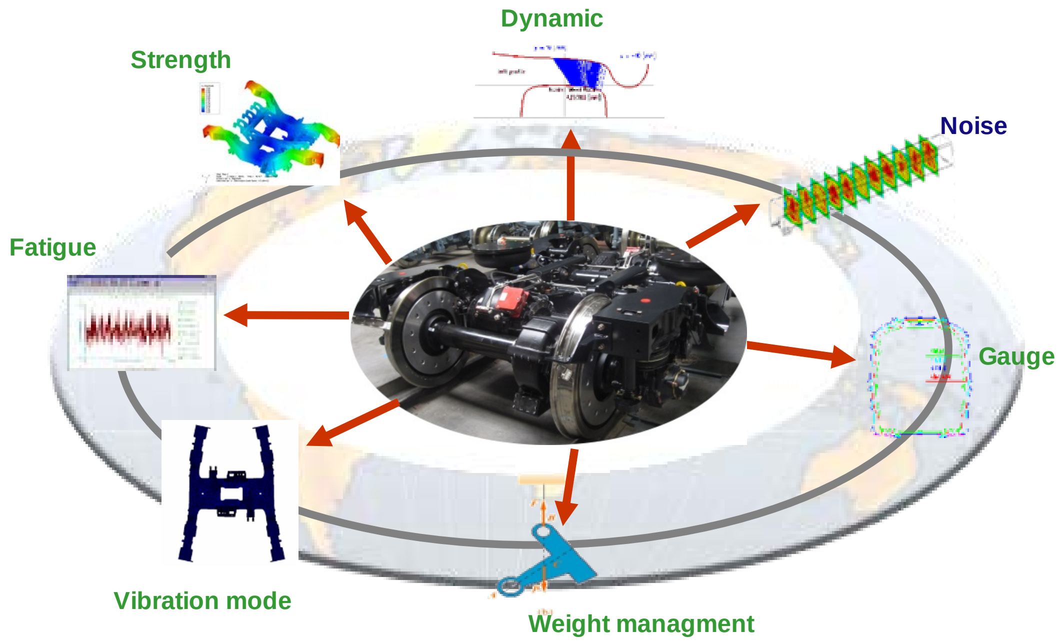
For the transit industry, Bradken has provided trucks for Toronto (TTC), Washington (WMATA), San Francisco (BART) and Atlanta (MARTA). It is the TTC truck that CNR focused on for their MBTA design. The TTC truck has inboard journals and the same axle center distance as the MBTA. This truck had been in service for 37 years and will soon be having a second life in Lagos, Nigeria. This kind of service dependability, along with the fact that these trucks will be reconditioned for an expected 20 years of additional service, provided CNR the confidence that Bradken trucks can withstand the rugged service environment of the MBTA heavy rail vehicles.

CNR has a large truck design engineering team of more than 70 engineers and has been designing and fabricating trucks since 1954. This design team has extensive truck experience from lower speed LRVs to high-speed intercity cars. These cars include trucks for LRVs, EMUs including subway cars for speeds of 50-125 mph (80-200 km/hr), and intercity high speed trucks for 236 mph (380 km/hr) cars. Based on this extensive experience CNR is confident in being able to complete the design and integrate the total truck assembly.

In addition, CNR has extensive truck production experience and fabricates up to 6,000 trucks per year.

CNR's truck design capabilities include CAD or CATIA, and classical/finite element stress analysis using ANSYS, dynamic performance analysis using SIMPACK or VAMPIRE. CNR's Advance Technology Test Center provides static and fatigue testing for truck structural elements, and can also provide dynamic performance simulation tests of a complete car including trucks.

Below are figures showing CNR's simulation and analysis platform, truck static and fatigue strength test and the roller rig where a complete car including trucks can be dynamically tested. Note while CNR is indicating their overall testing capabilities, for this particular design, the truck static and fatigue testing will be performed by Bradken utilizing a company in the US that Bradken has used in the past for their designs. CNR will provide oversight of these tests.



CNR's Simulation and Analysis Platform

CNR has successfully designed dozens of trucks which have passed both static and fatigue tests.

Truck Frame Static and Fatigue Strength Test

Vehicle Roller Rig Test

1.4.2 Technical Description

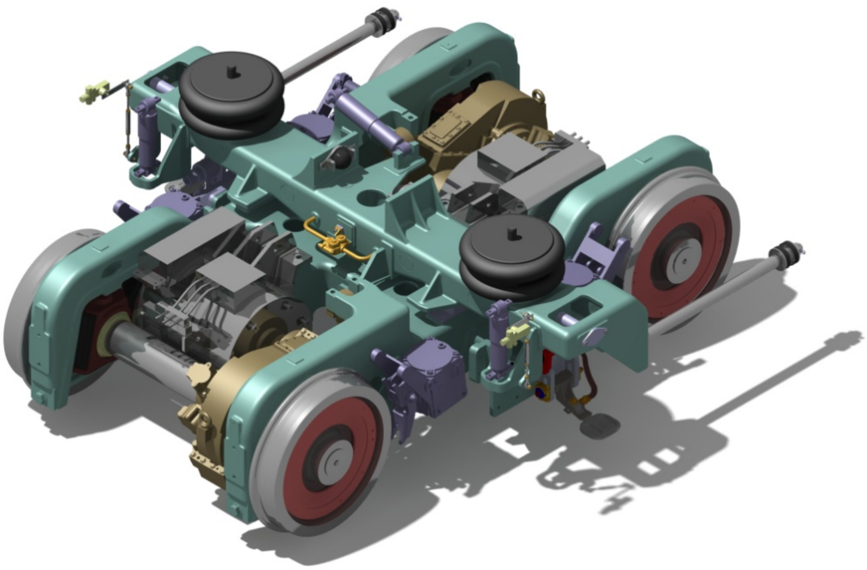
1.4.2.1 General Description

The truck is inboard bearing with widely spaced bolster air springs, and is designed for stringent North American operations in accordance with the MBTA Technical Provisions as well as the applicable FRA, APTA, and AAR standards.

The truck utilizes a conventional rigid 'H' type frame. Two air springs per truck are used to support the carbody and to provide the required ride comfort. The primary suspension consists of chevron springs. The truck is designed with two motors per truck (one per axle). The traction motors are mounted to the frame and are therefore fully suspended. The gearbox is double reduction with a flexible coupling

g. Besides the electrodynamic braking system using the traction motors, the trucks are equipped with pneumatically operated wheel tread brake units.

For the truck general arrangement drawing, see Section 1.13 of this proposal. The 3D concept of the complete truck assembly is shown below:



3D Concept of No.2 Truck Assembly

These trucks will use many standard parts and interfaces to carry out reliability evaluation on each part and to optimize the truck in accordance with the principle of reducing whole life cycle cost.

The truck design considers the following special requirements during design:

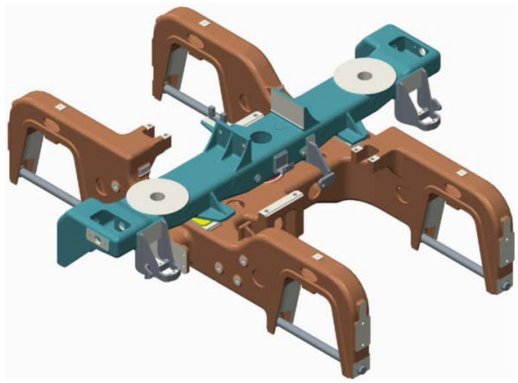
- Inboard bearing design;
- Average Red Line axle load 31,250 lbs (14.2 t), average Orange Line axle load 27,500 lbs (12.5 t);
- Max operating speed 63 mph (101.4 km/hour);
- Maximum design speed 70 mph (113 km/hr);
- Wheel diameter new 28 inches (711.2 mm), worn 25.75 inches (654.05 mm);
- Minimum truck equipment clearance 2.75 inches (69.9 mm) above top of running rail;
- Excellent running stability and comfort;
- Service life of 30 years;
- Reduced maintenance;
- Reduced whole life cycle cost.

1.4.2.2 Truck Frame and Bolster

The truck frame is a one piece casting, rigid H-frame, which has mounting brackets for equipment such as current collectors, brakes, motors and gearboxes, and has lifting lugs on top of the frame and jacking pads on the underside. The truck frame also has rotational stops as per Section T 11.06.04 C.

The truck bolster is also a one piece casting, and will provide additional air volume for the secondary suspension and serve as an auxiliary reservoir. The interior of the bolster casting will be coated with a permanent anti-corrosion coating.

The 3D concept of the truck frame and bolster is shown below:



3D Concept of Truck Frame and Bolster

Bradken utilizes in-house solidification software Magma as a Foundry Process Engineering tool. This analysis is performed prior to pouring the first samples and utilized further to enhance the design of the casting production.

The bolster will be pressure tested in accordance with ASME pressure vessel requirements. The tests will be performed at 1.5 times the maximum main reservoir pressure prior to being assembled into the truck assembly.

The truck bolster will be attached to the truck frame by means of a locking center pin.

The truck frame castings will be tested for static loading and fatigue loading per Section T 11.09 of the Technical Provisions.

Each truck frame casting is designed to carry a 50,000 lb. centerplate load to accommodate the 125,000 lb. maximum Red Line AW3 car weight.

The truck frame casting is designed to withstand the truck-to-carbody connection requirement of a horizontal load of 150,000 lbs. applied anywhere on the truck frame as per Section T 3.04.01K.3 of the Technical Provisions to protect against truck separation in the event of a derailment.

The truck frame and bolster will be painted in accordance with Section T 18.18.01 of the Technical Provisions.

The structural reliability of trucks with cast steel framing has been proven over many years of service at the MBTA and many other locations throughout North America.

This proposed truck frame and bolster design will have even further improvements in material strength using Bradken's C4 alloy steel; which will enhance its yield strength to 48,000 psi and ultimate tensile strength to 75,000 psi, yet still meeting all of the requirements of AAR M-201 Grade B specification. The AAR specification M-201 Grade indicates the tensile strength of 70,000 psi and the yield strength of 38,000 psi. The Bradken C-4 alloy steel ensures Charpy "V" Notch Impact Test values of 15 ft-lbs. @ -20°F.

A total of 300+ trucks on the Chicago Metra gallery cars and approximately 150+ trucks for Virginia Rail Express (VRE) as well as SCRRA/SFRTA/ROTEM fleet of 292 trucks for California and Miami were manufactured from this improved Bradken's C-4 Steel.

A similar Bradken cast steel truck frame and bolster has been in revenue service operation with the TTC for 37 years.

This design has had superb performance and a project is now underway to refurbish these trucks and corresponding vehicles for a new installation for Lagos, Nigeria's 17-mile (27 km) Blue Line.

1.4.2.3 Primary Suspension

A pair of chevron springs transmits loads from the truck frame to the axle. Primary chevron springs provide the desired lateral, longitudinal, vertical and yaw stiffness between the truck frame and axle. This kind of suspension allows flexibility in longitudinal, lateral and vertical direction, not only to ensure the required spring deflection of the primary suspension, but also to meet the requirements of flexible positioning of the journal box. At the same time, it has good performance absorbing high frequency vibration and insulating against noise.

Tie bar and bump stops are also incorporated within the primary suspension system to protect against excessive wheelset deflections. The installed tie bar also provides wheel axle retention during lifting.

The stiffness of the chevron springs may vary according to the weights of Red and Orange line cars if necessary, but the interfaces will be kept the same.

The use of chevron springs is a service-proven feature and meets the requirements of Section 11.06.01. Chevron spring vertical stiffness per journal box is 6,270 lbs./in. AW0 to AW3 static spring deflection is approximately 0.78 inches. At AW0 load, the vertical distance to the primary suspension solid stop will be 2.0 inches.

A simulation using either SIMPACK or VAMPIRE and the track data to be obtained within 90 days of contract will be done to determine if this spring rate needs to be revised for either the Red Line and/or the Orange Line trucks. While the static and dynamic movement of the truck meets the requirements of the clearance diagram, CNR will perform detailed calculations of the final car configurations during the detailed design phase to optimize static and dynamic envelop clearances.

1.4.2.4 Secondary Suspension

The air springs support the carbody weight and provide the vertical, lateral, and rotational suspension stiffness between truck and carbody, which are provided primarily to reduce the vibration and shock and provide good passenger riding comfort while maintaining proper floor height relative to the station platforms. This air spring system also achieves a constant vertical body bounce frequency over its operating range, reducing the effect of dynamic resonance between the truck and the carbody.

The secondary air spring has a progressive rubber bumper located inside, in the event of an air spring failure (loss of air) allowing the car to still run safely.

The air springs are connected to auxiliary air reservoirs in the bolster, which provide an additional air column to soften the vertical stiffness to achieve the required vertical ride comfort.

The lateral rubber bumper stops are provided to limit infrequent excessive lateral movements thereby controlling the displacements for the kinematic envelope.

One secondary lateral hydraulic damper per truck, fitted between the underside of the carbody and the truck bolster, controls lateral body oscillations.

Two secondary vertical hydraulic dampers are fitted in parallel with the air springs. These provide the damping of the vertical oscillations of the carbody.

Three (3) leveling valves (No. 1 truck with a single leveling valve and the No. 2 truck with two leveling valves), per Section T 11.06.03, are used per car to control the air supply to the springs to suit the varying passenger load. The air springs on the No. 2 truck will be connected by means of a differential pressure valve so that the rupture of one spring will deflate the other.

The air spring vertical stiffness at AW0 is 1,990 lbs./in. and at AW3 is 3,420 lbs./in. This spring rate will be verified by dynamic analysis after the track data evaluation. The air gap for secondary suspension motion to contact the progressive internal rubber bumper stop is 1.25 inches. This distance to contact the rubber bumper will be optimized for ride quality so it will not be contacted during normal vehicle operation.

The traction and braking forces are transferred between the carbody and bolster via two longitudinal bolster anchors. The bolster anchors are forged with resilient rubber bushings at each end.

In the proposed design, the vertical load is supported by non-metallic side bearings on the truck frame. The side bearing frictional resistance is carefully calculated to provide the correct amount of torsional damping to control truck hunting at high operating speeds. No lubrication or maintenance is required.

Reduction in vehicle height due to wheel wear can be restored by packing shims under the loaded side bearing assembly. The shims will be arranged so they will not come loose. The height adjustment arrangement will be submitted to the Authority during design review.

1.4.2.5 Wheelsets

Each truck has two wheel sets. Each wheelset contains wheels with noise reduction dampers, axle, journal bearing housings, journal bearings, gear box and grounding rings. Wheels are forged AAR M-107 Grade B steel structure. The axle is in accordance with AAR M - 101 Grade F and designed for a minimum fatigue life of 40 years. The bearing housing is a whole cast structure. The journal bearings are 6x11 Class E self-sealed tapered roller bearing with double row, and will have an L-10 life ≥ 1,500,000 miles (2,414,016 km). The inspection interval for the journal bearing will not be less than 300,000 miles (482,803 km). Each journal housing will be drilled to enable installation of an over-temperature sensor. CNR will make every effort to reduce the unsprung mass of the truck and therefore minimize impact forces to the rail. CNR is currently investigating the use of hollow axles to reduce the unsprung mass and overall vehicle weight.

1.4.2.6 Braking System

All trucks are fitted with tread brake units at all four wheel positions. The tread brakes will be mounted directly to the truck side frame with bolts. Each brake unit will be fitted with a brake shoe. The brake shoe will be secured to the brake unit by an easily removable brake key. The tread brake units containing the parking brake feature will be located on the No. 1 truck. The parking brake will be spring applied air released and have a backup mechanical release. The No. 1 truck of each car also has trip cocks, one on each side.

1.4.2.7 Traction Equipment

The truck is designed with two motors and gear units per truck in compliance with the requirements of Section T 11.04. Each axle of the truck is driven by a traction motor which is hung on the frame and arranged in parallel with the axle. A double reduction gearbox will be provided and have one end supported by the axle and the other end hung on the frame by resilient rubber mounts. Between the traction motor and gear box is a coupling to transfer the torque. In addition, the traction motor and gearbox are also equipped with a ground return device and speed sensor. There will be at least two ground brushes per axle in compliance with Section T 9.03.03 A of the Technical Provisions.

In addition, current collectors will be mounted on each side of each truck. An air-operated sleet scraper will be mounted on each side of the No.1 truck, forward of the current collector.

1.4.2.8 Additional Equipment

The truck is designed with mounting seats on both ends of the frame, which will be used for installing ATP/ASR Antenna or snow plows, flange lubrication, and other additional equipment.

1.4.2.9 Truck Weight

It is currently estimated that the (Red Line or Orange Line) No. 1 truck total weight will be approximately 13,700 lbs. (6.2 t) and the No. 2 truck total weight will be approximately 13,200 lbs. (6.0 t).

1.4.2.10 Noise Control Device

Rubber is used extensively in the lateral bumper stops, bolster anchor connections, hydraulic damper connections along with rubber chevron primary springs and secondary air springs, gearbox, motor mounts, and other items. In addition, the wheels will be equipped with a noise damping arrangement. These components are provided to reduce noise transmission and minimize resonant vibration while in operation.

1.4.2.11 Interchangeability

The truck can be interchanged between the Red and Orange cars, except perhaps the suspension parameters of truck (the parameters of both the primary springs and air springs) may be different due to the weight variation between the Red and Orange Line cars. Besides the interchangeability between the Red and Orange Line vehicles, there is also interchangeability between the trucks between the No. 1 and No.2 ends on the same car, including the truck frame assembly, bolster assembly, wheel set assembly, journal bearing housing journal bearing, motor, gear box drive device, primary spring, air spring, and other items. The differences between the trucks are the parking brake equipment, trip cock, wheel flange lubrication, automatic train protection/automatic speed regulation (ATP/ASR) antenna, leveling valves and piping. All of the fixed brackets will be located on each truck to make them interchangeable and will only require attachment by bolting.

1.4.2.12 Safety and Dynamic Performance

1.4.2.12.1 Wheel Load Equalization

The truck will be designed to meet the wheel load equalization requirements of Section T 11.10.02 of the Technical Provisions. A chevron primary suspension truck design has already demonstrated good equalization characteristics to the MBTA. An analysis to ensure this as well as a test will be done to satisfy this requirement.

1.4.2.12.2 Safety and Stability

An analysis of the truck will be performed using either SIMPACK or VAMPIRE software to optimize the vehicle dynamic performance (including safety against derailment and high speed stability) and in order to optimize the proper suspension parameters for the truck if necessary. The key objective in the designing of the truck is selecting the optimum combination of roll stability and vertical and lateral spring flexibility. Usually one of these characteristics is obtained at the expense of the other. However, in this truck configuration, it is possible to obtain a high degree of roll stability by the wide spacing of the air springs while still obtaining a soft secondary suspension system.

The track input will be obtained within 90 days of the contract award. These parameters will be verified by the pilot trainset running test to insure the requirements of Sections T 11.10 and T 11.11 of the Technical Provisions are satisfied.

1.4.2.12.3 Ride Quality

The ride quality will be in accordance with Sections T 2.02.16 and T 11.10.05. The wide spacing of the secondary air springs provides good roll restraint while allowing a soft vertical suspension spring rate providing enhanced ride quality for the passengers and the vehicle body. The air springs provide a variable spring rate and ensure maintaining a constant frequency for different passenger loads. This results in uniform ride quality throughout the loading range. Vertical and lateral hydraulic dampers control vertical and lateral body oscillations, and make up the remaining elements affecting ride quality.

1.4.3 Application History and Manufactured Location

The truck frame and bolster are similar to the Bradken H5 and Bi-Level trucks built in 1977 and 1992 respectively.

The axles, journal bearings, primary springs and air springs will be of designs similar to previous Red Line Cars. The wheels will be equipped with a noise damping arrangement based on the Blue Line vehicles.

The locations where the major truck components will be manufactured and assembled are shown in the table below:

Description of Parts	Manufacturing Location	Assembly Location
Truck Frame Assembly	USA	USA
Truck Bolster Assembly	USA	USA
Rubber Chevron Primary Spring	USA or EU	USA
Air Spring Assembly	USA or EU	USA
Lateral Shock Absorber	EU	USA
Vertical Shock Absorber	EU	USA
Bolster Anchor Assembly	USA/EU or China	USA
Wheel with damper	USA	USA
Axle	USA	USA
Journal Bearing	USA or EU	USA
Journal Box	USA or EU	USA
Final Truck Assembly		USA - MA

1.5 WEIGHT MANAGEMENT PLAN

Below is the RFP requirement for the proposed trucks:

Tab I.1 (e) Weight Management Plan
Describe how the absolute weight requirements are met and how the weight is managed during the design phase and during manufacturing. Describe how the Weight Management Plan is coordinated with the various subcontractors.

CNR's weight management efforts begin during the proposal phase of a project when, based on the weight and balance of the vehicle platform on which the proposed vehicle is based, CNR will confirm the feasibility of the required weight and balance requirements. Should it be necessary to deliver a new vehicle having more restrictive weight and balance limits, CNR will closely evaluate the steps needing to be taken to achieve these limits. Only when CNR is satisfied that the specified weight and balance requirements can be achieved will it commit to deliver the vehicles.

Also during the proposal phase of the project, all suppliers of systems and major pieces of equipment will be required to commit to a maximum weight for their scope of supply. A requirement of all supplier purchase specifications is that each supplier indicates the weight of materials and assemblies on drawings. For heavy equipment, the supplier is also required to identify the center of gravity of the equipment.

CNR is fully aware of the absolute (AW3) weight limitations imposed by Part T 1.04.03 A of the Technical Provisions and Part T 2.01.08 of the Technical Provisions: 110,000 lbs for the Orange Line cars and 125,000 lbs for the Red Line cars. However, it should be noted that CNR only has direct control over the car AW0 weight, the number of passenger seats, and designing the cars such that they will only accommodate 225 passengers on the Orange Line cab cars, 240 passengers on the Orange Line non-cab cars, 270 passengers on the Red Line cab cars and 289 passengers on the Red Line non-cab cars using a standee area of 1.5 ft^2 per passenger. CNR has carried out detailed weight analyses for each of the Red and Orange car types, and has full confidence in meeting MBTA's specified vehicle weight targets.

At the beginning of the design development phase of the project, CNR will generate a Weight and Balance Calculation Sheet for each vehicle type (Orange Line cab car, Orange Line non-cab car, Red Line cab car, Red Line non-cab car) based on the Bills of Materials for the proposed vehicle configurations. Normally, the Weight and Balance Calculation Sheet lists all components entering into the construction of the cars down to the line replaceable unit level, together with the weight of the item and the location of the center of gravity (CG) of each component with respect to the orthogonal axes of the cars. Using this sheet, the total weight of each vehicle is calculated, together with location of the vehicle CG and the resulting longitudinal and lateral imbalance. However, for the MBTA project, CNR will also include passenger weight and distribution for the AW1, AW2 and AW3 loading cases in the calculation.

During the design development stage, the engineering group will lay out the car structure and superimpose on it all systems, subsystems, and major components, such that the required equipment dimensions and clearances are maintained. Components are initially located to follow specification requirements and original equipment manufacturer recommendations, to take into consideration equipment access and equipment maintainability (including frequency of maintenance), the ability to mount the equipment to structural members of adequate strength, as well as past experience with similar vehicles built for other clients. To remain within the vehicle imbalance limits imposed by Section T 2.01.09 of the Technical Provisions, components are adjusted on their x, y and z axes, as needed, to provide the required overall imbalance, while still meeting the aforementioned location criteria.

As the vehicle design develops and supplier drawings are received, equipment weight values and equipment CGs are entered into the Weight and Balance Calculation Sheet for each car type. Actual weights are used whenever possible, including weights obtained at first article inspection, source inspection, or other means.

As-built drawings are distributed to Receiving Inspection, and when material arrives, the first sample of each component or assembly is weighed on a calibrated scale to confirm compliance with the suppliers' estimates. As an alternative, suppliers may provide certified weights. The actual material weights are recorded by Quality Control personnel and provided to the Engineering Department, which then refines the weight estimate for the complete vehicle. Should there be any significant departure from the estimated weight, a mitigation plan will be implemented, and equipment will be redesigned or relocated in order to meet the required parameters. Underweight as well as overweight differences are accounted for so that car balancing is closely regulated.

Strategies used to manage weight and weight distribution first include the specification of lightweight materials and designs for all components, and then working with suppliers to modify their designs should weight become a factor. Other key strategies include maintaining close tolerances on the location of heavy underfloor- and roof-mounted equipment from the centerline of the car; reorienting components to change the CG location; and the redesign of equipment to reduce weight and to modify CG locations. The actual component weights derived from the assembly of the first cars will allow for one final adjustment.

As required by Section T 3.04.10 A of the Technical Provisions, CNR will provide regular weight estimates of the carbody throughout the design process, and carbody weight records will be included in each car's Car History Book.

Within 60 days after NTP, CNR will submit monthly weight reports to the MBTA, as required by Section T 2.01.07 B of the Technical Provisions. The weight reports will be detailed to the line replaceable unit level and will include weight targets for new systems and any weight reduction measures currently underway.

Each production car will be weighed on a calibrated scale, recording the car weight individually at both ends and under each axle. A weight ticket recording these values, plus the combined total car weight, will be provided for each vehicle and will be placed in the car manufacturing history book delivered with each vehicle. Should weights for the same type of vehicle produced vary by more than 300 pounds, the cause will be investigated.

Below is the summary weight estimate table for both car types on the Orange and Red lines.

		Orange Line		Red Line	
		Cab car	Non-cab car	Cab car	Non-cab car
No.	Assembly	Weight	Weight	Weight	Weight
1	Carbody	15,874	15,874	20,283	20,283
2	Interior Arrangement	7,417	7,860	9,418	9,480
3	Doors and windows	4,172	4,398	5,451	5,677
4	Electrical above floor	1,642	1,895	1,828	2,045

		Orange Line		Red Line	
		Cab car	Non-cab car	Cab car	Non-cab car
5	Electrical under floor	6,989	6,989	6,989	6,989
6	Brakes	2,017	1,363	2,017	1,363
7	HVAC	5,077	5,011	5,122	5,055
8	Coupler and Draft Gear	1,874	1,874	1,874	1,874
9	Truck	26,900	26,900	26,900	26,900
10	Cab Electrical Equipment	1,245	-	1,356	-
11	Cab Mechanical Equipment	1,421	-	1,421	-
12	Underframe Thermal and Sound Insulation	441	441	441	441
	Σ （AW0）	75,070	72,605	83,100	80,108
	Σ （AW3）	109,945	109,805	124,950	124,903
	Requirements in T 2.01.08				
	Σ （AW0）	75,125	72,800	83,150	80,205
	Σ （AW3）	110,000	110,000	125,000	125,000

1.6 VEHICLE SAFETY

Below is the RFP requirement for the details pertaining to the safety designed into the systems and the vehicle as a whole:

Tab I.1 (f) Vehicle Safety
Describe how Safety of the vehicles is ensured, and what methods are applied to verify and certify the safety of all subsystems and the vehicle as a whole.

While there exist established protocols and design methodologies to ensure that safety features are integrated into system design characteristics to prevent operation of the vehicle except in a safe manner, CNR believes it is necessary that the entire organization be imbued with a sense of safety awareness, such that it becomes second nature to ensure that the operating environment, the riding public and equipment are not subject to events which could result in injury to personnel or damage to the equipment.

CNR's general approach is to use both CNR's staff and the equipment suppliers' knowledge to identify potential hazards and to initiate the necessary actions to prevent, minimize, or control these hazards. It is also necessary, of course, to work closely with the end user to ensure that the vehicles provided interface correctly with the transit system and can be easily used by the riding public.

As required by Section T 2.06.01 A of the Technical Provisions, CNR will provide MBTA, prior to conditional acceptance by the Authority, with a comprehensive safety certification (CDRL 02-21) that all known hazards associated with the vehicle have been mitigated to an agreed risk and Mean Time Between Hazardous Events. As part of this, and as required by Section T 2.06.01 B of the

Technical Provisions, CNR will develop a Safety Certification Plan (CDRL 02-26) detailing how safety certification of each sub-system and the vehicle as a whole will be achieved.

As part of this same process, and as required by Section T 2.06.01 C 1a, CNR will develop a System Safety Program Plan (CDRL 02-17) detailing how all hazards related to the vehicle will be identified categorized, mitigated, tracked, and closed. Within 60 days of Notice to Proceed, as required by Section T 2.06.01 C 2a of the Technical Provisions, CNR will provide MBTA with an initial Hazard List for approval that identifies all potential hazards associated with the vehicle, including those caused by mechanical failures, electrical/electronic component failures, software errors or defects, environmental impacts, human error, maintenance, and operational conditions.

Following approval of the initial Hazard List, CNR will then submit a Preliminary Hazard Analysis (CDRL 02-23) as required Section T 2.06.01 C 3a of the Technical Provisions. The analysis will define the potential cause of the hazards, the probability of the hazards, the severity of the hazards, the potential or proposed mitigation and the residual probability and severity of the hazards.

In accordance with Section T 2.06.01 C 4a of the Technical Provisions, following approval of the Preliminary Hazard Analysis, CNR will develop and submit to the MBTA for approval a Hazard Tracking Log (CDRL 02-24), which will be used to track the status of all supporting documentation for each of the logged hazards. This log will be regularly updated and will be submitted to the MBTA for review on a monthly basis. CNR fully understands that all hazards in the Hazard Tracking Log must be closed before the MBTA is able to issue a Safety Certification.

As part of the safety analysis process, CNR will carry out comprehensive Failure Modes, Effects and Criticality Analyses (FMECA) for all safety related components, as defined in Section T 2.06.01 C 5a of the Technical Provisions. In addition, CNR will carry out a Fault Tree Analysis (FTA) as required by Section T 2.06.01 C 6a of the Technical Provisions. As required by Section T 2.06.01 C 7a of the Technical Provisions, CNR will submit a subsystem hazard analysis for each vehicle subsystem, including subsystem Hazard Tracking log, FMECA, and FTA. These will be submitted as part of the Preliminary Design Review and the Final Design Review submittals.

For individual component failures rates used in the safety analyses, CNR will use published failure rates or values for ground mobile equipment published in MIL-HDBK-217F. Unless certified information is available, software failure probability rates used in the safety analyses will be assumed to have a Safety Integrity Level of zero as defined by EN 50128.

All non-metallic elements used in the construction of the vehicles will be required to meet the requirements of NFPA 130, 49 CFR Part 238, and BSS 7239, as required by Section T 2.06.02 of the Technical Provisions. Also, the car floor assembly will be designed to resist a 30-minute fire test in accordance with ASTM E-119, NFPA 130, and 49 CFR Part 238. As required by Section T 2.06.02 D of the Technical Provisions, smoke detectors will be installed in each fresh/return air mixing plenum and supply duct, and automatic dampers shall close to prevent external smoke from entering the vehicle.

CNR will also work closely with the MBTA to ensure that the vehicles are as blast-resistant as feasible, as required by Section T 2.06.03 of the Technical Provisions.

Electrical systems and subsystems of the vehicles will be designed and tested to meet the electrical interference requirements of Section T 2.07 of the Technical Provisions. Sub-suppliers' systems will be required to meet specific electromagnetic interference and compatibility requirements, such that when the systems are installed on the cars and running on the MBTA's property, the vehicles as a whole will not interfere with any wayside equipment, MBTA on-board radio equipment, or passenger equipment, such as personal electronic devices or medical equipment. CNR realizes that, in addition to sub-systems meeting specified requirements, careful attention will be paid to how the equipment is installed on the vehicles to minimize interference and to maximize compatibility. This will be achieved by integrating signal-to-noise levels, transmitter frequencies, filtering, inverter pulse frequencies, the location of emission sources, the separation of power and signal wire and cables, wire and cable shielding, wire and cable terminations, the filtering of inductive loads, and other factors.

Considerations for passenger safety will include, as a minimum:

- Designing the interior of the vehicles and areas that passengers might come into contact with to minimize sharp edges or protuberances.
- Designing heater guards to ensure that metallic objects pushed through the ventilation openings cannot contact heater element terminals.
- Designing the locations of stanchions, grab rails and handholds to maximize their availability to standees.
- Ensuring that tripping hazards are eliminated. This will include the optimization of the coefficient of friction of the floor covering to ensure it is not too slippery when wet, but does not cause excess grip when dry.

Considerations for safety of maintenance staff will include, as a minimum:

- Minimizing sharp edges on vehicle structure and equipment enclosures.
- Ensuring that the existence of high voltage equipment is suitably highlighted.
- Ensuring that electrical equipment enclosures are grounded, including their covers.
- Wherever possible, mounting terminal blocks vertically to prevent dropped foreign objects from bridging terminals.
- Incorporating drip loops into cable connections to minimize the ingress of water into equipment enclosures.
- Ensuring that equipment is as easily maintainable with the minimum of special tools as feasible.

1.7 PERFORMANCE SIMULATION / SUMMARY DUTY CYCLE ANALYSIS

Below is the RFP requirement for the performance simulation and summary duty cycle analysis:

Tab I.1 (g) Performance Simulation and Summary Duty Cycle Analysis
Using the provided track charts, provide a performance simulation and summary duty cycle analysis.

1.7.1 Introduction

In the process of soliciting technical and commercial proposals from potential propulsion system suppliers, CNR requested that preliminary performance simulations be provided as part of each supplier’s technical proposal. CNR reviewed the proposals and all were similar in the information provided. That information was used to develop the initial simulation and analysis presentation in this document.

1.7.2 General

Because identical propulsion systems are to be used for both the Red Line and Orange Line vehicles and because the performance simulations for both the Red and Orange lines show that the Red Line conditions are somewhat more severe than that of the Orange Line, this document mainly addresses the propulsion system performance for the Red Line vehicle. Refer to Section 1.7.5, Analysis, for a general Red/Orange Line comparison.

The simulations are based on the route profile information contained in the nine sheets from drawings 39106 and 39107 located in Appendix II of the Red and Orange Line New Vehicle Procurement Technical Provisions, document VE-10-036 dated October 22, 2013 including Addenda 1 through 10. CNR wishes to point out that the provided Red Line and Orange Line route profiles are missing much distance/speed limit data and some grade data. For the purposes of the simulations, that data was created by measuring/scaling off the route profiles. CNR believes that this created data is sufficiently accurate for initial performance analyses.

Since the Technical Provisions state that the successful contractor "Within 90 days of Notice to Proceed (NTP), the Contractor shall set up and instrument a geometry car and perform a track geometry test of the entire Red and Orange Line (including yards) to verify and update the data used in the simulations." (Reference CDRL 11-13, Track Geometry), CNR recognizes that, based on the results from the track geometry testing, future adjustments may need to be made to the performance simulations. CNR does believe, however, that the performed simulations are sufficiently complete and accurate to be the basis for the initial determination of the propulsion component requirements to meet MBTA's performance criteria and needs.

1.7.3 Scope

This performance simulation/summary duty cycle analysis is initial and preliminary and, since there are a limited number of pages allotted for the Technical Proposal portions of the response to MBTA's RFP No. CAP 27-10, CNR has chosen to limit the presented data to the minimum and maximum propulsion and dynamic braking design conditions given in the Technical Provisions. Those conditions are propulsion at a third rail voltage of 530 VDC with AW3 vehicle loading and dynamic braking at a third rail voltage of 660 VDC with AW3 vehicle loading. However, simulations for both the Red Line and Orange Line have been performed for all combinations of vehicle loading (AW0 to AW3) and third rail voltage limits (530 VDC to 700 VDC), including abnormal operation, and can be made available to MBTA.

1.7.4 Simulations

1.7.4.1 Propulsion

The Figure 1 propulsion motor curves during starting, acceleration, and running were simulated using the following criteria and from data extracted from the Red Line route profiles:

- Train Configuration: 3 married pairs (6 vehicles)
- Loading: AW3 – 750,000 lbs
- Maximum Design Speed: 63 mph
- Wheel Diameter: 28 inches
- Gear Ratio: 5.7:1
- Acceleration at start: 2.75 mphps

- Starting train resistance (0-3 mph): 11 lb/ton
- Train resistance at speeds above 3 mph calculated with modified Davis Formula
- Adhesion: 11.9%

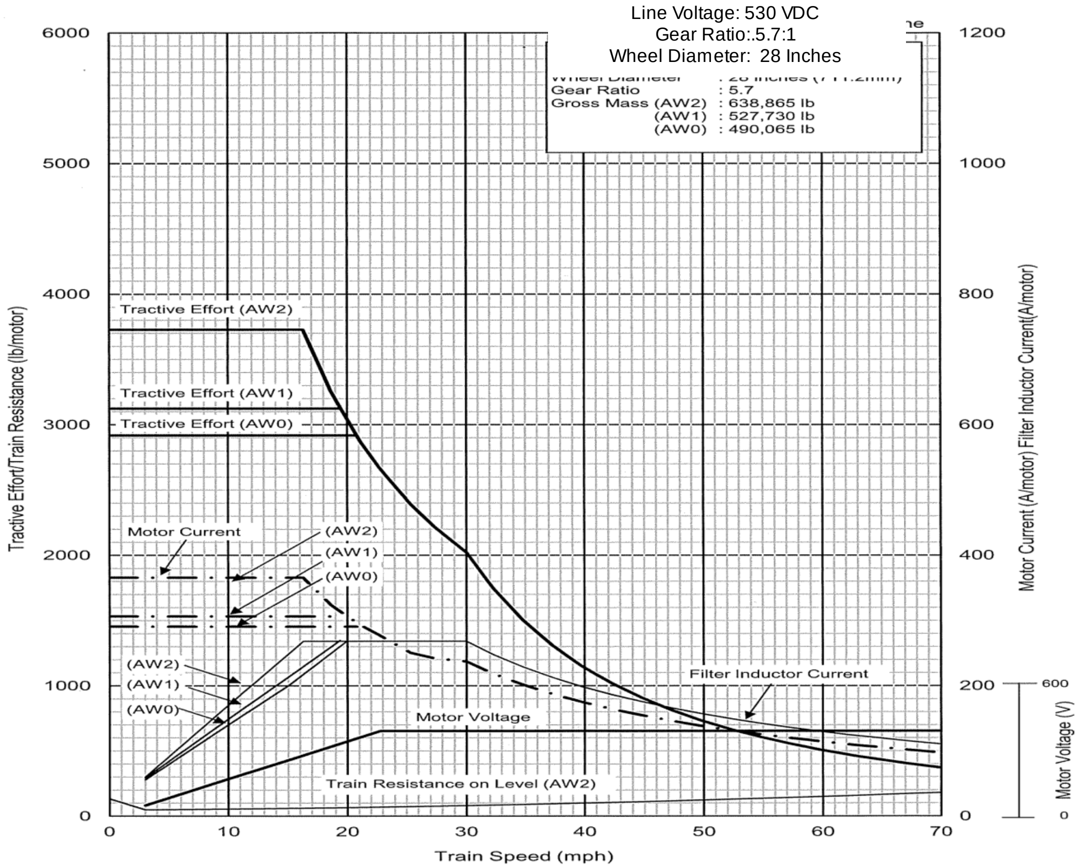


Figure 1. Propulsion Performance Curves

1.7.4.2 Dynamic Braking

The Figure 2 dynamic braking motor curves during deceleration were simulated using the following criteria and from data extracted from the Red Line route profiles:

- Train Configuration: 3 married pairs (6 vehicles)
- Load: AW3 - 750,000 lbs
- Maximum Design Speed: 63 mph
- Wheel Diameter: 28 inches
- Gear Ratio: 5.7:1
- Deceleration: 3.0 mphps
- Adhesion: 14.6%

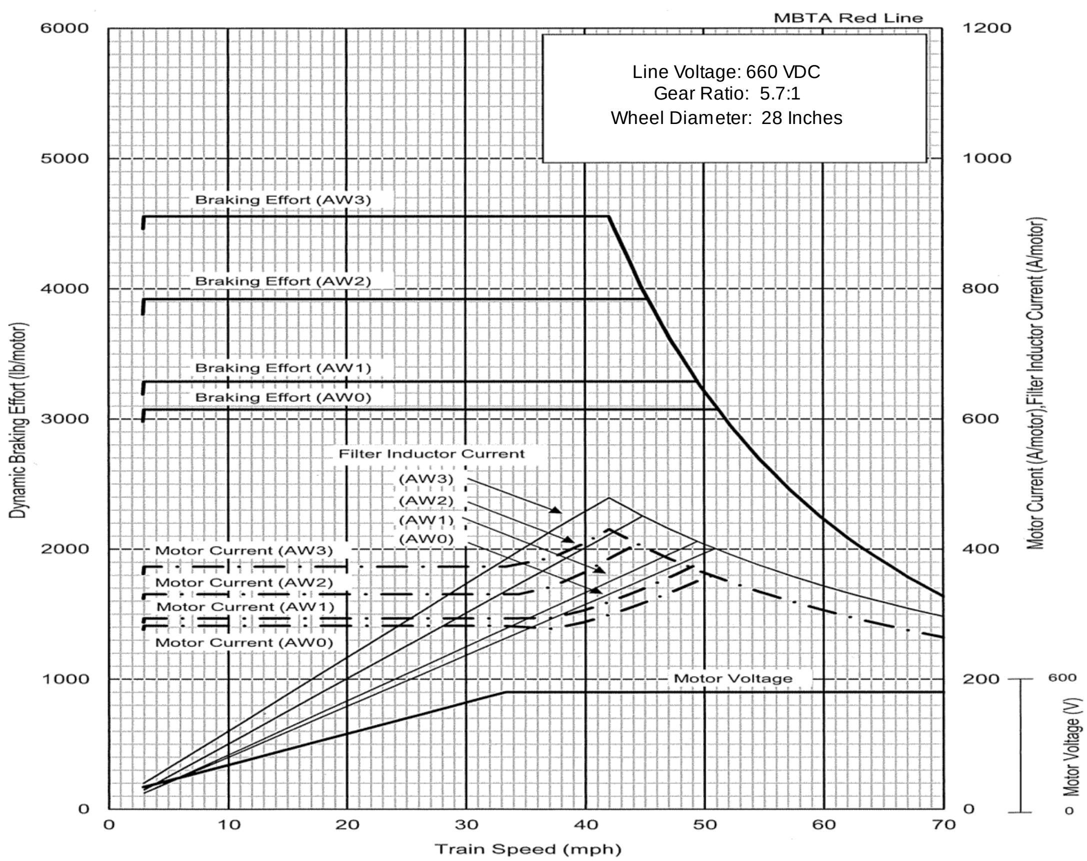


Figure 2. Dynamic Braking Performance Curves

1.7.4.3 Duty Cycle – Red Line

Duty cycles were simulated using the following criteria:

- Line voltage: Propulsion - 530 VDC, Dynamic Braking - 660 VDC
- Train Configuration: 3 married pairs (6 cars)
- Loading: AW3 – 750,000 lbs
- Wheel Diameter: 28 inches

- Acceleration: Maximum service rate
- Deceleration: Maximum service rate
- Dwell time: 30 seconds at each station; 3 minutes layover at the end of each line

Table 1. Duty Cycle Simulation Data
Ashmont to Alewife

Station	Inter-Station Distance	Inter-Station Travel Time	Station Dwell Time	RMS Current		Power Consumption		
				Propulsion Current Per Motor	Line Current Per Motor	Propulsion Motors	Dynamic Braking	Total Power Consumption
	Miles	Minutes	Minutes	Amperes	Amperes	kWhours	kWhours	kWhours
ASHMONT	0.00	0.00	0.0	------	------	------	------	------
SHAWMUT	0.62	1.56	0.5	219	169	1.0	-0.6	0.4
FIELDS CORNER	0.58	1.56	0.5	193	124	0.6	-0.3	0.3
SAVIN HILLS	1.00	2.34	0.5	182	126	0.9	-0.4	0.5
JFK/UMASS	0.71	1.67	0.5	202	153	0.8	-0.6	0.2
ANDREW SQ.	0.74	1.99	0.5	172	88	0.4	-0.2	0.2
BROADWAY	0.83	1.53	0.5	233	199	1.4	-0.8	0.6
SOUTH STATION	0.83	2.07	0.5	200	154	1.0	-0.6	0.4
DOWNTOWN CROSSING	0.27	0.82	0.5	239	155	0.6	-0.2	0.4
PARK ST.	0.21	0.68	0.5	270	174	0.6	-0.2	0.4
CHARLES	0.56	1.41	0.5	231	185	1.2	-0.5	0.7
KENDALL	0.72	1.44	0.5	256	216	1.3	-0.9	0.4
CENTRAL SQ.	0.95	1.78	0.5	209	173	1.4	-0.7	0.7
HARVARD SQ.	1.07	3.40	0.5	151	105	1.0	-0.4	0.6
PORTER SQ.	1.09	3.19	0.5	214	130	1.2	-0.5	0.7
DAVIS SQ.	0.66	1.67	0.5	233	199	1.9	-0.5	1.4
ALEWIFE	0.97	2.25	3.0	192	155	1.2	-0.7	0.5
Total/Average	11.82	29.36	11.0	200	147	16.5	-8.1	8.4

Note: The values in the RMS Current and Power Consumption columns do not include the dwell time at each station.

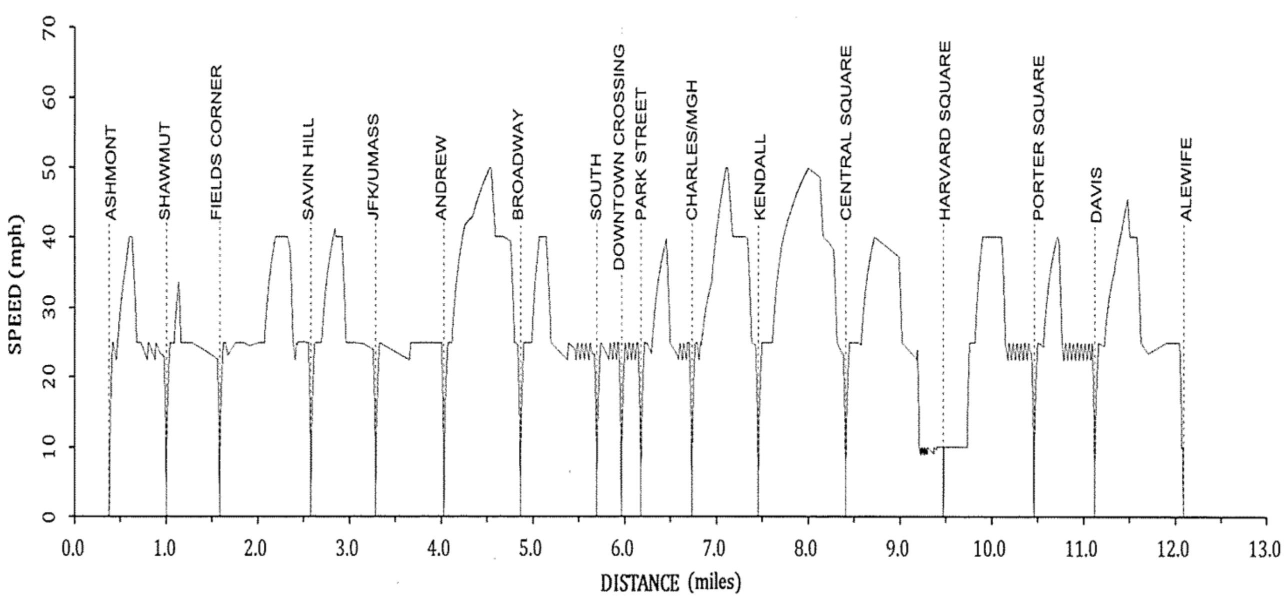


Figure 3. Duty Cycle Simulation Curves - Ashmont to Alewife

Table 2. Duty Cycle Simulation Data
Alewife to Ashmont

Station	Station to Station Distance	Travel Time	Station Dwell Time	RMS Current		Power Consumption		
				Propulsion Current Per Motor	Line Current Per Motor	Propulsion Motors	Dynamic Braking	Total Power Consumption
	Miles	Minutes	Minutes	Amperes	Amperes	kWhours	kWhours	kWhours
ALEWIFE	0.00	0.00	0.0	------	------	------	------	------
DAVIS SQ.	0.97	2.03	0.5	193	154	1.2	-0.6	0.6
PORTER SQ.	0.66	1.75	0.5	225	102	0.3	-0.2	0.1
HARVARD SQ.	1.09	3.32	0.5	204	138	1.9	-0.5	1.4
CENTRAL SQ.	1.07	3.10	0.5	174	139	1.4	-0.8	0.6
KENDALL	0.95	1.83	0.5	209	174	1.3	-0.7	0.6
CHARLES	0.72	1.61	0.5	236	185	1.6	-0.4	1.2
PARK ST.	0.56	1.49	0.5	205	113	0.5	-0.3	0.2
DOWNTOWN CROSSING	0.21	0.66	0.5	282	142	0.3	-0.2	0.1
SOUTH STATION	0.27	0.80	0.5	254	128	0.3	-0.2	0.1
BROADWAY	0.83	1.90	0.5	213	160	1.3	-0.4	0.9
ANDREW SQ.	0.83	1.59	0.5	211	170	1.2	-0.5	0.7
JFK/UMASS	0.74	1.92	0.5	197	158	1.2	-0.5	0.7
SAVIN HILLS	0.71	1.63	0.5	193	149	0.9	-0.4	0.5
FIELDS CORNER	1.00	2.27	0.5	183	149	1.3	-0.5	0.8
SHAWMUT	0.58	2.60	0.5	161	96	0.7	-0.3	0.4
ASHMONT	0.62	2.65	3.0	170	82	0.6	-0.2	0.4
Total/Average	11.82	31.15	11.0	195	132	16.0	-6.7	9.3

Note: The values in the RMS Current and Power Consumption columns do <u>not</u> include the dwell time at each station.

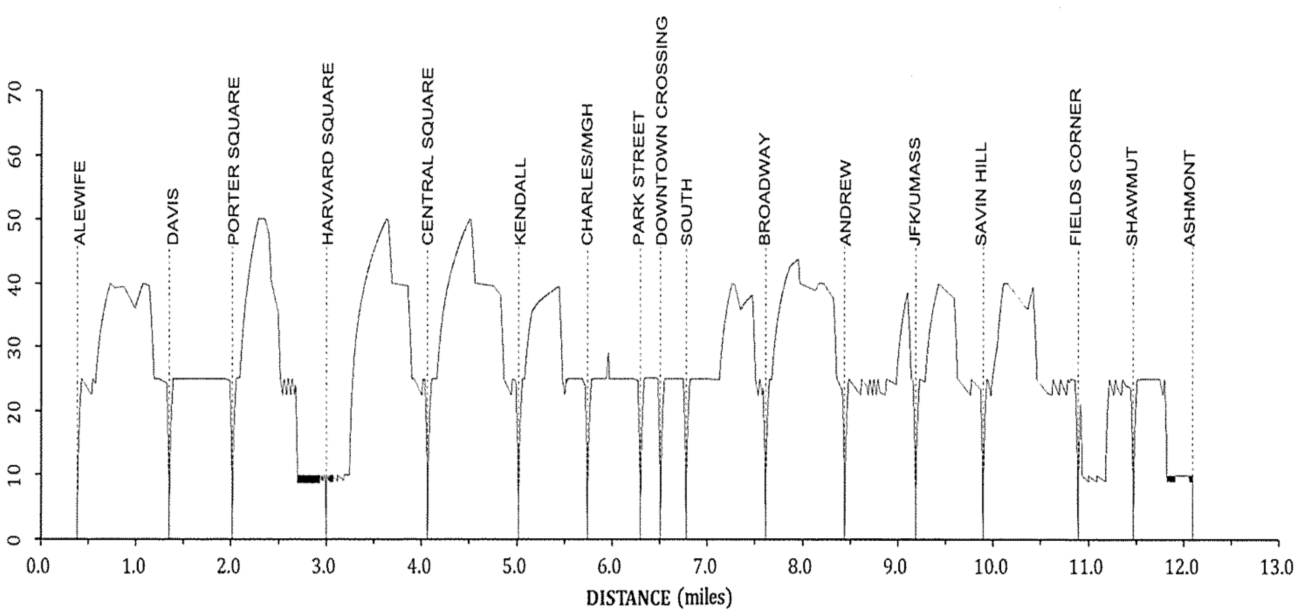


Figure 4. Duty Cycle Simulation Curves - Alewife To Ashmont

Table 3. Duty Cycle Simulation Data
Braintree to Alewife

Station	Station to Station Distance	Travel Time	Station Dwell Time	RMS Current: Propulsion Current Per Motor	RMS Current: Line Current Per Motor	Power Consumption: Propulsion Motors	Power Consumption: Dynamic Braking	Power Consumption: Total Power Consumption
	Miles	Minutes	Minutes	Amperes	Amperes	kWhours	kWhours	kWhours
BRAINTREE	0.00	0.00	0.0	------	------	------	------	------
QUINCY ADAMS	1.87	2.83	0.5	178	148	1.3	-0.9	0.4
QUINCY CENTER	1.34	2.18	0.5	191	160	1.3	-0.7	0.6
WOLLASTON	1.26	2.14	0.5	197	173	1.5	-0.8	0.7
NORTH QUINCY	0.79	1.52	0.5	229	192	1.3	-0.8	0.5
JFK/UMASS	3.58	5.96	0.5	142	121	2.5	-0.5	2
ANDREW SQ.	0.74	1.79	0.5	218	171	1.5	-0.4	1.1
BROADWAY	0.83	1.53	0.5	234	199	1.4	-0.8	0.6
SOUTH STATION	0.83	2.07	0.5	198	154	1.1	-0.6	0.5
DOWNTOWN CROSSING	0.27	0.82	0.5	240	160	0.6	-0.2	0.4
PARK ST.	0.21	0.68	0.5	271	178	0.6	-0.2	0.4
CHARLES	0.56	1.41	0.5	228	186	1.2	-0.5	0.7
KENDALL	0.72	1.45	0.5	252	215	1.3	-0.9	0.4
CENTRAL SQ.	0.95	1.78	0.5	207	173	1.3	-0.7	0.6
HARVARD SQ.	1.07	3.40	0.5	150	106	1	-0.4	0.6
PORTER SQ.	1.09	3.19	0.5	208	130	1.2	-0.5	0.7
DAVIS SQ.	0.66	1.67	0.5	236	202	1.9	-0.5	1.4
ALEWIFE	0.97	2.24	3.0	190	155	1.2	-0.7	0.5
Total/Average	17.73	36.66	11.5	210	166	22.2	-10.1	12.1

Note: The values in the RMS Current and Power Consumption columns do not include the dwell time at each station.

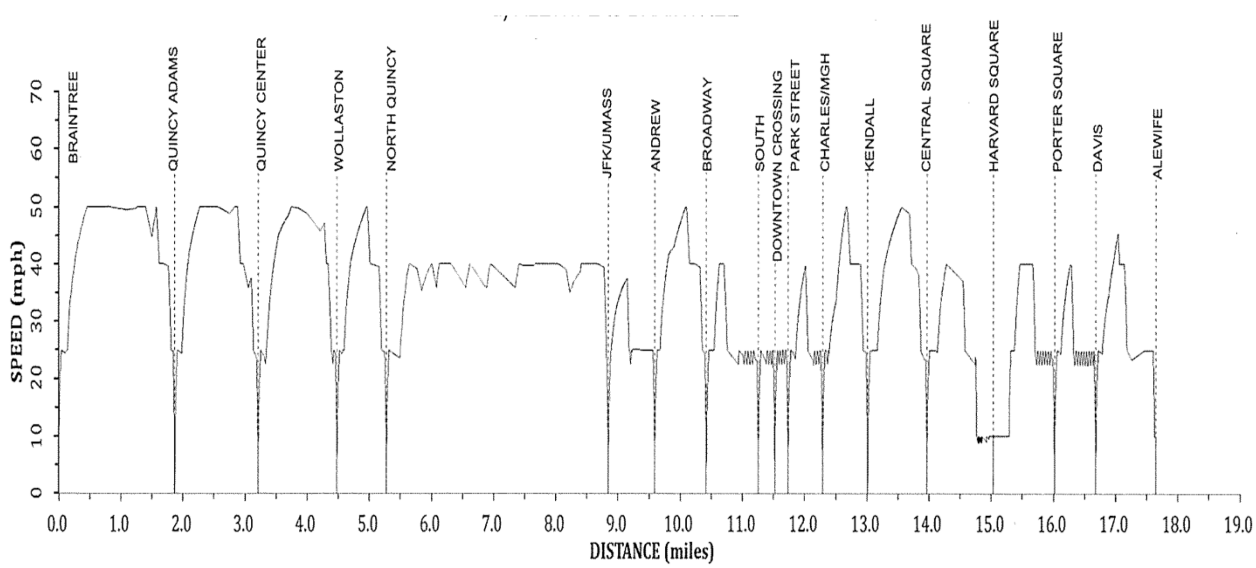


Figure 5. Duty Cycle Simulation Curves - Braintree To Alewife

Table 4. Running Simulation Data
Alewife to Braintree

Station	Station to Station Distance	Travel Time	Station Dwell Time	RMS Current		Power Consumption		
				Propulsion Current Per Motor	Line Current Per Motor	Propulsion Motors	Dynamic Braking	Total Power Consumption
	Miles	Minutes	Minutes	Amperes	Amperes	kWhours	kWhours	kWhours
ALEWIFE	0.00	0.00	0.0	------	------	------	------	------
DAVIS SQ.	0.97	2.03	0.5	28.67	192	155	1.2	-0.6
PORTER SQ.	0.66	1.75	0.5	22.63	218	101	0.3	-0.2
HARVARD SQ.	1.09	3.32	0.5	19.70	204	139	1.9	-0.5
CENTRAL SQ.	1.07	3.10	0.5	20.71	172	139	1.4	-0.8
KENDALL	0.95	1.83	0.5	31.15	207	174	1.3	-0.7
CHARLES	0.72	1.61	0.5	26.83	234	187	1.6	-0.4
PARK ST.	0.56	1.49	0.5	22.55	202	114	0.5	-0.3
DOWNTOWN CROSSING	0.21	0.66	0.5	19.09	277	144	0.3	-0.2
SOUTH STATION	0.27	0.80	0.5	20.25	250	129	0.3	-0.2
BROADWAY	0.83	1.90	0.5	26.21	211	161	1.3	-0.4
ANDREW SQ.	0.83	1.59	0.5	31.32	209	170	1.2	-0.5
JFK/UMASS	0.74	1.81	0.5	24.53	220	173	1.2	-0.6
NORTH QUINCY	3.58	5.17	0.5	41.55	146	132	2.7	-0.7
WOLLASTON	0.79	2.12	0.5	22.36	172	130	0.9	-0.4
QUINCY CENTER	1.26	2.21	0.5	34.21	197	163	1.5	-0.7
QUINCY ADAMS	1.34	2.21	0.5	36.38	187	159	1.6	-0.6
BRAINTREE	1.87	3.68	3.0	30.49	150	130	2	-0.5
Total/Average	17.73	37.28	11.5	203	147	21.2	-8.3	12.9

Note: The values in the RMS Current and Power Consumption columns do not include the dwell time at each station.

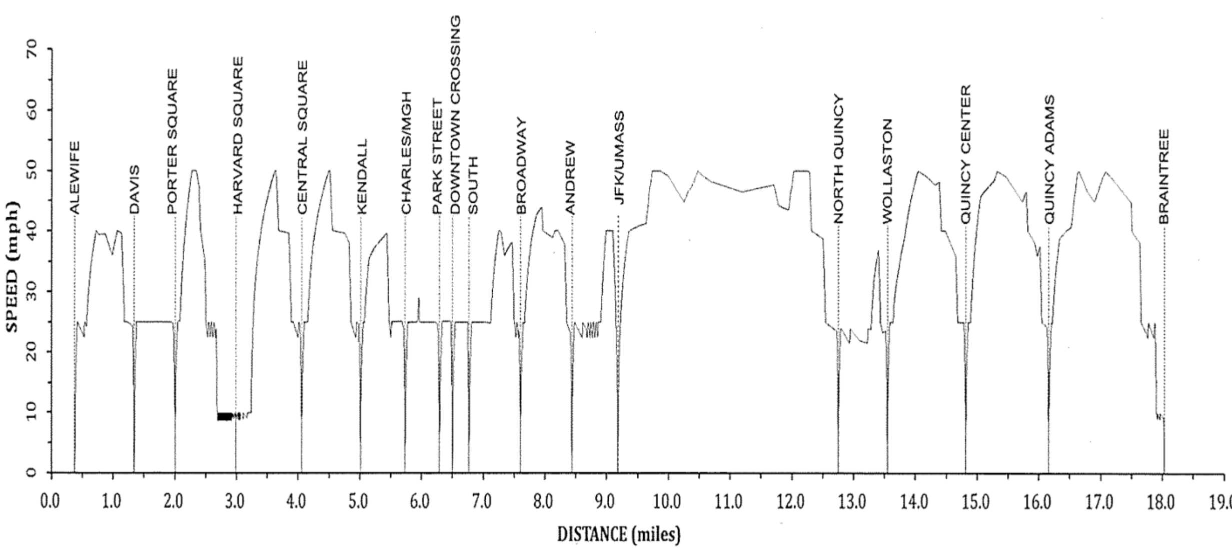


Figure 6. Duty Cycle Simulation Curves – Alewife to Braintree

1.7.5 Analysis

1.7.5.1 Performance

Propulsion

An acceleration rate of 2.75 mphps$^{\pm 5\% \text{ mphps}}$ from 0 to 16.3 mph$^{\pm 0.2 \text{ mph}}$ at 530 VDC and AW3 is achieved as shown in Figure 1.

The MBTA Technical Provisions require an acceleration rate of 2.75 mphps to at least 16.3 mph.

The maximum permissible propulsion motor winding temperature was not exceeded.

Dynamic Braking

With dynamic brake only, the MBTA required deceleration rate of 3 mphps from 42 to 0 mph at 660 VDC and AW3 is achieved as shown in Figure 2.

Above 42 mph, the blending of friction and dynamic brake provides the required deceleration rate.

The maximum permissible propulsion motor winding temperature was not exceeded.

Regeneration

Regenerative braking simulation results are shown in the Table 5.

Table 5. Red Line/Orange Line Regenerative Braking

Speed	Minimum Required Regenerative Rate	Simulated Regenerative Brake Rate
42→5 mph	72 %	76.2 %
50→5 mph	65 %	66.2%

Note: The above is based on the following:

- Line voltage: 660 VDC Continuous
- Train Configuration: 3 married pair (6 cars)
- Loading: AW3
- Wheel Diameter: 28 inches
- Track Condition: Straight, level, tangent, and dry

1.7.5.2 Travel Time and Average Speed

From the performance simulations above, the travel times and average speeds at route segments for the Red and Orange lines are summarized in Tables 6 and 7.

Table 6. Red Line Travel Times And Average Speeds In Each Direction

Route	Travel Time	Average Speed
	Minutes	MPH
Ashmont to Alewife*	29.36	24.16
Ashmont to Alewife	36.86	19.24
Alewife to Ashmont*	31.14	22.77
Alewife to Ashmont	38.64	18.35
Braintree to Alewife*	36.64	19.36
Braintree to Alewife	44.64	16.07
Alewife to Brintree*	37.29	19.02
Alewife to Brintree	45.29	15.83

* Station dwell time not included.

Table 7. Orange Line Travel Times And Average Speeds In Each Direction

Route	Travel Time	Average Speed
	Minutes	MPH
Forest Hills to Oak Grove*	23.55	28.20
Forest Hills to Oak Grove	32.05	20.72
Oak Grove to Forest Hills*	23.38	28.41
Oak Grove to Forest Hills	31.88	20.83

* Station dwell time not included.

1.7.5.3 Traction Motor Data

Using the traction motor data provided by the Red Line and Orange Line simulations, the recommended traction motor size is 84 KW (113 HP). See Tables 8 and 9.

Table 8. Red Line Traction Motor

Route (Round Trip)	Motor Current (A_{rms})	Motor Load (kW)	Motor Winding Temperature (°F)	Motor HP To Gearbox
Alewife to Braintree	182	83.39	388	101

Table 9. Orange Line Traction Motor

Route (Round Trip)	Motor Current (A_{rms})	Motor Load (kW)	Motor Winding Temperature (°F)	Motor HP To Gearbox
Oak Grove To Forest Hills	172	78.80	336	95

Note: The above calculation is based on the following:

- Motor Voltage: 389 V
- Power Factor: 0.68
- Efficiency: 0.90
- Normal Operation
- Station dwell times included

1.8 VEHICLE DESIGN APPROACH – RED AND ORANGE LINES

Below is the RFP requirement for the vehicle design approach for each vehicle type:

Tab I.1 (h) Red and Orange Line Vehicle Design Approach
Describe how the design of the two different vehicles is approached while ensuring the use of same subsystems and components to the maximum extent possible.

With almost all transit vehicle projects, there are at least two different vehicle types, and sometimes three or more, to be designed and manufactured. For the MBTA Orange and Red Line project, there will be four types of vehicle. There are three major aspects to be considered in such projects: the maximization of common systems and components; the optimization and control of manufacturing systems; and the optimization and control of the design engineering process. CNR is well acquainted with this.

Quite logically, it is in the best interests of both the transit agency and the vehicle supplier to utilize as many common systems and components as possible. CNR recognizes that Section T 2.01.01 I 2 of the Technical Provisions specifically requires that the Vehicle Monitoring System, the air compressor, and the battery be common to all vehicles. In addition, CNR recognizes that Section T 2.01.01 J of the Technical Provisions requires that the Red and Orange Line cars be designed to be as similar as possible and that all subsystems be as identical as possible. CNR also notes the requirement for a report to be prepared documenting all major subsystem parts that will not be common on the two lines, with technical and commercial justification as to why common parts would be a disadvantage to the MBTA (CDRL 02-01).

CNR will design each of the different vehicle types using a single design team, under the supervision of a single Project Engineer. In addition to formal design reviews (Preliminary and Final), CNR will carry out internal reviews at which the designs of each of the vehicle types will be discussed and critiqued. These internal reviews will be attended by representatives of CNR's Quality Assurance, Procurement, and Manufacturing Engineering departments, which will ensure that designs are as common as possible, utilize as many common components as possible, and that as much common tooling and the minimal number of manufacturing techniques are utilized. Strenuous efforts will be undertaken to ensure that common equipment will be used on all car types, and value analysis will be a core tool. Some of the considerations are outlined below.

- Based on the sizes of the Red and Orange Line cars delineated in Table 2-1 in Section T 2.01.02 B of the Technical Provisions and upon common performance requirements, it can be safely stated that the propulsion system, braking system, air conditioning system, coupler system, communication and passenger information system, and auxiliary power supply equipment for each car type will be identical. In addition, the door operators will be identical.
- Also based on Table 2-1, the underframes, roof frames, and sideframes of the Red and Orange Line cars will be different, but it is likely that the roof carlines could still use the same cross sections, which would reduce tooling costs. With respect to the underframes, construction could be very similar, with the cross sections of the side sills, center sills (if used), floor beams, and the majority of the end underframes being very similar, again reducing tooling costs.
- Also, the width of the Red Line car over thresholds is larger than that of the Orange Line car, and the width of the Red Line car at the underframe is larger than that of the Orange Line,

which means that the profile of the two cars' sideframes are likely to be different. However, the cross section of the side frame structural members could be the same, and the window cutouts in the side sheets can be the same size.

- The distance from the top of rail to the top of the floor on the Red Line car is greater than that on the Orange Line car, which, because the same trucks will be used under both car types, means that the truck interface with the carbody bolster will likely be different. Except for primary suspension details, the trucks should be almost identical.
- Although the carbody sideframes of the Red and Orange Line cars will likely have different profiles, it may still be possible to utilize the same door leaves; this will, of course, be investigated. It is also envisaged that many of the passenger compartment windows could be common. While it may not be entirely possible to incorporate common interior finish panels, the window masks should be identical, and it should be feasible to utilize a common panel installation system.
- It will be important to ensure that common floor panels will be used, which means common floor beam spacing. And, of course, it will be possible to use common floor covering material.
- It is also envisaged that most of the passenger compartment lighting fixtures, air conditioning system and air diffusers could be common.
- And, of course, all vehicle types will utilize common pneumatic piping, wire and cabling, thermal insulation, electrical terminals, contactors and relays, etc.

1.9 ELECTROMAGNETIC COMPATIBILITY (EMC)

Below is the RFP requirement for Electromagnetic Compatibility:

Tab I.1 (i) Organization Chart, Resume and Responsibilities of Key Staff
Describe how EMC will be achieved and interferences with the train control system avoided.

1.9.1 General

CNR recognizes that the new MBTA Red Line and Orange Line vehicles and vehicle systems need to be designed and manufactured to not only be immune to wayside and vehicle conductive, inductive, and radiated emissions, but to also not generate conductive, inductive, or radiated emissions that would negatively affect the operation and performance of onboard systems and wayside equipment and adjacent areas. Electrostatic discharge also needs to be of concern in the design of the vehicles systems and subsystems.

Where applicable, CNR will follow MIL-STD-461E, "Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment".

CNR will prepare an EMC plan covering the steps below. The EMC plan will include a process to mitigate potential electromagnetic radiation health or safety hazards to humans on the vehicle or at wayside locations such as stations. The limits will be based on the criteria given in Section T 2.07.04 of the MBTA Technical Provisions.

The EMC plan will be submitted to MBTA under CDRL 02-18, Electromagnetic Compatibility Plan, as part of the Preliminary Design Review package.

EMC considerations will be an integral part of CNR's systems integration process. Refer to Section 1.12 for details on the systems integration process.

1.9.2 Approach

CNR's approach to achieving the EMC requirements given in Section T 02.07 of MBTA Technical Provisions includes the following steps:

- Determine the conductive, inductive, and radiated emission limits necessary to ensure vehicle and train emissions will not adversely affect onboard and wayside signal equipment.
- Establish design and manufacturing criteria to control and limit the generation of electromagnetic emissions from onboard systems, subsystems, and components. Particular attention will be paid to the vehicle equipment effects on the train control system.
- Establish design and manufacturing criteria to eliminate or reduce onboard systems, subsystems, and components susceptibility to electromagnetic emissions produced by other systems, subsystems, and components and by wayside equipment.
- Verify the results of the EMC control design effort through EMC testing at vehicle and train levels. The final designs will meet the requirements of EN 50155, "Railway Applications - Electronic Equipment Used On Rolling Stock".

1.9.3 Electromagnetic Emissions Measurement

Within ninety days from notice to proceed, CNR will undertake the task of establishing, by test, the electromagnetic emissions limits for the signaling systems on the Red Line and Orange Line routes. CNR will use UMTA-MA-06-0153-87-2, "UMTA Suggested Procedures," and will follow the guidelines given in Sections T 2.07.02.A, B, C, and D. of the MBTA Technical Provisions. At the conclusion of these tasks, CNR will produce a report showing the results of the measurements and data collection. The report will be submitted to MBTA as CDRL 02-19, Verification of Emissions Limits, and will include an interference sources and receivers analysis as outlined in Section 5.4 of APTA Standard SS-E-10-98, "Standard for the Development of an Electromagnetic Compatibility Plan".

Presently, CNR is investigating combining the performance of the EMC measurements procedures at the same time CNR performs the track profile procedures.

1.9.4 Design/Manufacturing Criteria to Limit Onboard System Susceptibility to Electromagnetic Emissions

As a minimum and as part of the systems, subsystems, and components design effort, CNR and their suppliers will follow the guidelines shown below.

- Signal levels will be chosen to ensure all signals are at least 6 db higher than any measured or anticipated interference noise levels.
- Where suppression of voltage spikes by inductive devices is not sufficient, suitable filters will be used on susceptible equipment.
- Where possible, components that are or may be a source of electromagnetic emissions will be physically located to minimize interference with other systems, subsystems, or components.

- Cabling and wiring will be properly shielded, terminated, routed, and enclosed in conduit to reduce interference and cross-talk. Section 4.8.2.1 of IEEE STD 16-2004, "IEEE Standard for Electrical and Electronic Control Apparatus on Rail Vehicles" will be used as guidance.

1.9.5 Design/Manufacturing Criteria to Limit Onboard System Generation of Electromagnetic Emissions

As a minimum and as part of the systems, subsystems, and components design effort, CNR and their suppliers will follow the guidelines shown below.

- Signal levels will be chosen to ensure all interference noise levels are at least 6 db lower than signal levels.
- Propulsion, APS, and LVPS inverters/converters will be provided with input filtering to limit conductive emissions to the third rail. At the minimum, the line filters will be inductive at frequencies of 40 Hz and above and will be designed to have inductance sufficient to suppress substation 60 Hz harmonics to levels below the limits established in CDRL 02-19, Verification of Emissions Limits.
- All voltage spikes caused by inductive device switching will be properly suppressed.
- Where possible, equipment overly susceptible to electromagnetic emissions will be physically located to minimize the effects of the emissions.

1.9.6 Electromagnetic Emission Safety Analysis

CNR will perform a Failure Modes Effects Criticality Analysis (FMECA) for the traction inverters, APS inverter, and LVPS converter. The data will be used to create a fault tree analysis. The results will be submitted to MBTA as CDRL 02-20, Train to Wayside Emissions Safety Analysis.

1.9.7 EMC Verification and Testing

CNR will prepare and submit for approval a conductive, inductive, and radiated emissions test plan that will verify that the train-to-wayside emission limits do not exceed the requirements given in Section T 2.07.02 of the MBTA Technical Provisions. CNR will use the following documents as guidelines for the test plan.

- UMTA-MA-06-0153-85-6, "Conductive Interference in Rapid Transit Signaling Systems" - Volume II: Suggested Test Procedures, Method RT/CE02A, "Conducted Emission Test, Vehicle"
- UMTA-MA-06-0153-85-8, "Inductive Interference in Rapid Transit Signaling Systems" - Volume II: Suggested Test Procedures, Method RT/IE01A, "Inductive Emissions of Vehicular Electrical Power Subsystem, Rail-to-Rail Voltage from 20 Hz to 20 kHz"
- UMTA-MA-06-0153-85-11, "Radiated Interference in Rapid Transit Signaling Systems" - Volume II: Suggested Test Procedures, Method RT/RE01A, "Broadband Emissions of Rapid Transit Vehicles -140 kHz to 400 MHz"
- EN 50121-3-1, "Electromagnetic Compatibility – Part 3-2: Rolling Stock – Apparatus".

As part of qualification testing, CNR will ensure that laboratory tests are conducted as necessary to verify that the Propulsion, APS, and LVPS converters/inverters conductive and inductive emissions do not exceed their allotted portion of the allowed total vehicle or train emissions defined in MBTA Technical Provisions Section T 2.07.

CNR will verify that the train control systems are immune to the levels of electromagnetic interference given in Section T 2.07 of the MBTA Technical Provisions.

CNR will verify that the resonant frequency of all auxiliary input filters, under worst case conditions of temperature, tolerance and aging, are in compliance with requirements of Section T 2.07 of the MBTA Technical Provisions.

To show that the requirements of the EMC Plan are met, the APS inverter output voltage and current harmonics will be measured under all loads and input voltages. The results will be used to also show that the harmonics do not exceed the specified requirements of any connected motors.

1.10 PROJECT SCHEDULE

Below is the RFP requirement for the Project Schedule:

Tab I.1 (j) Project Schedule
Submit a detailed schedule for the design, manufacture, testing and delivery of each car in the form of a milestone type bar chart. Each chart shall indicate anticipated dates for starting and completing all major aspects of the program including, but not limited to, First Article Inspection and completion of major hardware components; the delivery to the MBTA of the Pilot Cars and subsequent delivery of the balance of the Cars on order. Quantity to be delivered shall be clearly noted.

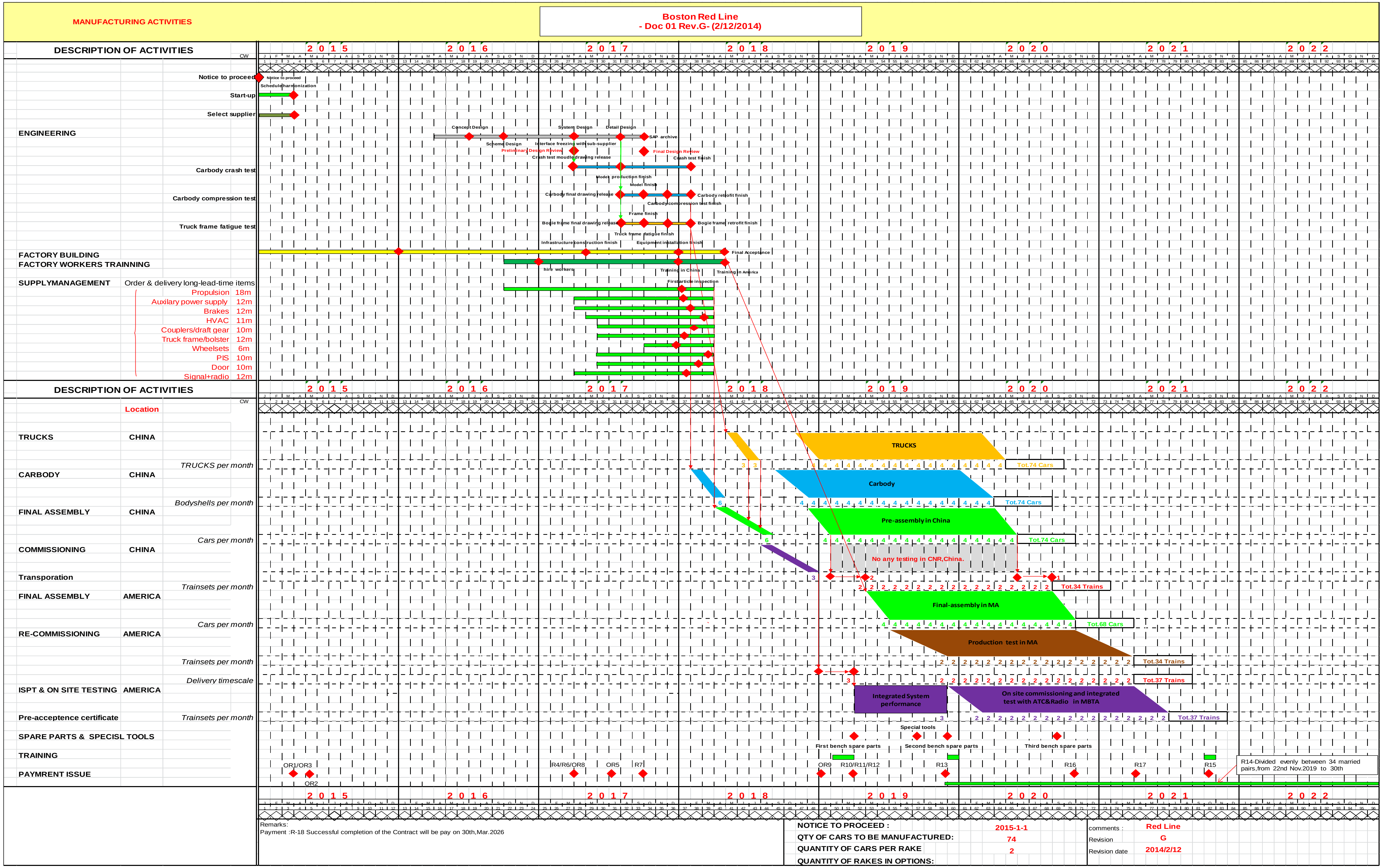
This section provides an overview of CNR's scheduling process and provides a look a "Summary Schedule" which is used to identify key delivery dates and milestones established by MBTA. As required by Section C6.05 of the MBTA's Request for Proposals CAP 27-10 the summary schedule shows key areas such as;

- The 6 Orange Line Pilot Cars will be delivered to the MBTA within 36 months from Notice to Proceed.
- Delivery of the Orange Line production cars will begin within 48 months from Notice to Proceed at the rate of 4 cars per month per line.
- The 6 Red Line Pilot Cars will be delivered to the MBTA within 51 months from NTP.
- Delivery of the Base Red Line production cars will begin within 59 months from Notice to Proceed at the rate of 4 cars per month per line.
- Manuals,
- Training Aids and Other Components

These dates, as well as other key dates in the summary schedule are established by customer expectations which are specified in the current project documentation. These dates, once approved post award, will be used as a basis to plan project activities in the detailed base line schedule, for both base contract and options, in such a way to ensure that all expected dates are met. The detailed schedule will also serve as a means to regularly report to MBTA how CNR is performing against the baseline schedule. CNR will present Critical Path Methodology (CPM) Project Master Schedule as stated in section C4.03 within 30 days of NTP.

Additionally the "Summary Baseline" schedule serves as an effective global view of the overall schedule and can be adjusted, by highlighting specific areas, to serve the particular requirements of stake holders.

In the following pages you will see the summary schedule for both the Red and Orange line programs.


MANUFACTURING ACTIVITIES
Boston Red Line
- Doc 01 Rev.G- (2/12/2014)
DESCRIPTION OF ACTIVITIES
2015
2016
2017
2018
2019
2020
2021
2022
Notice to proceed
Start-up
Select supplier
ENGINEERING
Concept Design
System Design
Detail Design
Scheme Design
Interface freezing with sub-supplier
SAP archive
Preliminary Design Review
Final Design Review
Crash test moudle drawing release
Crash test finish
Carbody crash test
Model production finish
Model finish
Carbody final drawing release
Carbody retrofit finish
Carbody compression test
Carbody compression test finish
Frame finish
Bogie frame final drawing release
Bogie frame retrofit finish
Truck frame fatigue test
Truck frame fatigue finish
Infrastructure construction finish
Equipment installation finish
FACTORY BUILDING
Final Acceptance
FACTORY WORKERS TRAINNING
hire workers
Training in China
Training in America
SUPPLYMANAGEMENT
Order & delivery long-lead-time items
First article inspection
Propulsion 18m
Auxilary power supply 12m
Brakes 12m
HVAC 11m
Couplers/draft gear 10m
Truck frame/bolster 12m
Wheelsets 6m
PIS 10m
Door 10m
Signal+radio 12m
Location
TRUCKS CHINA
TRUCKS per month
TRUCKS
Tot.74 Cars
CARBODY CHINA
Bodyshells per month
Carbody
Tot.74 Cars
FINAL ASSEMBLY CHINA
Pre-assembly in China
Cars per month
Tot.74 Cars
COMMISSIONING CHINA
No any testing in CNR,China.
Transporation
Trainsets per month
Tot.34 Trains
FINAL ASSEMBLY AMERICA
Final-assembly in MA
Cars per month
Tot.68 Cars
RE-COMMISSIONING AMERICA
Production test in MA
Trainsets per month
Tot.34 Trains
Delivery timescale
Tot.37 Trains
ISPT & ON SITE TESTING AMERICA
Integrated System performance
On site commissioning and integrated test with ATC&Radio in MBTA
Pre-acceptence certificate
Trainsets per month
Tot.37 Trains
SPARE PARTS & SPECISL TOOLS
Special tools
First bench spare parts
Second bench spare parts
Third bench spare parts
TRAINING
PAYMRENT ISSUE
OR1/OR3
OR2
R4/R6/OR8
OR5
R7
OR9
R10/R11/R12
R13
R16
R17
R15
R14-Divided evenly between 34 married pairs,from 22nd Nov.2019 to 30th
Remarks:
Payment :R-18 Successful completion of the Contract will be pay on 30th,Mar.2026
NOTICE TO PROCEED : 2015-1-1
QTY OF CARS TO BE MANUFACTURED: 74
QUANTITY OF CARS PER RAKE 2
QUANTITY OF RAKES IN OPTIONS:
comments : Red Line
Revision G
Revision date 2014/2/12

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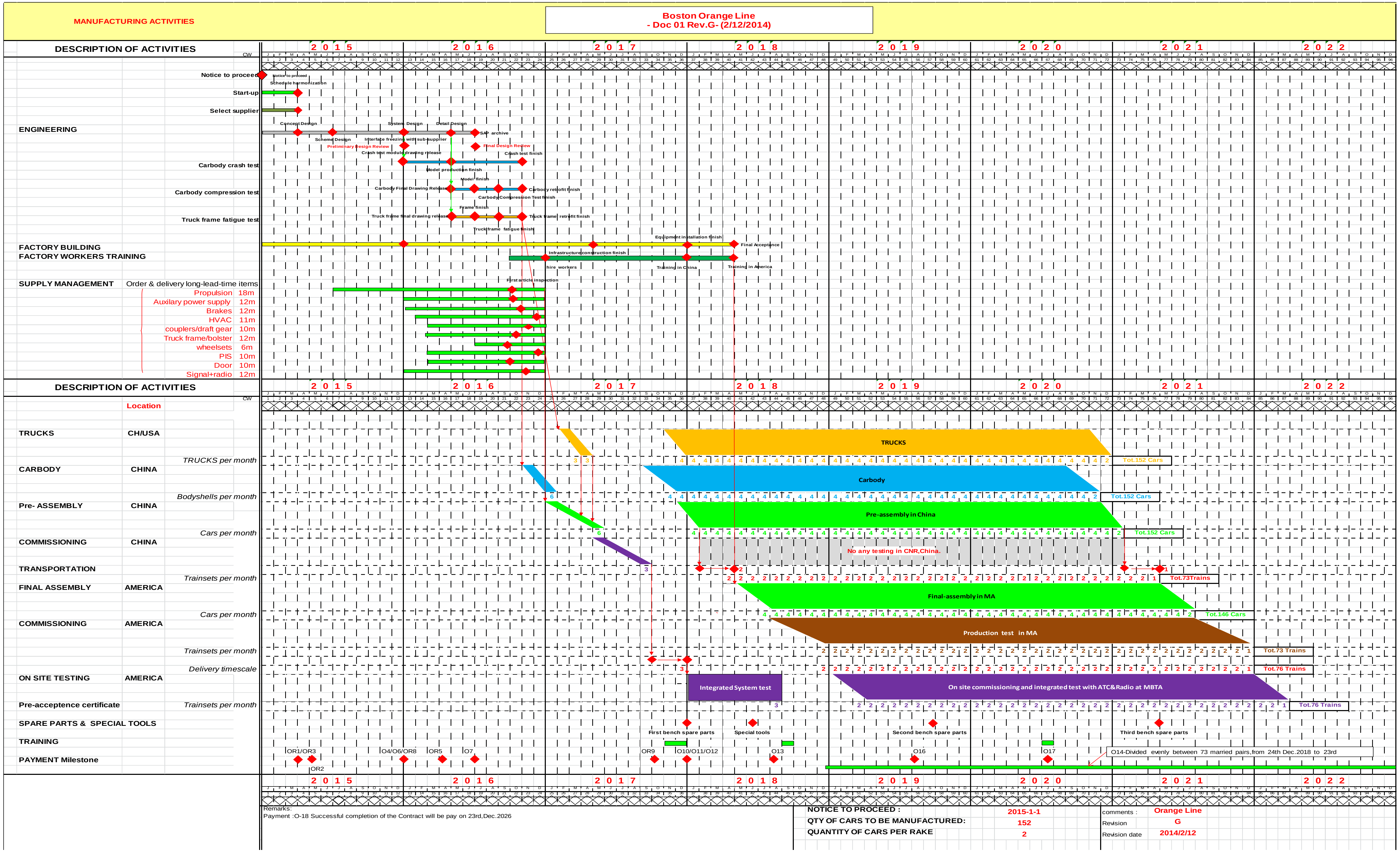
MANUFACTURING ACTIVITIES
Boston Orange Line
- Doc 01 Rev.G- (2/12/2014)
DESCRIPTION OF ACTIVITIES
2015
2016
2017
2018
2019
2020
2021
2022
Notice to proceed
Start-up
Select supplier
ENGINEERING
Carbody crash test
Carbody compression test
Truck frame fatigue test
FACTORY BUILDING
FACTORY WORKERS TRAINING
SUPPLY MANAGEMENT
Order & delivery long-lead-time items
Propulsion 18m
Auxilary power supply 12m
Brakes 12m
HVAC 11m
couplers/draft gear 10m
Truck frame/bolster 12m
wheelsets 6m
PIS 10m
Door 10m
Signal+radio 12m
Concept Design
Scheme Design
Preliminary Design Review
System Design
Detail Design
SAP archive
Final Design Review
Final Acceptance
Location
TRUCKS CH/USA
CARBODY CHINA
Pre- ASSEMBLY CHINA
COMMISSIONING CHINA
TRANSPORTATION
FINAL ASSEMBLY AMERICA
COMMISSIONING AMERICA
ON SITE TESTING AMERICA
Pre-acceptance certificate
SPARE PARTS & SPECIAL TOOLS
TRAINING
PAYMENT Milestone
TRUCKS per month
Bodyshells per month
Cars per month
Trainsets per month
Delivery timescale
TRUCKS
Carbody
Pre-assembly in China
No any testing in CNR,China.
Final-assembly in MA
Production test in MA
Integrated System test
On site commissioning and integrated test with ATC&Radio at MBTA
Tot.152 Cars
Tot.73Trains
Tot.146 Cars
Tot.73 Trains
Tot.76 Trains
First bench spare parts
Special tools
Second bench spare parts
Third bench spare parts
OR1/OR3
OR2
O4/O6/OR8
OR5
O7
OR9
O10/O11/O12
O13
O16
O17
O14-Divided evenly between 73 married pairs,from 24th Dec.2018 to 23rd
Remarks:
Payment :O-18 Successful completion of the Contract will be pay on 23rd,Dec.2026
NOTICE TO PROCEED : 2015-1-1
QTY OF CARS TO BE MANUFACTURED: 152
QUANTITY OF CARS PER RAKE 2
comments : Orange Line
Revision G
Revision date 2014/2/12

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The detailed CPM schedule is based on the key established dates of this RFP and the capacity of CNR's entire organization. The schedule will integrate all critical activities for Project Management, Engineering, Purchasing, Planning, Quality, Manufacturing, and Commissioning. In all cases where a review and approval process with the customer is necessary CNR will allow adequate time to ensure that these reviews do not negatively impact the team's ability to meet the established dates. Recognizing that during the design review process there may be occasions where there will be more time necessary to satisfy all stake holders prior to finalizing design so CNR will make every accommodation to limit its impact on overall schedule.

First Article Inspections (FAI's) can also require additional time to close so again CNR will make all necessary accommodations to mitigate negative impact on schedule by building float into the schedule and provide plans for recovery if necessary.

CNR has many years of experience in planning, preparing, controlling and reporting on complex schedules. CNR's experience demonstrates its ability to deliver on time by the means described above as well as having developed proven approaches to correcting schedules that have slipped for reasons that often occur during the course of a large procurement such as MBTA's Red Line / Orange Line vehicle procurement. As the description of "Critical Path Methodology" implies, identifying those risks that have the greatest potential to negatively impact CNR's ability to adhere to the baseline schedule is key to both the customer and CNR. CNR has already, for the purpose of this proposal, created a baseline schedule that has been constructed consistent with MBTA's requirements as well as CNR's processes and practices. If CNR is selected to serve MBTA on this procurement this initial baseline will be used as the foundational document to gain approval and acceptance for the CPM Project Master Schedule as stated in section C4.03 within 30 days of NTP.

CNR has created the detailed schedule with this in mind by providing all design, procurement, logistics, purchase orders, FAI's of components, material delivery, vehicle manufacture, vehicle delivery, testing/commissioning with logical linking and sequencing to ensure that risks can be identified and on-time completion can be achieved. These steps are detailed out for each major system and logically linked. Items with recognized long lead times will be prioritized in the sequencing.

CNR is planning, and will commit, to having a central team working in Boston, Massachusetts in very close contact with designated MBTA officers and managers. Having engineering, manufacturing, purchasing, planning and executive management staff located on site will be a significant benefit for the project, especially for dealing with any changes that might occur as a result of unanticipated issues that might arise during the course of the project. CNR will be able to move quickly and maintain a necessary level of flexibility to accommodate customer needs and overall project needs. This approach will be necessary during all phases of the project, including the initial manufacturing site build out. CNR will make the additional of having local representation at the earliest stages of the planning and construction of the manufacturing facility in Springfield. CNR believes that by having this local representation there are efficiencies realized that cannot be realized by not having the local presence. Additionally, having this local presence allows CNR to collaborate with MBTA on this critical step in incorporate details that better serve the project and thus MBTA.

An area of particular concentration to CNR will be in dealing with suppliers. Knowing that schedule adherence by CNR will be enormously impacted by its suppliers adhering to their respective schedules. CNR will enter into supplier agreements with a clear understanding and clear expectations from all suppliers that their respective ability to adhere to the baseline schedule has a direct impact on CNR's ability in meeting MBTA's expectations for delivery. These schedule details, as well as relevant technical requirements and supplier deliverables, will be included in contract language between CNR and its suppliers to mitigate problems during the course of the program. CNR recognizes, and accepts, its own responsibility in working with suppliers by ensuring that all commercial and technical matters are addressed in an expeditious way.

CNR believes that the systems integrator will play a significant role in minimizing negative schedule impacts during design reviews, FAI's and testing. CNR recognizes that the better it manages the integration of all systems the less risk there will be to the project and it is for this reason that special emphasis will be placed on systems integration as usual.

In the event that there are schedule delays, CNR has appointed the program manager as having ultimate responsibility to address them with the necessary authority to make those changes necessary to remedy the problem. Additionally CNR has established the executive committee that will serve as a governing board which will include a representative from MBTA. The purpose of this board is to meet regularly and to review the efficient functioning of the entire project team. As it relates to schedule adherence the executive committee will ensure that the project manager has the necessary tools, responsibility and authority to take necessary corrective action to mitigate schedule delays.

The detailed schedule will contain the following key activities (not all inclusive):

- As required by Section C6.05C of the MBTA's Request For Proposals CAP 27-10, the 6 Orange Line Pilot Cars will be delivered to the MBTA within 36 months from Notice To Proceed.
- As required by Section C6.05D of the RFP, delivery of the Orange Line production cars will begin within 48 months from Notice to Proceed at the rate of 4 cars per month per line.
- As required by Section C6.05E of the RFP, the 6 Red Line Pilot Cars will be delivered to the MBTA within 51 months from NTP.
- As required by Section C6.05F of the RFP, delivery of the Base Red Line production cars will begin within 59 months from Notice to Proceed at the rate of 4 cars per month per line.
- The Conceptual Design Review period, the Preliminary Design Review period and the Final Design Review period. It should be noted that design engineering work will be taking place throughout these periods.
- The Manufacturing Engineering phase. CNR's Manufacturing Engineering department will be transforming Design Engineering documentation into a form that is readily usable by Manufacturing department technicians, and designing the necessary tooling to assist the manufacturing processes.
- The Manufacturing tooling phase. Tooling is being manufactured and installed to support all manufacturing processes.
- The carbody structure parts manufacturing and final assembly phase.
- The First Article Inspection dates for the carbody structure, trucks, propulsion system, auxiliary power supply system, ATC system, communications system, HVAC system, door system, interior finish and seats, final car assembly. This, of course, also identifies the completion of major hardware components.
- The delivery dates for the Orange and Red Line Pilot cars, and the delivery dates for individual Orange and Red Line production cars.

- The training period. CNR and its sub-suppliers will be holding training sessions for MBTA personnel in how to maintain car-borne equipment.
- The vehicle commissioning/Qualification test period.
- The delivery dates for the maintenance manuals, training manuals and spare parts catalogs.
- The reliability assessment period.
- The warranty support period.

In the following pages CNR presents excerpts from both the Orange line and Red line detailed schedule. As previously mentioned CNR has prepared these detailed schedules consistent with the requirements and currently have over 1500 activities each. In the event CNR has the opportunity to serve MBTA's interest on this program then this document will be the basis for achieving mutual agreement on the baseline schedule to be delivered within 30 days of NTP.

ID	Task Name	Start	Finish
1	**General milestone**		
2	Notice to proceed		1/1
3	Start up	1/1	4/1
4	Harmonize schedule finalize		4/1
5	Select supplier	1/1	4/1
6	**Schedule submission**		1/31
24	**Engineering**		
25	Concept design	1/1	3/31
26	Scheme design	4/2	6/30
27	System design	7/1	12/31
28	Priliminary Design Review		12/31
29	Detail design	1/1	4/29
30	SAP archive	5/2	6/30
31	Final Design Review		6/30
32	**CDRL**		
412	**General test**		
413	**Carbody crash test**		
419	**Carbody compression test**		
426	**Truck frame fitigue test**		
433	**Factory building**		
434	Land acquisition	1/1	12/31
435	Land acquisition finish		12/31
436	Infrastructure construction	1/1	4/28
437	Infrastructure construction finish		4/28
438	PIS system	5/1	12/29
439	Equipment installation finish		12/29
440	Final Acceptance	1/1	4/30
441	Final Acceptance finish		4/30
442	**Final acceptence certificatetory workers training**		

Timeline: 14 H2; 2015 H1 H2; 2016 H1 H2; 2017 H1 H2; 2018 H1 H2; 2019 H1 H2; 2020 H1 H2; 2021 H1 H2; 2022 H1 H2; 2023 H1 H2; 2024 H1 H2; 2025 H1 H2; 2026 H1 H2; 202[7] H1

Project: MSProj11
Date: Tue 5/13/14

Task	Rolled Up Progress	Inactive Task	Manual Summary Rollup	Deadline
Milestone	Split	Inactive Milestone	Manual Summary	
Summary	External Tasks	Inactive Summary	Start-only	
Rolled Up Task	Project Summary	Manual Task	Finish-only	
Rolled Up Milestone	Group By Summary	Duration-only	Progress	

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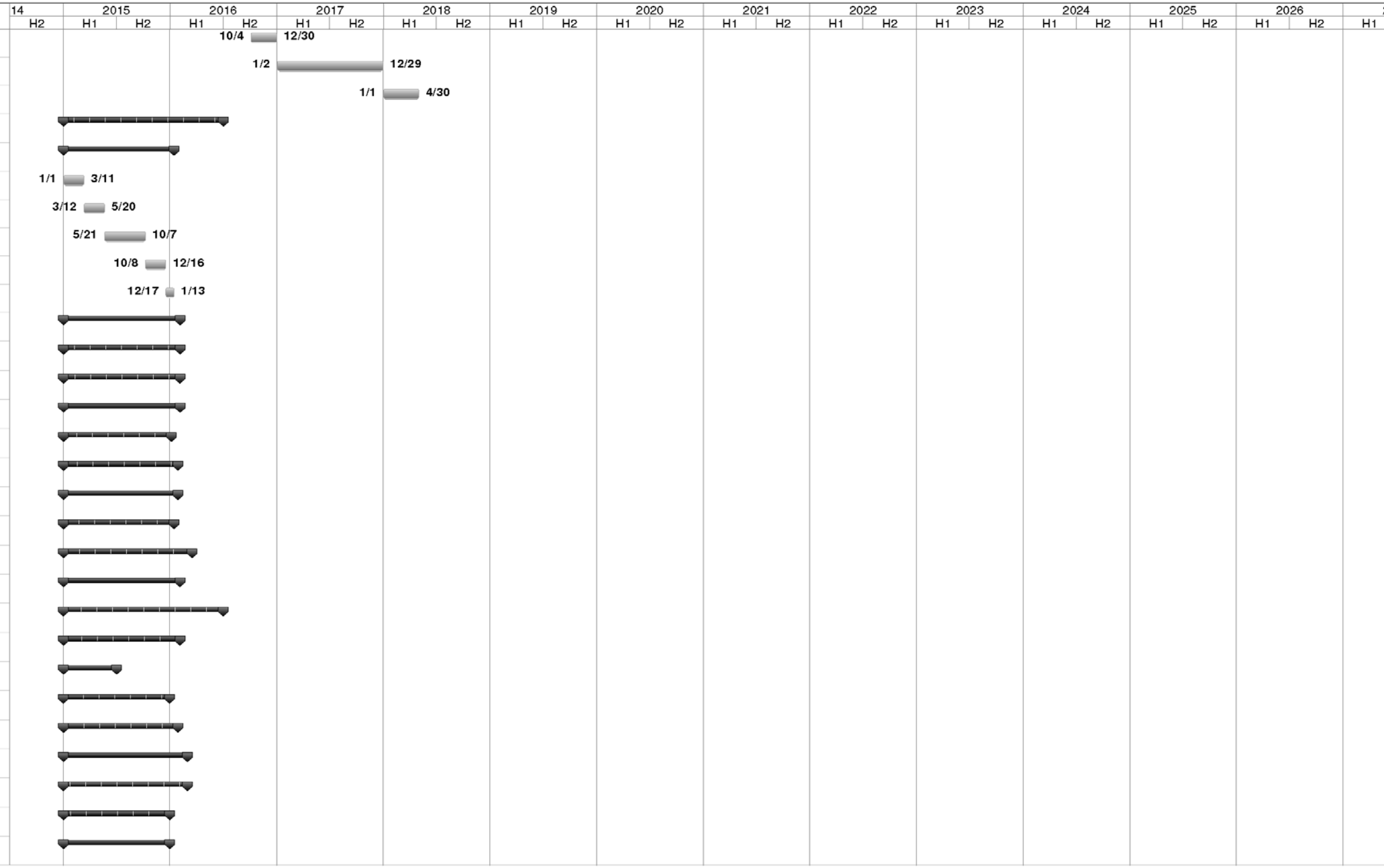
ID	Task Name	Start	Finish
443	Hire workers	10/4	12/30
444	Training in China	1/2	12/29
445	Training in America	1/1	4/30
446	**Main parts design phase**		
447	**Carbody**		
448	Concept design	1/1	3/11
449	Scheme design	3/12	5/20
450	System design	5/21	10/7
451	Detail design	10/8	12/16
452	SAP archive	12/17	1/13
453	**Cab**		
459	**Interior**		
465	**Light system**		
471	**Battery**		
477	**UF equipment installation**		
483	**UF electric installation**		
489	**Roof equipment installation**		
495	**Onboard electric installation**		
501	**Cab installation**		
507	**Truck frame/bolster**		
513	**Wheelsets**		
519	**Coupler/draft gear**		
525	**Propulsion system**		
531	**Brakes system**		
537	**HVAC system**		
543			
549	**Door system**		
555	**Signal & radio system**		
561	**Auxilary power supply**		



Project: MSProj11
Date: Tue 5/13/14

Task | Milestone | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress | Split | External Tasks | Project Summary | Group By Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | Progress | Deadline

Page 2

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ID	Task Name	Start	Finish
567	**Purchase**		
568	**Carbody**		
569	Drawing release	1/13	
570	Leadtime	1/14	8/24
571	First article inspection	8/25	9/5
572	Delivery to CNR	9/6	10/31
573	**Cab**		
578	**Interior**		
583	**Light system**		
588	**Battery**		
589	Drawing release	2/3	
590	Leadtime	2/4	9/21
591	First article inspection	9/22	9/26
592	Delivery to CNR	9/27	12/30
593	**Under frame equipment installation**		
598	**UF electric installation**		
603	**Roof equipment installation**		
608	**Onboard electric installation**		
613	**Cab installation**		
618	**Truck frame/bolster**		
623	**Wheelsets**		
628	**Coupler/draft gear**		
633	**Propulsion system**		
638	**Brakes system**		
643	**HVAC system**		
648	**PIS system**		
653	**Door system**		
658	**Signal & radio system**		
663	**Auxilary power supply**		

Project: MSProj11
Date: Tue 5/13/14

Task | Milestone | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress | Split | External Tasks | Project Summary | Group By Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | Progress | Deadline

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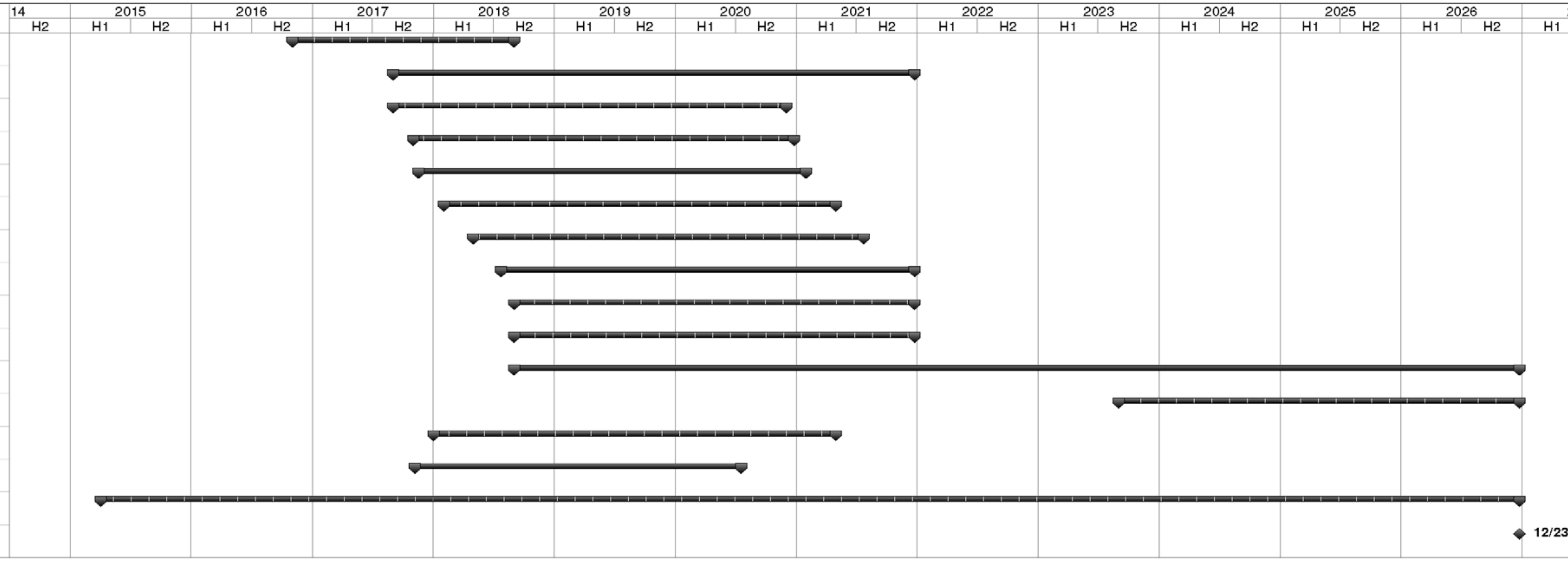
ID	Task Name
668	Pilot cars production
698	Second batch production
699	Carbody production
773	Truck production
847	Shell assembly(CHINA)
921	Transportation
995	Final assembly(America)
1069	Commissioning
1143	Pre-acceptence certificate
1220	Operation
1297	Warranty
1374	Final acceptence certificate
1451	Spare parts & Special tools delivery
1456	Training
1464	Payment
1556	Finish Project



Project: MSProj11
Date: Tue 5/13/14

Task | Rolled Up Progress | Inactive Task | Manual Summary Rollup | Deadline
Milestone | Split | Inactive Milestone | Manual Summary
Summary | External Tasks | Inactive Summary | Start-only
Rolled Up Task | Project Summary | Manual Task | Finish-only
Rolled Up Milestone | Group By Summary | Duration-only | Progress

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1.11 DESIGN REVIEW PROCESS

Below is the RFP requirement for the performance simulation and summary duty cycle analysis:

Tab I.1 (k) Design Review Process
Present the Design Review Process, including the presentation of the contents of Preliminary and Final design reviews. The Offeror shall present the proposed process for progressing through these as well as the approach to addressing questions and concerns of the MBTA.

CNR's normal practice is to develop the design of the vehicles in a carefully controlled manner, proceeding through an Internal, Preliminary, and Final design review phase, during which the designs are progressed in ever increasing detail until the client is satisfied that the component, systems and overall vehicle design meets the requirements of the Technical Provisions. On the MBTA Orange and Red Line project, CNR will perform an internal design review, and will informally review with MBTA for their comments. After the internal design is completed, Preliminary and Final design reviews will be conducted with MBTA in accordance with Section T 21.06 of the Technical Provisions.

CNR will submit to the MBTA for review and acceptance a detailed schedule for the entire design review program including the applicable Contractual Deliverable Requirement List (CDRLs), from the preliminary design phase through the final design phase. This schedule will identify all design submissions, which will be grouped into logical packages.

Based on the requirements of the MBTA Technical Provisions, the Systems Engineering Group and the Design Engineering Group will produce technical descriptions of all vehicle systems and equipment, which will describe in detail all pertinent requirements to allow the design of the systems and equipment to proceed. This will include the requirements for the carbody structure and appurtenances, the vehicle interior, major equipment, etc. Such requirements will include function, interface, RAMS, EMC, fire safety, weight, noise emissions, etc. These documents will be checked by other Design Engineers, then an internal meeting will be held attended by the System Engineer/Design Engineers, the Systems Integrator and Quality Assurance to review these documents to make sure the requirements of MBTA are fully satisfied. After this review the Design Engineer will update these documents. Using the technical descriptions, the engineering team will generate interface control documents defining all interface requirements. These documents will be reviewed with the pertinent equipment/system suppliers, who will also be signatories for configuration management purposes.

As the design process proceeds, using the technical descriptions and interface control documents as a basis, frequent internal design reviews will be held with the Design Engineers, the Systems Engineers, the Systems Integrator, the Industrial Designer and Quality Assurance to resolve issues and to ensure that the design objectives, including schedule adherence, are being met. Naturally, comments received from MBTA and the various suppliers will be discussed and addressed during these review sessions.

Informal and formal discussions with MBTA, and formal design reviews with MBTA will also provide important feedback, and will serve to ensure that the vehicle design is in compliance with MBTA's requirements. The design review sessions will be conducted by the CNR Project Engineer with support, as necessary, from CNR Engineers and equipment supplier engineers. This will allow

MBTA to gain an in-depth knowledge of the systems and equipment, and allow designs to be approved as quickly as possible.

The design review submissions will be such as to logically progress the completion of the designs based on comments received from MBTA, coupled with responses and design suggestions from CNR and equipment suppliers. It is understood that the design for any particular system or piece of equipment may not progress from one formal design phase to the next without having received formal approval from MBTA.

Following the design reviews, the appropriate drawings and engineering data will be corrected and updated and resubmitted to MBTA for acceptance. Critical drawings and data, such as general arrangement drawings and the weight analysis described in more detail in Section I.1e, will be regularly updated and reissued on a regular basis, to allow all parties to be completely up to date and familiar with the current vehicle configuration.

Mock-ups will also be constructed during the Detail Design Phase to act as a design aid to allow MBTA to readily visualize the car configuration. Samples of materials to be used on the vehicles will also be submitted to MBTA for approval during this phase of the design. In addition, all stress analyses will be submitted for MBTA's approval during the Detail Design Phase.

This entire process is iterative, and results in fully-integrated designs that meet the requirements of the Technical Provisions, and that have built-in consensus from all concerned parties.

1.12 SYSTEMS INTEGRATION

Below is the RFP requirement for the Systems Integrator:

MBTA RFP No. CAP 27-10 Requirement
Tab I.1 (l) Systems Integrator
Identify the engineer proposed as the System Integrator, as required by T 21.03, and present the Systems Integration Plan referenced require in T 21.03.

1.12.1 Introduction

The systems integration process ensures that all of the discrete elements between associated systems function properly together and that the systems as a whole interface correctly with their operating environment. To accomplish that, the vehicle designers must confirm that individual components and systems have been accurately specified, that interfacing requirements for the equipment and systems are known, accepted, and implemented by each interfacing supplier, that hardware can be physically and properly installed on the vehicle in accordance with the manufacturers' specifications, that individual systems are physically (electrically, mechanically, pneumatically, etc.) and functionally compatible, and that, when tested, the vehicle as a whole performs in accordance with the MBTA Technical Provisions and in accordance with MBTA's needs. This means that when tested on the MBTA Red and Orange lines, the vehicle must be able to successfully operate and must perform in accordance with MBTA's expectations.

It is the Systems Integrator's sole responsibility to oversee and control all aspects of the vehicle design integration process described above.

1.12.2 Scope

CNR, generally, and the Systems Integrator, specifically, will control and monitor the systems integration functions during the vehicle design process, including participation in the execution and acceptance of all vehicle, system, subsystem, and component qualification testing. At the top level, this includes the external interfaces of the electrical and mechanical systems with the rolling stock and existing MBTA systems, including wayside equipment, communications command centers, and maintenance facilities. The scope also includes the internal interfaces between the various onboard vehicle electrical and mechanical systems.

The MBTA Red and Orange line vehicle project will be set up so that systems integration is performed as an integral part of the project organization and design advancement. The systems integration function is authorized by the Project Manager and reports directly to the Project Engineer. Systems integration, as a discipline, spans across all CNR systems engineers as well as all suppliers.

In support of the systems integration scope, CNR will, during the design process, initiate and control the following tasks.

- Establish a comprehensive Systems Integration Plan that outlines the framework for the interfacing scope and function by:
    - Establishing interface control criteria.
    - Supporting the project team during design reviews, qualification testing, first article inspections, and conditional acceptance of the first several vehicles on both the Red and Orange lines.
    - Establishing an interface verification process.
- Develop a verbal and written communications protocol.
- Develop an interface conflict resolution process.

1.12.3 Organization

In keeping with the approach for the Pilot car development that will be done in China to utilize the experience and familiarity with CNR designs, CNR has assigned a senior Systems Integrator to oversee this stage in the Changchun facility. Referring to the organization chart shown in Section 1.1, CNR has designated Mr. Zhonghai Wang as the Systems Integrator. Mr. Wang has had several previous and successful experiences as a systems integrator on many previous projects for CNR. A paragraph of Mr. Wang's experience is included in Section 1.1, along with a matrix showing the Systems Integrator's responsibilities, physical location, and decision-making authority.

Subsequently, the Production car development will be completed in the Springfield facility. Therefore, CNR will assign an experienced American to fill the role of Systems Integrator at this location. This person will be the point of contact with the MBTA regarding all matters related to Systems Integration. Since the timing of production at the Springfield facility is still far away, this position has not been named yet; however, this position will be subject to MBTA approval.

The main focus of systems integration is to ensure that all functional areas, vehicle systems, and interfaces with wayside equipment and facilities have been fully identified, prioritized, and interconnected. Systems integration begins with the correct identification of project management and project development functions and relationships, including the departments of Project Management, Contract Administration, Engineering, Procurement, QA/QC and Testing and

Commissioning. Systems integration also ensures that all necessary resources and qualifications are timely applied and are working in a coordinated manner.

It is fundamental that these functions be properly staffed and interconnected and that clear authority, responsibilities, and accountability be assigned to each. The establishment of these relationships will facilitate the development, procurement, installation, and testing of all car systems and components.

As noted, the Systems Integrator will report to the Project Engineer, who reports directly to the local Project Manager. The Systems Integrator will review all drawings issued by CNR engineering and suppliers for critical interface aspects, including electrical, mechanical, and functional interfaces. The Systems Integrator will attend all design review meetings between MBTA, CNR, and CNR's suppliers and deal directly with the CNR's engineering department and with CNR's suppliers in addressing resolution of any integration issues. This function will be primarily coordinative as the Systems Integrator will be specifically checking for systems integration items. The Systems Integrator will provide direct input to project management for appropriate visibility of all interface issues.

Ultimately, CNR retains responsibility for the total system integration, interface management between systems, all aspects relating to performance at both car and train levels, design, including vehicle assembly, carbody structure and truck, and design and delivery time schedule management.

1.12.4 Establishing the Interfaces

A matrix (example shown below), defining all vehicle systems and major pieces of equipment, will be developed with the same systems, subsystems, and components being identified vertically and horizontally in the matrix. The responsible engineers will then review this matrix and identify the appropriate equipment/system interface for a particular system/equipment by placing a dot in intersecting box. For example, trucks would indicate an interface with, at least, the carbody, the braking system, the propulsion system, and the ATP/ASR system.

In addition to producing the systems integration matrix, the Systems Integrator, in concert with all CNR system engineers, will prioritize the vehicle systems based on criticality of function. This order of priority can then be applied to the subsets of related systems and components to establish a single parent system or device within each group. The parent entity and its associated system engineer will be recognized as the group lead for the purpose of communicating technical information. This process minimizes the risk of suppliers making costly mistakes due to erroneous assumptions and miscommunication. For example, the leveling time of an air spring system can be adversely affected by the pneumatic demands of other more critical pneumatic systems. In addition, the volume of reservoirs, size of piping and other system constraints can affect the time required to add pressure to the suspension and level the vehicle. In this instance, the design and selection of suspension components is dependent upon parameters dictated by the friction brake system and the friction brake system engineer should have lead responsibility for the group.

A final, comprehensive, matrix, complete with inter-group lead responsibility, will then be produced by integrating the inputs from all engineers. Refinements will be made to the final matrix by holding discussions with the individual engineers, and others, as required.

CRC Engineer																								
												●	●	●	●	●	●	●	●	●	●	●	●	●
	Software	●	●	●		●			●	●	●		●	●			●		●					
	Weight Management	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	

Systems Integration Matrix

1.12.5 Defining the Interfaces

An Interface Control Specification (ICS) will be created for each interfacing vehicle system and major piece of equipment. The ICS will delineate the system/equipment functional requirements and define the general interfaces. An Interface Control Drawing (ICD) will be created to accompany the ICS if needed to further define clearances, tolerances, and physical relationships between groups of equipment, systems, and structure that compose portions of the vehicle. In some cases, only an ICD will be required. Both the ICSs and ICDs will be made an integral part of CNR's agreements with their suppliers.

The interface control documents and drawings will next be further refined during comprehensive meetings held between CNR (Systems Integrator) and the interfacing suppliers. As a prelude to the integration meetings and to assure that their equipment will function correctly in the vehicle, each supplier will be required to correspond will all other interfacing suppliers for the specific requirements of the other suppliers' equipment. Conversely, each supplier will be required to identify the interface requirements for all interfacing equipment to enable his equipment to function correctly in the vehicle. Where applicable, this information will include, but not be limited to:

- Equipment input requirements/tolerances.
- Equipment outputs and tolerances.
- Equipment electric power supply/power consumption requirements.
- Equipment pneumatic power supply/power consumption requirements.
- Equipment power supply circuit protection.
- Equipment mounting constraints.
- Equipment location constraints.
- Equipment servicing constraints.
- Equipment environmental constraints such as heat dissipation, cooling, and spray protection.
- Equipment EMC constraints.
- Segregation/Shielding requirements associated with equipment wiring.
- Equipment shock and vibration limits and dampening requirements.
- Equipment operational clearances.
- Equipment operational noise production.
- Equipment diagnostic interface requirements.
- Compatibility with existing equipment infrastructure such as locomotives, wayside, etc.
- Software requirements.
- System failure mode constraints.
- System bypass/cutout requirements.

Following the acceptance of an ICS and/or ICD by all involved parties, including the Systems Integrator, the documents will be signed by all participants and signed copies distributed.

1.12.6 Controlling the Interfaces

Approved ICSs and ICDs will be controlled by the Systems Integrator and may only be revised on authority of the Systems Integrator. The ICSs and ICDs cannot be changed without the approval and acceptance of the original signatories. This will assure that all critical interfaces will be tightly controlled and will not be changed without the express knowledge and consent of all concerned parties.

1.12.7 Systems Integrator

The primary responsibility of the Systems Integrator is to make sure that all systems are designed and tested so that the vehicles are properly assembled and will function as intended. To achieve this goal, the Systems Integrator will identify the interface requirements, monitor the flow of information between all system groups and suppliers, and verify that the interface objectives have been satisfied. The participation of the Systems Integrator will be continuous throughout the project.

General systems integration responsibilities will include:

- Reporting the systems integration status to CNR's Project Engineer.
- Identifying the interface points, parameters, and requirements for systems integration.
- Producing and controlling the interface control documents (ICS/ICD).
- Reviewing drawings and inspection/test procedures developed by the CNR engineers and their suppliers for all interface items. Reviews will include electrical and mechanical interface and operational/functional interface and compatibility items.
- Attending design review meetings with MBTA, CNR, and CNR's suppliers.
- Participating in responses to and addressing systems integration concerns raised by the MBTA, CNR engineers, and CNR suppliers.
- Resolving systems integration issues.
- Coordinating systems integration through direct communication between CNR and CNR's suppliers.

While CNR's engineering manager is responsible for managing CNR's engineering department and its daily work orders and administration, the Systems Integrator is responsible for the status and completion of systems integration items for the project. In this capacity, the Systems Integrator provides input to the engineering team, reviews their work, and coordinates completion of systems integration tasks in accordance with the project's schedule.

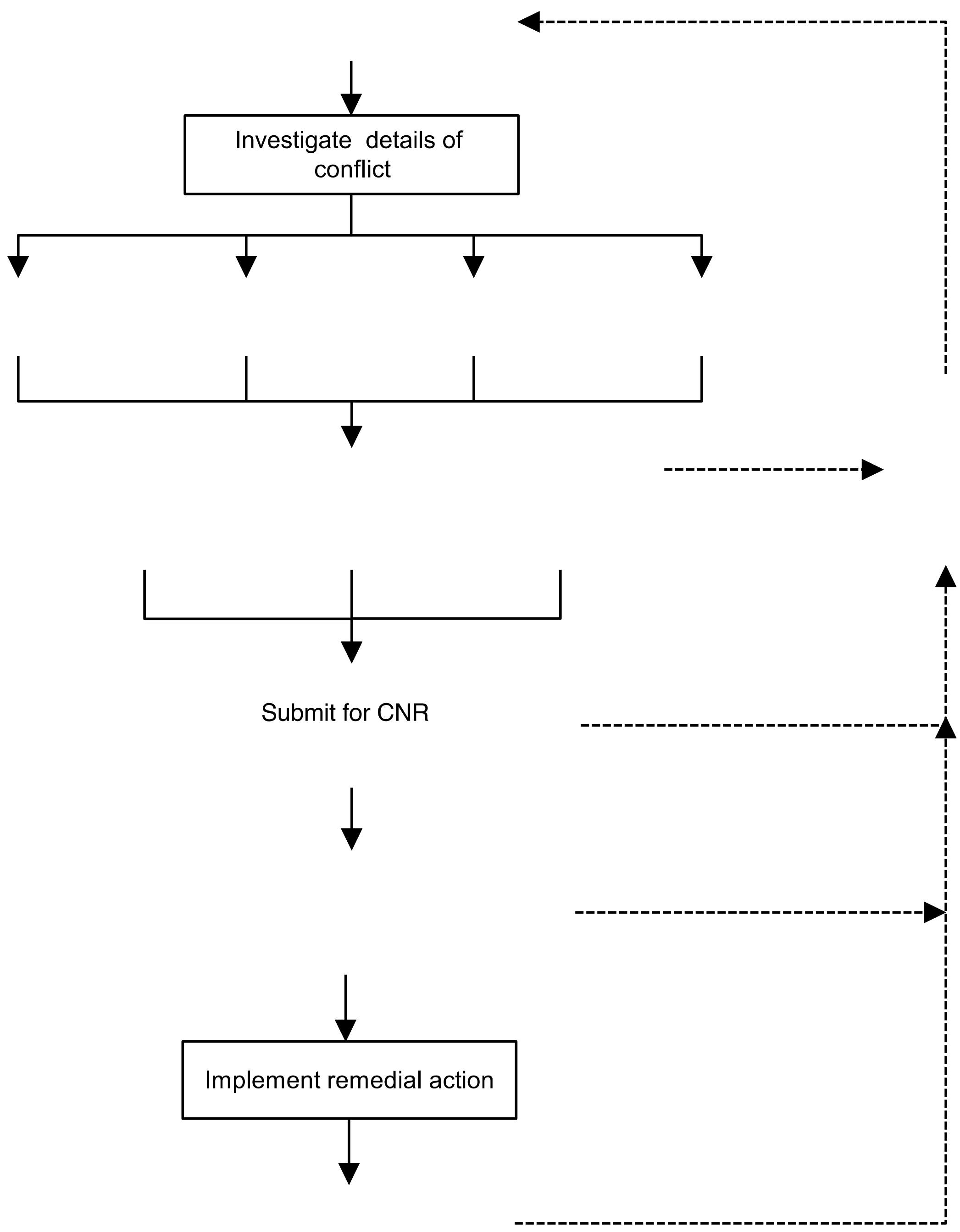
Specific responsibilities of the Systems Integrator include:

- Assisting with the RAMS effort.
- Verification of completeness and satisfactory interface of noise control, weight control, EMC engineering, software management, and related subcontractor information.
- Review of technical descriptions for adequate integration information.
- Verification of hard-mounted installation points between the vehicle and all components and between related components.
- Verification of electrical, mechanical, and pneumatic interconnections between the vehicle and components and between components.
- Resolution of interconnectivity issues.
- Reporting to the Project Engineer the status of the system integration effort.

1.12.8 Interface Conflict Resolution

The Systems Integration process will be designed to identify areas where interface problems exist. Resolution of interface issues will take place using defined procedures. This process will include CNR, CNR's supplier, and MBTA interaction as necessary.

The following simplified flow chart illustrates the primary steps of the interface conflict resolution process.


Investigate details of conflict
Submit for CNR
Implement remedial action

1.13 CONCEPTUAL DESIGN DRAWINGS

Below is the RFP requirement for the Conceptual Design Drawings:

Tab I.1 (m) Organization Chart, Resume and Responsibilities of Key Staff
Provide one (1) print each of the following conceptual designs for each car type (Orange, Red, Cab Car, Non-Cab Car): General Arrangement Drawings (Interior and Exterior); Floor Plans; Equipment Arrangement; Carbody structural Diagram; Truck General Arrangement Drawing; and Cab and Console Layout.

The conceptual design drawings are included in Section 6 Appendix.

1.14 MOBILIZATION PLAN – QUALIFICATION TESTING

Below is the RFP requirement for the mobilization plan and approach for the dynamic vehicle qualification tests:

Tab I.1 (n) Mobilization Plan for Dynamic Vehicle Qualification Testing
Describe the mobilization plan and approach for conducting the dynamic vehicle – level qualification testing required in Section T20 of the Technical Provisions. Provide a preliminary indication of test sequencing for the two fleets. Describe the methods by which on-going test results will be cycled through the design process to ensure that design modifications are implemented prior to the delivery of Pilot Cars. Describe how such design modifications are implemented into the ongoing manufacturing and assembly process of the production cars.

Tests will be performed as part of the engineering activity in support of the Orange Line and Red Line vehicle projects, which will be in response to the MBTA's Technical Provisions, Part T 20.00 in particular. The baseline for the test program will be that required by the Technical Provisions (contractual tests), but this may be supplemented by additional tests required by CNR's Engineering Department. The full test program for the project will be summarized in the Master Test Plan, which will be developed during the proposal phase, or the early part of the design phase, by the Project Test Engineer. CNR normally carries out the following types of tests:

Development Tests - These are internal tests that may be required by Design Engineering to prove design concepts. These tests may be performed to demonstrate that a new or modified design is suitable for transit service, to demonstrate equipment reliability, or to isolate a failure mode. Frequently, prototype equipment and design concepts will be proven by Development Tests. These tests may also be referred to as Engineering Tests.

For this project, MBTA has no specific requirements for performance/submittal of Development Tests, including procedures and reports. CNR may prepare test procedures to help ensure that the test objectives are met and provide a means to control the costs of the test. By their nature, development tests are frequently informal, in that outcomes may not be clearly known beforehand. As a result, the full extent of the testing cannot always be covered in a procedure. Whenever a procedure is prepared, it is reviewed by the responsible engineer. Depending on the nature of the test, a report may not be required.

Qualification Tests - Qualification Tests are performed on a limited number of units during any production run, frequently only on one piece (component, system, vehicle, and consist), to demonstrate performance, determine operating margins, and confirm the effectiveness of equipment tested. Reliability Tests are also classified as Qualification Tests. Qualification Tests are also referred to as Type Tests.

Qualification test procedures and reports will be produced by the Design Engineering Department, and the system or equipment engineer responsible for the equipment to be tested will be responsible for the test documents.

Set-up Tests - Set-up tests are carried out by the Production Test Department to set up equipment to be tested before conducting acceptance or other production tests. Generally, these tests calibrate or otherwise perform an initial, one-time set-up of the equipment under test. Set-up tests are used when the activity covered in them is not permitted within, or during, the acceptance test. Set-up test instructions are prepared by the Engineering Department when considered necessary by the responsible engineer or by mutual agreement with Production Test or Quality Test. Set-up tests may be applicable in preparing for Acceptance or Commissioning Tests. Generally, no report will be required as a result of performing the test.

In-process Tests - In-process tests are performed at an intermediate stage during the manufacture or assembly of equipment, which may later be subjected to an Acceptance Test. Process verification, such as weld quality, is usually classified as an In-process test. In-process test procedures are produced by the Quality Department. However, should the responsible engineer believe that an in-process test is appropriate to maintain the quality of the delivered product, the requirement for such is communicated to the responsible quality engineer and manufacturing engineer. The product or system engineer responsible for the equipment to be tested will approve the In-process Test Procedure, and when the test is intended for field use, the Field Service Engineer will also approve the procedure.

Acceptance Tests - Acceptance tests are performed on each piece of equipment or subsystem before shipment to demonstrate that it functions correctly. These tests may also be referred to as Routine, Functional, Shop, Production Conformance, or Factory Tests. Acceptance test procedures will be prepared by the Engineering Department and the tests may be carried out specifically for the project, may be component specific, or may be carried out using generic acceptance test procedures.

Acceptance tests will be performed by the Production Test Department.

Commissioning Tests - Commissioning tests are performed on each completed vehicle on the MBTA's property, to ensure that the vehicle running characteristics and functioning are in accordance with defined requirements. These tests may also be referred to as Vehicle Acceptance or Vehicle Running Tests. Commissioning Test procedures will be prepared by the Engineering Department. They will cover all tests required on a completed vehicle necessary to ensure that each vehicle is ready for acceptance by the Customer and is suitable for use in service. Commissioning Test procedures are prepared on a project-specific basis, and include all Customer requirements and any additional requirements considered necessary by CNR to ensure that a safe, fully operational vehicle is offered for Customer formal acceptance.

Commissioning Tests are normally performed by the Project Test Engineer and the Production Test Department, with oversight and support by the Quality Engineer.

All test procedures, except those for in-process tests, will be produced by the responsible system or equipment engineer. The Project Test Engineer will also assist in preparing test procedures. All test procedures, except those for in-process tests, will be validated by the Test Engineering staff. Any changes to the procedure must be approved by the responsible system or equipment engineer.

The Project Test Engineer will be responsible for the performance of Qualification Tests. This will include scheduling the test, coordinating participation by others in the test, and supervising the test activities. Reports for these tests will be prepared by the Test Engineer responsible for the test. Should a Supplier provide a test procedure or report, it will be converted to a CNR test document.

The Master Test Plan will define the scope of all testing required to be performed on the project and it contains the following information:

1. Item number.
2. Equipment description.
3. Test procedure number.
4. Test procedure title.
5. Type of test (Qualification, Acceptance, etc.)
6. Technical Provisions testing section reference.
7. Technical Provisions design section reference.
8. Reference information (industry test, FRA, AAR, NEMA, ASTM, AWS, etc.).
9. Summary of the test requirements.
10. Responsibility (CNR, subcontractor, independent test laboratory, etc.).

Following successful completion of all required testing at CNR's final assembly facility, cars will be shipped to the MBTA's facility for further Qualification and Commissioning testing. The testing will be carried out by CNR's Project Test Engineer and the Production Test Department under the guidance of CNR's Design Engineering Department with the oversight and support of the Quality Engineer. Generally, the testing of major systems and pieces of equipment will be carried out by the supplier of the system or equipment. It is expected that representatives from the MBTA will be in attendance during the testing and will facilitate the performing of the tests on MBTA property, and will be authorized to accept test results.

CNR's testing mobilization plan will be based on two major elements – the Master Test Plan and the Project Schedule. The Master Test Plan will define the scope of all testing required to be performed on the project and the Project Schedule defines the sequence of testing.

Should testing of the vehicles necessitate design changes to the equipment or systems to allow successful completion of the testing, the identification for the need for the change and the implementation of the changes will fall under CNR's Engineering Change Notice system. An approved Engineering Change Notice (ECN), which defines the revised equipment configuration and all required changes to implement this new configuration, must be issued before updated equipment can be accepted by CNR and can be installed on vehicles. The affected equipment in CNR's final assembly facility (and in the Changchun manufacturing facility, if applicable) and on vehicles having been shipped to the MBTA's property will then be immediately "red-tagged" by CNR's Quality department as being non-conforming. The "red tags" may only be removed by CNR's Quality department after the ECN has been implemented and the equipment has been brought into conformance.

Vehicles having already been shipped from CNR's final assembly facility to MBTA's property will require retrofitting to the new configuration, and the work will be carried out by CNR's Customer Service Department in accordance with an approved Field Modification Instruction referencing the approved ECN.

Changes to equipment that originate during the manufacturing process are handled in an identical manner.

Depending upon the arrangements made with the MBTA, basic (safety) testing of all married pairs (braking rate, acceleration performance, coupling, etc.) could take place at a single location before the vehicles are moved to the Orange Line and to the Red Line for line-specific testing, such as electro-magnetic compatibility, signaling system functionality, etc.

Following delivery of cars from CNR's final assembly facility to MBTA's property, Orange Line and Red Line cab and non-cab cars will be coupled to form married pairs. Testing will then be carried out to ensure the proper coupling (mechanical, electrical and pneumatic) of cars and the general functionality of the married pairs. Following these checks, the tests specified in Section T 20.23 of the Technical Provisions (On-Site Commissioning Tests on All Vehicles) will be carried out; namely:

- Parking Brake Tests
- Service Brake Rate Tests
- Emergency Brake Tests
- Propulsion System Tests
- ATP/ASR Tests

It is planned that the 500-Mile Operational Test, as outlined in Section T 20.23.07, will be conducted following completion of the testing specified in Section T 20.20 of the Technical Provisions (On-Site Qualification Tests on Pilot Cars).

The tests specified in Section T 20.20 (On-Site Qualification Tests on Pilot Cars) will be carried out, in approximately the following order. It should be noted, however, that some tests, such as "Mechanical Towing Compatibility with Existing Cars," "Vehicle Compatibility Tests with Authority Equipment," or "Inching Switch Test," could be carried out in parallel with other tests. It is also noted, that prior to dynamic testing on the Orange Line and Red Line, CNR would carry out a comprehensive clearance check at low speed to ensure that the vehicles remain within the clearance limits. As part of this clearance test, CNR would perform the "Coupler and Draft Gear Clearance Test" and the "Headlight and Inter-Car Barrier Verification."

- Dynamic and Friction Full Service Brake Tests
- Emergency Brake Tests on a 6 car train-set
- Propulsion System Tests
- Spin/Slide Control Capability
- Test of Slide Control During Emergency Braking
- Parking Brake Hold Test
- Roll Back Tests
- ATP/ASR Aspect Enforcement Tests
- ATP/ASR Test of Operational Modes
- Train-To-Wayside Emission Limits Tests
- Overspeed and Emergency Overspeed Response Time Verification
- Overspeed Limits
- Brake Assurance Rate
- Braking Resistor Temperature Rise Test

- Air System Tests
- Trainline Tests
- Collector Shoe Special Tools Testing
- Multiple Trainset Tests
- Noise And Vibration Tests
- Model Validation Test
- Journal Bearing Over-Temperature Indication Test
- Inching Switch Test
- Four-season HVAC Test
- Vehicle Monitoring System Test
- Mechanical Towing Compatibility with Existing Cars
- Vehicle Compatibility Tests with Authority Equipment
- Maintainability Qualification Testing
- Efficiency
- Reliability Testing

CNR's preference, however, would be to perform all non-Line specific qualification tests at its Changchun manufacturing facility, and to limit the tests performed on the Orange and Red Lines to those requiring the Orange and Red Line characteristics, such as ATP/ASR tests, Train-To-Wayside Emission Limits tests, and others. The scope of these tests will be mutually agreed with MBTA.

The On-Site Qualification Tests on Pilot Cars will be carried out in accordance with the requirements of the vehicle delivery schedule, which means that the Orange Line car testing will be carried out and completed prior to similar testing on the Red Line cars.

1.15 RELIABILITY

Below is the RFP requirement for the reliability of all major subsystems:

Tab I.1 (o) Reliability Requirement
Describe how the Reliability requirement of T2.03 will be met and what methods the Offeror will undertake to ensure all major subsystem suppliers achieve this requirement.

The requirements for Reliability are contained in Section T 2.03.02 of the Technical Provisions for vehicle Mean Distance Between Failure (MDBF), and Section T 2.03.03 for system and component Mean Distance Between Component Failure (MDBCF). The vehicle reliability will be designed to achieve the fleet availability requirements as detailed in Section T 2.03.04.

During the proposal phase, CNR carefully studies the agency's reliability requirements with respect to overall feasibility. Also during the proposal phase, CNR will, at a minimum, pass down the reliability requirements contained in the Technical Provisions to prospective sub-suppliers.

As required by Section T 2.03.06 B, within 90 days from Notice to Proceed, CNR will submit a Reliability Program Plan (RPP) for MBTA's review and approval (CDRL 02-07). The RPP will detail how CNR intends to satisfy all reliability requirements for the Orange Line and Red Line project, and will include the monitoring and control of subcontractors and suppliers, program review, the

Failure Reporting, Analysis, and Corrective Action System (FRACAS), the Failure Review Board (FRB), reliability modeling, reliability allocations, reliability predictions, component de-rating, thermal reliability, and reliability development/growth testing.

At project inception, CNR will assign an experienced, dedicated RAMS (Reliability, Availability, Maintainability, Safety) Engineer to the project, as per the requirements of Section T 2.03.06 C (CDRL 02-08). The RAMS Engineer will have the authority within the project organization to plan and implement the reliability program.

At the beginning of the design process, CNR will prepare a reliability prediction summary, using as a basis the requirements of Section T 2.03 of the Technical Provisions and CNR's past experience. During this process, it is possible that some sub-suppliers may not consider it feasible to meet the reliability requirement required by CNR. In such cases, it may be necessary for CNR to accept a lower-than-desired reliability, but it will then be necessary for CNR to impose a more restrictive reliability requirement on other equipment and systems in order to meet the vehicle MDBF requirement. In no case will the MBDCF requirements be less than those specified in Section T 2.03.03. The completed report will be submitted to MBTA to satisfy the requirements of Section T 2.03.05 A (CDRL 02-06) during the Preliminary Design Review.

CNR will develop a reliability model, consisting of reliability block diagrams and probability of success equations, which show each equipment element essential to the successful performance of the system, including element interrelationships. These block diagrams will be kept current with design iterations.

As required by Section T 2.03.05 B, CNR will perform reliability analyses to identify weaknesses in system hardware and software design whenever these details are not established by historical records of equipment operation. The analyses will provide input to system designs for theoretical circuit behavior, random component failures, electrical interference, systematic component failures, and software errors in software-based logic. The reliability predictions will be identified through the use certified field failure data, or MIL-HDBK-217, when no field data is available. As also required by Section T 2.03.05 B, IITRI/RAC Document NPRD-95 will be used for non-electronic components. CNR will perform a Failure Modes Effects and Criticality Analysis (FMECA) for subsystems to identify weaknesses in safety critical system hardware/software design and to document the modes and effects of failures. The analyses will be updated throughout the development of the vehicle design.

FMECA is an inductive, bottom-up analysis method which analyzes the effects of single component or function failure on equipment or subsystems, and while FMECA is very effective at thoroughly documenting initiating faults and identifying their local effects, it is limited at examining multiple failures or their effects at a system level. Fault Tree Analysis (FTA), on the other hand, is a deductive, top-down method that analyzes the effects of initiating faults and events on a system. It is very effective at showing how resistant a system is to single or multiple initiating faults, but it is not very effective at finding all possible initiating faults. FTA considers external events, whereas FMECA does not. CNR may also supplement these analyses by utilizing FTA for these reasons.

One of the design techniques that CNR will consider to improve reliability and to reach reliability targets is redundancy. In the case that one part of a system were to fail, an alternative success path will be provided. Redundancy is particularly useful when field reliability data is not available. Although redundancy can be more expensive, high reliability can be readily achieved. In addition, by incorporating different backup designs into the system (multiple suppliers, reduced infant mortality sensitivity), high levels of reliability can be achieved throughout the life cycle.

As required by Section T 2.03.05 C, the reliability prediction report will be maintained and updated through the design, testing, manufacturing, delivery and warranty periods, and will be submitted to MBTA for review and approval on a monthly basis. Any design or manufacturing changes that could affect vehicle reliability will be highlighted in the report.

At least 60 days prior to the start of pilot car testing, CNR will establish a FRB in accordance with MIL-STD 785B. The FRB will be responsible for reviewing all system and component failures to determine their relevance to overall vehicle reliability. The FRB will also determine the need for, and the type of, failure analyses and corrective action. Representatives from CNR's Engineering Department including the RAMS Engineer, Manufacturing, Customer Service, Field Service, Quality Assurance, and others, as required, will participate in the FRB. It is also expected that the MBTA will be an active participant in the FRB.

As required by Section T 2.03.07 A, before the Pilot Train is accepted by MBTA, the vehicles will need to successfully complete the Pilot Train Reliability Test (CDRL 02-09).

Following the delivery of the 30th car from each fleet, in accordance with Section T 2.03.08 A each fleet will undergo the Fleet Reliability Demonstration Test to confirm that the vehicles and their systems meet the specified reliability and availability targets. Prior to testing, CNR will submit its FRACAS implementation plan to MBTA for acceptance (CDRL 02-10).

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2 MANUFACTURING PLAN

The vehicles for the MBTA's Orange Line and Red Line will be designed, built, and delivered by CNR, one of the largest and most advanced railcar builders in the world and the largest of the premier railcar builders in China. CNR has developed and constructed its own railcar designs as well as worked in close cooperation with, and under license to, some of the world's leading rail vehicle designers and manufacturers, including Alstom, Bombardier, Siemens, Tokyu Car and Hitachi. This experience has provided CNR with invaluable knowledge of many different vehicle technologies and manufacturing methods and places CNR in the unique position of having the knowledge, skills and capability to produce a wide range of world-class vehicles to international standards for varying markets. CNR's plan to manufacture MBTA's vehicles has been carefully developed and steps have already been taken to ensure its timely and successful implementation as described in this section.

2.1 MANUFACTURING CAPACITY AND LOGISTICS

Tab I.2 (a) Manufacturing Capacity and Logistics
The Plan should address the manufacturing capacity and logistics for the production of the Red Line and Orange Line Vehicles. It should include the overall approach to manufacturing and assembly of car body components, testing and commissioning, the availability plant capacity at the various locations, qualified and, where applicable, certified personnel and other resources to perform the work, including the local on-site staff, the methods of transportation between the various work locations as well as to the Authority, and the Offerors' plans or local coordination with, and support to, the Authority, and all efforts will undertake to comply with the obligation in Section C7.18 that Final Assembly of All Production (Non-Pilot) Vehicles delivered under the Contract take place in Massachusetts.

2.1.1 General

In accordance with the RFP, CNR will manufacture, assemble and pre-test the first three married pairs of each car type, the Pilot cars, in their entirety in CNR's manufacturing facility in Changchun, China. This means that all material, including US-manufactured components, will be shipped to Changchun for incorporation into these vehicles. The trucks for the Pilot cars will likewise be assembled completely in Changchun. The Pilot cars will be fully-protected and transported by ocean freight to Boston, Massachusetts, and then by flatbed truck to the MBTA's property for commissioning and qualification testing.

For the production cars, the stainless steel carbodies will be fabricated in the Changchun facility. The production carbodies will be transported to Boston via ocean freight, and then by flatbed truck to CNR's final assembly facility in Springfield, Massachusetts.

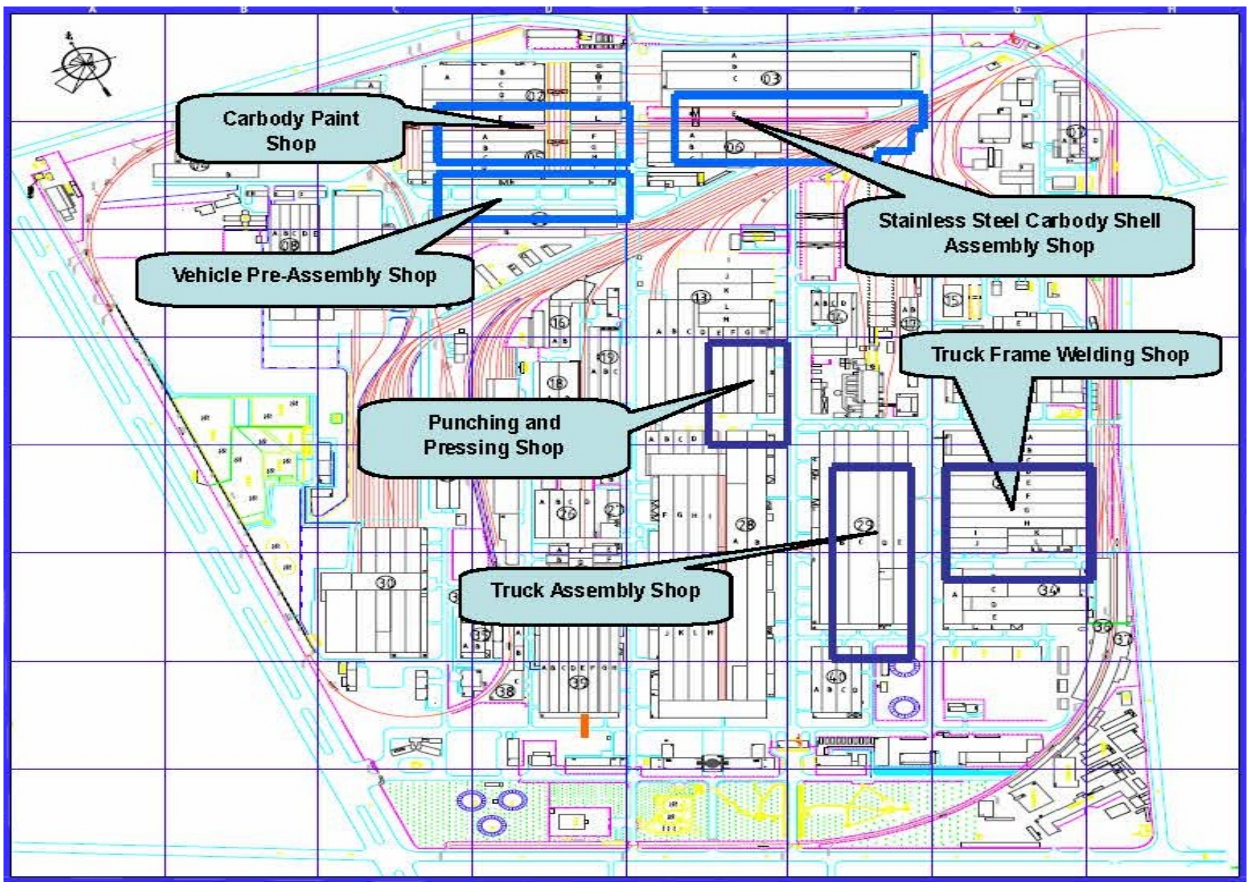
At its Massachusetts final assembly facility, CNR will perform final assembly and pre-testing of the production cars. Final assembly will consist of installing all underfloor and roof-mounted equipment including propulsion equipment, auxiliary power supply equipment, braking system, couplers and draft gear, HVAC equipment, ATC system equipment, and other systems, passenger seats, stanchions and hand rails, cab equipment, and all miscellaneous equipment installed on the carbodies. The trucks will likewise be completely assembled and tested in Massachusetts. Finally, completed carbodies will be mounted over the trucks, followed by comprehensive static testing and dynamic testing at our on-site test track at the Springfield facility.

Completed tested production cars will be transported from the Massachusetts final assembly facility to MBTA's property by flatbed truck. This Springfield facility has the additional ability to make shipments directly by rail to the Orange Line. This alternative has not been pursued in accordance with Addendum 3 instruction to ship by (flatbed) truck, however this alternative exists if it would be of benefit to MBTA.

2.1.2 CNR's Changchun Manufacturing Facility

The Changchun facility can produce 1,200 mass transit vehicles per year.

The Changchun manufacturing facility covers a total area of approximately 872,000 ft^2 (81,000 m^2), of which 270,000 ft^2 (25,000 m^2) is used for the fabrication of components for carbody, 366,000 ft^2 (34,000 m^2) is used for the assembly of carbody, 161,000 ft^2 (15,000 m^2) is taken up by the Paint Shop, and 75,000 ft^2 (7,000 m^2) is used for pre-assembly work. A layout of the Changchun facility and primary shops is shown below.



Layout of Changchun Manufacturing Facility

The 366,000 ft^2 (34,000 m^2) area dedicated to carbody assembly work is capable of supporting four production lines, with each production line able to simultaneously manufacture four different types of car shells. The facility has the capability to produce **1,000 stainless steel carbodies annually** and is a world-class facility and the largest facility of its kind in China. It has already manufactured over 5,000 stainless steel carbodies for rail vehicles operating around the world.

The fabrication and welding of the carbon steel and stainless steel portions of the carbodies will be carried out in separate areas to prevent carbon steel contamination of stainless steel components. The carbon steel end underframe components, including collision post reinforcements, will be cut to size and profile, machined, and then pressed to shape. Components and welded subassemblies will be installed into dedicated welding fixtures and fusion welded. Complete end underframe units will then be shot blasted to remove extraneous surface contamination, and prime painted, undercoated and finish coated. Areas within 2.95 inches (75 mm) of edges to be welded directly to the stainless steel portion of the car underframes will be masked to ensure they are not painted in order to accommodate subsequent welding operations.

Stainless steel components will be produced by cutting raw materials to size and shape, and then pressing and stretch forming, as appropriate for each part. Window and doorway cutouts in side sheets will be laser cut. Components and spot-welded subassemblies will then be installed in their respective fixtures: which are the roof frame fixture, left and right hand sideframe fixtures, end frame fixtures, and underframe fixture. The sideframe assemblies, end frame assemblies, roof frame assembly and underframe assembly will be formed by welding the components together. Generally, spot welding and fusion welding will be used, but areas visible to the riding public from station platforms will be laser welded. The stainless steel portion of the underframe will be loaded into the final assembly fixture with the carbon steel end underframes, and the subassemblies will be joined by fusion welding. The sideframe assemblies, end frame assemblies and roof frame assembly will then be installed in the final assembly fixture where they will be welded together (by spot welding and fusion welding) to form an integral carbody structure. Pertinent portions of the carbon steel end underframes will be primed, undercoated and finish coated as necessary.

Welds visible to passengers from the station will be laser welded.

Following completion of all welding, welded seams in the passenger compartment skins will be leak tested. Any required repairs will be made and re-tested to confirm watertightness of each carbody.

Approximately 86,000 ft^2 (8,000 m^2) of floor space is devoted to the manufacture of fabricated truck frames and bolsters. This area includes six welding production lines, five assembly lines, and two painting lines, and is capable of producing over 6,000 trucks per year. The production lines include numerous robotic welders, machining centers, 3-D measuring equipment, and static load testing and specialty equipment.

The truck proposed by CNR for the Orange and Red Line cars utilizes cast frames and bolsters supplied by Bradken (formerly known as Atchison Casting Corporation). Bradken has designed and manufactured over 5,000 railway passenger trucks since 1961 and more than 90,000 locomotive trucks since 1936. These trucks have provided millions of miles of safe and highly reliable service for many long distance and commuter rail transit agencies in North America.

The pilot car trucks will be assembled in the Changchun facility.

CNR has the additional capability of designing and manufacturing trucks with fabricated truck frames and bolsters in its Truck Shop. These capabilities including equipment and skilled staff will be utilized to aid in the assembly of the Bradken cast trucks.

The following images show some of the various shops and equipment in the Changchun manufacturing facility.

CNR Changchun Plant Photos

Main Assembly Facility

Overhead Walkway for Roof Access

Vehicle Access Walkways

Water Test Facility

Car Weighing Track

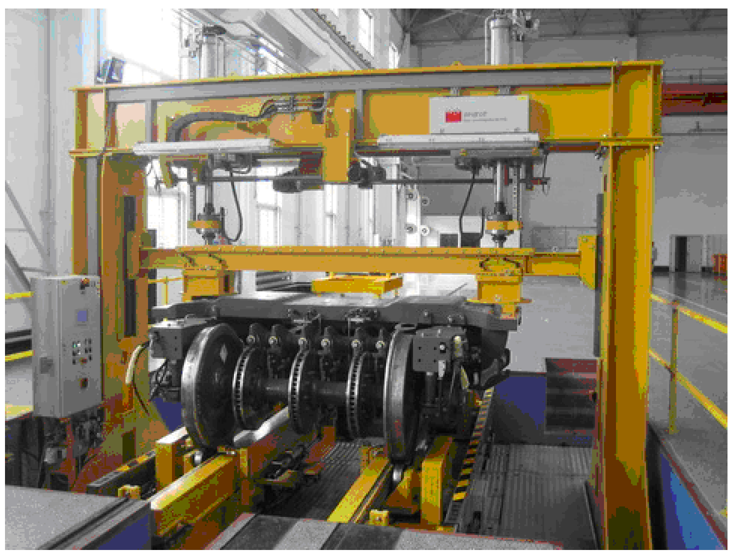
Spot Welding a Sideframe Subassembly

Automatic Spot Welding of Sideframe Sheets

Automatic Seam Welding of Corrugated Roof Sheets

Laser Welding Machine

Robotic Welding Machine Welding Truck Sideframe



Truck Loading Machine

The final assembly area consists of 30 fixed stations with a separate track onto which the trucks are run for trucking. All car assembly work is carried out in a single station, and on completion of the carbody, it is removed from the assembly station by overhead cranes and lowered onto its trucks on the trucking track. The car is then moved out of the final assembly area on the truck track.

CNR's Changchun facility employs a skilled staff of over 10,000 workers to accomplish the production rates described above. All shops are fully equipped and staffed for construction of the Orange and Red Line cars. At the time of anticipated contract award for the Orange Line and Red Line cars, no work is currently scheduled for the manufacture of other rapid transit vehicles in the Changchun facility, ensuring there will be far more than ample factory capacity for the manufacture and assembly of the Orange Line and Red Line vehicles.

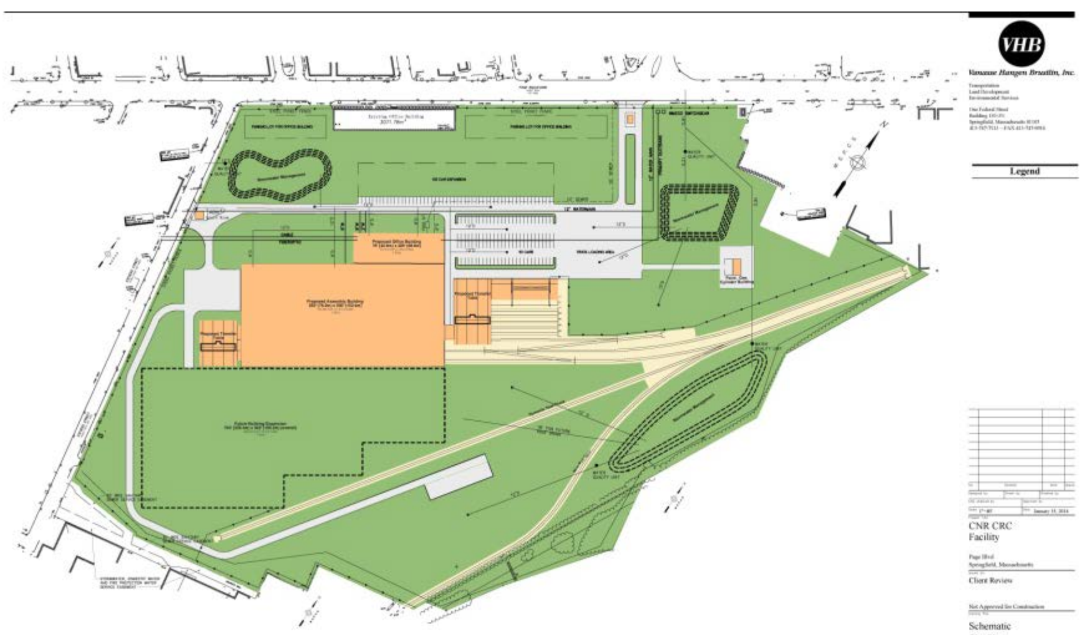
2.1.3 CNR's Massachusetts Final Assembly Facility

CNR has taken action to construct a brand new U.S. final assembly facility at 655 Page Boulevard, Springfield, Massachusetts.

> CNR has arranged to build a new final assembly facility in Springfield, MA.

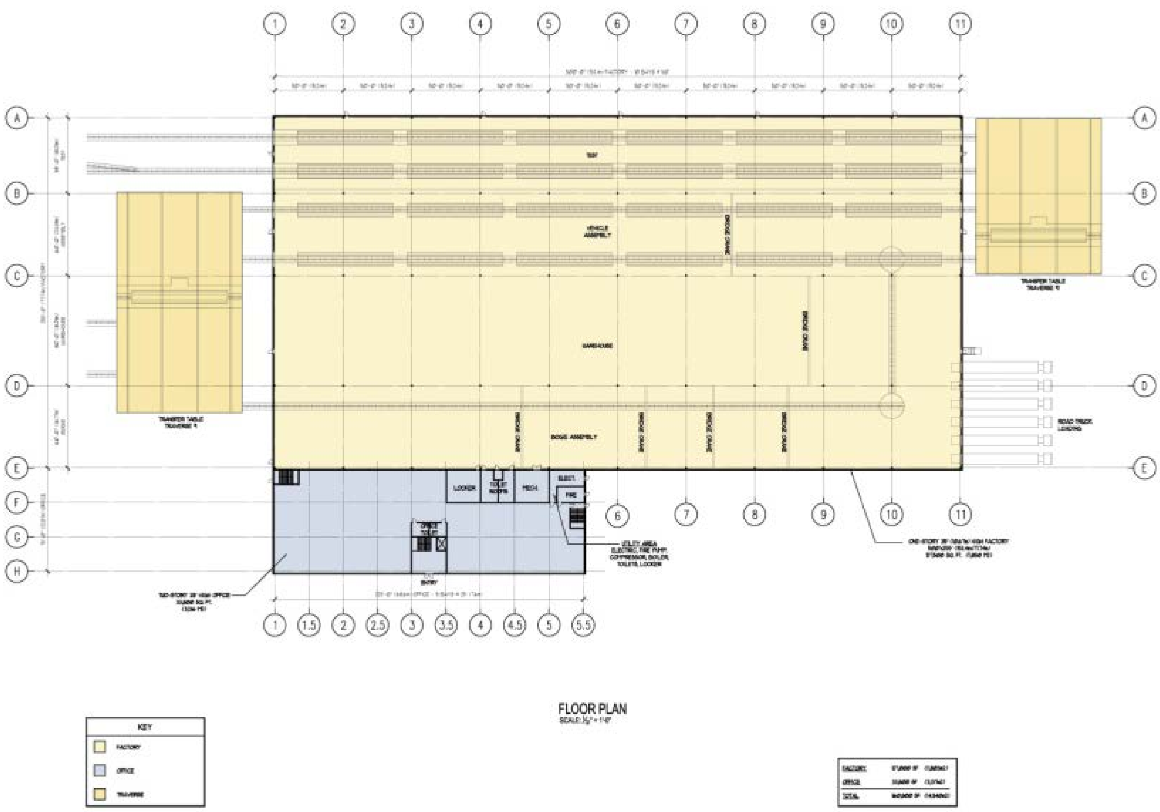
The following pages provide an aerial view of the land, a site plan, a three-dimensional visualization of the plant, and a plant layout of the Springfield facility.

Aerial View of Springfield Final Assembly Facility



Site Plan of Springfield Final Assembly Facility

3-D Visualization of Springfield Final Assembly Facility



Springfield Final Assembly Facility Layout

The site is shovel-ready and covers an area of 40 acres (161,800 m^2) which will include vehicle production facilities and a test track, as well as office space and parking. The following visualization shows a view of the main assembly shop looking from west to east.

3-D Visualization of Springfield Main Assembly Shop

All equipment delivered to the final assembly facility, including equipment manufactured by CNR and by suppliers, will pass through Receiving Inspection where it will be inspected to ensure that it complies with all pertinent requirements before being released to either the Warehouse or to the Manufacturing Workshop. Noncompliant material will be quarantined to prevent its inadvertent use before being dispositioned in accordance with CNR's Quality Assurance procedures. If the material can be restored to compliance with specifications by CNR or the supplier on site, it will be rectified and moved to the Warehouse; otherwise, it will be returned to the supplier for correction.

CNR will use truck frames, bolsters and other components supplied by Bradken supplemented with the remaining components provided by CNR. For the production vehicles, the unpacked and inspected truck frames and bolsters will be moved into the Truck Shop. The chevron primary suspension will be installed on the truck frames, and the frames mounted on the wheelset assemblies which are complete with gearboxes and journal bearings. Traction motors will be installed on the truck frames and connected to the gearboxes using flexible couplings. The truck bolster will then be installed on the truck frame and the air springs mounted. Truck assembly will be completed by installation of tread brake units, brake piping and hoses, trip cocks, current collector equipment, power cabling, grounding cables, speed sensors, control wiring, ATC system equipment, car leveling valves and other items.

After the truck has been assembled, a number of truck tests will be performed. The truck will be subjected to a vertical load test to ensure that the primary springs are properly adjusted and secondary spring height is correct, electrical resistance of electrical connections will be checked, a leakage test will be performed on pneumatic piping and hoses, wire and cabling checked for continuity and megger and hipot tested, voltage will be applied to the traction motors to ensure the power cables are connected to the correct terminals, and other checks will be performed.

Carbody and other equipment will be delivered to the manufacturing facility at the east end of the main assembly shop (left side when viewing the previous three-dimensional image). Each carbody will be lifted from the flatbed truck using the gantry cranes shown in the image, and loaded onto dummy shop trucks. The carbody on its dummy trucks will then be moved onto the transfer table and transported to the main assembly shop.

Two final assembly lines will be utilized, each having six build stations, with the cars moving through the main assembly shop from east to west. The following work will be performed in each station:

- **STATION 1** Installation of diagnostic equipment, door system, operator cab electrical lockers, ATP and ASR equipment, and communication equipment.
- **STATION 2** Installation of roof-mounted HVAC units, passenger compartment electrical lockers, roof equipment wire and cable and connections, braking system equipment, cab electrical equipment.
- **STATION 3** Installation of air ventilation ducting (including air tightness testing), passenger compartment wiring and connections, passenger seats, and other equipment.
- **STATION 4** Installation of cab equipment, cab door, miscellaneous passenger compartment equipment, propulsion system equipment, hostler panel, auxiliary power supply equipment, battery box, and other equipment.
- **STATION 5** Connection of underfloor electrical equipment, installation of couplers, ATP antenna assembly, lighting equipment and signage.
- **STATION 6** Installation of trucks; dimensional checking.

Truck installation to the carbody will be accomplished by lowering the carbody onto the fully assembled trucks with the final carbody-to-truck connections made as well as attachment of the leveling valve arm to the bracket on the carbody.

After Station 6, the car will be moved onto the transfer table on the west side of the main assembly building and transported into the static test area. Here, the car will undergo car leveling to adjust the leveling valves to level the car within the prescribed tolerances. underfloor clearance test, wire and cable testing (continuity, megger, hipot), electrical equipment functional testing, pneumatic system response time test, functional testing of door system, communications equipment, ATP and ASR, and other tests.

Following the successful completion of all static testing, cars will be coupled and married pairs moved to the electrified test track for preliminary dynamic testing, including braking rate, acceleration, functional test of no-motion system, traction control system, and testing and measurement of other items.

Hold points will be established throughout the production line in conjunction with the MBTA to enable MBTA inspectors to fully inspect each phase of completed work. Details about the inspection program are provided in Section 4 Quality Assurance Plan in this proposal.

The facility will have the capability of producing 12 cars per month. This provides more than ample capacity to supply the 4 cars per month for each Line’s delivery rate in accordance with schedule requirements.

Following preliminary acceptance of vehicles at the factory, the vehicles will be transported to MBTA's property on flatbed trucks, where a series of commissioning and acceptance tests will be conducted. These tests will be performed by CNR Field Service technicians in conjunction with MBTA and supplier test engineers, as necessary. Following successful completion of these tests, the vehicles will be presented to MBTA for formal acceptance.

The MBTA and its representatives will have full access to all of CNR's manufacturing facilities, both in China and in Massachusetts. CNR will establish points of contact for the MBTA within CNR's organization. The primary point of contact will be the Project Manager, but secondary points of contact will be the Deputy Project Manager, Project Engineer, Quality Assurance Manager, Production Manager and Product Support Manager. The points of contact will be mutually agreed upon by the MBTA and CNR.

Detailed staffing information is provided in Section 2.6 herein.

2.2 FINAL ASSEMBLY REQUIREMENTS

Tab I.2 (b) Final Assembly Requirements
If the Offeror's anticipated final assembly operations, processes and measures it will use in connection with the Production Vehicles delivered under the Contract differ from or do not include at a minimum all operations, processes and measures listed in the definition of Final Assembly in Section C7.18, describe how the Offeror's final assembly will differ from the final assembly requirements in Section C7.18 and explain why the Offeror believes that its final assembly satisfies the general requirement of final assembly of all Production Vehicles in Massachusetts. OFFERORS ARE ADVISED THAT A PROPOSAL WHICH INCLUDES A MANUFACTURING PLAN WHICH DESCRIBES A MASSACHUSETTS FINAL ASSEMBLY PROCESS WHICH DOES NOT INCLUDE AT A MINIMUM ALL OF THE OPERATIONS, PROCESSES AND MEASURES LISTED IN THE DEFINITION OF FINAL ASSEMBLY IN SECTION C7.18 MAY BE REJECTED BY THE AUTHORITY AS NONCOMPLIANT. THE MBTA RESERVES THE RIGHT, ON A CASE BY CASE BASIS, TO DETERMINE WHETHER THE OFFEROR'S FINAL ASSEMBLY SATISFIES THE GENERAL REQUIREMENT OF SECTION C7.18 THAT FINAL ASSEMBLY OF ALL PRODUCTION VEHICLES TAKE PLACE IN MASSACHUSETTS.

CNR confirms that all final assembly work described in Section C7.18 of the RFP will be performed in the Massachusetts final assembly facility.

2.3 WORK DONE BY PRIME CONTRACTOR

Tab I.2 (c) Work Breakdown
List the work to be performed by the prime contractor and the location(s) at which this work will be performed. If major carbody manufacture is to be performed by subcontractors, identify by name and work locations.

The Pilot cars for both the Orange and Red Lines will be manufactured and assembled in their entirety in CNR's manufacturing facility in Changchun, China. This will allow direct support and supervision by design engineering, manufacturing engineering, Quality and other groups that are familiar with the product designs, manufacturing methods, and acceptance criteria.

For the production vehicles, the stainless steel carbodies will be fabricated and assembled in the Changchun facility. The carbodies will then be shipped to CNR's Massachusetts final assembly facility for final assembly and testing of the completed vehicles.

CNR is not planning on manufacturing other components.

2.4 MASSACHUSETTS FINAL ASSEMBLY CONTRACTOR

Tab I.2 (d) Massachusetts Final Assembly Contractor
List the Massachusetts final assembly contractor and location. Include sample assembly procedures and controls and sample material control program. Describe the group responsible for preparation of workflow plans, schedules, procedures, quality control, material control, etc., at the final assembly location. Describe how and where retrofit work might be performed if Authority facilities are not available. If more than one contractor is being considered, provide information for each.

CNR is planning to establish a final assembly facility at 655 Page Boulevard, Springfield, Massachusetts. The facility organization will, in many respects, mirror that of CNR's manufacturing facility in Changchun. However, the U.S. facility will be under the control of the Project Manager, who will manage the following functions:

- **Manufacturing** – The Production department is responsible for the assignment of adequate skilled labor, issuing of required tools, and performance of all manual work on the vehicles in accordance with project technical, quality and schedule requirements.
- **Manufacturing Engineering** – Manufacturing Engineering is provided by the Engineering department for transferring the design engineering documentation into processes and procedures to be implemented by the workforce.
- **Quality Assurance/Quality Control** (QA/QC) – The QA/QC department is responsible for establishing and implementing all in-plant processes necessary to maintain product and process quality. This includes receiving inspection, in-process inspection, supplier auditing, first article inspections, auditing of in-house shop floor documentation, and conducting many other activities pertaining to Quality. Note that while the Quality department will work with the Project Manager in scheduling and performing daily work, Quality staff has authority directly from the corporate Quality Director.
- **Scheduling** – Scheduling is performed by the Project Planner who is responsible for issuing and maintaining the master schedule and its timely updates/adjustments.
- **Procurement** – The Procurement department is responsible for ordering material in conformance to the technical specifications from qualified and approved suppliers in support of the production schedule.
- **Material Control** – The Material Control department is responsible for the storage of all material, issuing material to work stations on the production lines, maintaining adequate material quantities, and other material handling activities.
- **Plant and Machinery** – The Facility Maintenance department is responsible for installing and maintaining all machinery within the facility.
- **Environmental & Safety** – The Environmental & Safety department is responsible for ensuring that the facility complies with all applicable health and safety regulations, necessary safety devices and equipment are available and in working order, and on-site

staff and visitors are properly trained in matters relating to safety and have been provided with requisite safety equipment.

- **Human Resources** – The Human Resources department is responsible for the recruitment and hiring of all site staff, ensuring that personnel comply with state and local regulations, and for maintaining personnel records.
- **Accounting** – The Accounting department is responsible for all financial and cash flow operations in accordance with Generally Accepted Accounting Practices, and maintaining all financial records.

Samples of CNR procedures and documents are provided on the following pages as required by the RFP instructions.

The coupler installation procedure for the Rio de Janeiro Electrical Multiple Units is shown below. (Some sample documents have been reduced in size in order to fit within the specified page limits.)

IN-700BG-004V2.0

CNR 中国北车

Process Sheet

CCY-061-001-2011

Document No.	KZ-BXEMU60-ZP-013	**Part Name**	Coupler Installation		
Document Name	Coupler Installation Procedure	**Part Drawing No.**	CCD00000103311		
Product Type	Stainless Steel Urban Railway Vehicles	**Applicable Model**	DK130/DK130A/DK131		
Project Name	Rio de Janeiro 60 EMU Project	**Revision**	B	**Effective Date**	2014-01-26

Change Log

Rev.	Signed	Date	Comments
A	Zhang Xu	2013.9.1	First issue
B	Zhang Xu	2014.1.24	Add coupler stop installation and coupler hose connection, etc.

Prepared	Checked	Department Leader	Countersigned	Approved
Zhang Xu	**He Zhijun**	**Li Xuekun**	**Sun Qingfeng**	**W[illegible]nsheng**

Implementing Department(s)

Assembly Workshop	Quality Assurance Department								

Changchun Railway Veh[illegible]

Sample Document From Similar Project

CNR 中国北车

Process Sheet CCY-061-002-2011

Document Name	Product Type	Project Name	Part Drawing No.	Part Name	Document No.
Coupler Installation Procedure	Stainless Steel Urban Railway Vehicles	Rio de Janeiro 60 EMU Project	CCD00000103311	Coupler Installation	KZ-BXEMU60-ZP-013

Personal protection equipment (PTE)	 Protective gloves must be put on	 Protective footwears must be put on	 Work clothes must be put on	 Work cap must be put on		
Applicable station	**10-30**	**10-30**	**10-30**	**10-30**		
Personal protection equipment (PTE)						
Applicable station						

			Prepared	**Zhang Xu**	Page
Change Log	Signed	Date	Checked	**He Zhijun**	1/10

CNR 中国北车

Process Sheet CCY-061-003-2011

Document Name	Product Type	Project Name	Part Drawing No.	Part Name	Document No.
Coupler Installation Procedure	Stainless Steel Urban Railway Vehicles	Rio de Janeiro 60 EMU Project	CCD00000103311	Coupler Installation	KZ-BXEMU60-ZP-013

Work Flow Process

10 Preparation work-----20 Installation of fully automatic coupler and draft gear -----30 Installation of semi-permanent coupler and draft gear

			[illegible]	**[illegible]ang Xu**	Page
Change Log	[illegible]	[illegible]	Checked	**He Zhijun**	2/10

Sample Document From Similar Project

CNR 中国北车

Process Sheet CCY-061-004-2011

Document Name	Product Type	Project Name	Part Drawing No.	Part Name	Document No.
Coupler Installation Procedure	Stainless Steel Urban Railway Vehicles	Rio de Janeiro 60 EMU Project	CCD00000103311	Coupler Installation	KZ-BXEMU60-ZP-013

List of Technical Resources (I)

Equipment（S）, Tooling (G)			Measuring Gage, Template			Tool		Auxiliary Material	
Name	Type (Tooling No.)	Category	Name	Type (No.)	Category	Name	Spec.	Name	Spec.
Overhead travelling crane			Tape	5m		Torque wrench	300Nm-1830Nm	Sign pen	Red
Hydraulic lift car						Socket	S55/S24		
						Open-end wrench	S55/S24		
						Socket head wrench	S6		

			Prepared	**Zhang Xu**	Page
			Checked	**He Zhijun**	3/10
Change Log	Signed	Date			

CNR 中国北车

Process Sheet

CCY-061-005-2011

Document Name	Product Type	Project Name	Part Drawing No.	Part Name	Document No.
Coupler Installation Procedure	Stainless Steel Urban Railway Vehicles	Rio de Janeiro 60 EMU Project	CCD00000103311	Coupler Installation	KZ-BXEMU60-ZP-013

List of Technical Resources (II)

Reference Document			Special Process Environment Requirements			Personal Qualification Requirements			
S/N	Document Name	Document No.	Station No.	Station Name	Environment Requirement	S/N	Station Name	Personal Qualification	Qty.
1	Lock Tag Painting Application Procedure	KZT-011	20	Installation of fully automatic coupler and draft gear	Clean and tidy	20	Installation of fully automatic coupler and draft gear	Well trained and qualified	3
			30	Installation of semi-permanent coupler and draft gear	Clean and tidy	30	Installation of semi-permanent coupler and draft gear	Well trained and qualified	3

			Prepared	Zhang Xu	Page
Change Log	Signed	Date	Checked	He Zhijun	4/10

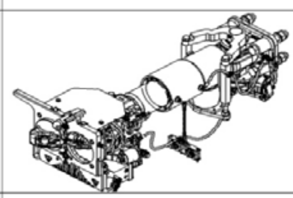
Sample Document From Similar Project

CNR 中国北车

Process Sheet

CCY-061-029-2011

Document Name	Product Type	Project Name	Part Drawing No.	Part Name	Document No.
Coupler Installation Procedure	Stainless Steel Urban Railway Vehicles	Rio de Janeiro 60 EMU Project	CCD00000103311	Coupler Installation	KZ-BXEMU60-ZP-013

Station No.	Picture/Sketch	Process Content	Tools & Auxiliary Materials
10		10 Preparation work 10.1 Check material/part installation holes and surface quality, which must conform to drawing indications and related technical requirements.	
10		10.2 Make preparation for tools such as torque wrench, socket and open-end wrench, etc. according to fasteners as indicated on drawings.	

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Change Log	Signed	Date	Checked	He Zhijun	5/10

Process Sheet CCY-061-029-2011

Document Name	Product Type	Project Name	Part Drawing No.	Part Name	Document No.
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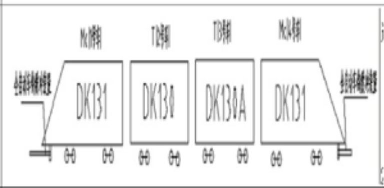
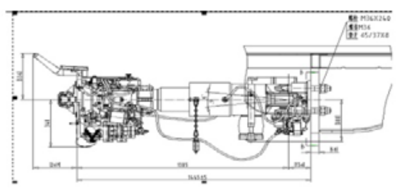
Station No.	Picture/Sketch	Process Content	Tools & Auxiliary Materials
20		20 Installation of fully automatic coupler and draft gear 20.1 Use the overhead travelling crane or hydraulic lift car to transport the qualified fully automatic couplers onto the installation position.	Torque wrench Socket Sign pen
20		20.2 After having aligned the fully automatic coupler with the carbody installation hole, tighten it with fasteners (without using torque wrench); when tightening the bolts and nuts, it is to use the diagonal tightening method. After having checked the coupler installation level, use the torque wrench to tighten it to the torque of 1825Nm, and apply lock tag (Apply lubricating grease RIVOLTA G.W.F during bolt installation). Note: Under conditions without wind and power, the electric connector ... automatic coupler shall be guarantee... in the closed ... cannot be changed artific...	

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Sample Document From Similar Project

Process Sheet CCY-061-029-2011

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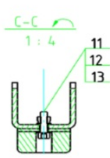
Station No.	Picture/Sketch	Process Content	Tools & Auxiliary Materials
20		20.3 Use fasteners (cylindrical socket head screw M8x30, etc.) to fix up the coupler stop on both coupler installation sides, and apply the lock tag. 20.4 Use the open-end wrench to connect the master air pipeline hose, trainline hose, and uncoupling solenoid hose; and complete the connection between the fully automatic coupler and the underframe brake pipeline; after having satisfied the pressure test requirements, apply lock tags on all hose connectors.	Open-end wrench、Socket head wrench Sign pen
20		Note: No interference is allowed either between hoses or between hose and other portions; when horizontally swinging the fully automatic coupler to the limit position, observe the hose state and avoid occurrence of flat hose, unsmooth ventilation and other phenomena caused by too small bending radius of the hose. After completion of coupler installation, complete a series of the coupler tests according to the requirements of the coupler test program.	

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Sample Document From Similar Project

Process Sheet

CCY-061-029-2011

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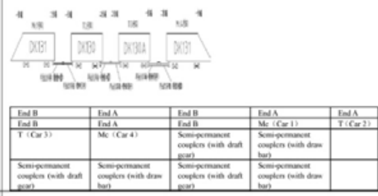
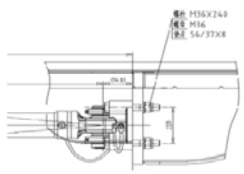
Coupler Installation Procedure	Stainless Steel Urban Railway Vehicles	Rio de Janeiro 60 EMU Project	CCD00000103311	Coupler Installation	KZ-BXEMU60-ZP-013

Station No.	Picture/Sketch	Process Content	Tools & Auxiliary Materials
30		30.1 Use the overhead traveling crane or hydraulic lift car to transport the qualified semi-permanent couplers and draft gear onto the installation position. Note: the semi-permanent couplers and draft gear is divided into the semi-permanent couplers (with draft gear); and the semi-permanent couplers (with draw bar).	
30	 Bolt Nut Washer	30.2 After having aligned the semi-permanent coupler with the carbody installation hole, tighten it with fasteners (without using torque wrench); when tightening the bolts and nuts, use the diagonal tightening method. After having checked the coupler installation level, use the torque wrench to tighten it to the to[illegible] of 1830Nm, and apply lock tag (Apply [illegible] RIVOLTA G.W.F during bolt installati[illegible]).	Torque wren[illegible] [illegible]

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Process Sheet

CCY-061-029-2011

Document Name	Product Type	Project Name	Part Drawing No.	Part Name	Document No.
Coupler Installation Procedure	Stainless Steel Urban Railway Vehicles	Rio de Janeiro 60 EMU Project	CCD00000103311	Coupler Installation	KZ-BXEMU60-ZP-013

Station No.	Picture/Sketch	Process Content	Tools & Auxiliary Materials
30		30.3 Use the open-end wrench to connect the master air pipeline hose, trainline hose; and complete the connection between the semi-permanent coupler and the underframe brake pipeline; after having satisfied the pressure test requirements of the brake pipeline, apply lock tags on all hose connectors.	Open-end wrench Sign pen
30		Note: No interference is allowed either between hoses or between hose and other portions; when horizontally swinging the semi-permanent coupler to the limit position, observe the hose state and avoid occurrence of flat hose, unsmooth ventilation and other phenomena caused by too small bending radius of the hose. After completion of coupler installation, complete a series of the coupler tests according to the requirements of the coupler test program.	

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Process Sheet CCY-061-029-2011

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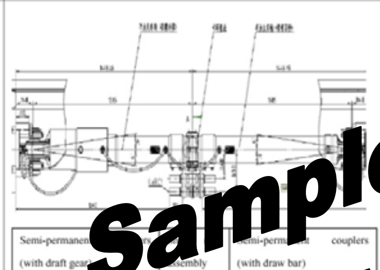
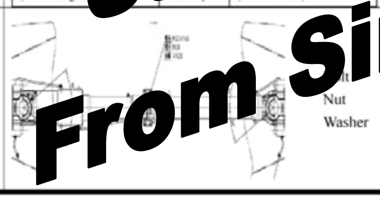
Station No.	Picture/Sketch	Process Content	Tools & [illegible]iliary Materials
30		30.4 During vehicle coupli[illegible] semi-permanent coupler ar[illegible] snap rings to connect the semi-perm[illegible] (with draft gear) and the semi-permanent [illegible]ler (w[illegible] bar); the tightening torque is 300± 10Nm, an[illegible] lock tag . Fill the grease AUTO[illegible] installation snap rings.	Torque wren[illegible] So[illegible]
30		[illegible] allowed either between hoses or between [illegible] other portions; when horizontally swinging the semi-permanent coupler to the limit position, observe the hose state and avoid occurrence of flat hose, unsmooth ventilation and other phenomena caused by too small bending radius of the hose. After completion of coupler installation, complete a series of the coupler tests according to the requirements of the coupler test program.	

Change Log	Signed	Date			
			Prepared	Zhang Xu	Page
			Checked	He Zhijun	10/10

Sample Document From Similar Project

A sample material control document for material receiving inspection is provided on the following pages as requested by the RFP instructions.

CNR

SM-320BG-001V2.0

Description List of Processes PMC-230V2.0★

A. Process Summary

Process Name:	Incoming material receiving and inspection processes		**Responsible Department:**	Production Material Control Department	
Prepared By:	Wang Shuhe Sun Shaolin	**Reviewed by (Leaders):**	Cai Xiaoyuan Sun Jingming	**Reviewed by (Department):**	Bai Xiaoli
Department & Personnel's Signature:					
Objective:	The process has been made for standardizing the management, streamlining processes, indentifying the responsibility and interface relations of relevant departments during receiving and inspecting incoming purchasing material, and ensuring efficient process of receiving material and in timely and accurately data input.				
Application Scope:	This process is suitable for managing receiving and inspection the purchasing material of MM module management, with the applicable to receive and inspect the incoming material for various departments in the company.				
Main Content:	Clarify the responsibility and interface relations of relevant departments during receiving and inspecting, made clear of receiving preparation, flow direction of incoming purchasing material, flow direction of certificate, and the flow direction of information and requirements.				
Bylaw:	The production material control department is responsible for modify and interpret this process since the date of issue.				

B. Revision Record

Revision Date	Revised By	Revision No.
2011.01	Wang Shuhe	First issue

C. Approved

Approved by	Date	Content
Lu Xiwei	2011-1-11	Agree to issue

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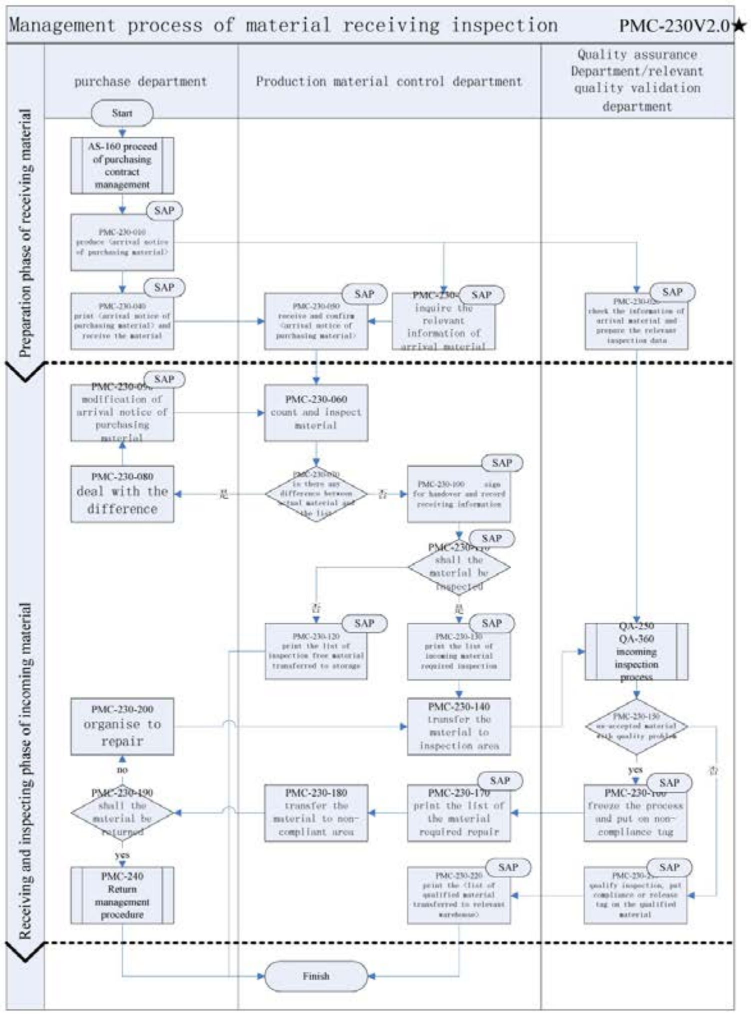

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D. Process Description

Action Name	Responsible Person	Confirm Time	Responsible Department	Action Description
PMC-230-010 produce <arrival notice of purchasing material>	Planner	At least 4 hours before purchasing material arriving	Purchasing Department	Based on delivery schedule and relevant information, to produce <arrival notice of purchasing material> in SAP to provide information support for receiving arrival material.
PMC-230-020 check the information of arrival material and prepare the relevant inspection data	Quality Inspector	11:30am and 16:30pm every day	Quality Assurance Department	Inquire about the information of arrival material in from the <arrival notice of purchasing material> in the system (object code ZRWM017), and check the quality certificate and other information, to prepare the quality inspection.
PMC-230-030 inquire the relevant information of arrival material	Acceptance Inspection Controller	11:30am and 16:30pm every day	Production Material Control Department	Inquire about the information of arrival material in from the <arrival notice of purchasing material> in the system (object code ZRWM017), check the storage conditions, such as overstock, shortage and other condition, to prepare for receiving material and acceptance.
PMC-230-040 print <arrival notice of purchasing material> and receive the material	Receiving Inspector	Receiving material	Purchasing Department	After receiving the information of arrival material, print two copies of the <arrival notice of purchasing material> in SAP, and receive the material
PMC-230-050 receive and confirm <arrival notice of purchasing material>	Acceptance Inspection Controller	When receiving the arrival notice of purchased material	Production Material Control Department	Receive <arrival notice of purchased material>, according the copy of <arrival notice of purchased material> to check the relevant <arrival notice of purchased material> in SAP whether it is existed or corrective. If no difference, it can do confirming operation; if there is any difference, it cannot do confirming operation, and then return the <arrival notice of purchased material> to the person who submit the notice to process. In the same time, according to delivery code and the condition of the material of <arrival notice of purchased material>, to check whether the receiving material is W or T, if the delivery code is W or T, it can sign for handover, otherwise it need to arrange relevant people to unload material.
PMC-230-060 count and inspect material	Acceptance Inspection controller	Confirming the arrival notice of purchased	Production Material Control	The Acceptance Inspection Controller from Production Material Control Department to arrange relevant

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	Receiving Inspector	material, (at the same time) confirming the condition is able to receive the material	Department/ Purchasing Department	people to unload, and with the Receiving Inspector from Purchasing Department together to count, mark, visual inspection, etc. according to <arrival purchased materials packaging and sign management inspection>, to [illegible] whether the packaging is compliant, the Purchasing Department will agree to carry out further counting work except the serious damage on package, and to fulfill [illegible] penalty charge notice>, and record the non-compliant package condition confirmed by both parties in the column of "packaging issues" on arrival notice of purchased material, and also need to identify the shortage amount. "The Purchasing Department will inform the [illegible] they shall inform CRC within [illegible] days if they do not agree", to carry out counting and handover normally, otherwise the Purchasing Department will punish or send the material back to supplier as per <returning purchasing material management process PMC-240>.
PMC-230-070 is there any difference between actual material and the list	Acceptance Inspection Controller Receiving Inspector	During receiving and counting	Production Material Control Department/ Purchasing Department	Confirm whether the condition of receiving and counting is compliant with <arrival notice of purchased material>, such as incorrect quantity or damage. If there is any difference between the actual condition and the notice, the material will be put into "to be clarified area" and the Purchasing Department will take over; if no difference, both party could go through the purchased material receiving process.
PMC-230-080 deal with the difference	Receiving Inspector	Found out the difference when receiving and counting (immediately)	Purchasing Department	Arrange inspection and handle the problematical material, and give the feedback to the relevant person
PMC-230-090 modification of arrival notice of purchased material	Planner	When confirming that it is able to modify the arrival notice of purchased material (within the receiving date)	Purchasing Department	Based on the actual condition to modify and re-make the arrival notice of purchased material
PMC-230-100 sign for handover and record receiving information	Acceptance Inspection Controller Receiving Inspector	No difference after counting and receiving (immediately)	Production Material Control Department / Purchasing	Both parties sign on the arrival notice of purchased material and confirm the handover, and keep the notice. The Acceptance Inspection Controller from Production Material Control

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			Department	Department to input the receiving information into SAP system based on the order number, and actual counting condition of the arrival notice of purchased material. Mark "not installed on car" on the material which will not be installed on car" on the <list of arrival notice of purchased material>, and check whether there is any difference and mistakes between the notice and SAP system, eg. the receiving information cannot be put into the system. If there is any difference, the material will be transferred to the area to be clarified; if no difference, the arrival notice of purchasing material can be closed.
[illegible]MC-230-110 [illegible]ll the [illegible]aterial be [illegible]ed	Acceptance Inspection Controller	After inputting the arrival material	Production Material Control Department	The SAP system will identify automatically whether the material shall be inspected or not.
[illegible]MC-230-120 [illegible]he list of [illegible]tion free material transferred to st[illegible]	Acceptance Inspection Controller	Within the same date of inputting the arrival material	Production Material Control Department	Print the list of inspection free material in SAP system and put into storage
P[illegible]230-[illegible] prin[illegible] of inco[illegible] mate[illegible] require[illegible] inspecti[illegible]	Acceptance Inspection Controller	Within the same date of inputting the arrival material	Production Material Control Department	Print the list of incoming material required inspection in SAP system and prepare for inspection
PMC-2[illegible]140 transfer th[illegible] material t[illegible] inspection [illegible]	Acceptance Inspection Controller	Within the same date of inputting the arrival material	Production Material Control Department	Transfer the material in SAP system to inspection area with the arrival notice of purchased material.
[illegible]MC-230-1[illegible] un-accepted material with quality problem	Material [illegible]spector/ [illegible]levant [illegible]ality [illegible]ector	When confirming the quality	Quality Assurance Department/ Relevant Quality Validation Department	According to <incoming inspection process of purchasing material QA-250>, the Material Inspector will inspect the quality of the purchased material which will be installed on car, and verify whether the material is compliant. According to <incoming inspection process of purchased material which will not be installed on car QA-360>, the relevant Quality Inspector will inspect the quality of the purchased material which will not be installed on car, and verify whether the material is compliant.
PM[illegible]0 freeze the process and put on non-compliance tag	Material Inspector/ Relevant Quality Inspector	Within 2 working hours after confirming quality issues existed	Quality Assurance Department/ Relevant Quality Validation Department	In SAP freeze the operation of the information of arrival materials, and put the non-compliant tag on the materials accordingly.

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Sample Document From Similar Project

PMC-230-170 print the list of the material required repair	Acceptance Inspection Controller	In the date of system freezing operations	Production Material Control Department	In SAP, print the list of the material required repair and prepare for transferring
PMC-230-180 transfer the material to non-compliant area	Acceptance Inspection Controller	In the date of printing the list of the material required repair	Production Material Control Department	Transfer the no[illegible]pliant materials put into non-compli[illegible] area with the material to n[illegible]pliant area.
PMC-230-190 shall the material be returned	Planner	In the date of transferring the material to unqualified area	Purchasing Department	According to th[illegible] condition of the material, to de[illegible]ed whether return the materi[illegible]-compliant area back to suppl[illegible]eturn process will implement [illegible]er < return purchasing material [illegible]gement process PMC-240>. It need arrange repair if not return.
PMC-230-200 organise to repair	Receiving Inspector	Within 3 days after system confirming non-compliance	Purchasing Department	Arrange to repair the n[illegible] non-compliant area, aft[illegible] inform the acceptance ins[illegible] controller from Productio[illegible] Control Department to tra[illegible] material back to inspection area.
PMC-230-210 qualify inspection, put compliance or release tag on the qualified material	Material Inspector/ Relevant Quality Inspector	Within 2 working hours after confirming that the material is compliant or releasable	Quality Assurance Department/ Relevant Quality Validation Department	In SAP, to select the informa[illegible] arrival material as compliant [illegible] and put compliance or release tag. If it need to change the quality of arrival purchased material from compl[illegible] noncompliant, it should impleme[illegible] per the relevant requirements of < receiving arrival material and inspection management specificatio[illegible] PMC-230GF>
PMC-230-220 print the <list of qualified material transferred to relevant warehouse>	Acceptance Inspection Controller	After system confirming compliance	Production Material Control Department	In SAP, print the list of compliant material and transfer them to storage, and prepare for storage handover. The material required inspection should be transferred with the <list of qualified material transferred to relevant warehouse> and the inspection free material should be taken with the <list of inspection free material put into storage>, both of them will be handover to the warehouse keeper. Both parties sign on <list of qualified material transferred to relevant warehouse> and <list of inspection free material transferred to storage>

E. Others

Assumption:	
Special condition:	

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Supporting management specification:	CRC Management Specification of Receiving and Inspection Materials PMC-230GF-001V2.0★ CRC Management Method of Receiving and Inspection Materials PMC-230BF-001V2.0		
Authority management:	**Position**	**Content**	**Relevant SAP Authority**
Report required:	1. Inspection sheet for incoming materials 2. Transferring and storage list for compliant products 3. The list of materials put into storage without inspection 4. Disposing list of non-compliant products.		
Difference of function:			
Integration:			
Interface:			

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From Similar Proj

In the case that retrofit work may need to be carried out on vehicles after delivery to the MBTA, while it may be expedient to perform such work on MBTA's property, CNR recognizes this may not always be possible. Accordingly, CNR will arrange to perform the retrofit work off site. Currently, it is CNR's plan to transport vehicles requiring significant work back to the final assembly facility on flatbed trucks. However, CNR realizes that this plan has certain drawbacks (such as time delay and potential transportation damage), and so CNR is exploring leasing a small facility close to Boston to mitigate these effects should performance of such work prove to be necessary.

2.5 MASSACHUSETTS FINAL ASSEMBLY FACILITY

Tab I.2 (e) Massachusetts Final Assembly Facility
Identify whether the Offeror will utilize an existing or new assembly facility in Massachusetts, the Offeror's schedule for the conversion or creation of a new assembly facility in Massachusetts in order to meet the delivery deadlines in the Contract, and measures the Offeror will take in accordance with this schedule, including but not limited to the hiring and training of skilled labor and the transfer or acquisition of equipment and technology in order to satisfy the manufacturing and assembly requirements. *List all efforts Offeror has undertaken in order to satisfy the requirements of this section, such as posting job opportunities in local papers, using employment recruitment firms or job placement organizations to fill newly created positions, forming partnerships to support the development of a skilled workforce capable of performing technically demanding tasks at the assembly facility, contacting unions and educational institutions in order to utilize local labor pools, advertising for or hiring designers and contractors for the assembly facility, beginning the permitting process for the assembly facility, and contacting suppliers for the purchase of tools and machinery for the assembly facility. The MBTA encourages Offerors to learn from the Workforce Initiative Now (WIN) model employed by Denver RTD, which aims to foster workforce development in targeted communities identified by key socio-economic factors, such as unemployment rate, low income job growth, and educational attainment, and to ensure that communities and groups historically underutilized in the vehicle manufacturing and transportation sectors have full and fair access to job opportunities generated by publically funded projects, such as this MBTA Red and Orange Line Vehicle Procurement.*

CNR began its site search for a rail car assembly facility in Massachusetts in early 2010 in anticipation of MBTA's Request for Proposal for Red Line and Orange Line car replacement. Criteria for the search and selection process was driven by CNR's plan to make Massachusetts its North American rail car assembly center from which it would compete for rail car projects in the US, South America and other overseas markets. Paramount was CNR's desire to develop a rail car assembly plant on a Massachusetts site with significant expansion capability and access to a robust manufacturing based labor force.

CNR has arranged to build a $60 M+ final assembly facility in Springfield, MA

CNR engaged the Boston based real estate advisory firm of NAI Hunneman, along with a team of consultants which included Vanesse Hangen and Brustlin (VHB) to assist with the search. Company officials made numerous trips to Massachusetts to visit sites in various regions of the state and to familiarize themselves with the resources Massachusetts had to offer.

Through 2011 and 2012, CNR continued to monitor the progress of the Red Line and Orange Line procurement, and in the fall of 2013 finalized its search for a rail car assembly site. **Specific site search criteria were:**

- Sites with rail accessibility to enable carbody delivery by rail in order to minimize shipping costs and damage to carbodies during transport; also to have the potential to ship finished cars to customers by rail.
- Sites/buildings that would allow for the expansion of an initial 150,000 ft^2 plant for the Red Line/Orange Line procurement to an additional 200,000 to 250,000 ft^2 for future railcar projects.
- Sites/buildings that could accommodate a test track of at least 1,000 ft. because CNR desired to have this testing capability on site to facilitate track testing of vehicles for delivery of problem-free cars to its customers.
- Sites/buildings accessible to at least 6,000 kVA of power for both the plant and the test track.
- Availability and accessibility of skilled manufacturing labor especially in the electrical, mechanical, metal working/welding and engineering fields. While CNR was anticipating an extensive training program for its Massachusetts labor force, it was deemed essential that new employees be drawn from a region with a deep manufacturing heritage with local technical training resources and opportunities.
- Sites/buildings that were fully permitted and "shovel ready" so that CNR would be assured that it could set the plant up and meet the delivery schedules required in the MBTA RFP.

Data was collected by NAI Hunneman and its subcontractors on more than 50 potential sites in Massachusetts. Site visits were conducted and detailed site analysis completed on finalist sites with program test fits, preliminary engineering, permitting, and labor force analysis.

Based on this analysis, CNR selected 655 Page Boulevard in Springfield as the site that best met its criteria for a North American manufacturing center. A purchase option agreement was executed between CNR and the owner of 655 Page Boulevard in March of 2014 giving CNR control of the site through the completion of the MBTA RFP and bid selection process.

A conceptual plan for CNR's railcar assembly plant at 655 Page Boulevard is presented in the images shown in Section 2.1.3 above. **Key points about this site are:**

- The plot covers 40 acres, level, cleared and ready for construction.
- There is a 13,800 volt electrical substation next to the site that will allow for cost effective extension of the 6,000 kVA service for the assembly plant and test track.
- The site is zoned for industrial use in a neighborhood with a history of industrial use. Westinghouse operated on the site for several decades.
- From a land use regulatory standpoint, all entitlements are in place save for a site plan review/special permit from the City of Springfield that will be completed in early 2015 should CNR receive the bid award. The City has declared its unanimous support for the project including a resolution of support voted on by the Springfield City Council. Additionally, the CNR project for 655 Page Boulevard has been endorsed by the East Springfield Neighborhood Association. Excerpted from its minutes:

  "On behalf of the East Springfield Neighborhood Council, including President Kathleen Brown, Vice President Gil Perron and participating council members, we have unanimously voted to support efforts by CNR Changchun Rail Vehicles Co., Ltd. to re-establish a manufacturing facility at the former Westinghouse manufacturing center that once housed the Stevens-Duryea automobile plant, the first mass produced auto plant in the United States. Springfield's rich manufacturing heritage supports the return of an assembly plant that will stimulate the economy through vocational training and job creation. The East Springfield Neighborhood Council embraces Changchun Rail as a partner and pledges to work cooperatively with them to realize this historical endeavor."

- The site has been environmentally cleared under the MCP by the prior owner. It is not anticipated that the first phase of development will trigger any MEPA thresholds.
- Rail access is via CSX. CNR will re-establish the rail spur that previously existed on the site as recently as 24 months ago. Planning to re-establish this spur is underway with CSX.
- The first phase building is 125,000 ft^2 of manufacturing space with 33,750 ft^2 of office space for a total of 158,750 ft^2.
- The site can accommodate an additional 206,830 ft^2 of building expansion for additional rail vehicle contracts.
- The site will allow CNR to construct a 1,800 ft. test track facility.
- A schedule for the development of CNR's railcar assembly plant is shown below. This schedule assumes an MBTA notice to proceed on 1/1/2015. Building design and permitting would be completed in 2015. Construction would start in Q1 of 2016 and finish in Q2 2017. Full railcar production at the new plant would begin in May of 2018, with the first production cars completed no later than December 31, 2018, 48 months after contract award as specified in the RFP.
- Estimated cost for the construction of the Phase I railcar assembly and test track facility described above is more than $60,000,000.00 including land and equipment purchase.

CNR executed a pre-proposal outreach plan inviting disadvantaged businesses to participate in an informational workshop outlining various subcontracting opportunities available to them. Two 4-hour workshops were held attracting 80 Minority and Women Owned Business Enterprise (M/WBE) businesses. The procurement process to identify subcontractors to provide rolling stock materials, assembly work, manufacturing equipment, and technical consultants began with the solicitation of a Business Profile and Statement of Qualifications.

Advance pre-proposal outreach included the following efforts:

- Contacted 873 M/WBE businesses via postal service inviting them to workshop.
- Maximized workshop participation in Western Massachusetts and Boston through targeted advertising in eleven (11) newspapers.

CNR made significant M/WBE outreach efforts already reaching 873 businesses.

- Coordination with the Massachusetts Office of Supplier Diversity (SDO) and the following minority organizations to share workshop(s) information via their member database: Massachusetts Small Business Association (SBA), Massachusetts Minority Contractors' Association, Boston Worker's Alliance, Urban League of Eastern Massachusetts, Center for Women & Enterprise.
- Provided project scope.
- Provided Powerpoint Presentation outlining M/WBE Outreach Plan.

- CNR representatives provided Q/A forum relating to Rolling Stock Subcontracting, Services, and Facility and Construction opportunities.

Similar to the Workforce Initiative Now (WIN) model initiated by Denver RTD, CNR is committed to helping the unemployed and local communities participate in career opportunities in the transportation and construction industries. CNR is underway with unique partnership building strategies comparable to the WIN model that has begun the process of engaging participation from Springfield officials, local communities, and organizations to collectively create an effective, inclusive, and diverse outreach program. CNR continues to work with the City of Springfield's Office of Planning and Economic Development on crafting a plan to stimulate the area's economy through career training and job creation.

CNR interest in the region's industrial and technological schools prompted a visit to one of Springfield's premiere technological schools, the Roger L. Putnam Vocational Technical Academy, where CNR representatives applauded the school's focused curriculum on the skills and training necessary to build a car manufacturing workforce, including a Research and Development Program. CNR also toured Springfield's Western New England University College where Electrical, Industrial, and Mechanical Engineering undergraduate programs are considered the most challenging in Western Massachusetts.

The outcome of connecting with these educational institutions has resulted in ongoing dialogue to collaboratively devise a plan to foster job training and placement. To further advance the search and participation of additional vocational institutions, CNR has identified, and will pursue potential partnerships with UMASS Amherst College of Engineering, Springfield Technical Community College, Westfield Technical, Chicopee Comprehensive High School, Pathfinder Regional in Palmer, and Franklin County Regional Technical.

CNR has partnered with David M. Cruise, President and CEO of the Regional Employment Board of Hampden County, Inc. (REB), to develop and implement training programs to ensure and retain full time career pathway employment positions with CNR. The REB will manage and coordinate the outreach and recruitment phase of the program. The Outreach and Recruitment Plan and process will ensure access equity in the selection process. REB will collaborate with partners in the implementation of the Outreach and Recruitment Plan including: FutureWorks Career Center in Springfield and CareerPoint in Holyoke, as well as the Region's Department of Veteran's Services (DVS) in order to develop a specific coordinated approach to identifying veterans. Additionally, the REB will coordinate the delivery of the classroom and hands-on training to applicants who have successfully completed the assessment program and have been interviewed by the REB for inclusion in the training program. Training will be conducted by the following Springfield-based educational institutions that have the required equipment, software, tooling and materials. The REB will contract with Springfield Technical Community College, with instructors from Roger L. Putnam Vocational Technical Academy, and with other instructors who are currently providing similar training services for the REB.

CNR continues to work with Dan D'Alma, President of the Pioneer Valley Building and Construction Trades with **74 member locals representing over 75,000 working men and women across the state.** Through their robust training programs, and commitment to apprenticeship training, particularly in association with this contract, the MBTC will play an integral role with the hiring and training of skilled labor including carpenters, electricians, roofers, sheet-metal workers, painters, boilermakers, plasterers, ironworkers, production workers, apprentices, and journeymen.

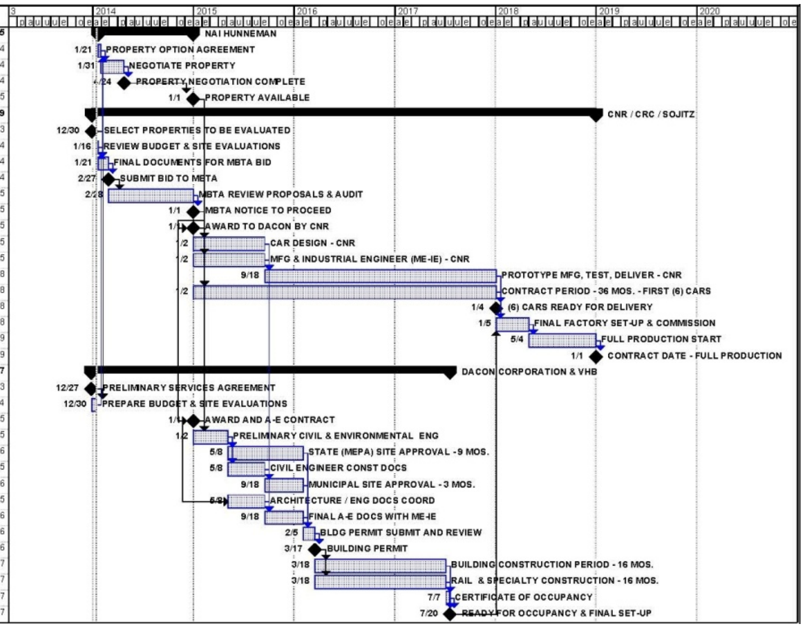
Further details of the scope of construction include:

- Installation of secure fencing around the facility and a gatekeeper's building.
- Installation of two car transfer tables, one at each end of the workshop bays, to transfer vehicles between bays.
- Installation of a test track, including a power rail and a 4,000 kVA substation, together with safety fencing.
- Installation of a sidings track.
- Installation of 5 workshop tracks, for two production lines, two in the static testing bay, and one in the Truck Shop.
- Installation of one overhead crane inside the workshop for the installation of roof-mounted equipment.
- Installation of four overhead cranes in the Truck Shop.
- Installation of one overhead crane inside the Warehouse.
- Installation of lifting jacks.
- Installation of weighing equipment.
- Installation of a water-tightness testing facility.
- Installation of heating and air conditioning system, lighting system, electrical power supply and distribution system (including a 5,000 kVA substation), and an air supply system.
- Construction of a secure chemical and paint storage facility.
- Creation of office space and manual workforce facilities.
- Construction of a loading and unloading area, including a 60-ton overhead crane.
- Construction of an internal roadway and employee parking space.

CNR has identified and planned all activities to acquire the property, obtain permits, run utilities, construct facilities, equip and commission facilities in advance of production needs per the project schedule. The facility mobilization schedule is shown below.

The mobilization schedule ensures facility will be complete prior to car production needs.

ID	Task Name	Duration	Start	Finish
1	**NAI HUNNEMAN**	**247 days**	**Tue 1/21/14**	**Thu 1/1/15**
2	PROPERTY OPTION AGREEMENT	8 days	Tue 1/21/14	Thu 1/30/14
3	NEGOTIATE PROPERTY	60 days	Fri 1/31/14	Thu 4/24/14
4	PROPERTY NEGOTIATION COMPLETE	0 days	Thu 4/24/14	Thu 4/24/14
5	PROPERTY AVAILABLE	0 days	Thu 1/1/15	Thu 1/1/15
6	**CNR / CRC / SOJITZ**	**1307 days**	**Mon 12/30/13**	**Tue 1/1/19**
7	SELECT PROPERTIES TO BE EVALUATED	0 days	Mon 12/30/13	Mon 12/30/13
8	REVIEW BUDGET & SITE EVALUATIONS	3 days	Thu 1/16/14	Mon 1/20/14
9	FINAL DOCUMENTS FOR MBTA BID	28 days	Tue 1/21/14	Thu 2/27/14
10	SUBMIT BID TO MBTA	0 days	Thu 2/27/14	Thu 2/27/14
11	MBTA REVIEW PROPOSALS & AUDIT	220 days	Fri 2/28/14	Thu 1/1/15
12	MBTA NOTICE TO PROCEED	0 days	Thu 1/1/15	Thu 1/1/15
13	AWARD TO DACON BY CNR	0 days	Thu 1/1/15	Thu 1/1/15
14	CAR DESIGN - CNR	185 days	Fri 1/2/15	Thu 9/17/15
15	MFG & INDUSTRIAL ENGINEER (ME-IE) - CNR	185 days	Fri 1/2/15	Thu 9/17/15
16	PROTOTYPE MFG, TEST, DELIVER - CNR	600 days	Fri 9/18/15	Thu 1/4/18
17	CONTRACT PERIOD - 36 MOS. - FIRST (6) CARS	785 days	Fri 1/2/15	Thu 1/4/18
18	(6) CARS READY FOR DELIVERY	0 days	Thu 1/4/18	Thu 1/4/18
19	FINAL FACTORY SET-UP & COMMISSION	85 days	Fri 1/5/18	Thu 5/3/18
20	FULL PRODUCTION START	173 days	Fri 5/4/18	Tue 1/1/19
21	CONTRACT DATE - FULL PRODUCTION	0 days	Tue 1/1/19	Tue 1/1/19
22	**DACON CORPORATION & VHB**	**930 days**	**Fri 12/27/13**	**Thu 7/20/17**
23	PRELIMINARY SERVICES AGREEMENT	0 days	Fri 12/27/13	Fri 12/27/13
24	PREPARE BUDGET & SITE EVALUATIONS	13 days	Mon 12/30/13	Wed 1/15/14
25	AWARD AND A-E CONTRACT	0 days	Thu 1/1/15	Thu 1/1/15
26	PRELIMINARY CIVIL & ENVIRONMENTAL ENG	90 days	Fri 1/2/15	Thu 5/7/15
27	STATE (MEPA) SITE APPROVAL - 9 MOS.	195 days	Fri 5/8/15	Thu 2/4/16
28	CIVIL ENGINEER CONST DOCS	95 days	Fri 5/8/15	Thu 9/17/15
29	MUNICIPAL SITE APPROVAL - 3 MOS.	100 days	Fri 9/18/15	Thu 2/4/16
30	ARCHITECTURE / ENG DOCS COORD	95 days	Fri 5/8/15	Thu 9/17/15
31	FINAL A-E DOCS WITH ME-IE	100 days	Fri 9/18/15	Thu 2/4/16
32	BLDG PERMIT SUBMIT AND REVIEW	30 days	Fri 2/5/16	Thu 3/17/16
33	BUILDING PERMIT	0 days	Thu 3/17/16	Thu 3/17/16
34	BUILDING CONSTRUCTION PERIOD - 16 MOS.	340 days	Fri 3/18/16	Thu 7/6/17
35	RAIL & SPECIALTY CONSTRUCTION - 16 MOS.	340 days	Fri 3/18/16	Thu 7/6/17
36	CERTIFICATE OF OCCUPANCY	10 days	Fri 7/7/17	Thu 7/20/17
37	READY FOR OCCUPANCY & FINAL SET-UP	0 days	Thu 7/20/17	Thu 7/20/17



Springfield Facility Mobilization Schedule

CNR estimates that a minimum of 150 full-time staff will be employed at the Springfield facility, of which approximately 100 will be production line technicians, including testing and commissioning staff. The remaining 50 will consist of managers and supervisors, office support staff, and after sales staff. In addition to this shop staff, CNR will engage other staff, such as cleaners and security personnel. CNR expects that all of the production line technicians will be hired locally, and that the vast majority of the managers, supervisors and office support staff will be hired in the U.S. However, CNR will also have a small number of Chinese staff stationed in the Springfield facility to ensure project continuity, act as trainers, and perform certain other functions.

CNR considers that it will be possible to hire managers, supervisors and office support staff from within Massachusetts that have the requisite skills and experience, and that minimal training will be required, except for integration into the CNR organization. CNR plans to hire all of the production line technicians locally. However, it is expected that a significant amount of training will need to be provided to ensure that they have the necessary skills and aptitude to work in a rail vehicle assembly facility. When hiring technicians, CNR will pay particular attention to individuals' aptitude and attitude, and past relevant experience. CNR's training program, which will take place over several weeks, will include craft skills assessment and training, safety awareness, drawing reading, manufacturing process sheet reading and understanding, computer skills, and other classroom and hands-on training. WBE and MBE companies will be used for local hiring.

Training for final assembly will include a technology transfer process. This will entail bringing key personnel from the U.S. to China for training by our Chinese staff having expert knowledge of these designs and procedures. This will be followed by deployment of Chinese supervisors and trainers to the U.S. for further training of local final assembly staff. In addition to hands-on training in mechanical/electrical assembly, worker training will also include familiarization with workmanship standards and acceptance criteria. After the technology transfer period, some Chinese staff will be retained at the Massachusetts final assembly site to monitor the performance and compliance of U.S. operations.

The project organization chart showing the final assembly staff is located in Tab I.1a in Section 1.1 of this proposal.

2.6 MASSACHUSETTS JOB CREATION AND RETENTION

Tab I.2 (f) Massachusetts Job Creation and Retention

In tabular format, identify by job classification (e.g. electricians, mechanics, welders, engineers, testers, quality assurance staff, administrators, building maintenance, etc.) each position Offeror expects to directly employ in Massachusetts, when each position will be created and filled in reference to the production schedule, the duration of each position in reference to the production schedule, and the hours of work required for the position in full-time equivalents calculated as the total number of hours of work required by the position per week divided by forty (40).

CNR is making a huge commitment to the State of Massachusetts by constructing a brand new facility in Springfield and making it our main manufacturing facility and headquarters for all U.S. operations continuing beyond performance of the Orange & Red Line Project. The following tables provide preliminary listings of the new jobs that will be created in association with CNR's performance of this contract. The first table shows CNR's planned staffing to accomplish the required Orange & Red Line Project delivery rates over the life of the project. The second table shows the jobs created to construct CNR's new final assembly facility in Springfield, MA.

The Springfield facility will create over 150 jobs spread over a period of 7 years.

CNR's project schedule mobilizes this workforce over 6 phases. Each phase is cumulative and the job quantities represent new hires coming in at that stage. To simplify the presentation of data for purposes of this table and RFP required page limits, <u>all positions are calculated to be full-time over the periods specified</u>. Positions to be filled by CNR employees are not counted in the job creation total. These numbers will be revised as work scopes are further refined.

CNR Job Creation Table

* Excluded from new position total; (position filled by CNR employee).

Job Position	Quantity	Start Date	End Date	Full-time Equivalent
Phase I: Transitioning design control to local Project Management and Design Team				
Executive Oversight Committee*	4	1/1/2015	6/1/2027	25%
General Manager*	1	1/1/2015	6/1/2022	100%
Construction Manager (Final Assembly)	1	1/1/2015	6/1/2022	100%
Project Manager	1	1/1/2015	6/1/2022	100%
Deputy Project Manager	1	1/1/2015	6/1/2022	100%
Administrative Assistant	1	1/1/2015	6/1/2022	100%
Project Engineer	1	1/1/2015	6/1/2022	100%
Industrial Engineer	1	1/1/2015	6/1/2022	100%
Systems Integrator	1	1/1/2015	6/1/2022	100%
Reliability Engineer	1	1/1/2015	6/1/2022	100%
Electrical Engineer (1 Lead)	2	1/1/2015	6/1/2022	100%
Mechanical Engineer (1 Lead)	2	1/1/2015	6/1/2022	100%
Quality Engineer	1	1/1/2015	6/1/2022	100%
Commercial Manager	1	1/1/2015	6/1/2022	100%
Accountant	1	1/1/2015	6/1/2022	100%

Job Position	Quantity	Start Date	End Date	Full-time Equivalent
Clerk	1	1/1/2015	6/1/2022	100%
Procurement Manager	1	1/1/2015	6/1/2022	100%
Purchasing Agent	1	1/1/2015	6/1/2022	100%
Phase I Sub-Total	18			
Phase II: Begin Mobilization Plan Orange Line to transfer of technology to Springfield				
Production Manager	1	7/1/2017	6/1/2022	100%
Training Supervisor	1	7/1/2017	6/1/2022	100%
Assembly Stage 1 Team Leader	2	7/1/2017	6/1/2022	100%
Assembly Stage 2 Team Leader	2	7/1/2017	6/1/2022	100%
Assembly Stage 3 Team Leader	2	7/1/2017	6/1/2022	100%
Assembly Stage 4 Team Leader	2	7/1/2017	6/1/2022	100%
Assembly Stage 5 Team Leader	2	7/1/2017	6/1/2022	100%
Assembly Stage 6 Team Leader	2	7/1/2017	6/1/2022	100%
Quality Assurance Manager	1	7/1/2017	6/1/2022	100%
Quality Assurance Inspector	2	7/1/2017	6/1/2022	100%
Test & Commissioning Manager	1	7/1/2017	6/1/2022	100%
Warehouse/Inventory Manager	1	7/1/2017	6/1/2022	100%
Product Support Manager	1	7/1/2017	6/1/2022	100%
Warranty Manager	1	7/1/2017	6/1/2022	100%
Phase II Sub-Total	21			
Phase III: Finalize Mobilization Plan for Orange Line, Assembly & Test				
Phase IV: Final Assembly for Orange Line, Mobilization Plan Red Line				
Human Resource Manager	1	1/1/2018	6/1/2022	100%
Safety & Health Manager	1	1/1/2018	6/1/2022	100%
Training Supervisor	1	1/1/2018	6/1/2022	100%
Test & Commissioning Engineer	1	1/1/2018	6/1/2022	100%
Test & Commissioning Technician	2	1/1/2018	6/1/2022	100%
Quality Assurance Auditor	1	6/1/2018	6/1/2022	100%
Quality Assurance Inspector	2	6/1/2018	6/1/2022	100%
Final Assembly Technician	64	6/1/2018	6/1/2022	100%
General Helper (warehouseman, forklift driver…)	3	6/1/2018	6/1/2022	100%
Phase III and IV Sub-Total	76			
Phase V: Red Line assembly & test, Orange Line Warranty Support				
Warranty Coordinator	1	12/1/2018	12/1/2026	100%
Quality Assurance Inspector	2	7/1/2019	6/1/2022	100%
Test & Commissioning Engineer	1	7/1/2019	6/1/2022	100%
Test & Commissioning Technician	2	7/1/2019	6/1/2022	100%
Final Assembly Technician	28	7/1/2019	6/1/2022	100%
Phase V Sub-Total	34			
Phase VI: Warranty Support, Warranty Support Red Line				
Warranty Coordinator	1	11/1/2019	7/1/2027	100%
Project Total	150			

Note the above table excludes janitorial and security services, which will create even more jobs.

Six Phases of CNR U.S. Manpower Loading

Phase I	New staff: 18	Transitioning design control to local Project Management and Design Team
Phase II	New staff: 21	Begin Mobilization Plan Orange Line to transfer of technology to Springfield
Phase III	New staff: 76	Finalize Mobilization Plan for Orange Line, Assembly & Test
Phase IV		Final Assembly for Orange Line, Mobilization Plan Red Line
Phase V	New staff: 34	Red Line assembly & test, Orange Line Warranty Support
Phase VI	New staff: 1	Warranty Support, Warranty Support Red Line

Phase I. CNR will establish a local office to provide MBTA convenient direct access to CNR project management, engineering and production staff. The 18 people indicated for this phase represent the liaison staff for project communications between CNR CRC and CNR MA and show the importance CNR places on effective project communications. The local office team will be the voice of the customer and will have the authority to direct all of CNR according to the project management process agreed between MBTA and CNR. The local office team will remain at the local office for the duration of design, manufacturing and delivery.

Phase II. CNR understands the need for a successful transfer of technology from Changchun to Springfield. This will be handled by assigned key personnel that will participate in the Pilot Car program in China. CNR intends to send a staff of 21 industry professionals from North America to Changchun, to remain in Changchun until delivery of the Orange Line Pilot cars, with the goal of duplicating the production process for the Pilot cars at the Springfield facility.

Phase III & IV. Phases III and IV will be the transition from a mobilization phase to permanent staffing at the Springfield headquarters. Production of the Orange Line will initiate during this phase. Staff members from Phase II will be utilized to train new staffing hired during these phases. It will be during this phase that assembly, testing and commissioning, and acceptance of the Orange Line vehicles will occur and the Red Line mobilization plan deployed. CNR QA staff will be increased to provide sufficient QA oversight of all production activities and incoming components. Testing and commissioning will also be occurring at the Springfield static test area and dynamic test track and at MBTA.

Phase V. CNR will establish a comprehensive warranty program through this phase and additional resources will be brought on for Red Line production. Test/commissioning staff and QA inspectors will also be added. Production will be at full capacity for the MBTA project during this phase.

Phase VI. CNR will add an additional Warranty Coordinator specifically for the Red Line to ensure ample staff to support both lines, and also support MBTA in their inventory process.

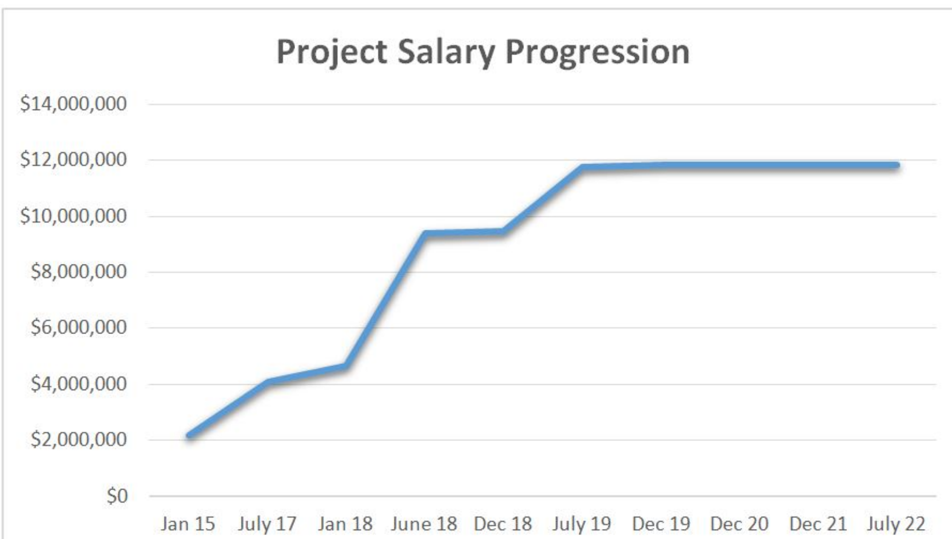
In addition to the above labor, additional jobs will be created for construction of the new Springfield facility. The following table identifies approximately 100 construction jobs over a period of 15 months from a quotation CNR has received.

Construction Jobs to Construct Springfield Facility

	2015			2016											
Trade	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Sitework	10	10	10	5	5	5	5	5	4	4	10	10	4		
Concrete	8	8	10	10	10	10	10			6	6	6			
Steel			8	8	8	8									
Misc Metals							4	4	4	4					
Roofing							12	12	12	12					
Walls								20	20	20	20	20			
Finishes											15	15	15	15	10
Food Service											3	3			
Elevator										3	3				
Fire Protection								4	4	4	4	4	4	2	2
Mechanical					4	4	6	10	10	10	10	6	6	6	3
Electrical					3	3	6	6	8	8	8	8	6	4	4
Plumbing					3	4	6	6	6	6	6	6	6	2	2
Other										10	10	10	10	10	8
Total Workforce Per Month	18	18	28	23	33	34	49	67	68	77	85	78	41	29	21

Local economic benefit from Springfield wages will be $90M from 2015 – 2022!

Excluding construction, janitorial and security, **the above jobs represent approximately $90,000,000.00 in wages for the CNR Springfield and Boston site staff over the next 7 years** based on calculating the median wages for each position over their respective periods of performance for this project. The chart below shows the total salaries per year for the new project staffing positions. Note this economic benefit is based only on direct wages and does not consider the significant additional impact of our supply chain and indirect and induced impacts for this project.



Beyond this, CNR additionally notes that it is our intention to retain all of these positions after the MBTA order to conduct other U.S. and North American jobs that we are planning to bid in the coming years as we grow our projects in the western hemisphere. This represents a very sizable commitment to and investment in the economy of the State of Massachusetts.

2.7 WORK BY OTHER ENTITIES

Tab I.2 (g) Work by Other Entities
List all other work for entities other than the MBTA at the separate locations indicated in (c) and (d) during the period of the Contract detailing the customer, the quantity and type of vehicle, and delivery dates for same. Describe plant capacity and indicate the capacity available for work under this contract while satisfying other commitments. This includes the final assembly contractor. Provide a statement, supported by further details, that the contractor has the capacity, personnel and other resources to build the Vehicles required to be delivered under the Contract within the time proposed.

CNR's Changchun manufacturing facility has the capacity to produce 1,000 stainless steel vehicles per year. At the time of manufacturing vehicles for the MBTA Orange and Red Line projects, no rapid transit vehicles are currently scheduled to be manufactured in Changchun, meaning that manufacturing capacity would not be in question.

CNR utilizes four production lines that are dedicated to the production of stainless steel car manufacturing in its Changchun manufacturing facility. Should other stainless steel vehicle projects be awarded to CNR in parallel with the MBTA project, CNR commits to prioritizing two production lines for the Orange and Red Line vehicles.

The Massachusetts final assembly facility will have an output of 12 cars per month. This facility will be dedicated to the final assembly of MBTA's Orange and Red Line vehicles, and no other work is currently planned to be performed at this facility.

Accordingly, CNR is able to categorically state that it has the capacity, personnel and other resources to build the vehicles required to be delivered under the Contract within the time proposed.

2.8 MAJOR SUB-SYSTEM SUPPLIERS

Tab I.2 (h) Major Sub-System Suppliers
List locations and capacities of proposed suppliers for major subsystems listed in Tab I.1 Technical Approach. Include information showing North American manufacturing experience and capacity for this project.

The following table identifies CNR's potential suppliers for the major subsystems and their manufacturing location and capacity for this project. Their experience with manufacturing these products is provided in Section 3 of this proposal.

TABLE OF MAJOR SUB-SYSTEM SUPPLIERS

Supplier	System/ Equipment	Type of Equipment	Facility Location(s)	Plant Capacity Description
Alstom Signaling, Inc.	Cab Signaling Equipment	Automatic Train Protection; Automatic Station Identification	Rochester, NY, USA	Alstom Signaling's facility is able to run up to 50 active projects simultaneously, and Alstom will be able to satisfy the proposed MBTA delivery schedule with no issues.
Ansaldo STS (ASTS)	Cab Signaling Equipment	Automatic Speed Regulation	Batesburg, SC, USA	The Batesburg facility has ample production capacity to fulfill MBTA's Red and Orange line project even with ASTS USA's current and anticipated contracts in progress.
Baultar Concept, Inc.	Composite Flooring	Abrastop Foam Lite, Abrastop Foam, and Abrastop Fibre	Windsor, QC, Canada	Baultar's production capacity is 50 panels per day per shift. The MBTA project will require ~ 30 panels per week, or 6 panels per day. This represents about 20% of actual capacity but only 12% of future (2015) capacity. Baultar can also implement a second shift to almost double capacity.
Bradken, Inc.	Trucks	Steel Castings	Atchison, KS, USA	Based on predicted orders, Bradken's plants are able to meet its commitments utilizing two shifts. Bradken can also utilize a third shift if required to further increase capacity.
		Machining, painting, assembly	St. Joseph, MO, USA	
CNR Changchun Railway Vehicles Co., Ltd.	Carbody		Changchun, China	CNR CRC's plant has far more than sufficient capacity, taking into account all projected work, to support the MBTA project.
Ellcon National Inc. (Faiveley Transport)	HVAC		Greenville, SC, USA	During the expected delivery period, Faiveley's facility will have the capacity to fulfill the delivery schedule for MBTA's Red and Orange line task.
	Friction Brake System			
	Door Systems	Includes Door Open Pushbuttons (Option VII), Gap Mitigation Device (Option VI)		
FAAC Inc.	Training Simulator (Option XI)		Royal Oak, MI, USA	FAAC has more than sufficient capacity taking into account projected projects.

Supplier	System/ Equipment	Type of Equipment	Facility Location(s)	Plant Capacity Description
Freedman Seating Company	Seating		Chicago, IL, USA	Freedman's facility currently produces ~2,000 seats per day and has adequate capacity to meet MBTA's schedule.
Kustom Seating	Seating		Bellwood, IL, USA	During the expected delivery period, the facility will be at 60% capacity using a single shift. Plant capacity can be increased, if necessary, using extra shifts.
LECIP Inc.	Lighting		Hornell, NY, USA	LECIP's plant capacity will be adequate to meet MBTA's project schedule.
Mitsubishi Electric Power Products, Inc.	Propulsion System		Itami, Japan	MELCO's plant produces between 250-300 traction motors and 125-150 inverters per month. MELCO's plant will be able to meet MBTA's delivery schedule for the propulsion system.
	Auxiliary Power Supply System; Low Voltage DC Power		Freedom, PA, USA	MELCO's facility has the capacity to produce approximately 9 auxiliary power supply systems and 75-85 HVAC units per month. MELCO's plant will be able to meet MBTA's delivery schedule for these systems.
	HVAC			
	Vehicle Monitoring System	Including Network Equipment and Integrator		
RL Controls, LLC	Communications Equipment including LED and LCD Signage (Option VIII)	CCTV (Option V), Active Route Maps (Option IX), Automatic Passenger Counting System (Option X)	Massachusetts/ Eden Prairie, MN, USA	RL Controls has current capacity to manufacture over 20 vehicle carset systems per month, and production lines will be available for the dates required. Production can be increased by 25% using overtime, Saturday work and support from other divisions. A second or third shift can also be implemented for accelerated delivery schedules on a project-by project basis. Thus, there is adequate contingency even for any unforeseen production delays in existing projects or to accommodate the need to accelerate projects.
Saft America, Inc.	Auxiliary Power Supply System	Battery	Valdosta, GA, USA	Saft America's plant has more than sufficient capacity, taking into account projected work, to support the MBTA project.
Simutech International Co., Ltd.	Training Simulator (Option XI)		Beijing, China	Simutech International has production capacity for 18 sets of full-mission simulators per year, which is more than sufficient capacity even with projected projects in parallel.

Supplier		System / Equipment	Type of Equipment	Facility Location(s)	Plant Capacity Description
TDG Transit Design Group, Inc.		Lighting		Niagara Falls, NY, USA	The MBTA Red and Orange Line project will take up between 13%-19% of TDG's total plant capacity. TDG will have more than adequate capacity to meet the MBTA schedule.
TOA Communication Systems		Communication Equipment	Communication Equipment	Moorestown, NJ, USA	For MBTA term, this facility will be at 40% capacity using a single shift. Plant capacity can be increased using extra shifts.
			Communication Equipment	Canisteo, NY, USA	The facility will be used only for assembly. Approximately 50% capacity will be available for spares, extra work, etc.
			LCD Monitor (Option VIII)	Japan and Moorestown, NJ, USA	The facility will be used only for assembly. Approximately 50% capacity will be available for spares, extra work, etc. during the MBTA project.
			Active Route Map LED Type (Option IX)		
			CCTV Camera and Display (Option V)		
			Automatic Passenger Counting System (Option X)		
Toyo Denki	**Toyo Denki USA, Inc.**	Propulsion System	Propulsion Inverter	Freedom, PA, USA	Toyo Denki produces 20 sets of inverters per month. During the expected delivery period, the facility will be at 40% capacity using a single shift. Plant capacity can be increased, if necessary, using extra shifts and extra space.
	Toyo Denki Seizo K.K.	Vehicle Monitoring System	Vehicle Monitoring System Components	Yokohama, Japan	Toyo Denki Seizo produces 12 sets of VMS components per month. During the expected delivery period, the facility will be at 40% capacity using a single shift. Plant capacity can be increased, if necessary, using extra shifts and extra space.
	Toyo Denki USA, Inc.	Auxiliary Power Supply System	Auxiliary Power System; Low Voltage Power System	Freedom, PA, USA	Toyo Denki USA produces 16 sets of APS equipment per month. During the expected delivery period, the facility will be at 50% capacity using a single shift. Plant capacity can be increased, if necessary, using extra shifts and extra space.

Supplier		System / Equipment	Type of Equipment	Facility Location(s)	Plant Capacity Description
UTC RAS, Inc		Wheelsets	Wheels, Axles, Journal Bearings and Housing	Morton, PA, USA	UTC RAS currently operates one shift and operates at 22% capacity, leaving a significant portion of potential for increases in production output.
Wabtec	**Wabtec Passenger Transit**	Friction Brake System	Includes Truck-Mounted Components	Duncan, SC, USA	Wabtec Passenger Transit (WPT) currently produces ~ 60 car sets per month per shift for all equipment using full "1st shift operation" in assembly. When additional production capacity becomes essential, WPT can activate 2 additional shifts of production. Overall production volume during the period when deliveries are expected to begin is expected to be at 50 to 60% of total capacity for all contracts during that time period. Based on the projected starting date of shipments and quantities required on a monthly basis, WPT does not anticipate issues in meeting the delivery requirements.
		Couplers			
	Vapor Stone Rail Systems	Door System	Includes Door Open Pushbuttons (Option VII)	Plattsburgh, NY, USA	
			Gap Mitigation Device (Option VI)		

2.9 VEHICLE SHIPPING METHOD AND LOGISTICS

Tab I.2 (i) Vehicle Shipping Method and Logistics
Describe the expected conveyance and route by which the cars will be shipped from the manufacturing site to the Massachusetts final assembly site and to the MBTA Facilities in the greater Boston area. Indicate methods to be used to protect the cars while in transit and during interim storage, if applicable.

The Pilot cars for both the Orange and Red Lines will be manufactured and assembled in their entirety in CNR's manufacturing facility in Changchun, China, and will be transported by ocean freight to Boston, Massachusetts, and from there, by flatbed truck, to the MBTA's property for qualification testing and commissioning.

For the production cars, the stainless steel carbodies will be fabricated and assembled in Changchun, China, and then transported by ocean freight to Boston, Massachusetts. Transportation of the carbodies from the docks to the Massachusetts final assembly facility, and from the Massachusetts final assembly facility to MBTA, will be by way of flatbed trucks.

For ocean shipment, the carbodies will be covered with a tight-fitting tarpaulin or plastic shrink-wrap, and Pilot cars and production carbodies will be stored below deck. The carbodies will remain packaged until ready to be inspected by Receiving Inspection.

For transportation by flatbed truck from the final assembly site to MBTA, cars will be protected by covering them with tarpaulins (likely the same ones as used for overseas transport).

2.10 STAFFING OF MASSACHUSETTS FINAL ASSEMBLY FACILITY

Tab I.2 (j) Staffing of Massachusetts Final Assembly Facility
Indicate the local area office in accordance with Section C4.07. Indicate expected staffing at this location for manufacturer and subcontractor representatives during period from 60 days after Notice-to-Proceed to end of warranty period. Describe decision making authority of such local staff.

CNR commits to establishing a local office within the MBTA service network for the duration of the Contract to facilitate clear and timely communications with the MBTA. The staff in the Boston office will have decision-making authority for this project to expedite engineering changes, to resolve problems, and to interact with suppliers. Reporting hierarchies are shown in the Project Organization Chart in Section 1.1 of this Proposal. CNR's Project Manager, Deputy Project Manager, Project Engineer, Lead Mechanical and Lead Electrical Engineers, and Administrative Assistant will be located in the Boston office, together with various support staff. The local office will have sufficient space to support work associated with the design review phase pilot car qualification testing phase. At this time, it is estimated that approximately 20 people will work from the Boston local office after notice to proceed and until the Springfield facility is built. Upon opening of the Springfield final assembly facility, key project staff will travel between the local office and final assembly facility as necessary to manage the work and address any issues to ensure that the project progresses smoothly.

The local office will have adequate space for the activities to be carried out there including meeting rooms and office equipment. CNR is currently researching possible locations for this office.

2.11 DEPARTMENTAL INTERPLAY

MBTA RFP No. CAP 27-10 Requirement – Section A1.14 (A)
The Manufacturing Plan shall also present the interplay between design, production, inspection and testing, commissioning and warranty support, including staffing and their level of responsibility and authority.

In the complex world of rail vehicle design and manufacturing, it is simply not feasible or desirable for an organization's departments to act completely independently, and interdepartmental interaction occurs from project inception.

Following the signing of the contract, all major departments will begin work on the project; however, the most significant interdepartmental interaction at this stage takes place with the Engineering Department. In conjunction with the Quality Assurance Department, CNR's Engineering Department will make a Design Plan, which will provide the basis for how all designs used on the project will meet the requirements of MBTA's Technical Provisions. The Design Plan will be approved by the QA Department. The Engineering Department will also work closely with CNR's Procurement Department to carefully define the technical requirements for all purchased equipment to be used for construction of the vehicles.

In addition to the formal design reviews required by the Technical Provisions during the design phase, it is CNR's practice to conduct a number of internal design reviews to incrementally advance and check the progress of the design. These internal design reviews will be attended by project representatives from several CNR departments including Engineering (both Design and Manufacturing Engineering), Manufacturing, Quality Assurance, Procurement (when concerning supplier equipment), Project Management, and others. The Manufacturing Department will ensure that designs are capable of being readily manufactured and factory tested, Manufacturing Engineering will provide input on tooling requirements and manufacturing sequence and process, the QA Department will ensure that designs comply with the overall requirements of the TPs and can be properly inspected, and Procurement will ensure that supplier requirements are respected and will communicate any issues to suppliers. The Project Manager will attend key design reviews to monitor and assure project progress.

Also during the project design phase, the Manufacturing and Manufacturing Engineering Departments will be in continual communication to ensure that manufacturing processes are designed with plant facilities and technician capabilities in mind. In addition, the Manufacturing and Material Control Departments will work closely to ensure that material and equipment is properly warehoused and staged to each work station. The QA Department and Manufacturing will jointly ensure that factory tests can be carried out, and will ensure that only current revisions of design documentation and work instructions are available to manufacturing technicians and inspectors.

As part of CNR's engineering change management system, representatives from each of the aforementioned departments will be members of a Change Control Board, which will review and approve all engineering changes.

During car delivery, CNR's Field Service Department will receive the vehicles on MBTA's property and perform the required commissioning tests. Should changes need to be made to cars that have left the factory, the Field Service Department will be responsible for incorporating the changes in accordance with a Field Modification Instruction produced by the Engineering Department and approved by MBTA. The Field Service Department will also be responsible for collecting vehicle and equipment performance (reliability) data and for ensuring that the data is transmitted to CNR's Engineering Department for evaluation and potential action.

The representatives from each department are empowered as necessary to accomplish their responsibilities as shown on the Organization Chart in Section 1.1. Staffing levels for each department are manned to accomplish assigned tasks within the allotted schedule. Planned staffing as described in Section 2.6 is summarized for each department in the table below.

Department	# of Personnel	
	MA [1]	Changchun
Project Management [2]	12	220
Engineering [3]	8	2200
Procurement	2	285 [4]
Manufacturing	108	10,000
Quality Assurance	9	1,020
Product Support/Warranty [5]	11	250

Project Staffing Levels by Department

[1] MA includes Boston Local office and Springfield Final Assembly facility.

[2] Project management includes Project Manager, Deputy Project Manager, Contract Administrator, and Assistant and does not include Director level and higher that will also participate in (part-time) project oversight.

[3] Engineering department staff includes manufacturing engineers.

[4] Changchun Procurement staff will focus on procuring material for carbody construction. US MA staff will generally be responsible for procurement of all other materials.

[5] Product Support staff includes Test & Commissioning engineers and technicians, warranty manager and warranty coordinators.

Staffing levels in Changchun exceed 10,000 production personnel and have far more staff than necessary for pilot car and production carbody production for the MBTA project, and can further provide additional personnel to supplement U.S. operations if necessary.

3 PAST PERFORMANCE

3.1 DESCRIPTION OF CNR CHANGCHUN RAILWAY VEHICLES CO., LTD

Changchun Cars Company (hereinafter referred to as CCC), the predecessor of CNR Changchun Railway Vehicles Co., Ltd. (CNR CRC), was founded in 1954 as one of the key construction projects of the state in the First Five-Year Plan. In March 2002, it was converted into Changchun Railway Vehicles Co., Ltd. In 2009, this Company was listed along with China CNR Corporation Limited.

3.1.1 Size of Company

CNR CRC has over 13,000 employees and a floor space of 1,223 acres (4.95 million sq. m). Since its foundation, CNR CRC has produced more than 30,000 railway vehicles of various kinds (incl. EMUs), accounting for approximately 44% of the total in-service operations throughout all the railway bureaus in China. It has produced over 7000 urban railway vehicles (incl. CRC-Bombardier) accounting for approximately 50% of the total in service throughout China. Out of the 17 cities within China that have urban railway transportation, 14 cities are using vehicles from CNR CRC.

With over 50 years of vehicle development and construction experience, CNR CRC has established a production capacity of 1000 high speed vehicles, 1200 urban railway vehicles, 500 general railway vehicles and 6000 trucks. It has become a base for development, manufacture, maintenance and export of high speed vehicles, urban railway vehicles and trucks with the worldwide first class scale of production, equipments and R&D capabilies.

3.1.2 History

Intensive and Pioneering Efforts:

Relying on their knowledge, skillset and will to succeed, the sole specialized passenger railcar manufactory was developed for the New China. The first railway passenger vehicle was made by the new China in 1959.

When only 60% of the planned investment had made by the country at the beginning of construction of CCC, it encountered the problem of possible discontinuation due to the departure of experts from the Soviet Union and the economic difficulty of the country. The people of this factory adhered to self-reliance and made a determined effort to do it well. They designed and manufactured, and repaired at the same time, with attention being paid to both passenger cars and wagons. The factory was built up from nothing through lifting with hands and shoulders. Thus a domestically largest railway passenger manufacturer was established and the first railway passenger car in China was made in Oct. 1959.

Starting from scratch and making an innovation, the first electric metro car in China was made in 1969 and this Factory became the cradle of metro cars for China.

Producing “910” cars laid the foundation for CCC’s special position occupying half of the domestic market of railway passenger cars. In 1985, in order to fulfill the Sixth Five-year Plan of the state, CCC improved its capacity by 33.8% and the number of newly made cars was up to 910, which laid the foundation for its special position occupying half of the domestic market of railway passenger cars.

Leading the development:

In 1986, it took the lead in China in introducing 25A type car manufacturing techniques, thus 30 years was recovered by introducing the technologies of 3 cars, which laid the foundation for leading the technological development of railway passenger cars in China.

In 1989, by applying the introduced technology and as a main contractor working with another two manufacturers, this Company was awarded the contract for development of 168 cars through international bidding and made technological transfer to the said two manufacturers. Production of the 168 internationally bid cars ended the 30-year history that only general type 22 railway passenger cars had been made in China and started a new era for China to develop type 25 railway passenger cars.

In 1992, it stopped production of type 22 cars and began producing type 25 cars, one year prior to the MOR, leading the upgrading and generation change of railway passenger cars in China.

On its own initiative, it assumed the task of developing the metro and urban railway equipment industry and influenced and facilitated the issuance of the national strategy of localization of urban railway and metro cars. a) It submitted a written statement to the State Council trying for the policy on localization, in order to prevent too many foreign brands of metro products came into China resulting from many cities' competing in introducing foreign metro systems. b) Notwithstanding the fact was no demand of metro in China Market, CCC neither dismissed the metro research institute nor reduced the staff and kept step with the world in terms of the vehicle development capability, guiding the domestic demand. c) CCC exports metro cars, creating an international brand and leading the domestic demand in return.

Technological R&D leads upgrading of product quality. In 1997, this Company purchased an aluminum car body with manually welded profiles from Germany, which was the first aluminum car body in China. CCC was the first to introduce a stainless steel car body production line and aluminum alloy car body production line and produced EMUs for Kunming, stainless steel metro cars for Beijing and aluminum alloy LRVs, 70% and 100% low-floor vehicles for Wuhan.

CCC provides a strong support for the railway transportation industry of China by making innovation and development:

- It assumed research of high speed maglev vehicles under the “863 Plan” of the state.
- It assumed the technological support project research in the “Eleventh Five-year Plan” of China (high speed EMUs, 100% low-floor vehicles).

Historical Timeline:

CNR CRC was reorganized in Mar. 2002. At the first Party Congress of the Company in 2005, a perspective to build an internationally first class railway passenger car manufacturer was proposed. A development strategy objective of “Moving in three steps” was proposed at the second Party Congress in 2009. In face of the new situation and new opportunity with great-leap-forward development of high speed railways, rapid growing up of the mass transit vehicle market and continuous prosperity of the international market demand, the Party Committee of the Company made a strategic decision promptly to increase production and expand capacity in order to build up a largest modern high speed EMU development base in China. Mr. Xiaofeng Dong, secretary of the Party Committee and president of the Company, put forward timely the historical assertion of “great development, rapid development and steep hill climbing.” On May 24th 2008, CRC started to construct the High Speed Train Manufacturing Base and Engineering Test Center. On May 27th 2010, the first phase of construction of the Base was completed and the first 380 km/h high speed motor car was released. Once completing the construction of the Base, the Company will have the production capacity of 1000 high speed motor cars per year and provide an essential platform for R&D for experiment and manufacture of high speed trains with speed levels over 380 km/h. This indicates that the production scale, product level and R&D and test capabilities of CNR CRC have reached the worldwide highest level.

Currently, the Company owns the most perfect infrastructure hardware and capabilities and has nearly 2000 engineering staff, of which approximately 600 staff are dedicated to product R&D.

The Company has established an operation and development configuration like the three legs of a tripod, i.e. annual production of more than 1000 high speed motor cars, annual production of 1000 mass transit vehicles and annual mean earnings of foreign currencies of USD 500 million from export of vehicles.

3.1.3 Resplendent Footmark

High speed EMUs:

Taking the lead in technology and quality, CNR CRC owns technological R&D platforms for 250-km/h, 350-km/h and 380-km/h EMUs as well as the high speed EMU network control technologies fully independently innovated. CRH5 cars are the only high quality EMUs in China adapted to the service environment of ±40℃. 380BL cars are the high quality high speed EMUs with higher operating speed, more advanced technology, higher safety and high comfort. 380C cars are the high speed EMUs created by CNR CRC with fully independent intellectual property rights with stronger traction power, better resistance reduction and noise reduction performance, more energy saving and better environmental protection. The comprehensive inspection cars of 250-km/h high speed EMUs with fully independent intellectual property rights are the most popular EMU called “yellow doctor”, the industrial design of which is awarded the first prize of Chinese patent industrial design.

Mass transit and metro cars:

Designing many types, CNR CRC has established the R&D and manufacturing capabilities for different operating modes, namely single track and double track, different traction modes, namely, electric rotating motors and linear motors, different materials, namely carbon steel, stainless steel and aluminum alloy, different car types, namely A, B and C and different series of product, namely low-floor vehicles, high speed maglev vehicles and low speed maglev vehicles, etc, becoming the sole “all purpose” enterprise in the worldwide mass transit vehicle manufacturing field.

Exported vehicles:

CNR CRC has become the top manufacturer with respect to coverage and foreign currency earning. CNR CRC’s products have been exported to such countries or regions as Sri Lanka, Saudi Arabia, Thailand, Brazil, Argentina, Australia, Hong Kong and Taiwan, etc. covering Western Asia, Southeast Asia, South America and Australia. In recent years, the average annual earnings of foreign currencies is over USD 500 million and by 2010, the total earnings of foreign currencies is over USD 3 billion.

Development of trucks:

Winning the champion for quantity and capabilities. CNR CRC owns the capacity to manufacture 6000 trucks of various kinds with different speed levels, different operating needs and different track modes. CW400 trucks are, currently, the most excellent high speed EMU trucks, with their elastic suspension technique and two-point support technique reaching the internationally advanced level. CW400 trucks possess a national patent for invention and three national patents of utility model. The independently developed independent-wheel truck technique supports 100% “creation by China” for 100% low-floor LRVs.

3.1.4 Business Scope

Through many years of product development and innovation, CNR CRC has established four business fields, namely passenger coaches (incl. EMUs and main line cars), mass transit vehicles, trucks and maintenance, created many No.1 in the country and filled many blanks domestically.

3.1.5 Overseas Business

CNR CRC’s vehicles have been exported successively to more than ten countries or regions, including Brazil, Argentina, Australia, New Zealand, Thailand, Hong Kong, Saudi Arabia, Bangladesh and Sri Lanka. CNR CRC has good performance on the main markets such as South America, Oceania, Southeast Asia and the Middle East. Totally over 4000 vehicles have been exported with the total export contract valued over USD 4 billion. CNR CRC steadily leads the industry domestically in terms of the quantity of product exported.

3.1.6 R&D Capability

In June 2011, CNR CRC was recognized by the Ministry of Industry and Information Technology and the Ministry of Finance as one of the first “National Model Enterprises of Technological Innovation” and become the only enterprise under CSR and CNR being so recognized. In March 2011, the Postdoctor Workstation of CNR CRC was honored as a “National Excellent Postdoctor Scientific Research Workstation.” In addition, the Company has been successively recognized by competent ministries and commissions of the state as one of the “Innovative Experimental Enterprise,” the “Innovative Enterprise of the States” and the “National Experimental Enterprises or Institutions in Respect of Intellectual Property Rights of the 4th Batch.” The product of the Company is entitled “National High Quality Well-known Products.”

3.1.7 Technical Equipment

Presently, CNR CRC’s equipment of critical processes is at the internationally leading level. The Company possesses specialized production facilities of the international level, such as the aluminum alloy car production line of the highest international level, the stainless steel car production line of the strongest capability, the truck welding line of the highest automation level, the most advanced painting line and the dynamic commissioning line of the fullest power supply modes, etc. In addition, the High Speed Vehicle Manufacturing Base, constructed by the CNR CRC in the Railway Transport Equipment Manufacturing Industry Park in Changchun Lvyuan District, is the specialized high speed EMU manufacturing base of the largest scale worldwide with the most advanced facilities presently.

3.1.8 Fundamentals of Management

Based on the core value of “Improving product quality,” CNR CRC strives to link the management system to the international standard while consolidating fundamental management. We are among the first in the industry in China who are successfully certified according to ISO 9001 quality system, ISO 1002-1 metrology and inspection system, ISO 14001 environmental management system, OHSMS professional safety and health management system, IRIS international railway industry management system and German DIN 6700 quality system. In addition, CNR CRC takes the lead in the industry to implement the quality management concepts and methods such as SAP management system, lean management, P3E management, project management and "gate, milestone and point" management. The management capability of CNR CRC is always kept at the leading level in the industry.

3.1.9 Far-reaching Prospects

The development strategy of "Moving in three steps" was proposed at the second Party Congress of the Company in Oct. 2009, which are: achieving sales income of CNY 15 billion and completing upgrading of main types of product by 2011; by 2015, it is to achieve sales income of CNY 30 billion and become a railway vehicle manufacturer with significant influence on the international market; by 2020, it is to become a top class enterprise in the international railway vehicle manufacturing industry, integrating four kinds of activities, namely complete vehicle sale, spare part production and supply, vehicle maintenance and service operation after sales service.

The development goal of the Company specified for the subsequent four years are: consolidating the "two great advantages" of domestic and international markets; establishing the three business fields of high speed vehicles, urban railway vehicles and trucks; achieving "three worldwide first classes" of production scale, vehicle product level and R&D and test capabilities; creating four large bases of high speed EMUs, railway vehicles, urban railway vehicles and trucks and build the Company into a railway vehicle manufacturer with strong international competitiveness.

In addition to the goals mentioned above, the income of employees is to be kept increasing continuously and stably so that they can lead a rich modern life.

For the last several years, the operating performance has set records successively. Currently, CNR CRC is, according to the latest market demand and development strategy, constructing four specialized manufacturing bases, namely of high speed EMUs, railway vehicles, urban railway vehicles and trucks, try to achieve "three worldwide first classes" of production scale, product level and R&D and test capabilities and work hard to build the Company into an international top class railway vehicle manufacturer.

3.2 HEAVY RAIL TRANSIT CAR CONTRACTS

Below is the RFP requirement for the heavy rail transit car contracts list of past performance:

Tab I.3 (a) Heavy Rail Transit Car Contracts
List (in a matrix format) reliability information for all heavy rail transit contracts, of similar size, scope, and operating environment as described in Technical Specification Section 2 for the past ten (10) years and describe how these projects (e.g. duty cycles, climate, other) are similar to this procurement. Past ten (10) years shall include all contracts that were active at any time during the past ten (10) years, inclusive of warranty stage as well as any executed contracts during this period. For each entry, the Offeror shall: • *Include customer, type, quantity, major vendors, and a brief description of the vehicle (dimension, weight, capacities, features, etc.)* • *Describe whether the vehicles delivered were an existing design or an entirely new design; and indicate the extent of the Offeror's design responsibility (i.e., total vehicle including carbody and all systems, carbody only, systems only etc.)* • *Include the contractual reliability requirement (MDBF, MTBF, definition of failures, warranty period(s), etc.)* • *Provide a description of the data collection process, the method of reliability calculation and sample of the raw defect history data* • *Include actual reliability achieved at the end of the warranty period* • *Include actual reliability currently being realized, if data is available* • *Identify each project for which the actual vehicle level reliability has met or exceeded the requirements of T2.03.03.* • *Submit a formal letter of concurrence from the listed customers for each listed project* • *Provide current customer contact information for verification* • *State the total length of every contract (closed and current) since 1995. Provide the date of Notice to Proceed and if closed, date of closeout.*

Tab I.3(a) –Reliability Information for Heavy Rail Transit Cars

<table>
<tr><td colspan="4" rowspan="3">Project Name: Beijing Metro 14#</td><td colspan="2">Contract Year</td><td colspan="2">2012 – 2014</td></tr>
<tr><td colspan="2">Notice to Proceed</td><td colspan="2">1/2012</td></tr>
<tr><td colspan="2">Closeout</td><td colspan="2">7/2014</td></tr>
<tr><td colspan="2">Transit Authority/Customer</td><td>Contact</td><td>Email</td><td colspan="4">Phone Number</td></tr>
<tr><td colspan="2">Beijing Construction Management Co.Ltd.</td><td>Zhang Bao</td><td>zhangbao_mrt@126.com</td><td colspan="4">13856485123</td></tr>
<tr><td>Vehicle Type</td><td>Vehicle Quantity</td><td>Vehicle Weight</td><td>Seating/Standing Capacity</td><td colspan="4">Dimensions (L x W)</td></tr>
<tr><td>A type
Stainless Steel
Metro vehicle</td><td>38 trainsets</td><td>Tc: 37.2t
Mp: 37.8t
M: 37.66t</td><td>Tc :
AW1 : 56 passengers
AW2 : 310 passengers
AW3 : 430 passengers
Mp, M :
AW1 : 56 passengers
AW2 : 310 passengers
AW3 : 430 passenge</td><td colspan="4">Tc : 80.05 x 9.84 ft
(24,400 x 3,000 mm)
Mp, M: 74.80 x 9.84 ft
(22,800 x 3,000 mm)</td></tr>
<tr><td colspan="8">List of Major Vendors</td></tr>
<tr><td colspan="2">Propulsion systerm: Jiangsu Bombardier Propulsion systerm Co.Ltd.</td><td colspan="2">Brake system: Beijing Zongheng Electrical & Mechanical Technology Developmrny Co. Ltd.</td><td colspan="2">Air conditioning: Huadong (Beijing) Transit Equipment Co.Ltd.</td><td colspan="2">Door: Qingdao Sifang Faiveley Rail Brake Co.Ltd.</td></tr>
<tr><td colspan="2">Coupler: Qingdao Sirui Technology Co.Ltd.</td><td colspan="2">Broadcast: Beijing Huagao Shiji Technology Co.Ltd</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="8">Description of Vehicle (e.g. features, existing or new design, etc.)</td></tr>
<tr><td colspan="8">Max running speed is 80 km/h, configuration form is 4 motor car and 2 trail car (=Tc-Mp-T+M-Mp-Tc=) ; using overall stainless steel load bearing structure ; no painting on carbody surface ; meet the requirement of EN15227 for 25km/h entirety vehicle crush energy absorption ; front anti-climber integration energy absorption deformation tube, which can effect on anti-climbing and energy absorbing at the same time, using bolt to connect the anti-climber and carbody, which is easier to replace after damaging ; using modular design, using symmetrical layout on left-hand side and right-hand side of No.1 end and No.2 end, to improve interchangeability ; the steel structure is using entirety arc roof, no individual AC unit platform and pantograph platform ; using bolt to connect cab frame and carbody, which is easier for maintenance after accident ;</td></tr>
<tr><td colspan="8">Description of CNR CRC's Design Responsibilities (e.g. total vehicle, carbody and systems, carbody only, system only, etc.)</td></tr>
<tr><td colspan="8">Responsible for entire vehicle design and system integration; independent design and manufacture carbody stainless steel structure and trucks; propulsion, brake and coupler system etc are integrated.</td></tr>
<tr><td colspan="8">Description How Project is related to this MBTA Project (e.g. duty cycle, climate, etc.)</td></tr>
<tr><td colspan="8">Overall stainless steel load bearing; entirety vehicle crush energy absorption.
Electric propulsion system is VVVF control AC drive system; electric brake system is the combination of regeneration and brake resistor
Brake system use microcomputer control direct EP brake, foundation brake use tread brake.</td></tr>
<tr><td rowspan="2">System</td><td colspan="2">Mean Distance Between Failure (MDBF)</td><td rowspan="2">Mean Time Between Failure (MTBF)</td><td colspan="2" rowspan="2">Definition of Failure</td><td colspan="2" rowspan="2">Warranty Period(s)</td></tr>
<tr><td>Km</td><td>Miles</td></tr>
<tr><td>Vehicle</td><td>65371 Miles</td><td>104594 km</td><td></td><td colspan="2">Failure level 1: rescue, off line, failed</td><td colspan="2">2years</td></tr>
</table>

				to leave depot on time; MDBF for every trainset is 100,000 miles	
Vehicle			14942 hours	Failure level 2: delay 5mins. MTBF of every trainset is 2500 hours.	2years
Propulsion system	163428 Miles	261486 km		Failure level 1: rescue, off line, failed to leave depot on time	2years
Propulsion system			14942 hours	Failure level 2: delay 5mins.	2years
Auxiliary power supply system	326857 Miles	522971 km		Failure level 1: rescue, off line, failed to leave depot on time	2years
Auxiliary power supply system			14942 hours	Failure level 2: delay 5mins.	2years
Network	326857 Miles	522971 km		Failure level 1: rescue, off line, failed to leave depot on time	2years
Network			14942 hours	Failure level 2: delay 5mins.	2years
Brake system	326857 Miles	522971 km		Failure level 1: rescue, off line, failed to leave depot on time	2years
Brake system			14942 hours	Failure level 2: delay 5mins.	2years
Door system	163428 Miles	261486 km		Failure level 1: rescue, off line, failed to leave depot on time	2years
Door system			7471 hours	Failure level 2: delay 5mins.	2years
AC system	326857 Miles	522971 km		Failure level 1: rescue, off line, failed to leave depot on time	2years
AC system			14942 hours	Failure level 2: delay 5mins.	2years
Communication system	326857 Miles	522971 km		Failure level 1: rescue, off line, failed to leave depot on time	2years
Communication system			14942 hours	Failure level 2: delay 5mins.	2years
Coupler	326857 Miles	522971 km		Failure level 1: rescue, off line, failed to leave depot on time	2years
Coupler			14942 hours	Failure level 2: delay 5mins.	2years
Trucks	326857 Miles	522971 km		Failure level 1: rescue, off line, failed to leave depot on time	2years
Trucks			14942 hours	Failure level 2: delay 5mins.	2years
Interiors	326857 Miles	522971 km		Failure level 1: rescue, off line, failed to leave depot on time	2years
Interiors			14942 hours	Failure level 2: delay 5mins.	2years

Description of Data (e.g. collection process, reliability calculation, raw defect history data, etc.)

1. Determination during validation period

Reliability performance has been evaluated by the validating the running miles of the trainset being in service during test period, and the running time has been calculated by the average speed theoretical calculation. In general the early stage failures are not on the scope of this validation period. If there is not special request of start point of the reliability validation, both parts can mutually agree with the period of validation. Normally the validation period will last 12 months, and the trainset will run 120,000km, the entirety trainset will be the target. This project has not started to validate.

2. Failure data collection

During reliability validation, CNR CRC is using the FRACAS system which is developed by CNR CRC and service proven to failures closed-loop management, and produce a report monthly, the recorded date has to include following parameter, but not limited: Train number, time of failure, accumulative mileage, failure parts and the system they belong to, failure description, failure reason, the impacts on system and service, the measures took immediately, and other relevant date, e.g. weather, route condition, and the detail information the diver who is diving the failure train.

3. Reliability validation calculation and judgment standard for "accept/reject"

According to MIL-HDBK-781A, in the range of reliability validation the minimum single side confidence coefficient C is 90%, the risk of user β=1-C=10% timing test plan, regarding to the occurred failure and analysis communicate and discuss with customer, and to identify the responsibility of the failures.

Reliability at End of Warranty Period	Current Reliability	Met/Exceed Reliability Requirement in T2.03.03
not available	met the contract requirement	Yes

Project Name: Beijing Metro 6#					Contract Year	2011 – 2014
					Notice to Proceed	2/2011
					Closeout	12/2014
Transit Authority/Customer		**Contact**	**Email**	**Phone Number**		
Beijing Construction Management Co.Ltd.		Zhang Bao	zhangbao_mrt@126.com	13856485123		
Vehicle Type	**Vehicle Quantity**	**Vehicle Weight**	**Seating/Standing Capacity**	**Dimensions (L x W)**		
B type Stainless Steel vehicle	64 trainsets	Tc: 33t Mp: 33.7t M: 33.1t	Tc: AW1 : 36 passengers AW2 : 226 passengers AW3 : 290 passengers Mp, M: AW1 : 42 passengers AW2 : 254 passengers AW3 : 325 passengers	Tc: 65.49 x 9.19 ft (19,960 x 2,800 mm) Mp, M: 62.34 x 9.19 ft (19,000 x 2,800 mm)		

List of Major Vendors

Propulsion systerm: Shanghai Alstom Transport Electric Equipment Co., Ltd.	Brake systerm: Knorr-Bremse	Air conditioning: China Railway Vehicle (Beijing) Transit Equipment Co.Ltd.	Door: Qingdao Sifang Faiveley Rail Brake Co.Ltd.
Coupler: Dana Coupler System Technology (Shanghai) Co., Ltd.	Broadcast: Beijing Huagao Shiji Technology Co.Ltd		

Description of Vehicle (e.g. features, existing or new design, etc.)

The maximum operating speed is 100km/h. The paint-free stainless steel car body is taken. The strength of the car body is designed to meet the EN12663 Structural Standard of Bodies and the compression load reaches 800KN. The planing anti-creep energy absorbing device structure is designed and connected with the car body with bolts and easy to replace after it is damaged. The head forms the independent module and it is assembled with the car body after its self-reassembly is completed. The headlamp, tail light and window wiper are installed to the external part of the vehicle, facilitating the maintenance and overhaul of the equipment. The wheel disc brake bogie with the wheel base of 2300mm is taken. The saloon door takes the double-leaf electric built-in sliding door and the side door of the driver's cab takes the single electric sliding door. The air conditioning unit is installed on top of the ceiling arc, with the lower air outlet and return on top of the vehicle. The gangway in the flexible side guard plate structure is taken. The partition wall between the saloon and the driver's cab is set with the relevant end door of the front escape door, facilitating the passenger's barrier-free access. If any emergency occurs, the passengers can escape from the driver's cab. The electric traction system is the VVVF-controlled AC transmission system and the electric brake is the regenerative brake. The microcomputer-controlled closed-loop numerical and simulated electro-pneumatic brake system and the foundation brake is the disc brake.

Description of CNR CRC's Design Responsibilities (e.g. total vehicle, carbody and systems, carbody only, system only, etc.)

It is responsible for the design and system integration of the whole vehicle. The carbody steel structure, bogies and train network are completely independently designed and manufactured. Some main systems of traction, brake and couplers, etc. are integrated.

Description How Project is related to this MBTA Project (e.g. duty cycle, climate, etc.)

Load bearing as a whole; the collision energy absorption of the whole vehicle is taken into account.

System	Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Definition of Failure	Warranty Period(s)

	km	Miles			
Vehicle	160130	100081		Failure level 1: Service failure rescue, off line, failed to leave depot on time Target: MDBF for every trainset is 100000 km.	2 years
Vehicle			8693	Failure level 2: Delay failure, delay for 3min. Target: MDBF for every trainset is 3000h.	2 years
Propulsion system	1216987	760617		Failure level 1: Service failure ; rescue, off line, failed to leave depot on time	2 years
Propulsion system			43464	Failure level 2: Delay failure, delay for 3min.	2 years
Auxiliary power supply system	1216987	760617		Failure level 1: Service failure ; rescue, off line, failed to leave depot on time	2 years
Auxiliary power supply system			28976	Failure level 2: Delay failure, delay for 3min.	2 years
Network	2028312	1267695		Failure level 1: Service failure ; rescue, off line, failed to leave depot on time	2 years
Network			Over 173855	Failure level 2: Delay failure, delay for 3min.	2 years
Brake system	608494	380309		Failure level 1: Service failure ; rescue, off line, failed to leave depot on time	2 years
Brake system			Over 173855	Failure level 2: Delay failure, delay for 3min.	2 years
Door system	1216987	760617		Failure level 1: Service failure ; rescue, off line, failed to leave depot on time	2 years
Door system			28976	Failure level 2: Delay failure, delay for 3min.	2 years
AC system	6084937	3803086		Failure level 1: Service failure ; rescue, off line, failed to leave depot on time	2 years
AC system			Over 173855	Failure level 2: Delay failure, delay for 3min.	2 years
Communication system	1014156	633848		Failure level 1: Service failure ; rescue, off line, failed to leave depot on time	2 years
Communication system			43464	Failure level 2: Delay failure, delay for 3min.	2 years
Coupler	Over 6084938	Over 3803086		Failure level 1: Service failure ; rescue, off line, failed to leave depot on time	2 years
Coupler			Over 173855	Failure level 2: Delay failure, delay for 3min.	2 years
Truck	3042469	1901543		Failure level 1: Service failure ; rescue, off line, failed to leave depot on time	2 years
Truck			Over 173855	Failure level 2: Delay failure, delay for 3min.	2 years

Interiors	6084937	3803086		Failure level 1: Service failure ; rescue, off line, failed to leave depot on time	2 years
Interiors			Over 173855	Failure level 2: Delay failure, delay for 3min.	2 years

Description of Data (e.g. collection process, reliability calculation, raw defect history data, etc.)

1. **Determination during validation period**

Reliability performance has been evaluated by validating the running miles of the trainset being in service during test period, and the running time has been calculated by the average speed theoretical calculation. In general the early stage failures are not on the scope of this validation period. If there is not special request of start point of the reliability validation, both parts can mutually agree with the period of validation. Normally the validation period will last 12 months, and the trainset will run 120,000km, the entirety trainset fleet will be the target.

2. **Failure data collection**

During reliability validation, CNR is using the FRACAS system which is developed by CNR CRC and service proven to failures closed-loop management, and issue a report monthly, the recorded information has to include, but not limited the following parameters: Train number, time of failure, accumulative mileage, failure parts and the system they belong to, failure description, failure reason, the impacts on system and service, the measures took immediately, and other relevant date, e.g. weather, route condition, and the detail information the diver who is diving the failure train.

3. **Reliability validation calculation and judgment standard for "Accept/Reject"**

According to MIL-HDBK-781A, in the range of reliability validation the minimum single side confidence coefficient C is 90%, the risk of user β=1-C=10% timing test plan, it is to execute discussion and analysis with the customer regarding to the occurred failure per month, and to identify the responsibility of the failures.

Reliability at End of Warranty Period	Current Reliability	Met/Exceed Reliability Requirement in T2.03.03
Not yet available	Met the contract requirement	Yes

Project Name: Shenyang Metro Line 1	Contract Year	2006 – 2010
	Notice to Proceed	12/2006
	Closeout	3/2010

Transit Authority/Customer	Contact	Email	Phone Number
Shenyang Metro Group Co., Ltd.	Yang Pengfei	YanPengfeiCRC@163.com	13840519115

Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)
B type Stainless Steel vehicle	23 trainsets	Tc: 32.1t T: 28t Mp: 34.6 t M: 34.3 t	Tc: AW1 : 36 passengers AW2 : 230 passengers AW3 : 290 passengers Mp, M, T: AW1 : 42 passengers AW2 : 245 passengers AW3 : 310 passengers	Tc: 63.98 x 9.19 ft (19,500×2,800 mm) Mp, M, T: 62.34 x 9.19 ft (19,000×2,800 mm)

List of Major Vendors

Propulsion system: Mitsubishi Electric Corporation	Brake system: Knorr-Bremse	Air conditioning: Shandong Langjin Technology Co., Ltd.	Door: Beijing Bode Traffic Equipment Co., Ltd.
Coupler: Voith Turbo Power Transmission Shanghai Co. Ltd.	Broadcast: Tianjin Beihai Communication Technology Co., Ltd.		

Description of Vehicle (e.g. features, existing or new design, etc.)

The typical B stainless steel vehicle and the paint-free carbody surface is taken. The electric traction system is the VVVF-controlled AC transmission system and the electric brakes combines the regenerative brake and brake resistance. The brake system is the microcomputer-controlled electro-pneumatic brake and the foundation brake is the pedal brake.

Description of CNR CRC's Design Responsibilities (e.g. total vehicle, carbody and systems, carbody only, system only, etc.)

It is responsible for the design and system integration of the whole vehicle. The steel structure of the car body, the interior decoration of the vehicle and bogies are completely independently designed and manufactured. Some main systems such as traction system, pantograph system, brake system, coupler system, air conditioning system and door system, etc. are integrated.

Description How Project is related to this MBTA Project (e.g. duty cycle, climate, etc.)

Load bearing as a whole; the collision energy absorption of the whole vehicle is taken into account.

System	Mean Distance Between Failure (MDBF)		Mean Time Between Failure (MTBF)	Definition of Failure	Warranty Period(s)
	km	Miles			
Vehicle	306667	191667		Failure level 1: Service failure rescue, off line, failed to leave depot on time Target: MDBF for every trainset is 100000 km.	2 years
Vehicle			8762	Failure level 2: Delay failure, delay for 3min. Target: MDBF for every trainset is 3000h.	2 years
Propulsion system	1840000	1150000		Failure level 1: Service failure	2 years

				rescue, off line, failed to leave depot on time	
Propulsion system			87619	Failure level 2: Delay failure, delay for 3min.	2 years
Auxiliary power supply system	1533333	958333		Failure level 1: Service failure rescue, off line, failed to leave depot on time	2 years
Auxiliary power supply system			131429	Failure level 2: Delay failure, delay for 3min.	2 years
Network	4600000	2875000		Failure level 1: Service failure rescue, off line, failed to leave depot on time	2 years
Network			Over 262857	Failure level 2: Delay failure, delay for 3min.	2 years
Brake system	920000	575000		Failure level 1: Service failure rescue, off line, failed to leave depot on time	2 years
Brake system			262857	Failure level 2: Delay failure, delay for 3min.	2 years
Door system	1314286	821429		Failure level 1: Service failure rescue, off line, failed to leave depot on time	2 years
Door system			32857	Failure level 2: Delay failure, delay for 3min.	2 years
AC system	Over 9200000	Over 5750000		Failure level 1: Service failure rescue, off line, failed to leave depot on time	2 years
AC system			262857	Failure level 2: Delay failure, delay for 3min.	2 years
Communication system	Over 9200000	Over 5750000		Failure level 1: Service failure rescue, off line, failed to leave depot on time	2 years
Communication system			Over 262857	Failure level 2: Delay failure, delay for 3min.	2 years
Coupler	Over 9200000	Over 5750000		Failure level 1: Service failure rescue, off line, failed to leave depot on time	2 years
Coupler			Over 262857	Failure level 2: Delay failure, delay for 3min.	2 years
Truck	Over 9200000	Over 5750000		Failure level 1: Service failure rescue, off line, failed to leave depot on time	2 years
Truck			Over 262857	Failure level 2: Delay failure, delay for 3min.	2 years
Interiors	Over 9200000	Over 5750000		Failure level 1: Service failure rescue, off line, failed to leave depot on time	2 years
Interiors			Over 262857	Failure level 2: Delay failure, delay for 3min.	2 years

Description of Data (e.g. collection process, reliability calculation, raw defect history data, etc.)

1. Determination during validation period

Reliability performance has been evaluated by validating the running miles of the trainset being in service during test period, and the running time has been calculated by the average speed theoretical calculation. In general the early stage failures are not on the scope of this validation period. If there is not special request of start point of the reliability validation, both parts can mutually agree with the period of validation. Normally the validation period will last 12 months, and the trainset will run 120,000km, the entirety trainset fleet will be the target.

2. Failure data collection

During reliability validation, CNR is using the FRACAS system which is developed by CNR CRC and service proven to failures closed-loop management, and issue a report monthly, the recorded information has to include, but not limited the following parameters: Train number, time of failure, accumulative mileage, failure parts and the system they belong to, failure description, failure reason, the impacts on system and service, the measures took immediately, and other relevant date, e.g. weather, route condition, and the detail information the diver who is diving the failure train.

3. Reliability validation calculation and judgment standard for "Accept/Reject"

According to MIL-HDBK-781A, in the range of reliability validation the minimum single side confidence coefficient C is 90%, the risk of user β=1-C=10% timing test plan, it is to execute discussion and analysis with the customer regarding to the occurred failure per month, and to identify the responsibility of the failures.

Reliability at End of Warranty Period	Current Reliability	Met/Exceed Reliability Requirement in T2.03.03
Failure Level 1 MDBF=306667 km Failure Level 2 MTBF=8762h	Met the contract requirement	Yes

Project Name: Chongqing Rail Transit Line 6					Contract Year	2010 – 2011
					Notice to Proceed	3/2010
					Closeout	9/2011
Transit Authority/Customer		**Contact**	**Email**	**Phone Number**		
Chongqing Rail Transit Group Co., Ltd.		Wu Jing	WUJING@163.com.cn	13983115816		
Vehicle Type	**Vehicle Quantity**	**Vehicle Weight**	**Seating/Standing Capacity**	**Dimensions (L x W)**		
B type Stainless Steel vehicle	21 trainsets	Tc：34.3t Mp：33.8t M：33.2t	Tc: AW1：36 passengers AW2：226 passengers AW3：290 passengers Mp, M: AW1：42 passengers AW2：254 passengers AW3：325 passengers	Tc: 63.98 x 9.19 ft (19,500 x 2,800 mm) Mp, M: 62.34 x 9.19 ft (19,000 x 2,800 mm)		

List of Major Vendors

Propulsion system：Zhuzhou Electric Locomotive Research Institute Co.Ltd.	Brake system：Beijing Zongheng Mechanical and Electrical Technology Development Co.	Air conditioning: Zhejiang Liebherr Zhongche Transportation Systems Co., Ltd	Door: Nanjing Kangni Mechanical&Electrical Co., Ltd.
Coupler：CNR Sifang Rolling Stock Research Institute	Broadcast: Beijing Aotewei Technology Development General Corporation		

Description of Vehicle (e.g. features, existing or new design, etc.)

The train takes the energy absorption structures of coupler crushing tube and car body front-end deformation area, etc., assuring the safety of passengers and the driver, to the maximum extent; the structural strength of the car body meets the requirements of European EN12663：2000 "Structural Requirements of Railway Vehicle Bodies " and the requirement of the longitudinal compression load of 800KN; the car body takes the paint-free stainless steel carbody structure, with some advantages such as high strength and strong corrosion resistance, etc. and reducing the environmental pollution caused by the paint maintenance; the trailer car with the driver's cab first takes the axle-disc brake; the operating speed of the bogie reaches 100km/h and the flange lubricating devices are set to the bogies of some trains; the electric traction system is VVVF-controlled AV transmission system and the electric brake is the form combining the regenerative brake and floor resistance absorption.
The brake system takes the microcomputer-controlled electro-pneumatic brake. The foundation brakes are the axle-disc brake for the trailer car and the pedal brake for the motor car.

Description of CNR CRC's Design Responsibilities (e.g. total vehicle, carbody and systems, carbody only, system only, etc.)

It is responsible for the design and system integration of the whole vehicle. The steel structure of the car body, the interior decoration of the vehicle and bogies are completely independently designed and manufactured. Some main systems such as traction system, pantograph system, brake system, coupler system, air conditioning system and door system, etc. are integrated.

Description How Project is related to this MBTA Project (e.g. duty cycle, climate, etc.)

Load bearing as a whole; the collision energy absorption of the whole vehicle is taken into account.

System	Mean Distance Between Failure (MDBF)		Mean Time Between Failure (MTBF)	Definition of Failure	Warranty Period(s)
	km	Miles			
Vehicle	471130	294457	13461	Rescue, evacuation, off line, failed to leave depot on time, delay over 3min.	2 years

				MTBFS (Mean time between failures for service) over 3500h.	
Vehicle	361200	225750	10320	Delay less than 3min. MTBFS should not be less than 3000h.	2 years
Propulsion system	1806000	1128750	51600	Rescue, evacuation, off line, failed to leave depot on time, delay over 3min.	2 years
Propulsion system	3612000	2257500	103200	Delay less than 3min.	2 years
Auxiliary power supply system	2167200	1354500	61920	Rescue, evacuation, off line, failed to leave depot on time, delay over 3min.	2 years
Auxiliary power supply system	602000	376250	17200	Delay less than 3min.	2 years
Network	2709000	1693125	77400	Rescue, evacuation, off line, failed to leave depot on time, delay over 3min.	2 years
Network	3612000	2257500	103200	Delay less than 3min.	2 years
Brake system	10836000	6772500	309600	Rescue, evacuation, off line, failed to leave depot on time, delay over 3min.	2 years
Brake system	Over 10836000	Over 6772500	Over 309600	Delay less than 3min.	2 years
Door system	2709000	1693125	77400	Rescue, evacuation, off line, failed to leave depot on time, delay over 3min.	2 years
Door system	2709000	1693125	77400	Delay less than 3min.	2 years
AC system	10836000	6772500	309600	Rescue, evacuation, off line, failed to leave depot on time, delay over 3min.	2 years
AC system	Over 10836000	Over 6772500	Over 309600	Delay less than 3min.	2 years
Communication system	5418000	3386250	154800	Rescue, evacuation, off line, failed to leave depot on time, delay over 3min.	2 years
Communication system	5418000	3386250	154800	Delay less than 3min.	2 years
Coupler	Over 10836000	Over 6772500	Over 309600	Rescue, evacuation, off line, failed to leave depot on time, delay over 3min.	2 years
Coupler	Over 10836000	Over 6772500	Over 309600	Delay less than 3min.	2 years
Truck	Over 10836000	Over 6772500	Over 309600	Rescue, evacuation, off line, failed to leave depot on time, delay over 3min.	2 years
Truck	Over 10836000	Over 6772500	Over 309600	Delay less than 3min.	2 years
Interiors	Over 10836000	Over 6772500	Over 309600	Rescue, evacuation, off line, failed to leave depot on time, delay over 3min.	2 years
Interiors	Over 10836000	Over 6772500	Over 309600	Delay less than 3min.	2 years

Description of Data (e.g. collection process, reliability calculation, raw defect history data, etc.)

1. Determination during validation period

Reliability performance has been evaluated by validating the running miles of the trainset being in service during test period, and the running time has been calculated

by the average speed theoretical calculation. In general the early stage failures are not on the scope of this validation period. If there is not special request of start point of the reliability validation, both parts can mutually agree with the period of validation. Normally the validation period will last 12 months, and the trainset will run 120,000km, the entirety trainset fleet will be the target. **2. Failure data collection** During reliability validation, CNR is using the FRACAS system which is developed by CNR CRC and service proven to failures closed-loop management, and issue a report monthly, the recorded information has to include, but not limited the following parameters: Train number, time of failure, accumulative mileage, failure parts and the system they belong to, failure description, failure reason, the impacts on system and service, the measures took immediately, and other relevant date, e.g. weather, route condition, and the detail information the diver who is diving the failure train. **3. Reliability validation calculation and judgment standard for "Accept/Reject"** According to MIL-HDBK-781A, in the range of reliability validation the minimum single side confidence coefficient C is 90%, the risk of user β=1-C=10% timing test plan, it is to execute discussion and analysis with the customer regarding to the occurred failure per month, and to identify the responsibility of the failures.		
Reliability at End of Warranty Period	**Current Reliability**	**Met/Exceed Reliability Requirement in T2.03.03**
Not yet available	Met the contract requirement	Yes

Project Name: Shenzhen Metro Line 3, New Procurement					Contract Year	20092011
					Notice to Proceed	12/2009
					Closeout	5/2011
Transit Authority/Customer		Contact	Email	Phone Number		
Shenzhen Metro Line 3 Investment Co., Ltd.		Li Guanpeng	Liguanpeng123@163.com.cn	15002052776		
Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)		
B type Stainless Steel vehicle	19 trainsets	Tc：33t M：33.1t	Tc: AW1：36 passengers AW2：226 passengers AW3：290 passengers M： AW1：42 passengers AW2：254 passengers AW3：325 passengers	Tc: 63.98 x 9.19 ft (19,500 x 2,800 mm) M: 62.34 x 9.19 ft (19,000×2,800mm)		

List of Major Vendors

Propulsion system： Hyundai Group Korea	Brake systerm: Knorr-Bremse	Air conditioning: Zhejiang Liebherr Zhongche Transportation Systems Co., Ltd	Door: Beijing Bode Traffic Equipment Co., Ltd.
Coupler： CNR Sifang Rolling Stock Research Institute	Broadcast: Guangzhou GlobalLink Co., Ltd.		

Description of Vehicle (e.g. features, existing or new design, etc.)

When the vehicle is operated in the climatic conditions with a lot of overhead lines and typhoons in Shenzhen, it is required that the vehicle should have the high technical performances, safety performance and fashion. The design of the vehicle technically and fully represents the characteristics connecting with the technologies of the international advanced railway vehicle such as science and technology, human culture and environment friendliness, etc. The carbody steel structure is improved to meet the strength and rigidity requirements of the carbody structure with 8 sets of electric sliding doors. The electric system is the VVVF-controlled AC transmission system and the electric brake combines the regenerative brake and brake resistance. The brake system is the microcomputer-controlled electro-pneumatic brake and the foundation brake is the pedal brake.

Description of CNR CRC's Design Responsibilities (e.g. total vehicle, carbody and systems, carbody only, system only, etc.)

Responsible for the design and system integration of the whole vehicle. The carbody steel structure, bogies and train network are completely independently designed and manufactured. Some main systems of traction, brake and couplers, etc. are integrated.

Description How Project is related to this MBTA Project (e.g. duty cycle, climate, etc.)

Load bearing as a whole; the collision energy absorption of the whole vehicle is taken into account.

System	Mean Distance Between Failure (MDBF)		Mean Time Between Failure (MTBF)	Definition of Failure	Warranty Period(s)
	km	Miles			

Vehicle	206052	128782		Not suitable for continuous servic/(Passengers) cannot be sent Target: 0.41 pce per million km./car, i.e. MDBF=120000km	2 years
Vehicle	154539	96587		Operation interrupted, delay for 2min. or above. Target: 2.4 pce per million km./car, i.e. MDBF=70000km	2 years
Propulsion system	1030259	643912		Not suitable for continuous servic/(Passengers) cannot be sent	2 years
Propulsion system	2060518	1287824		Operation interrupted, delay for 2min. or above.	2 years
Auxiliary power supply system	1545389	965868		Not suitable for continuous servic/(Passengers) cannot be sent	2 years
Auxiliary power supply system	1030259	643912		Operation interrupted, delay for 2min. or above.	2 years
Network	2060518	1287824		Not suitable for continuous servic/(Passengers) cannot be sent	2 years
Network	2060518	1287824		Operation interrupted, delay for 2min. or above.	2 years
Brake system	1545389	965868		Not suitable for continuous servic/(Passengers) cannot be sent	2 years
Brake system	2060518	1287824		Operation interrupted, delay for 2min. or above.	2 years
Door system	1030259	643912		Not suitable for continuous servic/(Passengers) cannot be sent	2 years
Door system	412104	257565		Operation interrupted, delay for 2min. or above.	2 years
AC system	3090778	1931736		Not suitable for continuous servic/(Passengers) cannot be sent	2 years
AC system	6181555	3863472		Operation interrupted, delay for 2min. or above.	2 years
Communication system	2060518	1287824		Not suitable for continuous servic/(Passengers) cannot be sent	2 years
Communication system	1030259	643912		Operation interrupted, delay for 2min. or above.	2 years
Coupler	Over 6181555	Over 3863472		Not suitable for continuous servic/(Passengers) cannot be sent	2 years
Coupler	Over 6181555	Over 3863472		Operation interrupted, delay for 2min. or above.	2 years
Truck	6181555	3863472		Not suitable for continuous	2 years

				servic/(Passengers) cannot be sent	
Truck	3090778	1931736		Operation interrupted, delay for 2min. or above.	2 years
Interiors	6181555	3863472		Not suitable for continuous servic/(Passengers) cannot be sent	2 years
Interiors	3090778	1931736		Operation interrupted, delay for 2min. or above.	2 years

Description of Data (e.g. collection process, reliability calculation, raw defect history data, etc.)

1. **Determination during validation period**

Reliability performance has been evaluated by validating the running miles of the trainset being in service during test period, and the running time has been calculated by the average speed theoretical calculation.In general the early stage failures are not on the scope of this validation period. If there is not special request of start point of the reliability validation, both parts can mutually agree with the period of validation.Normally the validation period will last 12 months, and the trainset will run 120,000km, the entirety trainset fleet will be the target.

2. **Failure data collection**

During reliability validation, CNR is using the FRACAS system which is developed by CNR CRC and service proven to failures closed-loop management, and issue a report monthly, the recorded information has to include, but not limited the following parameters: Train number, time of failure, accumulative mileage, failure parts and the system they belong to, failure description, failure reason, the impacts on system and service, the measures took immediately, and other relevant date, e.g. weather, route condition, and the detail information the diver who is diving the failure train.

3. **Reliability validation calculation and judgment standard for "Accept/Reject"**

According to MIL-HDBK-781A, in the range of reliability validation the minimum single side confidence coefficient C is 90%, the risk of user β=1-C=10% timing test plan, it is to execute discussion and analysis with the customer regarding to the occurred failure per month, and to identify the responsibility of the failures.

Reliability at End of Warranty Period	Current Reliability	Met/Exceed Reliability Requirement in T2.03.03
Not yet available	Met the contract requirement	Yes

Project Name: Brazil Rio de Janeiro Metro 1A		
	Contract Year	20092013
	Notice to Proceed	11/2009
	Closeout	3/2013

Transit Authority/Customer	Contact	Email	Phone Number
China National Machinery Imp. & Exp. (Group) Corp.	Wei Bing	Weibin-crc@163.com.cn	010-68991796

Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)
A type Stainless Steel vehicle	19 trainsets	Tc: 41t M: 40.5t	T : AW1 36 passengers AW2 280 passengers AW3 350 passengers M : AW1 36 passengers AW2 310 passengers AW3 385 passengers	T: 69.62 x 10.14 ft (21,220 x 3,090 mm) M: 69.62 x 10.14 ft (21,220 x 3,090 mm)

List of Major Vendors

Propulsion system：Mitsubishi Electric Corporation	Brake system： Knorr-Bremse	Air conditioning: Sigma Coachair Group Pty Ltd. UI CO	Door: IFE-VICTALL Railway Vehicle Door Systems (Qingdao) Co., Ltd.
Coupler：Wabtec Golden Bridge Transportation Technology (Hangzhou) Co., ltd.	Broadcast: ST Electronics （Shanghai） Co., Ltd.		

Description of Vehicle (e.g. features, existing or new design, etc.)

Refer to the NFPA-130 standard for the fire protection of the whole vehicle, presenting the higher requirements for the structure and choice of materials. The broad-gauge (1600 mm) bogie is independently designed. The big-openness three-door is taken. The electric traction system is the VVVF-controlled AC transmission system and the electric brakes combines the regenerative brake and brake resistance. The brake system is the microcomputer-controlled electro-pneumatic brake and the foundation brake is the disc brake.

Description of CNR CRC's Design Responsibilities (e.g. total vehicle, carbody and systems, carbody only, system only, etc.)

It is responsible for the design and system integration of the whole vehicle. The carbody steel structure and bogies are completely independently designed and manufactured. Some main systems of traction, brake and couplers, etc. are integrated.

Description How Project is related to this MBTA Project (e.g. duty cycle, climate, etc.)

Load bearing as a whole; the collision energy absorption of the whole vehicle is taken into account.

System	Mean Distance Between Failure (MDBF)		Mean Time Between Failure (MTBF)	Definition of Failure	Warranty Period(s)
	km	Miles			
Vehicle	164252	102658		Rescue, evacuation, off-line, and delay for 5min.or above， 0.167 pce per million km./car （About 27800 km./train for a 6-car	2 years

				formation)	
Vehicle	232691	145432		Delay for 5min.or above, 1 pce per million km./car (About 167000 km./train for a 6-car formation)	2 years
Propulsion system	1396144	872590		Rescue, evacuation, off-line, and delay over 5min.	2 years
Propulsion system	1396144	872590		Delay for 5min.or above	2 years
Auxiliary power supply system	558458	349036		Rescue, evacuation, off-line, and delay for 5min.or above	2 years
Auxiliary power supply system	Over 2792288	Over 1745180		Delay for 5min.or above	2 years
Network	2792288	1745180		Rescue, evacuation, off-line, and delay for 5min.or above	2 years
Network	2792288	1745180		Delay for 5min.or above	2 years
Brake system	1396144	872590		Rescue, evacuation, off-line, and delay for 5min.or above	2 years
Brake system	1396144	872590		Delay for 5min.or above	2 years
Door system	558458	349036		Rescue, evacuation, off-line, and delay for 5min.or above	2 years
Door system	465381	290863		Delay for 5min.or above	2 years
AC system	Over 2792288	Over 1745180		Rescue, evacuation, off-line, and delay for 5min.or above	2 years
AC system	Over 2792288	Over 1745180		Delay for 5min.or above	2 years
Communication system	2792288	1745180		Rescue, evacuation, off-line, and delay for 5min.or above	2 years
Communication system	2792288	1745180		Delay for 5min.or above	2 years
Coupler	Over 2792288	Over 1745180		Rescue, evacuation, off-line, and delay for 5min.or above	2 years
Coupler	Over 2792288	Over 1745180		Delay for 5min.or above	2 years
Truck	2792288	1745180		Rescue, evacuation, off-line, and delay for 5min.or above	2 years
Truck	Over 2792288	Over 1745180		Delay for 5min.or above	2 years
interiors	Over 2792288	Over 1745180		Rescue, evacuation, off-line, and delay for 5min.or above	2 years
interiors	Over 2792288	Over 1745180		Delay for 5min.or above	2 years

Description of Data (e.g. collection process, reliability calculation, raw defect history data, etc.)		
1. Determination during validation period Reliability performance has been evaluated by validating the running miles of the trainset being in service during test period, and the running time has been calculated by the average speed theoretical calculation. In general the early stage failures are not on the scope of this validation period. If there is not special request of start point of the reliability validation, both parts can mutually agree with the period of validation. Normally the validation period will last 12 months, and the trainset will run 120,000km, the entirety trainset fleet will be the target. **2. Failure data collection** During reliability validation, CNR is using the FRACAS system which is developed by CNR CRC and service proven to failures closed-loop management, and issue a report monthly, the recorded information has to include, but not limited the following parameters: Train number, time of failure, accumulative mileage, failure parts and the system they belong to, failure description, failure reason, the impacts on system and service, the measures took immediately, and other relevant date, e.g. weather, route condition, and the detail information the diver who is diving the failure train. **3. Reliability validation calculation and judgment standard for "Accept/Reject"** According to MIL-HDBK-781A, in the range of reliability validation the minimum single side confidence coefficient C is 90%, the risk of user β=1-C=10% timing test plan, it is to execute discussion and analysis with the customer regarding to the occurred failure per month, and to identify the responsibility of the failures.		
Reliability at End of Warranty Period	**Current Reliability**	**Met/Exceed Reliability Requirement in T2.03.03**
Not yet available	Met the contract requirement	Yes

<table>
<tr><td colspan="4" rowspan="3">Project Name: Saudi Arabia Metro</td><td>Contract Year</td><td>2009 – 2010</td></tr>
<tr><td>Notice to Proceed</td><td>4/2009</td></tr>
<tr><td>Closeout</td><td>11/2010</td></tr>
<tr><td colspan="2">Transit Authority/Customer</td><td>Contact</td><td>Email</td><td colspan="2">Phone Number</td></tr>
<tr><td colspan="2">China Railway Construction Corporation Limited</td><td>Wei Bing</td><td>Weibing-zt@163.com.cn</td><td colspan="2">010-68991796</td></tr>
<tr><td>Vehicle Type</td><td>Vehicle Quantity</td><td>Vehicle Weight</td><td>Seating/Standing Capacity</td><td colspan="2">Dimensions (L x W)</td></tr>
<tr><td>A type aluminum alloy vehicle</td><td>17 trainsets</td><td>Tc：37.2t
Mp：37.8t
M：37.66t</td><td>Tc：
AW0：45 passengers
AW1：133 passengers
AW2：244 passengers
AW3：310 passengers
AW4：398 passengers
Mp、M：
AW0：45 passengers
AW1：138 passengers
AW2：254 passengers
AW3：323 passengers
AW4：416 passengers</td><td colspan="2">Tc: 80.02 x 10.14 ft (24,390 x 3,091 mm)
Mp, M: 74.80 x 10.14 ft (22,800 x 3,091mm)</td></tr>
<tr><td colspan="6">List of Major Vendors</td></tr>
<tr><td colspan="2">Propulsion system： Bombardier</td><td colspan="2">Brake system： Knorr-Bremse</td><td>Air conditioning: Guangzhou Cold Huaxu Refrigeration and Air Conditioning Industry Co., Ltd.</td><td>Door: Beijing Bode Traffic Equipment Co., Ltd.</td></tr>
<tr><td colspan="2">Coupler：Voith Turbo Scharfenberg GmbH & Co.</td><td colspan="2">Broadcast: ST Electronics （Shanghai） Co., Ltd.</td><td></td><td></td></tr>
<tr><td colspan="6">Description of Vehicle (e.g. features, existing or new design, etc.)</td></tr>
<tr><td colspan="6">The maximum operating speed is 80km/h. The marshalling form is the long and big one including 8 motor cars and 4 trailer cars (+Tc-Mp-M-M-Mp- M-M- Mp- M-M- Mp-Tc+) ; meet the high-performance, safe and reliable operation in the environment of high temperature of 55°C and a lot of wind and sand; the aluminum alloy load bearing structure as a whole is taken; the carbody structural strength meets the EN 12663 standard; meet the 25km/h collision energy absorbing requirement of EN15227 as a whole; the front anti-creeper is integrated with the energy absorbing crushing tube, playing the roles of anti-creep and energy absorption in the collision of the vehicles; the modularized design is taken to keep the symmetrical layout of B-end and A-end and B-side and A-side of the vehicle and improve the interchangeability; the unit platform and pantograph unit are separately set; the head framework is connected with the car body with bolts, facilitating maintenance and repair after an accident occurs; the bogie with the axle load of 17 tons is taken; the wind and sand resistant, wearing and ultraviolet resistance paint is taken; the electric traction system is the VVVF-controlled AC transmission system and the electric brakes combines the regenerative brake and brake resistance. The brake system is the microcomputer-controlled straight electro-pneumatic brake and the foundation brake is the wheel disc brake.</td></tr>
<tr><td colspan="6">Description of CNR CRC's Design Responsibilities (e.g. total vehicle, carbody and systems, carbody only, system only, etc.)</td></tr>
<tr><td colspan="6">It is responsible for the design and system integration of the whole vehicle. The carbody steel structure and bogies are completely independently designed and manufactured. Some main systems of traction, brake and couplers, etc. are integrated.</td></tr>
<tr><td colspan="6">Description How Project is related to this MBTA Project (e.g. duty cycle, climate, etc.)</td></tr>
<tr><td colspan="6">Load bearing as a whole; the collision energy absorption of the whole vehicle is taken into account.</td></tr>
</table>

System	Mean Distance Between Failure (MDBF)		Mean Time Between Failure (MTBF)	Definition of Failure	Warranty Period(s)
	km	Miles			
Vehicle	Over 841011	Over 525632	Over 24029	Rescue, MTBF=25000h.	3 years
Vehicle	841011	525632	24029	Delay for 5min.or above, MTBF-2850h or MDBF=100000km.	3 years
Propulsion system	Over 841011	Over 525632	Over 24029	Rescue	3 years
Propulsion system	Over 841011	Over 525632	Over 24029	Delay for 5min.or above	3 years
Auxiliary power supply system	Over 841011	Over 525632	Over 24029	Rescue	3 years
Auxiliary power supply system	841011	525632	24029	Delay for 5min.or above	3 years
Network	Over 841011	Over 525632	Over 24029	Rescue	3 years
Network	Over 841011	Over 525632	Over 24029	Delay for 5min.or above	3 years
Brake system	Over 841011	Over 525632	Over 24029	Rescue	3 years
Brake system	Over 841011	Over 525632	Over 24029	Delay for 5min.or above	3 years
Door system	Over 841011	Over 525632	Over 24029	Rescue	3 years
Door system	Over 841011	Over 525632	Over 24029	Delay for 5min.or above	3 years
AC system	Over 841011	Over 525632	Over 24029	Rescue	3 years
AC system	Over 841011	Over 525632	Over 24029	Delay for 5min.or above	3 years
Communication system	Over 841011	Over 525632	Over 24029	Rescue	3 years
Communication system	Over 841011	Over 525632	Over 24029	Delay for 5min.or above	3 years
Coupler	Over 841011	Over 525632	Over 24029	Rescue	3 years
Coupler	Over 841011	Over 525632	Over 24029	Delay for 5min.or above	3 years
Truck	Over 841011	Over 525632	Over 24029	Rescue	3 years
Truck	Over 841011	Over 525632	Over 24029	Delay for 5min.or above	3 years
interiors	Over 841011	Over 525632	Over 24029	Rescue	3 years
interiors	Over 841011	Over 525632	Over 24029	Delay for 5min.or above	3 years

Description of Data (e.g. collection process, reliability calculation, raw defect history data, etc.)

1. **Determination during validation period**

Reliability performance has been evaluated by validating the running miles of the trainset being in service during test period, and the running time has been calculated by the average speed theoretical calculation. In general the early stage failures are not on the scope of this validation period. If there is not special request of start point of the reliability validation, both parts can mutually agree with the period of validation. Normally the validation period will last 12 months, and the trainset will run 120,000km, the entirety trainset fleet will be the target.

2. **Failure data collection**

During reliability validation, CNR is using the FRACAS system which is developed by CNR CRC and service proven to failures closed-loop management, and issue a report monthly, the recorded information has to include, but not limited the following parameters: Train number, time of failure, accumulative mileage, failure parts and the system they belong to, failure description, failure reason, the impacts on system and service, the measures took immediately, and other relevant date, e.g. weather, route condition, and the detail information the diver who is diving the failure train.

3. **Reliability validation calculation and judgment standard for "Accept/Reject"**

According to MIL-HDBK-781A, in the range of reliability validation the minimum single side confidence coefficient C is 90%, the risk of user β =1-C=10% timing test plan,it is to execute discussion and analysis with the customer regarding to the occurred failure per month, and to identify the responsibility of the failures.

Reliability at End of Warranty Period	Current Reliability	Met/Exceed Reliability Requirement in T2.03.03
1. No failure demanding rescure 2. One delay over 5min., MDBF is over 841011km	Met the contract requirement	Yes

Project Name: Hong Kong Metro West Island Line				Contract Year	2008 – 2012
				Notice to Proceed	7/2008
				Closeout	8/2012
Transit Authority/Customer		**Contact**	**Email**	**Phone Number**	
MTR Corporation		Zheng Jianwei	Zhengweijian@163.com.cn	13756132458	
Vehicle Type	**Vehicle Quantity**	**Vehicle Weight**	**Seating/Standing Capacity**	**Dimensions (L x W)**	
A type Stainless Steel vehicle	15 trainsets	Tc：39t Mp1：42.5t Mp2：42.5t M1：42.5t M2：42t	M1 zero load M2 average load of the train, 200 passengers each M3 no application M4 full load of the train, 312 passengers each M5 overload of the train, 450 passengers each	Tc: 77.99 x 10.24 ft (23,770 x 3,120 mm) Mp: 74.08 x 10.24 ft (22,580 x 3,120 mm) M: 74.34 x 10.24 ft (22,660 x 3,120 mm)	

List of Major Vendors

Propulsion system：Mitsubishi Electric Corporation	Brake systerm: Knorr-Bremse	Air conditioning: Sigma Coachair Group Pty Ltd. UI CO	Door: Qingdao Sifang Faiveley Rail Brake Co.Ltd.
Coupler：Faiveley Transport Witten GmbH	Broadcast: ST Electronics （Shanghai） Co., Ltd.		

Description of Vehicle (e.g. features, existing or new design, etc.)

The maximum operating speed is 80km/h. The marshalling form is 6 motor cars and 2 trailer cars (+Tc—MP2—M2=M1—MP1=M2—MP2—Tc+); the stainless steel load bearing structure as a whole is taken; the carbody surface is paint-free; the carbody strength meets EN12663 P II ; the front end is set with the anti-creeper, playing the roles of anti-creep and energy absorption in the collision of the vehicles. The interior decoration of the vehicle is designed to be simple, beautiful and top-grade and the interior decoration of the vehicle takes the stainless steel sand-blast surface seats, including the phenol aldehyde side wall, honeycomb ceiling, GRP lampshade, stainless steel embossed handrail and integrated gangway side wall board, meeting the fire protection standard of BS6853 1A. The train is marshaled with 8 cars, divided into 3 units. After the train is de-marshalled, 3 units can be separately controlled and operated. The electric traction system is the VVVF-controlled AC transmission system and the electric brakes combines the regenerative brake and brake resistance. The air brake of the train takes the simulated electro-pneumatic brake system and the foundation brake is the wheel disc brake.

Description of CNR CRC's Design Responsibilities (e.g. total vehicle, carbody and systems, carbody only, system only, etc.)

It is responsible for the design and system integration of the whole vehicle. The carbody steel structure and bogies are completely independently designed and manufactured. Some main systems of traction, brake and couplers, etc. are integrated.

Description How Project is related to this MBTA Project (e.g. duty cycle, climate, etc.)

Stainless steel load bearing as a whole; the collision energy absorption of the whole vehicle is taken into account.

System	Mean Distance Between Failure (MDBF)		Mean Time Between Failure (MTBF)	Definition of Failure	Warranty Period(s)
	km	Miles			
Vehicle	24199	15124		Accidents: All failure events (Rescure, evacuation, changing train at terminal, train not to depart, and delay for 2min. or above)	6 years

				Target: 6 pcs per million km./train, i.e.MDBF=20833km	
Vehicle	394093	246308		Delay for 2min. or above Target: 1.82 pcs per million km./train, i.e.MDBF=68681km	6 years
Vehicle	1379326	862079		Delay for 5min. or above Target: 0.4 pce per million km./train, i.e.MDBF=312500km	6 years
Propulsion system	689663	431039		Accidents: All failure events (Rescure, evacuation, changing train at terminal, train not to depart, and delay for 2min. or above)	6 years
Propulsion system	Over 2758652	Over 1724158		Delay for 2min. or above	6 years
Propulsion system	Over 2758652	Over 1724158		Delay for 5min. or above	6 years
Auxiliary power supply system	551730	344832		Accidents: All failure events (Rescure, evacuation, changing train at terminal, train not to depart, and delay for 2min. or above)	6 years
Auxiliary power supply system	2758652	1724158		Delay for 2min. or above	6 years
Auxiliary power supply system	Over 2758652	Over 1724158		Delay for 5min. or above	6 years
Network	1379326	862079		Accidents: All failure events (Rescure, evacuation, changing train at terminal, train not to depart, and delay for 2min. or above)	6 years
Network	Over 2758652	Over 1724158		Delay for 2min. or above	6 years
Network	Over 2758652	Over 1724158		Delay for 5min. or above	6 years
Brake system	212204	132628		Accidents: All failure events (Rescure, evacuation, changing train at terminal, train not to depart, and delay for 2min. or above)	6 years
Brake system	Over 2758652	Over 1724158		Delay for 2min. or above	6 years
Brake system	Over 2758652	Over 1724158		Delay for 5min. or above	6 years

Door system	137933	86208		Accidents: All failure events (Rescure, evacuation, changing train at terminal, train not to depart, and delay for 2min. or above)	6 years
Door system	551730	344832		Delay for 2min. or above	6 years
Door system	Over 2758652	Over 1724158		Delay for 5min. or above	6 years
AC system	919551	574719		Accidents: All failure events (Rescure, evacuation, changing train at terminal, train not to depart, and delay for 2min. or above)	6 years
AC system	Over 2758652	Over 1724158		Delay for 2min. or above	6 years
AC system	Over 2758652	Over 1724158		Delay for 5min. or above	6 years
Communication system	131364	82103		Accidents: All failure events (Rescure, evacuation, changing train at terminal, train not to depart, and delay for 2min. or above)	6 years
Communication system	Over 2758652	Over 1724158		Delay for 2min. or above	6 years
Communication system	Over 2758652	Over 1724158		Delay for 5min. or above	6 years
Coupler	Over 2758652	Over 1724158		Accidents: All failure events (Rescure, evacuation, changing train at terminal, train not to depart, and delay for 2min. or above)	6 years
Coupler	2758652	1724158		Delay for 2min. or above	6 years
Coupler	Over 2758652	Over 1724158		Delay for 5min. or above	6 years
Truck	2758652	1724158		Accidents: All failure events (Rescure, evacuation, changing train at terminal, train not to depart, and delay for 2min. or above)	6 years
Truck	Over 2758652	Over 1724158		Delay for 2min. or above	6 years
Truck	Over 2758652	Over 1724158		Delay for 5min. or above	6 years
interiors	459775	287360		Accidents: All failure events (Rescure, evacuation, changing train at terminal, train not to depart, and delay for 2min. or above)	6 years

interiors	Over 2758652	Over 1724158		Delay for 2min. or above	6 years
interiors	Over 2758652	Over 1724158		Delay for 5min. or above	6 years

Description of Data (e.g. collection process, reliability calculation, raw defect history data, etc.)

1. **Determination during validation period**

Reliability performance has been evaluated by validating the running miles of the trainset being in service during test period, and the running time has been calculated by the average speed theoretical calculation. In general the early stage failures are not on the scope of this validation period. If there is not special request of start point of the reliability validation, both parts can mutually agree with the period of validation. Normally the validation period will last 12 months, and the trainset will run 120,000km, the entirety trainset fleet will be the target.

2. **Failure data collection**

During reliability validation, CNR is using the FRACAS system which is developed by CNR CRC and service proven to failures closed-loop management, and issue a report monthly, the recorded information has to include, but not limited the following parameters: Train number, time of failure, accumulative mileage, failure parts and the system they belong to, failure description, failure reason, the impacts on system and service, the measures took immediately, and other relevant date, e.g. weather, route condition, and the detail information the diver who is diving the failure train.

3. **Reliability validation calculation and judgment standard for "Accept/Reject"**

According to MIL-HDBK-781A, in the range of reliability validation the minimum single side confidence coefficient C is 90%, the risk of user β=1-C=10% timing test plan, it is to execute discussion and analysis with the customer regarding to the occurred failure per month, and to identify the responsibility of the failures.

Reliability at End of Warranty Period	Current Reliability	Met/Exceed Reliability Requirement in T2.03.03
Not yet available	Met the contract requirement	Yes

Project Name: Bangkok BTS Metro Project				Contract Year	2007 – 2011
				Notice to Proceed	9/2007
				Closeout	11/2011
Transit Authority/Customer		**Contact**	**Email**	**Phone Number**	
Bargkok Mass Transit Sysrem Public Company Limitedl(BTSC)		Mr.Jarubodee	www.bls.co.th	(662)6177300	
Vehicle Type	**Vehicle Quantity**	**Vehicle Weight**	**Seating/Standing Capacity**	**Dimensions (L x W)**	
A type stainless steel vehicle	48 cars	Tc: 35.5t M: 37.6t	Tc: AW1 : 42 passengers AW2 : 161 passengers AW3 : 320 passengers M1, M2: AW1 : 42 passengers AW2 : 170 passengers AW3 : 341 passengers	Tc: 67.22 x 10.24 ft (20,490 x 3,120 mm) M1, M2: 74.08 x 10.24 ft (20,580 x 3,120 mm)	

List of Major Vendors

Propulsion system: Bombardier	Brake system: Knorr-Bremse	Air conditioning: Shanghai Faiveley Railway Technology Co. ltd	Door: Qingdao Sifang Faiveley Rail Brake Co., Ltd.
Coupler: Voith Turbo Scharfenberg GmbH & Co.	Broadcast: ST Electronics （Shanghai） Co., Ltd.		

Description of Vehicle (e.g. features, existing or new design, etc.)

The maximum operating speed is 80km/h. The marshalling form is 2 motor cars and 2 trailer cars (=Tc-M-M-Tc=); the stainless steel load bearing structure as a whole is taken; the carbody surface is painted; meet the energy absorption requirement that a 6-car train collides in AW0 with a static train in AW0 ; the front end and the end of the vehicle are set with the anti-creepers; the modularized design is taken to keep the symmetrical layout of B-end and A-end and B-side and A-side of the vehicle and improve interchangeability; the brand-new side sliding escape door and extroversion no-shelter emergency evacuation stair is taken; the high-voltage current collection is from the lower part of the three-rail, DC750V. The electric traction system is the VVVF-controlled AC transmission system and the electric brakes combines the regenerative brake and brake resistance. In addition, the vehicle is equipped with the battery traction function. It can be operated for 300m at maximum. The brake system is the microcomputer-controlled straight electro-pneumatic brake and the foundation brake is the wheel disc brake.

Description of CNR CRC's Design Responsibilities (e.g. total vehicle, carbody and systems, carbody only, system only, etc.)

It is responsible for the design and system integration of the whole vehicle. The carbody steel structure is completely independently designed and manufactured. Some main systems of traction, brake and couplers, etc. are integrated.

Description How Project is related to this MBTA Project (e.g. duty cycle, climate, etc.)

Load bearing as a whole; the collision energy absorption of the whole vehicle is taken into account.

System	Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Definition of Failure	Warranty Period(s)

	km	Miles			
Vehicle	4742924	2964328		Rescue， 0.1 pce per million km./train, i.e. ：MDBF=2500000km	2 years
Vehicle	296433	185270		Evacuated nearby， 1pce per million km./train, i.e. ：MDBF=250000km	2 years
Vehicle	175664	109790		Delay over 5min.， 3.3 pcs per million km./train, i.e. ：MDBF=76000km	2 years
Vehicle	278996	174372		Train not departured over 5min.， 10pce per million km./train, i.e. ：MDBF=2500	2 years
Propulsion system	Over 4742924	Over 2964328		Rescue	2 years
Propulsion system	1580975	988109		Evacuated nearby	2 years
Propulsion system	790487	494055		Delay over 5min.	2 years
Propulsion system	1580975	988109		Train not departured over 5min.	2 years
Auxiliary power supply system	4742924	2964328		Rescue	2 years
Auxiliary power supply system	2371462	1482164		Evacuated nearby	2 years
Auxiliary power supply system	2371462	1482164		Delay over 5min.	2 years
Auxiliary power supply system	4742924	2964328		Train not departured over 5min.	2 years
Network	Over 4742924	Over 2964328		Rescue	2 years
Network	4742924	2964328		Evacuated nearby	2 years
Network	4742924	2964328		Delay over 5min.	2 years
Network	Over 4742924	Over 2964328		Train not departured over 5min.	2 years
Brake system	Over 4742924	Over 2964328		Rescue	2 years
Brake system	4742924	2964328		Evacuated nearby	2 years
Brake system	4742924	2964328		Delay over 5min.	2 years
Brake system	4742924	2964328		Train not departured over 5min.	2 years
Door system	Over 4742924	Over 2964328		Rescue	2 years

Door system	2371462	1482164		Evacuated nearby	2 years
Door system	948585	592866		Delay over 5min.	2 years
Door system	2371462	1482164		Train not departured over 5min.	2 years
AC system	Over 4742924	Over 2964328		Rescue	2 years
AC system	4742924	2964328		Evacuated nearby	2 years
AC system	4742924	2964328		Delay over 5min.	2 years
AC system	790487	494055		Train not departured over 5min.	2 years
Communication system	Over 4742924	Over 2964328		Rescue	2 years
Communication system	Over 4742924	Over 2964328		Evacuated nearby	2 years
Communication system	Over 4742924	Over 2964328		Delay over 5min.	2 years
Communication system	Over 4742924	Over 2964328		Train not departured over 5min.	2 years
Coupler	Over 4742924	Over 2964328		Rescue	2 years
Coupler	Over 4742924	Over 2964328		Evacuated nearby	2 years
Coupler	Over 4742924	Over 2964328		Delay over 5min.	2 years
Coupler	4742924	2964328		Train not departured over 5min.	2 years
Truck	Over 4742924	Over 2964328		Rescue	2 years
Truck	Over 4742924	Over 2964328		Evacuated nearby	2 years
Truck	Over 4742924	Over 2964328		Delay over 5min.	2 years
Truck	Over 4742924	Over 2964328		Train not departured over 5min.	2 years
interiors	Over 4742924	Over 2964328		Rescue	2 years
interiors	Over 4742924	Over 2964328		Evacuated nearby	2 years
interiors	4742924	2964328		Delay over 5min.	2 years
interiors	4742924	2964328		Train not departured over 5min.	2 years

APS	Over 4742924	Over 2964328		Rescue	2 years
APS	592866	370541		Evacuated nearby	2 years
APS	592866	370541		Delay over 5min.	2 years
APS	2371462	1482164		Train not departure over 5min.	2 years

Description of Data (e.g. collection process, reliability calculation, raw defect history data, etc.)

1. Determination during validation period

Reliability performance has been evaluated by validating the running miles of the trainset being in service during test period, and the running time has been calculated by the average speed theoretical calculation. In general the early stage failures are not on the scope of this validation period. If there is not special request of start point of the reliability validation, both parts can mutually agree with the period of validation. Normally the validation period will last 12 months, and the trainset will run 120,000km, the entirety trainset fleet will be the target.

2. Failure data collection

During reliability validation, CNR is using the FRACAS system which is developed by CNR CRC and service proven to failures closed-loop management, and issue a report monthly, the recorded information has to include, but not limited the following parameters: Train number, time of failure, accumulative mileage, failure parts and the system they belong to, failure description, failure reason, the impacts on system and service, the measures took immediately, and other relevant date, e.g. weather, route condition, and the detail information the diver who is diving the failure train.

3. Reliability validation calculation and judgment standard for "Accept/Reject"

According to MIL-HDBK-781A, in the range of reliability validation the minimum single side confidence coefficient C is 90%, the risk of user β=1-C=10% timing test plan, it is to execute discussion and analysis with the customer regarding to the occurred failure per month, and to identify the responsibility of the failures.

Reliability at End of Warranty Period	Current Reliability	Met/Exceed Reliability Requirement in T2.03.03
Not yet available	Met the contract requirement	Yes

3.3 OFFEROR AND MAJOR SUBCONTRACTORS PAST PERFORMANCE

Below is the RFP requirement for the offeror and major subcontractors past performances:

Tab I.3 (b) Offeror and Major Subcontractors Past Performance
List (in a matrix format) the service proven reliability of each proposed major subcontractor for all comparable programs and service environment as described in Technical Specification Section 2 over the past ten (10) years. Past ten (10) years shall include all contracts that were active at any time during this period. Major systems and/or subsystems shall, at a minimum, include those identified in T2.03.03. Cited reliability data shall be for major systems and/subsystems which are fundamentally identical to that being proposed for this contract. Should the proposed system and/or subsystem be newly developed for this program, the Offeror shall provide reliability data for the most recent, technological predecessor to that which is being proposed. The proposed major systems and/or subsystems and their suppliers shall be those that the Offeror shall use, should they be successful. For each entry, the Offeror shall include: • *Reliability data provided shall be limited to those previous programs where a fundamentally identical system and/or subsystem has met or exceeded the reliability goals requirements of T2.03.03.* • *Include the contractual reliability requirements (MDBF, MTBF, definition of failures, warranty period(s), etc.)* • *A description of the data collection process, the method of reliability calculation and sample of the raw defect history data* • *Actual reliability achieved at the end of the warranty period* • *Actual reliability currently being realized, if data is available* • *A formal letter of concurrence from the listed customers for each listed project* • *A current customer contact information for verification*

CNR has requested the past performance data of their suppliers as part of this proposal RFP requirement. The information that has been gathered is all the data that the suppliers were able, or prepared, to supply. If data is shown as “unavailable”, the suppliers themselves were not able to provide or find the information for CNR as required by the proposal RFP. CNR remains committed to delivering a product with, at a minimum, the expected reliability of the MBTA. Further CNR is prepared to track reliability data for the benefit of MBTA and future customers.

Tab I.3(b) –Service Proven Reliability of Proposed Major Subcontractor

Project Name	Contract Year	Transit Authority	Customer Information: Contact Name	Customer Information: Email	Customer Information: Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Contractual Reliability Requirement: Mean Time Between Failure (MTBF)	Contractual Reliability Requirement: Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
COUPLER & DRAFT GEAR													
Wabtec: Coupler													
NYCT R142	1998-2005	NYCT	M. Wetherall Mr. G. Sansone	Mike.wehterall@nyct.com	718-694-4460 717-694-4484	1,000,000 miles	MDBCF 3,000,000 miles MDBF 6,000,000 miles	Not Req'd	3 Yrs.	Causing Train Delays or Removal from Service	**Data Gathering**: Vapor receives failure information from the Vapor field service team, the Vapor material and return process, and directly from the Carbuilder or Customer. Vapor receives the car fleet information regarding the number of cars in service and the mileage run from the Carbuilder. Vapor receives the initial relevant failures assigned by the Carbuilder. Relevant information is recorded into an electronic form which is compatible with the RAMS database. **Data Analysis**: This information is reviewed and categorized by a reliability engineer. The reliability engineer will cross check the in service failure information with the internal repair information. The failures and repairs are categorized in the FRACAS RAMS database. The Carbuilder relevant failures are reviewed and either accepted as part of the Vapor door scope or assigned a categorization of Carbuilder responsibility or of passenger responsibility. The failures are then reviewed with the Carbuilder's reliability engineer for data consolidation and confirmation. A review of the data over time will typically yield a door system reliability performance curve and a Vapor responsibility reliability performance curve. These	MDBF 14,320,000 miles	Data Unavailable
NYCT R142A/R142S	1999-2005	NYCT	M. Wetherall Mr. G. Sansone	Mike.wehterall@nyct.com	718-694-4460 717-694-4484	1,000,000 miles	MDBF 6,000,000 miles	Not Req'd	3 Yrs.	Causing Train Delays or Removal from Service		MDBF 26,959,000 miles	Data Unavailable
NYCT R143	2001-2005	NYCT	M. Wetherall Mr. G. Sansone	Mike.wehterall@nyct.com	718-694-4460 717-694-4484	1,000,000 miles	MDBF 6,000,000 miles	Not Req'd	3 Yrs.	Causing Train Delays or Removal from Service		MDBF 9,064,000 miles	Data Unavailable
NYCT R160	2003	NYCT	M. Wetherall	Mike.wehterall@nyct.com	718-694-4460	Unavail.	Unavail.	Unavail.	2 Yrs.	Not Disclosed		MDBSCF 3,048,780 miles MDBF 38,461,545 miles	Data Unavailable
MBTA #5 Blue Line		MBTA	S. Adkins	sadkins@mbta.com	617-293-4635	Unavail.	Unavail.	Unavail.	2 Yrs.	Not Disclosed		Unavail.	Data Unavailable
PATH PA5	2009	PATH	D. Dreisbach	ddreisbach@panynj.gov	973-350-2854	Unavail.	Unavail.	Unavail.	2 Yrs.	Not Disclosed		MDBF 1,727,116 miles (A-Car) MDBF 1,149,425 miles (C-Car)	Data Unavailable

Project Name	Contract Year	Transit Authority	Customer Information: Contact Name	Email	Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
											performance curves are compared to the Contractual reliability requirement. If the reliability is below the Contractual reliability requirement, trends are analyzed and areas of improvement are identified to the Vapor project team for improvement resolution and communication to the customer.		
PASSENGER DOORS & CONTROLS													
Faiveley: Door Systems, Door Open Pushbuttons interior/exterior													
Montreal MPM 10	2014	Montreal STM	Bev Olson	bev.olson@ca.transport.bombardier.com	807-473-3407	Not Disclosed	240,000 miles	Not Req'd	Unavail.	Electronic door control, Wiring chain assembly, Tooth belt, Sensitive edge cell assembly, Lock out device failure	Description not provided	Data Unavailable	Data Unavailable
Maryland Multi-level	2014	Maryland MTA	Kari Rasco	kari.rasco@us.transpot.bombardier.com	518-566-5218	Not Disclosed	165,000 miles	Not Req'd	Unavail.		Description not provided	Data Unavailable	Data Unavailable
NJT Multi-level (Option 2)	2013	NJT	Tom Rutkowski		201-955-5900	Not Disclosed	165,000 miles	190,000 hrs.	Unavail.		Description not provided	Data Unavailable	Data Unavailable
SEPTA SL V	2011	SEPTA	Dan J Gibbone	dgibbone@septa.org	215-580-8030	Not Disclosed	65,000 miles	Not Req'd	Unavail.		Description not provided	Data Unavailable	Data Unavailable
AMT Multi-level	2009	AMT	Louis Szabo	lszabo@amt.qc.ca	514-287-2464	Not Disclosed	170,000 miles	205,000 hrs.	Unavail.		Description not provided	Data Unavailable	Data Unavailable
NJT Multi-level (Option 1)	2008	NJT	Tom Rutkowski		201-955-5900	Not Disclosed	165,000 miles	190,000 hrs.	Unavail.		Description not provided	Data Unavailable	Data Unavailable
LACMTA P2550	2007	LACMTA	Not Disclosed			Not Disclosed	Unavail	Unavail.	Unavail.		Description not provided	Data Unavailable	Data Unavailable
DFW	2005	DART	Not Disclosed			Not Disclosed	Unavail	Unavail.	Unavail.		Description not provided	Data Unavailable	Data Unavailable
NJT Multi-level (Base)	2004		Tom Rutkowski		201-955-5900	Not Disclosed	165,000 miles	190,000 hrs.	Unavail.		Description not provided	Data Unavailable	Data Unavailable

Project Name	Contract Year	Transit Authority	Customer Information			Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement			Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
			Contact Name	Email	Phone Number		Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)				
NJT													
NJT Comet V 2001 NJT			Tom Rutkowski 201-955-5900			Not Disclosed	125,000 miles	160,000 hrs.	Unavail.		Description not provided	Data Unavailable	Data Unavailable
SEPTA M4 2000 SEPTA			Dan J Gibbone dgibbone@septa.org 215-580-8030			Not Disclosed	42,000 miles	100,000 hrs.	Unavail.		Description not provided	Data Unavailable	Data Unavailable
WMATA 3K, 4K, 5K 1983-1995 WMATA			Tim Bach tbach@wmata.com 2029621157			Not Disclosed	165,000 miles	195,000 hrs.	Unavail.		Description not provided	Data Unavailable	Data Unavailable
Wabtec: Door Systems, Door Open Pushbuttons interior/exterior, Gap Mitigation Device													
NYCT R142 1999 NYCT			Bruce Alexander 718 694-4485			Not Disclosed	MDBSCF 60,000 miles MDBF 320,000 miles	Not Req'd	2 Yrs.	Improper operation, maintenance, or testing of the item as a result of contractor supplied documentation or other contractor failure to meet its contractual obligations. Software failures which manifest themselves in an equipment failure or in an indication failure, resulting in loss of function of an item in accordance with the	<u>**Data Gathering**</u>: Vapor receives failure information from the Vapor field service team, the Vapor material and return process, and directly from the Carbuilder or Customer. Vapor receives the car fleet information regarding the number of cars in service and the mileage run from the Carbuilder. Vapor receives the initial relevant failures assigned by the Carbuilder. Relevant information is recorded into an electronic form which is compatible with the RAMS database. <u>**Data Analysis**</u>: This information is reviewed and categorized by a reliability engineer. The reliability engineer will cross check the in service failure information with the internal repair information. The failures and repairs are categorized in the FRACAS RAMS database. The Carbuilder relevant failures are reviewed and either accepted as part of the Vapor door scope or assigned a categorization of Carbuilder responsibility or of passenger responsibility. The failures are then	MDBF 2,500,000 miles	at end of warranty
NYCT R142A / R142S 1999 NYCT			Bruce Alexander 718 694-4485			Not Disclosed	MDBSCF 60,000 miles MDBF 320,000 miles	Not Req'd	2 Yrs.			MDBF 1,200,000 miles	at end of warranty
NYCT R143 2001 NYCT			Bruce Alexander 718 694-4485			Not Disclosed	MDBSCF 45,000 miles MDBF 240,000 miles	Not Req'd	2 Yrs.			MDBF 675,000 miles	at end of warranty
NYCT R160 2003 NYCT			Bruce Alexander 718 694-4485			Not Disclosed	MDBSCF 45,000 miles MDBF 100,000 miles	Not Req'd	2 Yrs.			not at end of warranty	MDBSCF 180,328 miles

Project Name	Contract Year	Transit Authority	Customer Information: Contact Name	Email	Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
LIRR M-7 2000 NYCT			John Gariti 718 558-4877			Not Disclosed	MDBCF 140,000 miles MDBSF 2,000,000 miles MDBF 4,000,000 miles	Not Req'd	2 Yrs.	specification. Pattern failures that have been so identified by the Failure Review Board (FRB).	reviewed with the Carbuilder's reliability engineer for data consolidation and confirmation. A review of the data over time will typically yield a door system reliability performance curve and a Vapor responsibility reliability performance curve. These performance curves are compared to the Contractual reliability requirement. If the reliability is below the Contractual reliability requirement, trends are analyzed and areas of improvement are identified to the Vapor project team for improvement resolution and communication to the customer.	MDBCF 180,400 miles	at end of warranty
PATH 2008 PATH			Mark Barberash 973 350-2854			Not Disclosed	MDBSC F 60,000 miles	Not Req'd	2 Yrs.			not at end of warranty	MDBSCF 131,163 miles
CTA 5000 2010 CTA			Robert Kielba 847 982-5164			Not Disclosed	Unavail	Unavail.	2 Yrs.			not at end of warranty	MMBCF 60,879 miles
MNR M-8 MNR			Amir Rahimi 212 499-4408			Not Disclosed	MDBCF 140,000 miles MDBSF 2,000,000 miles MDBF 4,000,000 miles	Not Req'd	2 Yrs.			not at end of warranty	MDBCF 158,640 miles MDBSF 2,419,267 miles MDBF 9,677,067 miles
HEATING, VENTILATION & AIR CONDITIONING													
Faiveley: HVAC													
DMRC-RS2 2007-2008 Delhi Metro			Karoly Surgay karoly.csurgay@ch.transport. bombardier.com			Not Disclosed	1,250,000 miles	26,785,714 hrs.	3 Yrs.	Train withdrawal Departure failure Service delay >3mins	Data solicitation from customer, field service engineers etc entered through Failure database	>6,429,936 miles	>6,429,936 miles
MELCO: HVAC													
MNR M-8 2008-2014 Metro North Railroad			Dan Alcantara (914) 376-4700			Not Disclosed	MDBCF 200,000 miles	Unavail.	2017	Component Failure	Official Information from Car-builder	not at end of warranty	MDBCF 358,410 miles

Project Name	Contract Year	Transit Authority	Customer Information			Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement			Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
			Contact Name	Email	Phone Number		Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)				
NJT Multilevel 2008-2009 New Jersey Transit			Kari Rasco (516) 566-5218			Not Disclosed	MBDF 320,000 miles	Not Req'd	2015		Official Information from Car-builder	MDBF 415,901 miles	MDBF 415,901 miles
AMT Multilevel 2009-2011 AMT			Jonathan Gobeil (514) 402-8167			Not Disclosed	MBDF 320,000 miles	Unavail.	2015		Description not provided	not at end of warranty	Unavail.
NYCT R188 2011-2013 NYCT			Yasutoshi Hinada (914) 376-4700, x.4368			Not Disclosed	MDBCF 100,000 miles	Unavail.	2015		Description not provided	not at end of warranty	Data Unavailable
NJT Multilevel 2 2012-2014 NJT			Kari Rasco (516) 566-5218			Not Disclosed	MBDF 320,000 miles	Unavail.	2015		Description not provided	not at end of warranty	Data Unavailable
Maryland Multilevel 2013-2014 Maryland MTA			Kari Rasco (516) 566-5218			Not Disclosed	MBDF 250,000 miles	Unavail.	2016		Description not provided	not at end of warranty	Data Unavailable
LIGHTING													
LECIP: Lighting													
Caltrans 2011 Caltrans			Gerald Fuller Gerald_fuller@dot.ca.gov (916)335-2237			MDBCF > 1,000,000 miles	890,000 miles	500,000 hrs.	2 Yrs.	Light turn off	Description not provided	No Recall	Data Unavailable
SEPTA 2011 SEPTA			Gerald Moore gmoore@septa.org (215)580-8355			MDBCF > 1,000,000 miles	500,000 miles	500,000 hrs.	2 Yrs.	Light turn off	Description not provided	No Recall	Data Unavailable
Amtrak 2011 Amtrak			George Moore moorege@Amtrak.com (215)349-4944			MDBCF > 1,000,000 miles	890,000 miles	500,000 hrs.	2 Yrs.	Light turn off	Description not provided	No Recall	Data Unavailable
JR East 2010 JR East			Masayasu Suemune masayasu.suemune@mb.lecip.co.jp 03-3971-0106			MDBCF > 1,000,000 miles	Unavail.	Unavail.	2 Yrs.	Light turn off	Description not provided	No Recall	Data Unavailable
JR East 2012 JR East			Masayasu Suemune masayasu.suemune@mb.lecip.co.jp 03-3971-0106			MDBCF > 1,000,000 miles	Unavail.	Unavail.	2 Yrs.	Light turn off	Description not provided	No Recall	Data Unavailable
Hankyu Railways 2010 Hankyu Railways			Hidekatsu Koizumi Hidekatsu.koizumi@mb.lecip.co.jp 06-6881-4685			MDBCF > 1,000,000 miles	Unavail.	Unavail.	2 Yrs.	Light turn off	Description not provided	2 Recalls	Data Unavailable

Project Name	Contract Year	Transit Authority	Customer Information: Contact Name	Customer Information: Email	Customer Information: Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Contractual Reliability Requirement: Mean Time Between Failure (MTBF)	Contractual Reliability Requirement: Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
Mitsubishi Heavy Industries	2012	Mitsubishi Heavy Industries	Hidekatsu Koizumi	Hidekatsu.koizumi@mb.lecip.co.jp	06-6881-4685	MDBCF > 1,000,000 miles	Unavail.	Unavail.	2 Yrs.	Light turn off	Description not provided	No Recall	Data Unavailable
J-TREC	2012	J-TREC	Masayasu Suemune	masayasu.suemune@mb.lecip.co.jp	03-3971-0106	MDBCF > 1,000,000 miles	Unavail.	Unavail.	2 Yrs.	Light turn off	Description not provided	1 Recall	Data Unavailable
JR Kyushu	2011	JR Kyushu	Hidekatsu Koizumi	Hidekatsu.koizumi@mb.lecip.co.jp	06-6881-4685	MDBCF > 1,000,000 miles	Unavail.	Unavail.	2 Yrs.	Light turn off	Description not provided	1 Recall	Data Unavailable
JR Central	2012	JR Central	Misato Handa	misato.handa@mb.lecip.co.jp	058-323-6183	MDBCF > 1,000,000 miles	Unavail.	Unavail.	2 Yrs.	Light turn off	Description not provided	No Recall	Data Unavailable
TDG: Lighting													
Metrolinx	2014	Go Transit	David Allen	dallen@tdgdesign.com	416-274-6716	None – system not in service yet.	MDBCF ≥ 2,000,000 miles	MTBF ≥ 58,824 hrs.	2 Yrs.	Single component failure. Failure analysis within 30 days. Reliability demonstration program	TDG records data when a field failure is reported to TDG. Use failure data of product with similar circuitry to determine MTBF. Apply MTBF value to specific system with specific instances of the core circuitry. No failures on similar circuitry to date.	No data, warranty period not reached.	Data Unavailable
King Abdullah Financial District Monorail Project	2012	King Abdullah Financial District Monorail	David Allen	dallen@tdgdesign.com	416-274-6716	No failures. MTBF calculated at 7,884,000 hours to date.	MDBF ≥ 2,500,000 miles	MTBF ≥ 200,000 hrs.	2 Yrs.	Failure which reduces light intensity below minimum. MTTR ≤ 0.5 hours Failure analysis as required.		No failures to date.	No failures to date.
ART MK III Platform	2011	NJT	David Allen	dallen@tdgdesign.com	416-274-6716	No failures. MTBF calculated at 3,431,000 hours to date.	MDBF ≥ 4,500,000 miles	MTBF ≥ 200,000 hrs.	2 Yrs.			No failures to date.	No failures to date.
POWER DISTRIBUTION & AUXILIARY ELECTRICAL EQUIPMENT													
Saft America Inc.: Battery													

Project Name	Contract Year	Transit Authority	Customer Information			Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement			Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
			Contact Name	Email	Phone Number		Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)				
NYCT R142	1998	NYCT	Not Disclosed			Not Disclosed	5,000,000 miles	Not Req'd	2.5 Yrs			Data Unavailable	Data Unavailable
LIRR/MNCR M7	2001	NYCT	Not Disclosed			Not Disclosed	100,00 0 miles	Not Req'd	2.5 Yrs.			Data Unavailable	Data Unavailable
Las Vegas	2002	RTCSNV	Not Disclosed			Not Disclosed	Not Req'd	40,000 hrs.	2.5 Yrs.			Data Unavailable	Data Unavailable
WMATA 6K	2004	WMATA	Not Disclosed			Not Disclosed	3 failure per million miles (FPMM)	Unavail.	3 Yrs.			Data Unavailable	Data Unavailable
MNR M8	2008	MNR	Not Disclosed			Not Disclosed	135,00 0 miles	Unavail.	6 Yrs.	No failures	Field Data	Data Unavailable	Data Unavailable
WMATA 7K	2011	WMATA	Not Disclosed			Not Disclosed	500,00 0 miles	Unavail.	4 Yrs.			Data Unavailable	Data Unavailable
Amtrak Viewliner II	2011	Amtrak	Not Disclosed			Not Disclosed	Not Req'd	200,000 hrs.	6 Yrs.			Data Unavailable	Data Unavailable
SMART	2012	SMART	Not Disclosed			Not Disclosed	Not Req'd	6,000 hrs.	6.5 Yrs.			Data Unavailable	Data Unavailable
Houston Metro	2013	METRO	Not Disclosed			Not Disclosed	Not Req'd	250,000 hrs.	3 Yrs.			Data Unavailable	Data Unavailable
Toronto Metrolinx DMU	2013	TTC	Not Disclosed			Not Disclosed	Not Req'd	6,000 hrs.	6.5 Yrs.			Data Unavailable	Data Unavailable
MELCO: Auxiliary Power Supply/Low Voltage DC Power													
SEPTA	2006-2015	ROTEM	Daniel Gibbone (SEPTA)		215- 580-8030	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
R179	2012-2015		Marie-Julie Blain		450-441-8157	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable

Project Name	Contract Year	Transit Authority	Customer Information: Contact Name	Email	Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
Bombardier													
BART 2012-2016 Bombardier			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Toyo Denki: Auxiliary Power Supply													
E231 Series 2000-2005 JR East			Not Disclosed			150,000 miles	9,640,000 miles	513,000 hrs.	2 Yrs.	Inverter, input circuit and reactor, and control unit failure	Operation: 350 day/year, 14 hour/day Total Operation Time: 8,735,000 hours Number of Failure: 17 Avg. Speed: 18.8 mph	Data Unavailable	Data Unavailable
PROPULSION & DYNAMIC BRAKING													
MELCO: Propulsion													
M-7 2002 LIRR/MNR			Dan Alcantara (914) 376-4700			Not Disclosed	MDBCF 200,000 miles	Not Req'd	2014	Component Failure	Provided by carbuilder (carbuilder monitors failure during revenue service)	MDBCF 345,000 miles	Data Unavailable
M-8 2009 MNR/CDOT			Dan Alcantara (914) 376-4700			Not Disclosed	MDBCF 200,000 miles MDBSF 500,000 miles	Not Req'd	2019			Not in Warranty yet	MDBCF 358,410 miles MDBSF 509,319 miles
Toyo Denki: Propulsion													
Chengdu Metro Line 1 2007 Chengdu Metro			CHEN YING 0086-13558667468 mailto:chenying_zy@sina.com			100,000 miles	841,187 miles	36,588 hrs.	3 Yrs.	A delay equivalent to or exceeding 2 minutes; Non-availability of the train to start revenue service after successful completion of pre-departure checkout.	Sample of raw defect history data	906,573 miles	1,057,668 miles

Project Name	Contract Year	Transit Authority	Customer Information			Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement			Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
			Contact Name	Email	Phone Number		Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)				
Dallas LRV	2003	Dallas DART	Allen Bud Beene	ABeene@dart.org	214-749-280	100,000 miles	280,371 miles	14,019 hrs.	2 Yrs. & 1 month	An abnormal component condition that necessitates removing or withholding the car from service for corrective action.		280,371 miles	Data Unavailable
TRUCKS													
Bradken: Trucks													
Gallary Car Truck	1961	Metra	Bill Koran	wkoran@metrarr.com	(312) 322-6574	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	Fleet = 58,000 miles/per/yr average x 52 yrs x 277 = 835,432,000 Miles	Data Unavailable	52 Yrs.
Gallary Car Truck	1992	Metra	Bill Koran	wkoran@metrarr.com	(312) 322-6574	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	Fleet = 58,000 miles/per/yr average x 22 yrs x 13 = 16,588,000 Miles	Data Unavailable	22 Yrs.
Gallary Car Truck	2002	Metra	Bill Koran	wkoran@metrarr.com	(312) 322-6574	MDBF Cab Car 20,000 miles MDBF Trailer Car 25,000 miles	Unavail.	Unavail.	30 Yrs.	No failures	Fleet = 58,000 miles/per/yr average x 12 yrs x 300 = 208,800,000 Miles	Data Unavailable	12 Yrs.
Gallary Car Truck	2005-2013	Virginia Rail Express	Bob (Takeo) Suzuki	takeo.suzuki@nipponsharyo.com	(815)562-8600	MDBF Cab Car 20,000 miles MDBF Trailer Car 25,000 miles	Unavail.	Unavail.	30 Yrs.	No failures	Fleet = 58,000 miles/per/yr average x 8 yrs x 60 = 27,840,000 Miles	Data Unavailable	8 Yrs.
BART	1969	BART	Ben Holland	bhollan@bart.gov	(510) 476-3727	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	Fleet = 70,000 miles/per/yr average x 44 yrs x 250 = 770,000,000 Miles	Data Unavailable	Data Unavailable
BART	1992	BART	Ben Holland	bhollan@bart.gov	(510) 476-3727	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	Fleet = 70,000 miles/per/yr average x 21 yrs x 80 = 117,600,000 Miles	Data Unavailable	Data Unavailable
1000 Series	1973	WMATA	Jeff Thompson	jathompson@wmata.com	(301) 955-5038	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	Fleet = 69,000 miles/per/yr average x 40 yrs x 300 = 828,000,000 Miles	Data Unavailable	Data Unavailable
5000 Series	1999		Jeff Thompson	jathompson@wmata.com		Allowable – 3 FPMM	Unavail.	Unavail.	30 Yrs.	No failures	Fleet = 69,000 miles/per/yr average x 14 yrs x 192 = 185,472,000 Miles	Data Unavailable	Data Unavailable

Project Name Contract Year Transit Authority	Customer Information: Contact Name Email Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Contractual Reliability Requirement: Mean Time Between Failure (MTBF)	Contractual Reliability Requirement: Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
WMATA	(301) 955-5038								
6000 Series 2003 WMATA	Jeff Thompson jathompson@wmata.com (301) 955-5038	Allowable – 3 FPMM	Unavail.	Unavail.	30 Yrs.	No failures	Fleet = 69,000 miles/per/yr average x 10 yrs x 184 = 126,960,000 Miles	Data Unavailable	Data Unavailable
MARTA 1978 MARTA	Richard Vernick rvernick@itsmarta.com (404) 848-3279	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	Fleet = 50,000 miles/per/yr average x 35 yrs x 100 = 175,000,000 Miles	Data Unavailable	Data Unavailable
MARTA 1995 MARTA	Richard Vernick rvernick@itsmarta.com (404) 848-3279	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	Fleet = 50,000 miles/per/yr average x 18 yrs x 5 = 4,500,000 Miles	Data Unavailable	Data Unavailable
Bi-level 1978-1991 Go Transit, Tri-Rail	Terry Pohjoisrinne terry.pohjoisrinne@ca.transport.bombardier.com (807) 475-2810	Not Disclosed	Unavail.	Unavail.	15 Yrs. or 1,000,000 miles	No failures	Fleet = 40,000 miles/per/yr average x 31 yrs x 549 = 680,760,000 Miles	Data Unavailable	Data Unavailable
Bi-level 1992-2004 SCRRA, Coaster, West Cost Express, ACE, Sounder, Trinity Railway Express, Caltran	Terry Pohjoisrinne terry.pohjoisrinne@ca.transport.bombardier.com (807) 475-2810	Not Disclosed	Unavail.	Unavail.	15 Yrs. or 1,000,000 miles	No failures	Fleet = 40,000 miles/per/yr average x 11 yrs x 541 = 238,040,000 Miles	Data Unavailable	Data Unavailable
Bi-level 2008 UTA	Terry Pohjoisrinne terry.pohjoisrinne@ca.transport.bombardier.com (807) 475-2810	Not Disclosed	Unavail.	Unavail.	15 Yrs. or 1,000,000 miles	No failures	Fleet = 40,000 miles/per/yr average x 6 yrs x 18 = 4,320,000 Miles	Data Unavailable	Data Unavailable
5650 Series 1997 Various	Will Burrows w.burrows@nationalrailway.com (708) 388-6002	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	Unavail.	Data Unavailable	Data Unavailable
TTC H-series 1965-1979 TTC	Bob Dougherty robert.dougherty@ttc.ca (416) 393-3196	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	H-5 Retired, will be rebuilt for Lagos, Nigeria Blue Line	Data Unavailable	Data Unavailable
TTC Workcar 2005-2010 TTC	Bob Dougherty robert.dougherty@ttc.ca (416) 393-3196	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	Maintenance service vehicles, not revenue service	Data Unavailable	Data Unavailable
EMD Loco 1936 Various	George Hickey george.hickey@emdiesels.com (708) 387-5539	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	Various frames and bolster in service 50+ yrs	Data Unavailable	Data Unavailable
GE Loco 1972 Varous	Elson Batista Elson.Batista@ge.com (814) 875-4913	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	Various frames and bolsters in service 40+ yrs	Data Unavailable	Data Unavailable

Project Name	Contract Year	Transit Authority	Customer Information: Contact Name	Email	Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
MPI Loco	1994	Metra	Ben Orr	BOrr@Wabtec.com	(208) 947-4901	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	2 axle & 3 axle truck frames and bolsters	Data Unavailable	Data Unavailable
Tri-Rail	2012	Brookville	Larry Conrad	l_conrad@brookvilleequipment.com	(814) 849-2000	Not Disclosed	Unavail.	Unavail.	30 Yrs.	No failures	Supplied frame and bolster castings, locomotives are not in service yet.	Data Unavailable	Data Unavailable
UTCRAS: Wheels, Axles, Journal Bearings and Housing													
SCRRA New Car Build	2008-2013	Hyundai Rotem	Andy Hyer	Andy.hyer@rotemusa.com	215-952-3637	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
SEPTA New Car Build	2009-2013	Hyundai Rotem	Andy Hyer	Andy.hyer@rotemusa.com	215-952-3637	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Denver RTD New Car Build	2012-2015	Hyundai Rotem	Andy Hyer	Andy.hyer@rotemusa.com	215-952-3637	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
MBTA New Car Build	2011-2014	Hyundai Rotem	Andy Hyer	Andy.hyer@rotemusa.com	215-952-3637	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Commuter Rail Running Repair	1994-Present	MBTA	Roland Cuniff	Roland.cunniff@mbcr.net	617-222-6399	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Amtrak Locomotive	2012-2014	Siemens	Steve Rocha	Steve.rocha.ext.@siemens.com	916-525-2887	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Amtrak Viewliner	2011-2015	CAF	Paul Cremidis	Paul.cremidis@cafusa.com	607-737-3158	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Running Repair	2008-2013	MARTA	Paul Christian		404-848-3199	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Repair and Repair Caltrans Overhaul	2012-2013	Amtrak	S. Tsuchiya	Tsuchiya@kawasakirailcar.com	914-376-4700	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable

Project Name	Contract Year	Transit Authority	Customer Information			Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement			Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
			Contact Name	Email	Phone Number		Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)				
SEPTA M4 Overhaul 2012-2015 Bombardier			Charles Sorce sorcec@amtrak.com 302-757-6745			Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
MARC Train Service Running Repair 1990-present MTA			Tom Martin 607-664-7374			Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Gear Unit Overhaul 2005-present PATCO			Bill Sullivan william.sullivan@us.transport .bombardier.com 484-636-7600			Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Brake Discs / Wheels 2012-2015 WMATA			John Shea JJshea@drpa.org 856-772-6953			Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
SCRRA Running Repair 2013-2017 Alstom			Wayne Bolander Jr, 202-641-4933			Not Disclosed	Unavail.	Unavail.	1 Yr.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
MBTA Greenline Overhaul 2013-2016 Alstom			Arturo Veloz Arturo.veloz@transport.alsto m.com 630-369-2311			Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
MBTA Bi-Level Overhaul 2013-2015 Alstom			Arturo Veloz Arturo.veloz@transport.alsto m.com 630-369-2311			Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
MTA LRV Overhaul 2013-2018 Alstom			Arturo Veloz Arturo.veloz@transport.alsto m.com 630-369-2311			Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Running Repairs 2013-2014 NCTD			Holly Lam hlam@nctd.org 760-966-6537			Not Disclosed	Unavail.	Unavail.	1 Yr.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Wabtec: Current Collectors													
R-142 1998-2005 NYCT			Mr. G. Sansone 717-694-4484			Not Disclosed	MDBF 20,000,000 miles	Not Req'd	3 Yrs.	Causing Train Delays or Removal from Service	12- Month Running Averages, Time in Revenue 4 yrs, 0 Months	MDBF 57,279,000 miles	Data Unavailable
R-142A 1999-2005 NYCT			Mr. G. Sansone 717-694-4484			Not Disclosed	MDBF 20,000,000 miles	Not Req'd	3 Yrs.	Causing Train Delays or Removal from	12- Month Running Averages, Time in Revenue 4 yrs, 0 Months	MDBF 26,959,000 miles	Data Unavailable

			Customer Information				Contractual Reliability Requirement						
Project Name	Contract Year	Transit Authority	Contact Name	Email	Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
										Service			
R-143 2001-2005 NYCT			Mr. G. Sansone 717-694-4484			Not Disclosed	MDBF 9,000,000 miles	Not Req'd	3 Yrs.	Causing Train Delays or Removal from Service	12- Month Running Averages, Time in Revenue 2 yrs, 5 Months	MDBF 9,064,000 miles	Data Unavailable
FRICTION BRAKES & PNEUMATIC SYSTEM													
Faiveley: Friction Brakes & Pneumatic System													
Metro NYCT 2013 NYCT			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
TGV (South East) 2008 SNCF			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Intercity Coaches ATLAS COPCO 2005 NS (Netherlands)			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
LRV/Tramway ALSTOM 1988 RATP			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Wabtec: Friction Brakes & Pneumatic System													
NYCT R142 1998-2005 NYCT			M. Wetherall Mike.wetherall@nyct.com 718-694-4460 Mr. G. Sansone 717-694-4484			80,000 miles	MDBCF 60,000 miles MDBF 1,510,000 miles	Not Req'd	3 Yrs.	Causing Train Delays or Removal from Service	**<u>Data Gathering</u>**: Vapor receives failure information from the Vapor field service team, the Vapor material and return process, and directly from the Carbuilder or Customer. Vapor receives the car fleet information regarding the number of cars in service and the	MDBCF 113,160 miles MDBF 1,123,000 miles	Data Unavailable
NYCT R142A / R142S 1999-2005			M. Wetherall Mike.wetherall@nyct.com			80,000 miles	MDBCF 60,000	Not Req'd	3 Yrs.	Causing Train Delays or		MDBCF 94,740	Data Unavailable

Project Name	Contract Year	Transit Authority	Customer Information: Contact Name	Customer Information: Email	Customer Information: Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Contractual Reliability Requirement: Mean Time Between Failure (MTBF)	Contractual Reliability Requirement: Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
		NYCT			718-694-4460		miles MDBF 720,000 miles			Removal from Service	mileage run from the Carbuilder. Vapor receives the initial relevant failures assigned by the Carbuilder. Relevant information is recorded into an electronic form which is compatible with the RAMS database. **Data Analysis**: This information is reviewed and categorized by a reliability engineer. The reliability engineer will cross check the in service failure information with the internal repair information. The failures and repairs are categorized in the FRACAS RAMS database. The Carbuilder relevant failures are reviewed and either accepted as part of the Vapor door scope or assigned a categorization of Carbuilder responsibility or of passenger responsibility. The failures are then reviewed with the Carbuilder's reliability engineer for data consolidation and confirmation. A review of the data over time will typically yield a door system reliability performance curve and a Vapor responsibility reliability performance curve. These performance curves are compared to the Contractual reliability requirement. If the reliability is below the Contractual reliability requirement, trends are analyzed and areas of improvement are identified to the Vapor project team for improvement resolution and communication to the customer.	miles MDBF 1,037,000 miles	
			Mr. G. Sansone		717-694-4484								
NYCT R143	2001-2005	NYCT	M. Wetherall	Mike.wetherall@nyct.com	718-694-4460	80,000 miles	MDBSCF 71,940 miles MDBF 720,000 miles		3 Yrs.	Causing Train Delays or Removal from Service		MDBSCF 103,020 miles MDBF 906,000 miles	Data Unavailable
			Mr. G. Sansone		717-694-4484								
NYCT R160	2003	NYCT	M. Wetherall	Mike.wetherall@nyct.com	718-694-4460	Not Disclosed	MDBSCF 60,000 miles	Not Req'd	2 Yrs.	Not Disclosed		MDBSCF 110,852 miles MDBF 1,260,504 miles	Data Unavailable
MBTA #5 Blue Line		MBTA	S. Adkins	sadkins@mbta.com	617-293-4635	Not Disclosed	MDBF 60,000 miles	Not Req'd	2 Yrs.	Not Disclosed		MDBF 94,925 miles	Data Unavailable
PATH PA5	2009	PATH	D. Dreisbach	dreisbach@panynj.gov	973 350-2854	Not Disclosed	MDBF 60,000 miles	Not Req'd	2 Yrs.	Not Disclosed		MDBF 497,084 miles (A-Car) MDBF 2,692,515 miles (C-Car)	Data Unavailable
COMMUNICATIONS & PASSENGER INFORMATION SYSTEM													
ISC Applied Systems: CCTV Operator, LCD monitors, Active Route Maps, Automatic Passenger Counting System													

Project Name	Contract Year	Transit Authority	Customer Information			Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement			Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
			Contact Name	Email	Phone Number		Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)				
Rapid Transit Cars	2012	PATCO	Eric Garzon	egarzon@iscappliedsystems.com	514-515-8645	MDBCF 130.000 miles @ 10 MPH	164,780 miles	16,478 hrs.	2 Yrs	Predicted failure rate	Use of historical field data on identical or similar equipment from other transit applications; Vendor supplied data; When available from other programs, Part Stress reliability prediction method specified in MILHDBK-217F, Notice 2;· Parts Count reliability prediction method specified in MIL-HDBK-217F, Notice 2;· For non-electronic equipment, "Non-Electronic Parts Reliability Data – 1995" (NPRD-95) maybe used;	Data Unavailable	Data Unavailable
MBTA No. 5 Blue Line	2007-2014	MBTA	Karen Love	klove@MBTA.com	617-222-3490	MDBCF 50.000 miles @ 10 MPH	249,000 miles	24,900 hrs.	2 Yrs.	Historical failure rate		Data Unavailable	MBDCF 249,000 miles
TOA Communication Systems: CCTV Operator, LCD monitors, Active Route Maps, Automatic Passenger Counting System													
SCRRA	2009	Metrolink	Mr. Telis	Kakaris@scrra.net	323 224 3472	3,413,334 miles	170,666 miles	16.49 Failure Per Million Hours (FPMH)	2 Yrs.	Handset has been damaged.	Reliability calculation	not at end of warranty	Data Unavailable
SFRTA	2010	South Florida RTA	Mr. Bradley A. Barkman	barkmanb@sfrta.flgov	954 788 7946	Not Disclosed	Not Req'd	16.49 FPMH	2 Yrs.	Key switch has been replaced.	Reliability calculation	not at end of warranty	Data Unavailable
Bangalore Metro India	2010	Bangalore Metro	B.L Yashavanth	chavan@bmrc.co.in	+91 80 22969300	Not Disclosed	Not Req'd	55,000 hrs.	3 Yrs.	LED back light will be attenuated.	Reliability calculation	Data Unavailable	Data Unavailable
Delhi Metro RS3	2009	Delhi Metro	S. S Joshi	edrs@dmrc.org	+91 11 29561394	Not Disclosed	Not Req'd	78,000 hrs.	3 Yrs.	Brightness of LED element will be attenuated.	Reliability calculation	Data Unavailable	Data Unavailable
AM3	2010	Attiko Metro S. A	Zafiris Dimitriadis	zdimitriadis@ametro@ametro.gr	+30 210679 2448	Not Disclosed	Unavail.	Unavail.	Unavail.	Brightness of LED element will be attenuated.	Reliability calculation	Data Unavailable	Data Unavailable
SCRRA	2009	Metrolink/ Southern California Regional Rail Authority	Mr. Telis	Kakaris@scrra.net	323 224 3472	Not Disclosed	1,137,778 miles	263,040 hrs.	2 Yrs.	Input is damaged.	Data collection	Data Unavailable	Data Unavailable

Project Name	Contract Year	Transit Authority	Customer Information: Contact Name	Customer Information: Email	Customer Information: Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Contractual Reliability Requirement: Mean Time Between Failure (MTBF)	Contractual Reliability Requirement: Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
INTERIOR & EXTERIOR APPOINTMENTS													
Freedman Seating: Passenger Seats													
Rocky Mountaineer	2012-2014	Rocky Mountaineer	Rocky Mountaineer		(604) 606-7200	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
United Streetcar	2013	WMATA	WMATA		(202) 962-1234	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Siemens	2012-2015	Amtrak	Amtrak		(888) 920-6378	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
United Streetcar	2012	Sun Tran	Sun Tran		(520) 623-4301	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Talgo	2011-2012	ODOT	Mathew Garrett		(888) 275-6368	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
United Streetcar	2011-2012	TriMet	TriMet		(503) 962-2428	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Talgo	2011	WisDOT	WisDOT		(608) 264-7898	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
SEPTA	2008-2009	SEPTA	Jim Richeal		(215) 580-8314	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Bombardier	2007-2009	GRCTA	GCRTA		(216) 781-4546	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
KPS/NipponSharyo	2003/2005	METRA	Metra		(312) 322-2800	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
PWI/Alstom	2003-2005	WMATA	WMTA		(202) 962-1234	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
CAF	2003	STA	STA		(800) 836-4115	Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Siemens			TriMet			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data	Data

Project Name	Contract Year	Transit Authority	Customer Information			Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement			Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
			Contact Name	Email	Phone Number		Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)				
2002-2003 TriMet			(503) 962-2428									Unavailable	Unavailable
CAF 2002-2003 Port Authority			Anthony Trona (412) 566-5138			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Amsterdam, The Netherlands 2012-2014 GVB			0900-8011			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Bucarest, Romania 2013 Caile Ferate Romane			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Lima, Peru 2012-2013 Peru Rail			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Panama, Panama 2012-2013 Panama Canal Railway			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Mexico City, Mexico 2010-2011 Mexico Metro			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Istanbul, Turkey 2010 Turkish State Railways			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Caracas, Venezuela 2010 Metro de Caracs			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Argel, Romania 2007 Romania			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Mallorca, Spain 2006 Mallorca			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Santo Domingo, Spain 2011-2012 Renfe			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Madrid, Spain 2005-2007, 2006, 2010-2011 Renfe			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Barcelona, Spain			Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data	Data

Project Name	Contract Year	Transit Authority	Customer Information: Contact Name	Customer Information: Email	Customer Information: Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Contractual Reliability Requirement: Mean Time Between Failure (MTBF)	Contractual Reliability Requirement: Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
	2004-2005, 2006-2010, 2008, 2010	Renfe										Unavailable	Unavailable
Rome, Italy	2008	Trenitalia	Not Disclosed			Not Disclosed	Unavail.	Unavail.	Unavail.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Kustom Seating: Passenger Seats													
DART	2008-2010	Dallas DART	Jerry Earwood		214-928-6140	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
WMATA	Ongoing	WMATA	Joe Reynalds	jreynolds@wmata.com	202-962-1566	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Houston III	Ongoing	METRO	Scott Grogan		713-982-8215	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Twin Cities	2011-2014	MVTA	Rick Carey		651-602-1934	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Portland	Ongoing	Tri Met	Jason Grohs	grohsj@trimet.org	503-962-2245	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Charlotte	Ongoing	CATS	Gary Lee	grlee@ci.charlotte	704-432-5010	Not Disclosed	Unavail.	Unavail.	2 Yrs.	Not Disclosed	Description not provided	Data Unavailable	Data Unavailable
Baultar: Composite Flooring													
GP-38 Locomotives	2006- actual	CSX Transportation	John Rimer	john_rimer@csx.com	518-858-7174 (cell)	Not Disclosed	Unavail.	Unavail.	2 Yrs.	No Failure	More than 300 locomotive floors done and project on going	Data Unavailable	Data Unavailable
F40- PH Locomotives	2002-2005	METRA	William J. Koran	wkoran@metrarr.com	312-322-6574	Not Disclosed	Unavail.	Unavail.	2 Yrs.	No Failure	Project for 104 Locomotive floors.	Data Unavailable	Data Unavailable
HSR 1st Class Coaches	2008-2010	AMTRAK	J. Blair Slaughter	slaughb@amtrak.com	302-463-6191 (Cell)	Not Disclosed	Unavail.	Unavail.	2 Yrs.	No Failure	Project for 21 cars in refurbishment to change the damage ply metal with Composite floor panels.	Data Unavailable	Data Unavailable
SD-100 Articulated Cars	2010-actual	Denver RTD	Phil Eberl	phillip.eberl@rtd-denver.com	604-834-6156 (Cell)	Not Disclosed	Unavail.	Unavail.	2 Yrs.	No Failure	Project for 49 cars in refurbishment to change the damage flooring with Composite floor panels.	Data Unavailable	Data Unavailable
Train Transilien-Locomotive Cab			Erwan Le Pichouron	erwan.le_pichouron@fr.trans		Not Disclosed	Unavail.	Unavail.	2 Yrs.	No Failure	No Failure reported Project for 172 new commuter trains. Baultar	Data Unavailable	Data Unavailable

Project Name	Contract Year	Transit Authority	Customer Information: Contact Name	Email	Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
	2009 – 2014	SNCF		port.bombardier.com	011-39.33.6.1073.1640						provided the Composite flooring for each of the 344 Cab areas. Option for more cars coming in 2015.		
Subway Cars MR 63 and MR 79	1985 – 1992	Montreal STM	Christophe Lhomel	christophe.lhomel@stm.info	514 280-6135	Not Disclosed	Unavail.	Unavail.	2 Yrs.	No Failure	Baultar have not supplied any spare panels since the installation was completed and the cars have been put in revenue service by STM. No failure over 759 cars.	Data Unavailable	Data Unavailable
New Subway cars MPM-10	2012 – 2017	Montreal STM	Christophe Lhomel	christophe.lhomel@stm.info	514 280-6135	Not Disclosed	Unavail.	Unavail.	5 Yrs.	Not Disclosed	This project is for 468 new cars but they are not yet in revenue service.	Data Unavailable	Data Unavailable
New Subway Cars – TTC Rocket	2008 – 2014	TTC	K. T. Kwok	kam.kwok@ttc.ca	(416) 393-3608	Not Disclosed	Unavail.	Unavail.	5 Yrs.	No Failure	Baultar have not supplied any spare panels and no failure was reported since the cars have been put in revenue service by TTC. Project for 234 cars base with 186 cars in option (not completed yet) and upcoming option of 60 cars.	Data Unavailable	Data Unavailable
New Monorail Cars	2013-2015	SPET	Mario Fukumori	mfukumori@metrosp.com.br	55 11 3371-7327	Not Disclosed	Unavail.	Unavail.	5 Yrs.	Not Disclosed	This project is for 378 new monorail cars but they are not yet in revenue service.	Data Unavailable	Data Unavailable
AUTOMATIC TRAIN PROTECTION & AUTOMATIC SPEED REGULATION													
Alstom: Automatic Train Protection/Automatic Station Identification													
Taipei TuCheng	2011	DORTS	Zhong-Xien WU	thwu@trts.dorts.gov.tw	866-02-2358-2035	Not Disclosed	Not Req'd	MTBF 5,000 hrs.	1 Yr.	Not Disclosed	DORTS provided raw data	Reliability data only available for Reliability Test Period.	MTBF 5,614 hrs.
Taipei OBLEX Phase 1	Completion date 2006	DORTS	Zhong-Xien WU	thwu@trts.dorts.gov.tw	866-02-2358-2035	Not Disclosed	Not Req'd	ATP MTBF 10,877 hrs. ATO MTBF 9,254 hrs.	2 Yrs.	The relevant failure of a component refers to an independent failure that causes a component to lose its function: caused by an operation			ATP 26,875 hrs. ATO 15,907 hrs.
Taipei OBLEX Phase 2	Completion date 2008	DORTS	Zhong-Xien WU	thwu@trts.dorts.gov.tw	866-02-2358-2035	Not Disclosed	Not Req'd	ATO 5,000 hrs.	2 Yrs.				ATO 8,487 hrs.

Project Name	Contract Year	Transit Authority	Customer Information: Contact Name	Customer Information: Email	Customer Information: Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Contractual Reliability Requirement: Mean Time Between Failure (MTBF)	Contractual Reliability Requirement: Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
										conducted within the allowable scope of the specified design and environment; or by improper operation conducted according to submitted contractor documents.			
Silverliner	2008	SEPTA	K.S.Lee	kwangsook@hyundai-rotem.co.kr	267-315-3696	Not Disclosed	MDBF 100,000 miles	Not Req'd	2 Yrs.	A chargeable failure is any equipment related occurrence rendering the car unfit for service; or as any maintenance action requiring repair or replacement of any subsystem or whole-vehicle component which is not an approved consumable item. Spec Sect 1.29	SEPTA provided assessment		MDBF 117,870 miles
WMATA 5K	1999	WMATA	Ken Mortford	KMorford@wmata.com	202 962 1451	Not Disclosed	8 Failures Per	Not Req'd	Unavail.	Not Disclosed	WMATA provided assessment		4.6 FPMM

Project Name	Contract Year	Transit Authority	Customer Information			Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement			Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
			Contact Name	Email	Phone Number		Mean Distance Between Failure (MDBF)	Mean Time Between Failure (MTBF)	Warranty Period(s)				
							Million Miles (FPMM)						
WMATA 2K/3K 2001 WMATA			Ken Mortford KMorford@wmata.com 202 962 1451			Not Disclosed	8 FPMM	Not Req'd	Unavail.	Not Disclosed			4.1 FPMM
WMATA 6K 2001 WMATA			Ken Mortford KMorford@wmata.com 202 962 1451			Not Disclosed	6 FPMM	Not Req'd	Unavail.	Not Disclosed			5.8 FPMM
Ansaldo STS: Automatic Speed Regulation													
MPM-10 2011-2018 Montreal STM			Etienne Malouin 3-57tienne.malouin@dessau.com 514-281-5020			Not Disclosed	2,839,890 miles	15,900 hrs.	2 Yrs.	No failures	Data Collection Process: FRCAP Method of Reliability Calculation: MIL-217	Data Unavailable	Data Unavailable
WMATA 7000 Series 2010-2017 WMATA			David Kubicek dkubicek@wmata.com 202-962-2585			Not Disclosed	344,272 miles	22,952 hrs.	2 Yrs.	No failures		Data Unavailable	Data Unavailable
MR-73 2005-2016 Montreal STM			Etienne Malouin 3-57tienne.malouin@dessau.com 514-281-5020			Not Disclosed	2228,579 miles	12,456 hrs.	1 Yr.	No failures		Data Unavailable	Data Unavailable
VEHICLE MONITORING SYSTEM													
MELCO: Vehicle Monitoring System													
M-8 2009 MNR/CDOT			Dan Alcantara (914) 376-4700			Not Disclosed	MDBCF 200,000 miles MDBSF 500,000 miles	Unavail.	2019	Component Failure	Provided by carbuilder (carbuilder monitors failure during revenue service) 190 Married pair(380 Cars) 25 Single car(25 Cars) Total 405 Cars Project is still ongoing.	Not end of warranty	MDBCF 1,209,633 miles MDBSF 9,677,067 miles
Toyo Denki: Vehicle Monitoring System													
TMS for Beijing Subway Line 10 2006 Beijing Mass Transit Railway Operation Corporation Limited			Li Li 0086-13801211811 mailto:cheliangbu@163.com			400,000 Miles	776,827 miles	35,733 hrs.	3 Yrs.	Failure which disables the train from departing on time	Sample of raw defect data	776,827 miles	Unavail.

Project Name	Contract Year	Transit Authority	Customer Information: Contact Name	Customer Information: Email	Customer Information: Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Contractual Reliability Requirement: Mean Time Between Failure (MTBF)	Contractual Reliability Requirement: Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
SYSTEM ASSURANCE													
Cory: Training Simulator													
NSB 2002 Norwegian State Railways			Halvor Persen GUNDERSEN halvorpersen.gundersen@nsb.no +47 32 27 55 33			Not Disclosed	Not Req'd	Contractual requirement for Reliability is expressed in % of availability Contractual obligation is availability $\geq$ 98%	2 Yrs.	Unavailability of a vital subsystem	Each subsystem of the simulator is designed to be compatible with a nominal usage time of 16 hours per day, 5 days per week except banking holidays. In order to be usable for the training of drivers, the following vital subsystems of the Simulator shall be fully functional: A: 1 Replica Simulator with its Instructor Station, excluding motion system (RS) B: 5 Desk Simulators with 1 Training Administration Station (DS / TAS) C: Data Administration Station (DAS) The availability Ai of each of the 3 vital subsystem shall be calculated according to the following formula: $\frac{\text{NominalUseTime} - \text{Downtime}}{\text{NominalUseTime}} * 100\%$ The overall subsystem availability at the end of the considered period (TOP or Warranty) will be the average of the monthly availability measured for each subsystem. The simulator shall be considered compliant with NSB's availability requirements, if the end of the considered period (TOP or Warranty) the following condition is fulfilled: $A \geq 98\%$	99.71%	99.59%
SNCF 1991-2012 French National Railways			Philippe DELERUE philippe.delerue@sncf.fr +33 (0)1 53 25 98 61			Not Disclosed	Not Req'd	95%	Various	A blocking event which prevents the use of a simulator.	Reliability is monitored for 158 simulators on a monthly basis with a nominal use time of 30,000 hours per month. The system downtime for a blocking failure is deducted from the nominal monthly use time. The availability is the ratio of the	Unavail.	99.43%

Project Name	Contract Year	Transit Authority	Customer Information: Contact Name	Customer Information: Email	Customer Information: Phone Number	Reliability Data (See Tech Spec. T2.03.03)	Contractual Reliability Requirement: Mean Distance Between Failure (MDBF)	Contractual Reliability Requirement: Mean Time Between Failure (MTBF)	Contractual Reliability Requirement: Warranty Period(s)	Definition of Failure	Description of Data (e.g. data collection process, method of reliability calculation, sample of raw defect history data, etc.)	Actual Reliability Achieved at the End of the Warranty Period	Actual Reliability Currently being Realized, if available
											measured use time over the nominal use time and is expressed in percent.		
Simutech International: Training Simulator													
Dalian Metro Full-mission Simulator 2013 China DaLian MTRC			Dalian Metro Full-mission Simulator Nayitian10681@163.com 0086-18901231006			Not Disclosed	Not Req'd	> 4,000 hrs.	2 Yrs.	No failure	More than the actual value of the project implementation.	Warranty Period not finish	> 4,000 hrs.
One set Train Simulator 2012 China National Machinery Import and Export Corporation			Train Simulator zhuyiys@yahoo.com.cn 0086-13501129460			Not Disclosed	Not Req'd	> 4,000 hrs.	1 Yr.	No failure		No problems occur during the warranty period.	> 4,000 hrs.
Dalian Fast Train Simulator 2011 Dalian Modern Rail Transit Co.			Fast Train Simulator jinyuming2002@163.com; 0086-0411-86533820			Not Disclosed	Not Req'd	> 4,000 hrs.	1 Yr.	Computer equipment motherboard damage.		There is a second computer's motherboard is damaged, replace it.	> 3,500 hrs.
Metro Simulator 2011 China Beijing Vocational College of Transportation			Metro Simulator 76228575@qq.com 0086-13611367702			Not Disclosed	Not Req'd	> 3,500 hrs.	1 Yr.	No failure		No problems occur during the warranty period.	> 3,500 hrs.

3.4 ALL PASSENGER TRANSPORTATION PAST PERFORMANCE

Below is the RFP requirement for all passenger transportation past performances:

Tab I.3 (c) Offeror and Major Subcontractors Past Performance
List (in a matrix format) project information for ***all*** *passenger transportation rail car (including light rail, streetcar/tram, commuter/suburban, metro/heavy rail, intercity and high speed) contracts issued to the Offeror for the past ten (10) years. Past ten (10) years shall include all contracts that were active at any time during the past ten (10) years, inclusive of warranty stage as well as any executed contracts during this period. For each entry the Offeror shall include:* • *The contractual delivery schedule (including pilot car, first production car, last production car, manuals, spare parts, special tools)* • *The actual delivery schedule (including for pilot car, first production car, last production car, manuals, spare parts, special tools)* • *Reasons for delays (technical, commercial, force majeure, other)* • *Penalties and/or liquidated damages* • *A current customer contact information for verification*

Project Name: Beijing Metro 14#	Contract Year	2012 – 2014

Transit Authority/Customer	Contact	Email	Phone Number
Beijing Construction Management Co.Ltd.	Zhang Bao	zhangbao_mrt@126.com	13856485123

Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)
A type Stainless Steel Metro vehicle	38 trainsets	Tc：37.2t Mp：37.8t M：37.66t	Tc： AW1：56 passengers AW2：310 passengers AW3：430 passengers Mp, M: AW1：56 passengers AW2：310 passengers AW3：430 passengers	Tc: 80.05 x 9.84 ft (24,400 x 3,000 mm) Mp, M: 74.80 x 9.84 ft (22,800 x 3,000 mm)

Contractual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
2012/8	2012/11	2014/7	2012/12	2013/3	2013/3

Actual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
2012/8	2012/11	Delivery not completed	2012/12	2013/3	2013/3

Reason for Delays (e.g. technical, commercial, force majeure, etc.)
N/A
Penalties/Liquidated Damages
N/A

Project Name: Beijing Metro 6#				Contract Year	2011 – 2014
Transit Authority/Customer		Contact	Email	Phone Number	
Beijing Construction Management Co.Ltd.		Zhang Bao	zhangbao_mrt@126.com	13856485123	
Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)	
B type stainless steel vehicle	64 trainsets	Tc: 33t Mp: 33.7t M: 33.1t	Tc: AW1 : 36 passengers AW2 : 226 passengers AW3 : 290 passengers Mp, M: AW1 : 42 passengers AW2 : 254 passengers AW3 : 325 passengers	Tc: 65.49 x 9.19 ft (19,960 x 2,800 mm) Mp, M: 62.34 x 9.19 ft (19,000 x 2,800 mm)	

Contractual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
8/2011	1/2012	7/2014	10/2013	8/2013	8/2013
Actual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
8/2011	1/2012	Delivery not completed	10/2013	8/2013	8/2013

Reason for Delays (e.g. technical, commercial, force majeure, etc.)
N/A
Penalties/Liquidated Damages
N/A

Project Name: Shenyang Metro Line 1				Contract Year	2006– 2010
Transit Authority/Customer		**Contact**	**Email**	**Phone Number**	
Shenyang Metro Group Co., Ltd.		Yang Pengfei	YanPengfeiCRC@163.com	13840519115	
Vehicle Type	**Vehicle Quantity**	**Vehicle Weight**	**Seating/Standing Capacity**	**Dimensions (L x W)**	
B type Stainless Steel vehicle	23 trainsets	Tc: 32.1t T: 28t Mp: 34.6 t M: 34.3 t	Tc: AW1 : 36 passengers AW2 : 230 passengers AW3 : 290 passengers Mp, M, T: AW1 : 42 passengers AW2 : 245 passengers AW3 : 310 passengers	Tc: 63.98 x 9.19 ft (19,500 x 2,800 mm) Mp, M, T: 62.34 x 9.19 ft (19,000 x 2,800 mm)	

Contractual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
11/2007.	3/2009	3/2010	8/2008	3/2009	11/2008

Actual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
11/2007.	3/2009	3/2010	8/2008	3/2009	11/2008

Reason for Delays (e.g. technical, commercial, force majeure, etc.)

N/A

Penalties/Liquidated Damages

N/A

Project Name: Chongqing Rail Transit Line 6						Contract Year	2010 – 2011
Transit Authority/Customer		Contact	Email		Phone Number		
Chongqing Rail Transit Group Co., Ltd.		Wu Jing	WUJING@163.com.cn		13983115816		
Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity		Dimensions (L x W)		
B type stainless steel vehicle	21 trainsets	T: 34.3t Mp: 33.8t M: 33.2t	Tc: AW1 : 36 passengers AW2 : 226 passengers AW3 : 290 passengers Mp, M: AW1 : 42 passengers AW2 : 254 passengers AW3 : 325 passengers		Tc: 63.98 x 9.19 ft (19,500 x 2,800 mm) Mp, M: 62.34 x 9.19 ft (19,000 x 2,800 mm)		

Contractual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
8/2010	10/2010	9/2011	10/2010	10/2010	7/2010
Actual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
8/2010	10/2010	9/2011	10/2010	10/2010	7/2010

Reason for Delays (e.g. technical, commercial, force majeure, etc.)

N/A

Penalties/Liquidated Damages

N/A

Project Name: Shenzhen Metro Line 3, New Procurement	Contract Year	2009– 2011

Transit Authority/Customer	Contact	Email	Phone Number
Shenzhen Metro Line 3 Investment Co., Ltd.	Li Guanpeng	Liguanpeng123@163.com.cn	15002052776

Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)
B type Stainless Steel vehicle	19 trainsets	Tc: 33t M: 33.1t	Tc: AW1 : 36 passengers AW2 : 226 passengers AW3 : 290 passengers M : AW1 : 42 passengers AW2 : 254 passengers AW3 : 325 passengers	Tc: 63.98 x 9.19 ft (19,500 x 2,800 mm) M: 62.34 x 9.19 ft (19,000 x 2,800 mm)

Contractual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
5/2010	9/2010	6/2011	12/2011	9/2010	9/2010

Actual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
5/2010	9/2010	6/2011	12/2011	9/2010	9/2010

Reason for Delays (e.g. technical, commercial, force majeure, etc.)
N/A
Penalties/Liquidated Damages
N/A

Project Name: Beijing Metro Line 5 New Procurement	Contract Year	2011 – 2013

Transit Authority/Customer	Contact	Email	Phone Number
Beijing Construction Management Co.Ltd.	Zhang Bao	zhangbao_mrt@126.com	13856485123

Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions
A type Stainless Steel vehicle	22 trainsets	Tc： 31.2t M： 33.6t T： 26.8t	Tc: AW1 36 passengers AW2 226 passengers AW3 290 passengers T, M : AW1 42 passengers AW2 254 passengers AW3 325 passengers	Tc: 65.49 x 9.19 ft (19,960 x 2,800 mm) T, M: 62.34 x 9.19 ft (19,000 x 2,800 mm)

Contractual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
6/2011	10/2011	8/2012	8/2011	7/2012	6/2011

Actual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
6/2011	10/2011	8/2012	8/2011	7/2012	6/2011

Reason for Delays (e.g. technical, commercial, force majeure, etc.)
N/A
Penalties/Liquidated Damages
N/A

Project Name: Beijing Metro Line 9	Contract Year	2009 – 2012

Transit Authority/Customer	Contact	Email	Phone Number
Beijing Construction Management Co.Ltd.	Zhang Bao	zhangbao_mrt@126.com	13856485123

Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions
B type Stainless Steel vehicle	24 trainsets	Tc: 33.071t M: 34.047t T: 27.065t	Tc: AW1 : 36 passengers AW2 : 226 passengers AW3 : 290 passengers T, M : AW1 : 42 passengers AW2 : 254 passengers AW3 : 325 passengers	Tc: 63.98 x 9.19 ft (19,500 x 2,800 mm) M: 62.34 x 9.19 ft (19,000 x 2,800 mm)

Contractual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
3/2011	5/2011	7/2012	5/2011	11/2011	5/2011

Actual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
3/2011	5/2011	7/2012	5/2011	11/2011	5/2011

Reason for Delays (e.g. technical, commercial, force majeure, etc.)
N/A
Penalties/Liquidated Damages
N/A

Project Name: Beijing Metro Line 10 Phase II				Contract Year	2009 – 2012
Transit Authority/Customer		Contact	Email	Phone Number	
Beijing Construction Management Co.Ltd.		Zhang Bao	zhangbao_mrt@126.com	13856485123	
Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions	
B type stainless steel vehicle	43 trainsets	Tc: 32.878t M:33.926t T:34.177t	Tc: AW1 : 36 passengers AW2 : 226 passengers AW3 : 290 passengers TM : AW1 : 42 passengers AW2 : 254 passengers AW3 : 325 passengers	Tc: 63.98 x 9.19 ft (19,500 x 2,800 mm) T, M: 62.34 x 9.19 ft (19,000 x 2,800 mm)	

Contractual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
2/2011	5/2011	11/2012	5/2011	1/2011	6/2010
Actual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
2/2011	5/2011	11/2012	5/2011	1/2011	6/2010

Reason for Delays (e.g. technical, commercial, force majeure, etc.)

N/A

Penalties/Liquidated Damages

N/A

Project Name: Beijing Metro 15#				Contract Year	2009 – 2011
Transit Authority/Customer		Contact	Email	Phone Number	
Beijing Construction Management Co.Ltd.		Zhang Bao	zhangbao_mrt@126.com	13856485123	
Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions	
B type Stainless Steel vehicle	30 trainsets	M : 34.99t Tc: 33.85t	Tc: AW1 : 36 passengers AW2 : 230 passengers AW3 : 327 passengers M : AW1 : 46 passengers AW2 : 250 passengers AW3 : 325 passengers	Tc: 63.98 x 9.19 ft (19,500 x 2,800 mm) M: 62.34 x 9.19 ft (19,000 x 2,800 mm)	

Contractual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
2/2010	6/2010	12/2011	5/2010	8/2010	8/2010

Actual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
2/2010	6/2010	12/2011	5/2010	8/2010	8/2010

Reason for Delays (e.g. technical, commercial, force majeure, etc.)
N/A
Penalties/Liquidated Damages
N/A

Project Name: Beijing Yizhuang Line				Contract Year	2009– 2011
Transit Authority/Customer		**Contact**	**Email**	**Phone Number**	
Beijing Construction Management Co.Ltd.		Zhang Bao	zhangbao_mrt@126.com	13856485123	
Vehicle Type	**Vehicle Quantity**	**Vehicle Weight**	**Seating/Standing Capacity**	**Dimensions**	
B type Stainless Steel vehicle	23 trainsets	Tc：32.939t M：33.790t T：27.091t	Tc: AW1：36 passengers AW2：226 passengers AW3：290 passengers T,M: AW1：42 passengers AW2：254 passengers AW3：325 passengers	Tc: 63.98 x 9.19 ft (19,500 x 2,800 mm) T, M: 62.34 x 9.19 ft (19,000 x 2,800 mm)	

Contractual Delivery Schedule					
Pilot Car	**1st Production Car**	**Last Production Car**	**Manuals**	**Spare Parts**	**Specials Tools**
12/2009	5/2010	11/2011	5/2010	5/2010	5/2010
Actual Delivery Schedule					
Pilot Car	**1st Production Car**	**Last Production Car**	**Manuals**	**Spare Parts**	**Specials Tools**
12/2009	5/2010	11/2011	5/2010	5/2010	5/2010

Reason for Delays (e.g. technical, commercial, force majeure, etc.)

N/A

Penalties/Liquidated Damages

N/A

Project Name: Chongqing Rail Transit Line 1				**Contract Year**	2009 – 2014
Transit Authority/Customer		**Contact**	**Email**	**Phone Number**	
Chongqing Rail Transit Group Co., Ltd.		Wu Jing	WUJING@163.com.cn	13983115816	
Vehicle Type	**Vehicle Quantity**	**Vehicle Weight**	**Seating/Standing Capacity**	**Dimensions**	
B type stainless steel vehicle	29 trainsets	Mp:33.97t M:33.43t Tc:34.28t	Tc: AW1 : 36 passengers AW2 : 226 passengers AW3 : 290 passengers Mp, M: AW1 : 42 passengers AW2 : 254 passengers AW3 : 325 passengers	Tc: 63.98 x 9.19 ft (19,500 x 2,800 mm) Mp, M: 62.34 x 9.19 ft (19,000 x 2,800 mm)	

Contractual Delivery Schedule					
Pilot Car	**1st Production Car**	**Last Production Car**	**Manuals**	**Spare Parts**	**Specials Tools**
12/2010	11/2011	2014/5	1/2011	4/2014	7/2010
Actual Delivery Schedule					
Pilot Car	**1st Production Car**	**Last Production Car**	**Manuals**	**Spare Parts**	**Specials Tools**
12/2010	11/2011	Delivery not completed	1/2011	4/2014	7/2010

Reason for Delays (e.g. technical, commercial, force majeure, etc.)
N/A
Penalties/Liquidated Damages
N/A

Project Name: Brazil Rio de Janeiro Metro 1A				Contract Year	2009 – 2013
Transit Authority/Customer		**Contact**	**Email**	**Phone Number**	
RIO DE JANEIRO SUBWAY CO.		Pedro Leite Sabino	Psabino@metrorio.com.br	+55-21-992353646	
Vehicle Type	**Vehicle Quantity**	**Vehicle Weight**	**Seating/Standing Capacity**	**Dimensions (L x W)**	
A type stainless steel vehicle	19 trainsets	Tc：41t M1：41.3t M2：40.8t	Tc： AW1 36 passengers AW2 280 passengers AW3 350 passengers M1，M2： AW1 36 passengers AW2 310 passengers AW3 385 passengers	Tc: 69.62 x 10.14 ft (21,220 x 3,090 mm) M1，M2: 69.62 x 10.14 ft (21,220 x 3,090 mm)	

Contractual Delivery Schedule					
Pilot Car	**1st Production Car**	**Last Production Car**	**Manuals**	**Spare Parts**	**Specials Tools**
2/2011	12/2011	2/2013	9/2012	2/2012	7/2011
Actual Delivery Schedule					
Pilot Car	**1st Production Car**	**Last Production Car**	**Manuals**	**Spare Parts**	**Specials Tools**
2/2011	12/2011	2/2013	9/2012	2/2012	7/2011

Reason for Delays (e.g. technical, commercial, force majeure, etc.)

N/A

Penalties/Liquidated Damages

N/A

Project Name: Saudi Arabia Metro				Contract Year	2009 – 2010
Transit Authority/Customer		Contact	Email	Phone Number	
China Railway Construction Corporation Limited		Yan Lin	Iacquiyan@gmail.com	010-51886081	
Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)	
A type Aluminum Alloy vehicle	17 trainsets	Tc: 37.2t Mp: 37.8t M: 37.66t	Tc : AW0 : 45 passengers AW1 : 133 passengers AW2 : 244 passengers AW3 : 310passengers AW4 : 398passengers Mp, M : AW0 : 45 passengers AW1 : 138 passengers AW2 : 254 passengers AW3 : 323 passengers AW4 : 416 passengers	Tc: 80.02 x 10.14 ft (24,390 x 3,091 mm) Mp, M: 74.80 x 10.14 ft (22,800×3,091 mm)	

Contractual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
12/2009	3/2010	10/2010	4/2010	3/2010	7/2009

Actual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
12/2009	3/2010	10/2010	4/2010	3/2010	7/2009

Reason for Delays (e.g. technical, commercial, force majeure, etc.)

N/A

Penalties/Liquidated Damages

N/A

Project Name: Bangkok BTS Metro Project					Contract Year	2007 – 2011
Transit Authority/Customer		Contact	Email		Phone Number	
Bargkok Mass Transit Sysrem Public Company Limitedl(BTSC)		Mr.Jarubodee	www.bls.co.th		(662) 6177300	
Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity		Dimensions (L x W)	
A type Stainless Steel vehicle	12 trainsets	Tc: 35.5t M1,M2: 37.6t	Tc: AW1 : 42 passengers AW2 : 161 passengers AW3 : 320 passengers M1, M2: AW1 : 42 passengers AW2 : 170 passengers AW3 : 341 passengers		Tc: 67.22 x 10.24 ft (20,490 x 3,120 mm) M1, M2: 67.52 x 10.24 ft (20,580 x 3,120 mm)	

Contractual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
5/2009	8/2009	11/2011	6/2009	6/2010	8/2009

Actual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
5/2009	8/2009	11/2011	6/2009	6/2010	8/2009

Reason for Delays (e.g. technical, commercial, force majeure, etc.)

N/A

Penalties/Liquidated Damages

N/A

Project Name: Hongkong MTR South Island Project			Contract Year	2011 – 2015
Transit Authority/Customer	**Contact**	**Email**	**Phone Number**	
MTR Corporation	Zheng Jianwei	Zhengweijian@163.com.cn	13756132458	

Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)
A type stainless steel vehicle	10 trainsets	Mc：42.5t M2：42t	M1: zero load M2: average load, 200passengers each M3: no application M4: full load, 312 passengers each M5: overload, 450 passengers each	Mc: 75.56 x 10.24 ft (23,030 x 3,120 mm) M2: 70.87 x 10.24 ft (21,600 x 3,120 mm)

Contractual Delivery Schedule					
Pilot Car	**1st Production Car**	**Last Production Car**	**Manuals**	**Spare Parts**	**Specials Tools**
2/2013	3/2014	8/2014	2/2014	2/2014	2/2014
Actual Delivery Schedule					
Pilot Car	**1st Production Car**	**Last Production Car**	**Manuals**	**Spare Parts**	**Specials Tools**
2/2013	3/2014	Delivery not completed	2/2014	2/2014	2/2014

Reason for Delays (e.g. technical, commercial, force majeure, etc.)
N/A
Penalties/Liquidated Damages
N/A

Project Name: Hong Kong Metro West Island Line				**Contract Year**	2008 – 2012
Transit Authority/Customer		**Contact**	**Email**	**Phone Number**	
MTR Corporation		Zheng Jianwei	Zhengweijian@163.com.cn	13756132458	
Vehicle Type	**Vehicle Quantity**	**Vehicle Weight**	**Seating/Standing Capacity**	**Dimensions (L x W)**	
A type Stainless Steel vehicle	15 trainsets	Tc: 39t Mp1: 42.5t Mp2: 42.5t M1: 42.5t M2: 42t	M1: zero load M2: average load of the train, 200 passengers each M3: no application M4: full load of the train, 312 passengers each M5: overload of the train, 450 passengers each	Tc: 77.99 x 10.24 ft (23,770 x 3,120 mm Mp: 74.08 x 10.24 ft (22,580 x 3,120 mm M: 74.34 x 10.24 ft (22,660 x 3,120 mm	

Contractual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
2/2010	7/2011	8/2012	3/2012	9/2011	9/2011

Actual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
2/2010	7/2011	8/2012	3/2012	9/2011	9/2011

Reason for Delays (e.g. technical, commercial, force majeure, etc.)

N/A

Penalties/Liquidated Damages

N/A

Project Name: Brazil EMU Project			Contract Year	2009 – 2012
Transit Authority/Customer	**Contact**	**Email**	**Phone Number**	
China National Machinery Imp. & Exp. (Group) Corp.	Wei Bing	Weibin-crc@163.com.cn	010-68991796	

Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)
A type stainless steel vehicle	30 trainsets	Mc：49.6t T：44.2t	Mc：AW1：54passengers AW2：246 passengers AW3：310passengers T：AW1：60passengers AW2：270passengers AW3 ：340passengers	Mc: 76.48 x 9.77 ft (23,310 x 2,978 mm) T: 71.33 x 9.77 ft (21,740 x 2,978 mm)

Contractual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
5/2011	7/2011	3/2012	4/2011	10/2011	4/2011

Actual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
5/2011	7/2011	3/2012	4/2011	10/2011	4/2011

Reason for Delays (e.g. technical, commercial, force majeure, etc.)

N/A

Penalties/Liquidated Damages

N/A

Project Name: Australia Double-Deck Stainless Steel EMU Project				Contract Year	2006–2014
Transit Authority/Customer		Contact	Email	Phone Number	
Dower EDI Rail Pty Ltd		John Seale	John.Seale@downergroup.com		
Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)	
Double-deck stainless steel EMU	78 trainsets	TDC：50t MC：51.4t TC：46.2t	TDC：102/243 passengers MC：118/279 passengers TC：110/274 passengers	TDC： 65.23 x 9.96 ft (19,882 x 3,035 mm) MC： 63.63 x 9.96 ft (19,393 x 3,035 mm) TC： 63.92 x 9.96 ft (19,482 x 3,035 mm)	

Contractual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
06/2009	10/2009	01/2014	To be handed over with the vehicles	To be handed over with the vehicles	To be handed over with the vehicles
Actual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
06/2009	10/2009	01/2014	To be handed over with the vehicles	To be handed over with the vehicles	To be handed over with the vehicles

Reason for Delays (e.g. technical, commercial, force majeure, etc.)
N/A
Penalties/Liquidated Damages
N/A

Project Name: CRH380CL High Speed EMU Project	Contract Year	2011 – 2013

Transit Authority/Customer	Contact	Email	Phone Number
Beijing Railway Bureau	Zhang Xuewen	zhangxuewen@itc.genertec.com.cn	(M) 15901036159

Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)
EMU	25 trainsets	Axle load ≤ 17t	1053 passengers / trainsets	79.31 x 10.69 ft (24,175 x 3,257 mm)

Contractual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
01/2013	07/2013	12/2013	To be handed over with the vehicles	To be handed over with the vehicles	To be handed over with the vehicles

Actual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
01/2013	07/2013	12/2013	To be handed over with the vehicles	To be handed over with the vehicles	To be handed over with the vehicles

Reason for Delays (e.g. technical, commercial, force majeure, etc.)

N/A

Penalties/Liquidated Damages

N/A

Project Name: CRH380B Low Temperature EMU Project				Contract Year	2009-2014
Transit Authority/Customer		Contact	Email	Phone Number	
Harbin Railway Bureau, Shenyang Railway Bureau, Beijing Railway Bureau /CNTIC		Zhang Xuewen	13911599881@126.com	13911599881	
Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)	
350km/h EMU (Low Temperature)	66 trainsets	Axle load ≤17 t	551 passengers / trainsets	79.31 x 10.69 ft (24,175 x 3,257 mm)	

Contractual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
1/2012	1/2012	1/2014	To be handed over with the vehicles	To be handed over with the vehicles	To be handed over with the vehicles

Actual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
1/2012	1/2012	1/2014	To be handed over with the vehicles	To be handed over with the vehicles	To be handed over with the vehicles

Reason for Delays (e.g. technical, commercial, force majeure, etc.)
N/A
Penalties/Liquidated Damages
N/A

Project Name：CRH380B Low Temperature EMU （Simplified） Project				Contract Year	2014-2016
Transit Authority/Customer		Contact	Email	Phone Number	
Harbin Railway Bureau, Shenyang Railway Bureau, /CNTIC		Lu Yang	13911599881@126.com	13911599881	
Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)	
350km/h EMU (Low Temperature)	47 trainsets	Axle load ≤ 17 t	556 passengers / trainsets	80.38 x 10.69 ft (24,500 x 3,257 mm)	

Contractual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
7/2014	7/2014	10/2014	To be handed over with the vehicles.	To be handed over with the vehicles.	To be handed over with the vehicles.
Actual Delivery Schedule					
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
Not yet completed	Not yet completed	Not yet completed	Not yet completed	Not yet completed	Not yet completed

Reason for Delays (e.g. technical, commercial, force majeure, etc.)
N/A
Penalties/Liquidated Damages
N/A

Project Name : CRH380B EMU （Simplified） Project					Contract Year	2013-2016
Transit Authority/Customer		Contact	Email		Phone Number	
Shanghai Railway Bureau, Jinan Railway Bureau, Beijing Railway Bureau /CNTIC		Lu Yang	13911599881@126.com		13911599881	
Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity		Dimensions (L x W)	
350km/h EMU (Non Low Temperature)	47 trainsets	Axle load ≤ 17 t	556 passengers / trainsets		80.38 x 10.69 ft (24,500 x 3,257 mm)	
Contractual Delivery Schedule						
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools	
3/2014	3/2014	9/2014	To be handed over with the vehicles	To be handed over with the vehicles.	To be handed over with the vehicles.	
Actual Delivery Schedule						
Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools	
3/2014	3/2014	Delivery not completed	Delivery not completed	Delivery not completed	Delivery not completed	

Reason for Delays (e.g. technical, commercial, force majeure, etc.)

N/A

Penalties/Liquidated Damages

N/A

Project Name : CRH380BL High Speed EMU Project	Contract Year	2009-2012

Transit Authority/Customer	Contact	Email	Phone Number
Beijing Railway Bureau /CNTIC	Zhang Xuewen	zhangxuewen@itc.genertec.com.cn	15901036159

Vehicle Type	Vehicle Quantity	Vehicle Weight	Seating/Standing Capacity	Dimensions (L x W)
350km/h Speed Level 16-Car Formation EMU	45 trainsets	Axle load ≤ 17t	1043 passengers / trainsets	79.31 x 10.69 ft (24,175 x 3,257 mm)

Contractual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
11/2010	11/2010	12/2012	To be handed over with the vehicles	To be handed over with the vehicles	To be handed over with the vehicles

Actual Delivery Schedule

Pilot Car	1st Production Car	Last Production Car	Manuals	Spare Parts	Specials Tools
5/2010	5/2010	12/2012	To be handed over with the vehicles	To be handed over with the vehicles	To be handed over with the vehicles

Reason for Delays (e.g. technical, commercial, force majeure, etc.)

N/A

Penalties/Liquidated Damages

N/A

3.5 DESCRIPTION OF HIGH SPEED PRODUCT OF CNR CHANGCHUN

3.5.1 Description of 155 mph (250 km/h) CRH5 EMUs

CRH5 EMUs are power distributed electric multiple units with large streamlined car noses and high strength lightweight drum-shaped section aluminum alloy car bodies. Each train consists of 8 cars, incl. 5 motor and 3 trailer cars. The traction power is 5500 kW and the service speed is 155 mph (250 km/h). Two trains can be operated in a coupled manner. They are adapted to transportation of long range and high volume in an extremely cold region.

3.5.1.1 Technical Features

1. International universal standards such as UIC, EN, IEC and ISO are applied. These standards are of high grade, with satisfactory universality. The fire rating of the trains conforms to UIC 564-2 and NF F16-101 with a smoke and fire alarm system, and the vehicle end are designed to control flame propagation. The strength of aluminum alloy car bodies conforms to EN 12663. The welding technique conforms to EN 15085. The electrical system conforms to international general standards such as IEC and ISO. EMC conforms to EN 50121. The quality management system conforms to the international standard IRIS.
2. Well proven high speed trucks are used, with absolute safety and reliability and satisfactory comfort.
3. A traction system with AC transmission technique is introduced. The internationally most advanced IGBT elements with the highest performance level are used for the traction and auxiliary converters. A non-power-interruption neutral-section passing technique is introduced so that auxiliary systems such as HVAC and lighting can work uninterruptedly.
4. A computer controlled straight-way type electropneumatic brake system is used and manual service brake application and emergency brake application can be achieved. It is linked to the signaling system effectively to realize overspeed automatic stopping and safety oriented stopping function so that rapid stable stopping is possible in any case. Through electric braking, energy is returned to the electric network for energy saving purpose. Through electropneumatic brake, a large braking effort is achieved at a high speed, minimizing effectively abrasion of brake discs and brake pads.
5. A train network control system based on TCN standard is used to achieve realtime monitoring, diagnosis and control of various items of equipment in order to monitor any change in the parameters and performance of the EMU. In case of any failure, it fails to the safe side automatically until the EMU stops. Remote wireless transmission of failure data of the EMU is possible in order to support remote diagnosis by the ground expert.
6. An HVAC system with automatic temperature adjustment function is used. Accurate temperature adjustment is possible. A pressure protection device is provided so that the pressure in the saloons can be controlled automatically when the train is running through a tunnel or passing by another train.
7. The design principle of humanization is introduced. Rotating seats are provided so that passengers can adjust the direction of the seats by themselves to meet their sitting requirement.
8. Adaptability design is introduced to meet the requirement of different platform levels used for different routes such as the existing ones and the high speed passenger service lines.
9. Longer repair cycle and lower maintenance cost.

3.5.2 Description of 155 mph (250 km/h) comprehensive inspection trains

The 155 mph (250 km/h) comprehensive inspection trains are power distributed electric multiple units developed based on the technical platform of CRH5 EMUs. Each train consists of 8 cars, incl. 5 motor and 3 trailer cars. The traction power is 5500 kW and the service speed is 155 mph (250 km/h). Inspection equipment are equipped with six systems, namely communication, signaling, contact line, track geometry, wheel-rail force and integrated system. It can fulfill the tasks of technical condition systematic inspection, safety monitoring and guided maintenance of a high speed passenger special line and is a dynamic intellectualized comprehensive inspection train, having been awarded successively “the first prize of railway technology by China Railway Society" and “the second prize of scientific and technological progress in Jilin Province.”

3.5.2.1 Technical features

1. Advanced instruments and meters are used for the communication inspection system, with brand new developed software, incorporating GSM-R techniques of China, meeting the demand for test on wireless communication of high speed railways.
2. The signaling inspection system inspects and records the track circuit insulation, track circuit information, compensation capacitance and responder information and analyzes the relevant data.
3. The contact line inspection system inspects the parameters in real time such as contact wire stagger, contact wire height, contact wire mutual position, contact wire abrasion, contact line geometry, pantograph-line dynamic action and analyzes the relevant data.
4. The track geometry inspection system inspects the track parameters such as track gauge, track gauge change rate, curvature change rate, lateral and vertical frame acceleration and lateral and vertical axle box acceleration and analyzes any relevant data.
5. By continuous measurement method, the wheel-rail force inspection system measures accurately the vertical, lateral and longitudinal wheel-rail forces, wheel axle force, derailment coefficient, load reduction rate and wheel-rail contact, etc and analyzes any relevant data.
6. The integrated inspection system has the functions to centrally store, display, inquire, comprehensively analyze and transmit the inspection data.
7. Through independent design, the Company has mastered the system integration technique of the high speed EMU and inspection equipment.

3.5.3 Description of 217 mph (350 km/h) CRH380BL EMUs

CRH380BL EMUs are power distributed electric multiple units with large streamlined aluminum alloy car noses and high strength lightweight drum-shaped section aluminum alloy car bodies. Each train consists of 16 cars, incl. 8 motor and 8 trailer cars respectively. The total traction power is 18,400 kW. The continuous service speed is 217 mph (350 km/h) and the max test speed is 303 mph (487.1 km/h).

3.5.3.1 Technical features

1. International universal standards such as UIC, EN, IEC and ISO are applied. The standards are of high grade, with satisfactory universality. The fire safety of the trains conforms to UIC 564-2 and DIN 5510 and provided are a smoke and fire alarm system and a vehicle end design to control flame propagation. The strength of aluminum alloy car bodies conforms to EN 12663. The welding technique conforms to EN 15085. The electrical system conforms to IEC and ISO standards. The quality system conforms to the international standard IRIS.
2. Well proven high speed trucks are used, with absolute safety and reliability and satisfactory comfort. The critical instability speed is over 342 mph (550 km/h).
3. A traction system with AC transmission technique is introduced. The internationally most advanced IGBT elements of the highest performance level are used for the traction and auxiliary converters. A non-power-interruption neutral-section passing technique is introduced so that the equipment such as HVAC and lighting can work uninterruptedly.
4. A computer controlled straight-way type electropneumatic brake system is used and manual service brake application and emergency brake application can be achieved. It is linked to the signaling system effectively to realize overspeed automatic stopping and safety oriented stopping function so that rapid stable stopping is possible in any case. Through electric braking, energy is returned to the electric network for energy saving purpose. Through electropneumatic brake, a large braking effort is achieved at a high speed, minimizing effectively abrasion of brake discs and brake pads.
5. A train network control system based on TCN standard is used to achieve realtime monitoring, diagnosis and control of various items of equipment in order to monitor any change in the parameters and performance of the EMU. In case of any failure, it fails to the safe side

automatically until the EMU stops. Remote wireless transmission of failure data of the EMU is possible in order to support remote diagnosis by the ground expert.

6. An HVAC system with automatic temperature adjustment function is used. Accurate temperature adjustment is possible. A pressure protection device is provided so that the pressure in the saloons can be controlled automatically when the train is running through a tunnel or passing by another train.
7. The design principle of human orientation is introduced to meet various demands of different passengers. VIP business cars are provided, equipped with top grade rotating slumber seats and independent video delight units. Thus it can compare beauty with the first-class cabin of an aeroplane, meeting the demand to handle official business. The remaining first class and second class cars are equipped with rotating seats, the direction of which is adjustable for passengers to meet their sitting requirement.
8. Longer repair cycle and lower maintenance cost.

3.5.4 Description of 217 mph (350 km/h) CRH380B EMUs for extremely cold regions

CRH380B EMUs for extremely cold regions are power distributed electric multiple units independently developed based on the platform of CRH380BL EMUs. Each train consists of 8 cars, including 4 motor and 4 trailer cars respectively. The traction power is 9200 kW and the continuous service speed is 217 mph (350 km/h). Two trains can be operated in a coupled manner. They are suitable to the extremely cold environment of Harbin-Dalian Line and are currently the EMUs with the highest service speed suitable to extremely cold regions of 40°F (-40°C).

Based on the platform of CRH380BL EMUs, key problems are tackled in respect of low temperature characteristics of materials, energy saving of vehicle systems, thermal insulation, snow and frost protection and low temperature adaptability of various sytems and the technical problems for the high speed EMUs to operate in an extremely cold environment at a high speed are solved.

3.5.4.1 Technical features

1. Low temperature adaptability of relevant materials such as metals, nonmetals and greases is realized through lots of experimental investigation.
2. Thermal load for heating is realized by optimizing the car body thermal insulation structure. With increased heating power, the passenger compartment temperature meets the requirement when operating in regions of extreme cold and thus, system energy saving goals are achieved.
3. A new sealing technique is introduced, solving the problem of environmental adaptability of the exterior structure of the car body for prevention of frost at a low temperature, protection from snow in winter and ventilation in summer. Several frost protection measures are taken, solving the problem of freezing blockage of the water supply and drainage systems at a low temperature so that the water system outside the vehicle works normally at a low temperature.
4. The structures of the car body and various items of functional equipment are optimized, solving the problem of condensation due to alternation of temperature so that all the systems work normally in an environment of low temperature.
5. A systematic noise reduction technique is introduced so that the noise radiated by the train to the outside world and the interior noise reaches the optimum parameters.

3.5.5 Description of 217 mph (350 km/h) CRH380CL EMUs

CRH380CL EMUs are power distributed electric multiple units independently developed based on the technical platform of CRH380BL EMUs. Each train consists of 16 cars as a long formation, with 8 motor and 8 trailer cars. The total traction power is 19,200 kW and the continuous service speed is 217 mph (350 km/h).

Through optimization design of the streamlined car noses and raising of traction power based on the platform of CRH380BL EMUs, quick starting acceleration and high continuous power of the EMUs are realized. The system integration capability is fully improved through independent design of the network system.

3.5.5.1 Technical features

1. Streamlined aluminum alloy car noses with a higher slender proportion are introduced, further minimizing the running resistance of the train. The aerodynamic resistance of the new kind of car noses is reduced by 10% and the aerodynamic noise by 2 dB (A).
2. Through independent design, the Company has mastered the technology to integrate the new traction system and network system based on the platform of CRH380BL EMUs.
3. New techniques of insulation and cooling are introduced. For improved starting acceleration and traction capacity, the traction power is increased from 18,400 kW to 19,200 kW.
4. The train control logic, the functional specifications and the interface relationship between systems are designed independently, settling the adaptation between the large power traction system and the new network control system and solving the problem of system integration between the brand new traction system and network control system.

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4 QUALITY ASSURANCE PLAN

The RFP requirement for the Quality Assurance Plan to be submitted with the Proposal states:

MBTA RFP No. CAP 27-10 Requirement
Tab I.4 Quality Assurance Plan
The Offeror is to provide an outline of the Quality Assurance Manual and Project Quality Plan requirements stipulated in T 19.03 of the Technical Provisions within Part B of its proposal. The outline should include details of approach, organization, sample procedures, sample documentation, and feedback mechanisms for all phases of the program (design, manufacture, final assembly, test/commissioning, warranty). *The Offeror shall describe their approach to subcontractor quality compliance, first article inspections and quality control/quality assurance role at the final assembly site.*

4.1 INTRODUCTION

This section provides information outlining CNR's Quality Assurance Plan to be implemented for this project. This outline has been carefully developed to ensure compliance with every requirement pertaining to quality in this RFP and its associated documents.

CNR MA, the U.S. Corporation that will sign this contract with MBTA, shares the same ownership and corporate management as CNR Changchun Railways Vehicles Co., Ltd. (CNR CRC). As such, CNR MA adopts the same Quality policies, standards and practices that have been developed and successfully employed by CNR CRC. For purposes of this proposal section (Tab 1.4), "CNR" is used to refer to the bidder even if the items referred to may actually come from CNR CRC (such as ISO 9001 certification).

4.2 DETAILS OF APPROACH

CNR has certified systems in accordance with recognized international standards:

- ISO 9001 quality management system
- ISO 10012 metrology system
- ISO 14001 environmental management system
- OHSMS occupational health and safety management system
- IRIS international railway industry management system
- EN 15085 certification of welding shops for rail vehicle construction

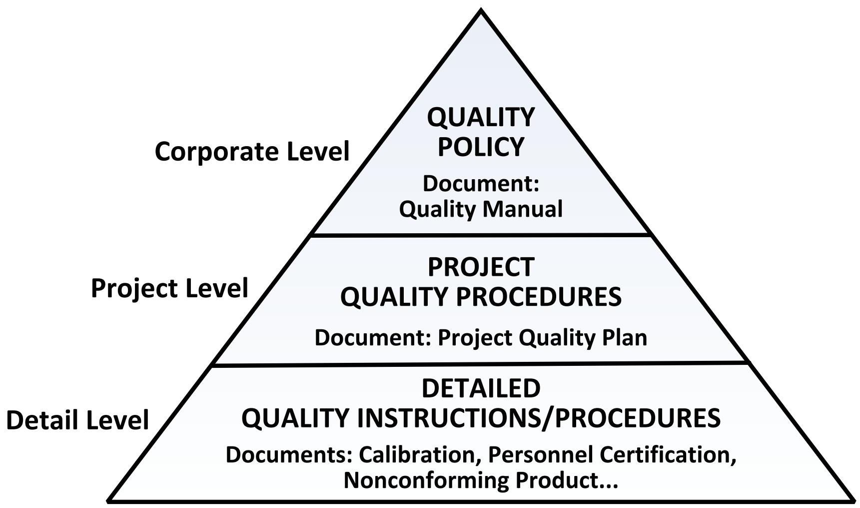
In addition, CNR has implemented leading quality management methods using, among others:

- SAP enterprise performance management
- Lean management
- P3e project management
- Gate/milestone/point PMP processes

Control of quality is an integral part of CNR's certified Quality management structure and operation to be applied to this program. Its application and documentation can be categorized in three levels.

- Corporate level quality policies of the company are documented in the Quality Manual. These practices are applied to all projects undertaken by the company.
- Project-specific procedures are written consistent with the unique requirements of each project and documented in the Project Quality Plan which contains the detailed procedures to be applied by the project team for that project.
    - The Project Quality Plan and its associated Inspection and Test Plan(s) represent the two main documents for quality for any particular project.
- Detailed instructions/procedures and forms are documented to carry out quality control (QC) and quality assurance (QA) tasks. These include a combination of corporate and project-specific documents providing instructions for control of calibration, certification of staff and equipment, and other areas.

A diagram illustrating the layers of CNR's Quality program and their controlling documentation is shown below.



CNR Quality Program Levels and Controlling Documents

Details of our approach to quality are described in the next sections organized following the RFP.

4.3 ORGANIZATION

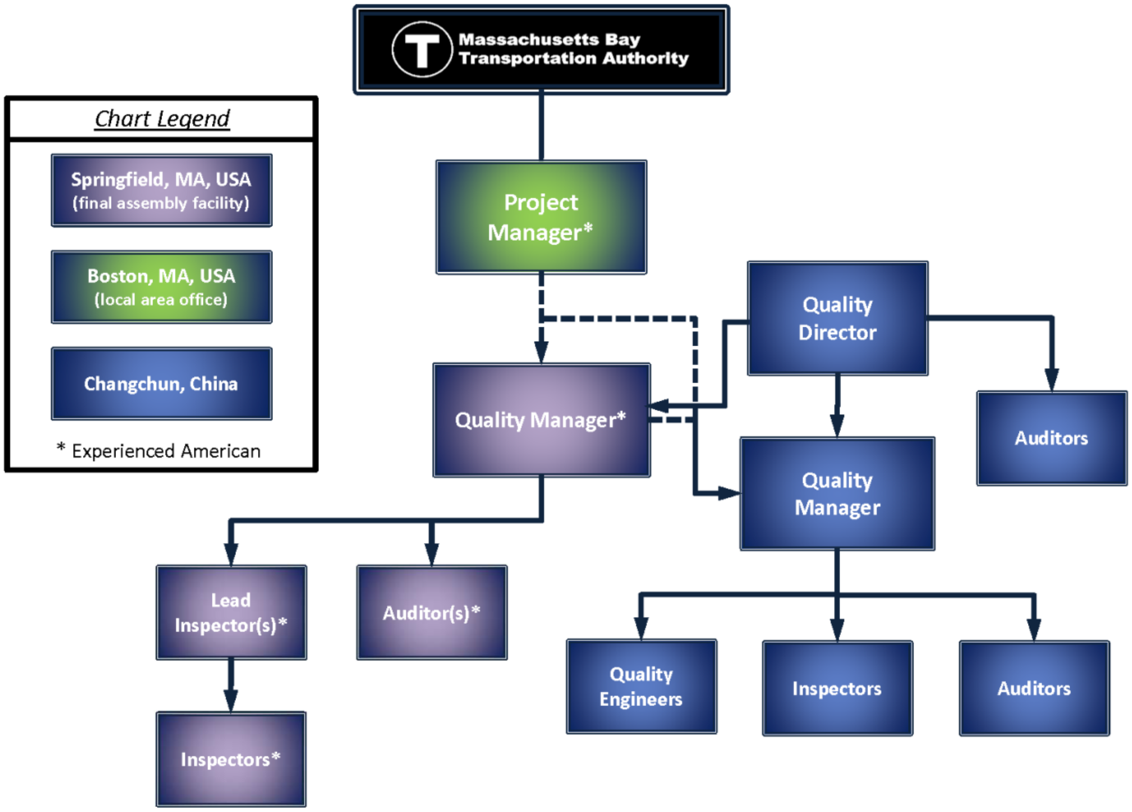
> All Quality staff have authority directly from the CNR corporate Quality Director.

CNR has a full-time, fully staffed Quality Department of professionals experienced with quality control and quality assurance of rail vehicle construction that will be brought to bear for this project. Staff engaged in Quality roles and responsibilities are authorized to report to executive management, separate from project production responsibilities. Quality personnel do report to project management for close coordination of scheduling, performance and follow-up of daily inspections and other Quality activities, however, each individual with responsibility for quality has the authority (through the Quality organization) to disapprove nonconforming product, processes and documentation.

A dedicated Project Quality Manager will be assigned to the project. Additionally for this project, the Project Quality Manager, in-plant inspectors and personnel conducting Quality audits will be certified to American Society for Quality (ASQ) standards, or approved equal, as required by MBTA.

A functional Organization Chart showing the lines of reporting of Quality Department personnel is shown below. The complete Project Organization Chart identifying the names for each role for the overall MBTA project can be seen in Section 1.1 of this proposal.

Project Quality Manager and all in-plant inspectors and auditors certified by ASQ.



CNR Quality Assurance Functional Organization Chart
For MBTA Red/Orange Lines Projects

The Project Quality Manager stationed at the Massachusetts final assembly site will have overall responsibility for all matters regarding quality for the project, and be MBTA's direct point of contact (through the Project Manager) for quality. To utilize the experience and proficiency with CNR proprietary designs and procedures and to prove that the manufacturing procedures can be effectively executed, the Changchun Quality Manager will lead the Quality oversight for the Pilot cars. The Project Quality Manager will be cross-trained at the Changchun facility to ensure the familiarity and consistency of practices at the final assembly facility with CNR's methods.

4.4 QUALITY MANUAL

CNR is certified to IRIS, ISO 9001:2008 and other international Standards as shown in Section 4.2 above. Our corporate Quality Manual is mature, maintained and incorporated throughout the company, and approved by many international customers. All policies of the Quality Manual will be applied to this project including at the Massachusetts final assembly facility.

MBTA's requirements for the Quality Manual have been carefully reviewed and all 14 elements specified in Section 19.02 of the Technical Provisions (TP) are confirmed to be addressed.

A copy of the corporate Quality Manual and current ISO 9001 certification will be submitted to MBTA after award in accordance with the TP (ref. CDRL 19-01).

4.5 PROJECT QUALITY PLAN

CNR routinely develops project-specific Project Quality Plans (PQP) to comply with international quality standards. Sample pages from CNR Project Quality Plans from similar projects are provided in the appendix to this section, including a table of contents and list of Quality procedures to show the scope of these plans. CNR is now actually in the process of developing the PQP for the MBTA project for submittal to MBTA at NTP + 60 days (ref. CDRL-19-05) in the case the project is awarded to CNR. The following sections provide a brief description explaining how CNR will ensure compliance with each requirement in Section 19.03 of the TP.

4.5.1 Project Description

The PQP will include a description of the project including the scope of work.

4.5.2 Project Roles and Responsibilities

CNR empowers Quality personnel to report directly to executive management, yet this staff works closely with project management on a daily basis to execute project duties with well-defined roles and responsibilities. The Project Quality Manager has responsibility for all Quality activities and documentation for the project. Other lead Quality staff includes the Lead Inspector and Auditor. These key positions will possess certifications in accordance with the American Society for Quality (ASQ) for Certified Manager of Quality/Organizational Excellence (CMQ/OE), Certified Quality Inspector (CQI) and Certified Quality Auditor (CQA) as applicable. CNR additionally agrees to certify all in-plant Quality Inspectors at Changchun and Massachusetts manufacturing facilities to ASQ CQI (ref. Addendum 6). Responsibilities for these primary roles are described below.

Project Quality Manager Responsibilities

- Responsible for overall development, implementation and compliance of Project Quality program;
- Report to corporate Quality Director and coordinate with Project Manager for all Quality matters for the project;
- Prepare and implement Project Quality Plan;
- Prepare and implement Inspection and Test Plans;
- Manage and supervise project Quality resources including resource allocation;
- Attend project meetings pertaining to quality and ensure Quality action items are resolved;
- Ensure control of quality of product manufacturing including in-house manufacturing, final assembly and supplied products;
- Ensure control of Quality records and documentation;
- Monitor control points and review and report quality performance to Project Manager and Quality Director;
- Implement periodic project audits;

- Define and implement corrective actions/improvements to Quality program as found to be necessary;
- Key support staff include ASQ (or equal) certified lead inspector and auditor;
- Supported by Quality Engineers and specialists in the areas of welding, NDT, supplier quality control, truck assembly, final assembly, testing and commissioning.

Lead Inspector Responsibilities

- Report to Project Quality Manager;
- Assist Project Quality Manager with preparing and implementing Inspection and Test Plans;
- Supervise and train Quality inspectors and testers;
- Conduct and document Quality inspections;
- Monitor/control quality of product manufacturing including in-house manufacturing, final assembly and supplied products;
- Monitor/control Quality records and documentation;
- Review Quality records for compliance including car history books;
- Check control points and monitor and report Quality performance to Project Quality Manager.

Quality Auditor Responsibilities

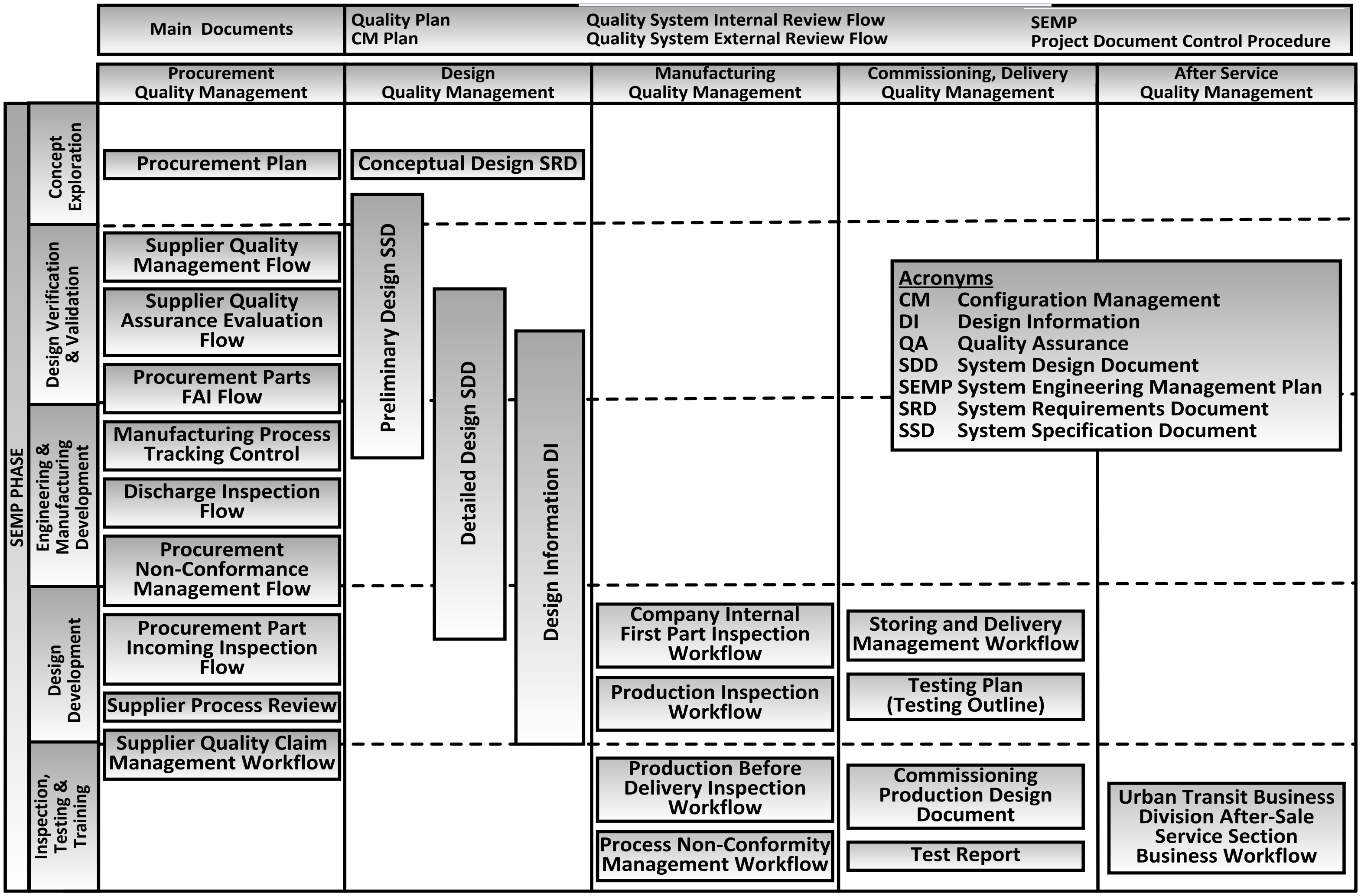
- Report to Project Quality Manager;
- Assist Project Quality Manager with preparing and implementing project audit plan;
- Write audit procedure for audit of each Quality area;
- Conduct and document Quality audits;
- Supervise and train Quality auditors;
- Review/monitor audit results to confirm control of product and process quality for in-house manufacturing and supplied products;
- Maintain records of Quality audits.

The CNR Project Quality Manager and Quality Lead positions will be stationed at the Massachusetts final assembly facility upon arrival of the first production carshells.

4.5.3 Project Specific Design Control Procedures

CNR has a mature Systems Engineering Management approach to design development and verification/validation.

CNR employs mature design management measures for all projects. The process starts with contract review and analysis of requirements, progresses through methodical design development and concludes with design verification and validation. The key to the effectiveness of our design control process is its systems engineering approach, which examines each part of the car from a systems engineering point of view through a 5 stage process. CNR will apply its Systems Engineering Management (SEM) approach for MBTA's specific requirements regarding design. The roles SEM plays through all phases of the project can be seen in the Project Quality Management Flowchart on the following page. This diagram identifies each procedure that is implemented at each SEM phase and the responsible department.



Sample Project Quality Management Flowchart through All Project Phases

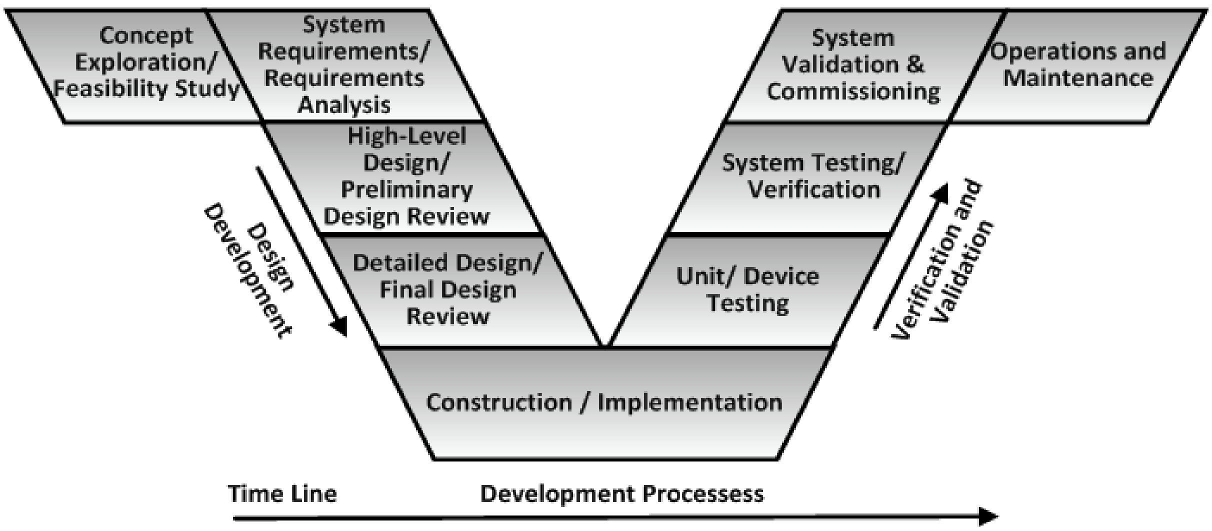
Key elements of the design management program pertain to control and verification of design inputs and outputs.

Input of Design

Management of design inputs is defined to ensure that they are adequate and properly disseminated through the design and development process. During the process, Requests for Information (RFI) will be issued as necessary and an RFI Log kept by CNR project management office by the Assistant Project Manager to ensure that all needed actions have been taken and issues closed.

Review of Design Development

The process for review and development of the design is defined. Methodical and progressive reviews are undertaken following development of each trainset system down to its piece parts, then validated that each part and interoperating system function properly and meet Specification requirements. The V-diagram below depicts the decomposition and definition of inputs and the system engineering approach to verification and validation of the outputs. Incremental steps for development of design inputs are shown on the left side of the diagram.



V-Diagram of Design Verification/Validation

The SEM approach involves multiple reviews that work together to provide a controlled design management process. Examples of these reviews include System Requirements Review (SRR), System Function Review (SFR), Preliminary Design Review (PDR), Intermediate Design Reviews (IDR) if required, Final/Detail Design Review (FDR), Test Readiness Reviews (TRR), System Verification Reviews (SVR), and others as needed. Actions identified from the reviews will be followed up and rectified in subsequent design activities. The results of reviews will be recorded and maintained by the Design Manager.

Design Verification and Validation

A process to systematically verify design outputs is developed to ensure that the user/system requirements, preliminary design and final detailed design have been carried out in fulfillment of the Contract requirements. This process follows the SEM approach and includes defining and documenting the following information:

- System functional requirements;
- System interface requirements;
- Assumptions made for system/subsystem parameters and characteristics;
- Proposed methodology of design verification and validation;
- Schedule of design verification and validation activities.

Output of Design Development

The incremental steps for verification and validation of design outputs are shown on the right side of the V-diagram above. At each step, CNR will confirm compliance of design outputs prior to presentation/submittal to MBTA for approval. Any comments from MBTA will be promptly addressed by CNR and suppliers as necessary to achieve approval. Approved design output will be documented and maintained in the project file, and approved designs taken forward to the next design stage or implemented into the final design for final verification and validation. The type of documents for outputs of the design and development process is dependent of the level of design and development in the different SEM stages. CNR ensures that the design documents to be submitted to MBTA will include all TP CDRL items, at a minimum. It is important to note that the verification and validation activities shown on the right side of the V-diagram will be performed for both pilot vehicles and production vehicles. Any findings from the verification/validation exercises will be fed back into the design documents of the left side of the diagram and re-inspected/re-tested as necessary to confirm compliance. Additional avenues for feedback of quality issues are discussed in Section 4.5.12 herein.

4.5.4 Project Specific Production/Manufacturing Procedures

CNR utilizes documented instructions for manufacturing operations for all its new car construction projects and this same practice will be implemented for this project. This instruction is provided through a combination of production drawings, work procedures, technical data and other information from CNR and suppliers. Written instructions are available to all staff having production responsibilities. Production procedures consist of detailed instructions to perform the work including specifying special tools/fixtures, consumable materials, safety warnings and other relevant information. Procedures will cover installation, workmanship, torque requirements, calibration, and material handling and specify pass/fail acceptance criteria. CNR will ensure that final procedures for production address all items listed in TP Section 19.03.02 item 4.

Production procedures will be developed and revised as necessary to prove them during construction of the pilot vehicles at the Changchun plant. The procedures for final assembly will then be conveyed to the Massachusetts final assembly plant through a technology transfer process. This will entail bringing key production personnel from the U.S. to China for training by our Chinese staff having expert knowledge of these designs and procedures. This will be followed by deployment of Chinese supervisors and trainers to the U.S. for further training of local final assembly staff. In addition to hands-on training in mechanical/electrical assembly, worker training will also include familiarization with workmanship standards and acceptance criteria. After the technology transfer period, some Chinese staff will be retained at the Massachusetts final assembly site to monitor the performance and compliance of U.S. production operations.

All production/manufacturing procedures are subject to revision control. Required procedures will be submitted to MBTA for approval prior to commencement of work. Sample pages of Work Process Sheets from a similar project are provided in the appendix to this section representative of the step by step instruction, tolerances, diagrams and other pertinent information.

4.5.5 Configuration Management

CNR has an established configuration management system to ensure that designs are traceable to requirements, changes are controlled and documented, and there is consistency between the product and its supporting documentation. Configuration management provides documentation that describes what is supposed to be produced, what is being produced, what has been produced, and what modifications have been made to what was produced. Configuration management is closely associated with technical data management and interface management. Configuration control focuses on two areas: identification of configuration and changes to configuration. The Configuration Plan describes procedures for the following functions.

- Identification of configuration: Identify all parts requiring serial numbering; specify procedures for serialization, and record serial numbers for all required items per vehicle specifying the revision level of each part for configuration control of hardware and software.
- Change control: Procedures will document and control any changes to hardware and software configuration that may be initiated by suppliers, CNR, contract change orders (modifications), engineering changes and field modifications.

The configuration control process will ensure that submittal of deliverables to MBTA such as drawings (especially final as-built drawings), specifications, and manuals accurately record the latest revision levels for all equipment.

Details of our configuration management program will be provided in the Configuration Plan to be submitted to MBTA for this project (ref. CDRL 21-09). Some of the section headings from the Configuration Plan are shown below to show the scope and level of detail of this plan.

CNR Configuration Plan Contents

Configuration management organization	Configuration controlling
Configuration organization member roles	Engineering change control
Determining configuration structure	Problem/fault management
Selecting configuration items	Documentation control
Configuration numbering	Configuration auditing
Establishing configuration baselines	Subcontractor control
Contract baseline (Award), Functional baseline (SRR),	Project CM schedule/deliverables
Design baseline (System DR), Product baselines	CM Plan updating and approval

4.5.6 Engineering Change Control

Documented procedures are utilized for control of engineering changes so that no changes are made to baseline designs without going through a review process and obtaining CNR and MBTA approval as required. Engineering change control procedures and forms are a part of CNR's Configuration Plan. Engineering changes can initiate from a variety of sources and involve multiple documents. Accordingly, separate forms have been utilized for Engineering Change Notice (ECN), Specification Approval Form (SAF) and Field Modification Instruction (FMI). ECN information will include the reason for the change, updated drawings and other documentation, plan and schedule for modification, vehicles affected (effectivity), and FMI procedures specifying parts required, tooling and other relevant information. Engineering changes initiating as a result of form, fit, function or corrective/preventive changes are captured. The Engineering Change Management procedure also contains a provision to prioritize a change via a High Priority/Emergency classification to allow rapid processing and approval of critical changes.

Details of CNR's engineering change control procedures will be included in the Configuration Plan to be submitted to MBTA for this project (ref. CDRL 21-09).

4.5.7 Non-conforming Material Control Procedures

CNR has established procedures to control nonconforming product. Procedures # QA-320, Product Nonconformity Management Flow, and QA-470, Process Nonconformity Management Flow, serve to prevent the use of nonconforming products in accordance with IRIS and ISO 9001 requirements. These procedures set rules for handling nonconforming product and the processes that produced them. They describe in detail the management methods, identification, document archive, classifications and handling of nonconforming products.

Nonconformity Reports (NCR) will be issued for any nonconforming products during project execution. Upon receiving an NCR, affected workshops and/or suppliers must execute certain measures:

1. Nonconforming product must be marked clearly by tagging or other marking procedure and kept in an Isolation Area/prevented from production use until the NCR is resolved;
2. Analyze the reason(s) for nonconformity and propose corrective measures to handle the root issue(s). A nonconformity can only result in one of the following dispositions:

SCRAP	RETURN TO VENDOR	REWORK	REPAIR*	USE AS IS*

* MBTA approval required for these dispositions.

3. Ensure responsible departments/companies implement corrective measures including re-inspecting/re-testing reworked product to verify conformity;
4. Conduct trend analysis;
5. Document response and closure of NCR in a timely manner.

If an NCR is proposed for disposition to "use as is" or "repair" (meaning any variance from Specification requirements or configuration), CNR will submit documentation of this to MBTA for approval before such disposition can be implemented, and the NCR will become part of the vehicle's manufacturing history book. In the case of "repair", written procedures for repair must also be approved by CNR and MBTA.

A Quality Engineer will be responsible for monitoring the status of NCRs generated during procurement and manufacturing to ensure that they are properly rectified, verified and closed. A sample NCR form from a similar project can be seen in the appendix to this Section.

Remedial actions to correct nonconformities are developed and controlled following procedures to ensure that corrective/preventive actions are effective. Sample pages from our Corrective/Preventive Measures Management Process are included in the appendix to this Section indicating the activities, timing, responsible party and other information showing the scope of this process.

4.5.8 Procurement and Vendor Quality Procedures

CNR has documented procedures for control of subcontractors/suppliers including qualification of suppliers, audit and performance monitoring. In addition, CNR Quality staff performs other activities to check supplier product and processes such as first article inspection, source (pre-shipment) inspection and receiving inspection discussed in the following sections.

CNR will require pre-qualification of potential suppliers who have not previously worked with CNR. These suppliers are first evaluated to prescribed criteria including company capabilities (facility, equipment and resources), financial viability, overall management and Quality management, and ability to implement QA/QC procedures. Records of previously demonstrated capability and performance on other projects including product standards achieved are also reviewed during the evaluation. Suppliers already having a working relationship with CNR are subject to routine checks of key criteria to ensure that their potential remains valid before engaging them in new work. A list of approved suppliers is maintained and reviewed regularly through a performance monitoring and appraisal process. Any suppliers that fail to meet the requirements and/or have not performed satisfactorily are removed from the list. In the case that suppliers are changed, CNR will notify MBTA of these changes for MBTA concurrence as required.

Quality, Procurement, Production, Engineering and Business departments participate in assessment of subcontractor/supplier performance, which evaluates the supplier's quality, procurement, production, logistic, technology, project management, after sales service and other indicators of performance. Suppliers are rated either A, B, C or D according to their score and a performance report is issued each year. Suppliers with level C and D grades will receive an on-site review and a written notice will be issued for the supplier to rectify cited issues. CNR's Quality Department will verify satisfactory implementation of supplier corrective actions to improve performance in the identified areas. Sample pages from our Supplier Audit Management Process procedure are included in the appendix to this Section indicating the activities, timing, responsible party and other information showing the scope of this process.

Other aspects of CNR's supplier management procedures include review of supplier tender offers, joint review of requirements with suppliers including quality, safety and environmental items and written resolution of any ambiguities, and on-site capability assessment. Suppliers being considered to perform services such as construction or final assembly work will receive additional, different evaluation from those supplying product only.

Diligent management of suppliers in this way will ensure the delivery of qualified product and services to MBTA.

4.5.9 Inspection Procedures

Documented procedures will be utilized for Quality inspections of all work performed for this project by CNR and its suppliers. The major controlling documents for inspections under the Project Quality Plan are the Inspection and Test Plans (ITP). CNR has established 5 ITPs organizing all inspections into the following areas:

- Supplied products
- Carbody production
- Truck production
- US final assembly
- Vehicle testing

Each ITP requires the approval of the CNR Project Quality Manager and MBTA, and will address the following information:

1. Sequence of inspection and test activities;
2. Inspection and testing requirements;
3. Applicable specification(s) and acceptance criteria including drawing/doc. no. and revision;
4. Level of inspection required with provision for hold point inspection/witnessing by MBTA;
5. Any certification requirements.

Supporting each ITP are detailed inspection procedures and forms to direct the inspection activity and record findings and remedial actions. Sample pages of inspection documents from a similar project are provided in the appendix to this Section, including an Inspection Process Check Card specifying items to be inspected, acceptance criteria and other relevant information.

CNR's approach for each primary inspection activity is described in the following sections.

4.5.9.1 QC/QA Role at Final Assembly Site

CNR Quality staff will directly supervise U.S. final assembly.

CNR will establish comprehensive Quality oversight at the U.S. final assembly site that will provide direct checking and control by CNR of all work done at this site. This scope will cover receiving inspection of materials, in process inspection, and outbound final inspections and testing of each vehicle, plus additional audits of all work performed. Review of documents will also be an inherent part of CNR verification especially of the manufacturing history records for truck assemblies and completed vehicles (i.e. Car History Book). CNR will specifically verify that the scope of work done at the final assembly site includes the items stipulated for final assembly in Massachusetts in MBTA's Contract.

A technology transfer process will be used to train U.S. final assembly staff.

The CNR Project Quality Manager and Quality Lead positions will be stationed in Massachusetts full-time – actually, key project management staff will spend much time at both the Boston local office and Springfield final assembly facility. This key staff will arrive at the final assembly facility at least 2 weeks before arrival of the first production carbody and work with the Project Manager to gauge and control the acceptability of work and product. These individuals will work closely with other Quality staff deployed to the final assembly plant from CNR headquarters especially during the technology transfer period at the beginning of final assembly of the production cars. This will entail bringing key QA/QC personnel from China for training/oversight of local final assembly staff by CNR staff proficient with these procedures. After the technology transfer period, some of this direct CNR staff will be retained at the final assembly site to monitor the compliance and performance of U.S. QA/QC operations throughout the period of performance.

Highlights of CNR's QA of U.S. final assembly operations are summarized in the following points:

- CNR will retain direct "ownership" and responsibility for Quality at the final assembly site;
- CNR will employ a technology transfer process to train U.S. personnel at Changchun during the pilot car phase;
- CNR will have direct QA staff at the final assembly site throughout the period of production;
- CNR will establish hold point inspections in the production line beyond which work cannot progress without CNR and MBTA approval (as mutually agreed);
- Hold points will include comprehensive pre-shipment inspection and testing prior to release of any vehicle for delivery to MBTA;

- Open items will be documented and tracked until closure is verified;
- In addition to routine QA of in-process and outgoing work, CNR will conduct audits of the final assembly plant's compliance with procedures and requirements.

Further details about CNR QA/QC coverage of the U.S. final assembly site are provided in the descriptions for each respective area below.

4.5.9.2 First Article Inspection

CNR will implement a First Article Inspection (FAI) program to ensure that all components meet contract specifications prior to commencement of production product. This process will include documented verification of compliance by CNR (Pre-FAI) prior to joint inspection with MBTA. Major components will undergo FAI by CNR Quality staff including all items named in Section 19.05C of the TP.

The FAI process can be divided into three primary stages: pre-requisite activities, pre-FAI and formal FAI.

Pre-requisite activities

CNR will ensure that certain pre-requisite activities are completed prior to engaging in FAI. This includes such items as having an executed Purchase Order with clearly defined work scope, specifications and QA/QC requirements, the supplier's passing CNR's QA evaluation process and achieving MBTA's concurrence, and having drawings, specifications, test procedures and other relevant documentation reviewed and approved by CNR and MBTA. This will ensure that FAIs are effective to establish definitive baselines for subsequent production.

CNR Pre-FAI

Next, CNR will conduct a Pre-FAI to verify that the product and its manufacturing processes comply with Specification and Quality requirements. Any open items found during the Pre-FAI will be corrected and closed and a complete package of documentation from the Pre-FAI will be submitted for MBTA review before the formal FAI is undertaken.

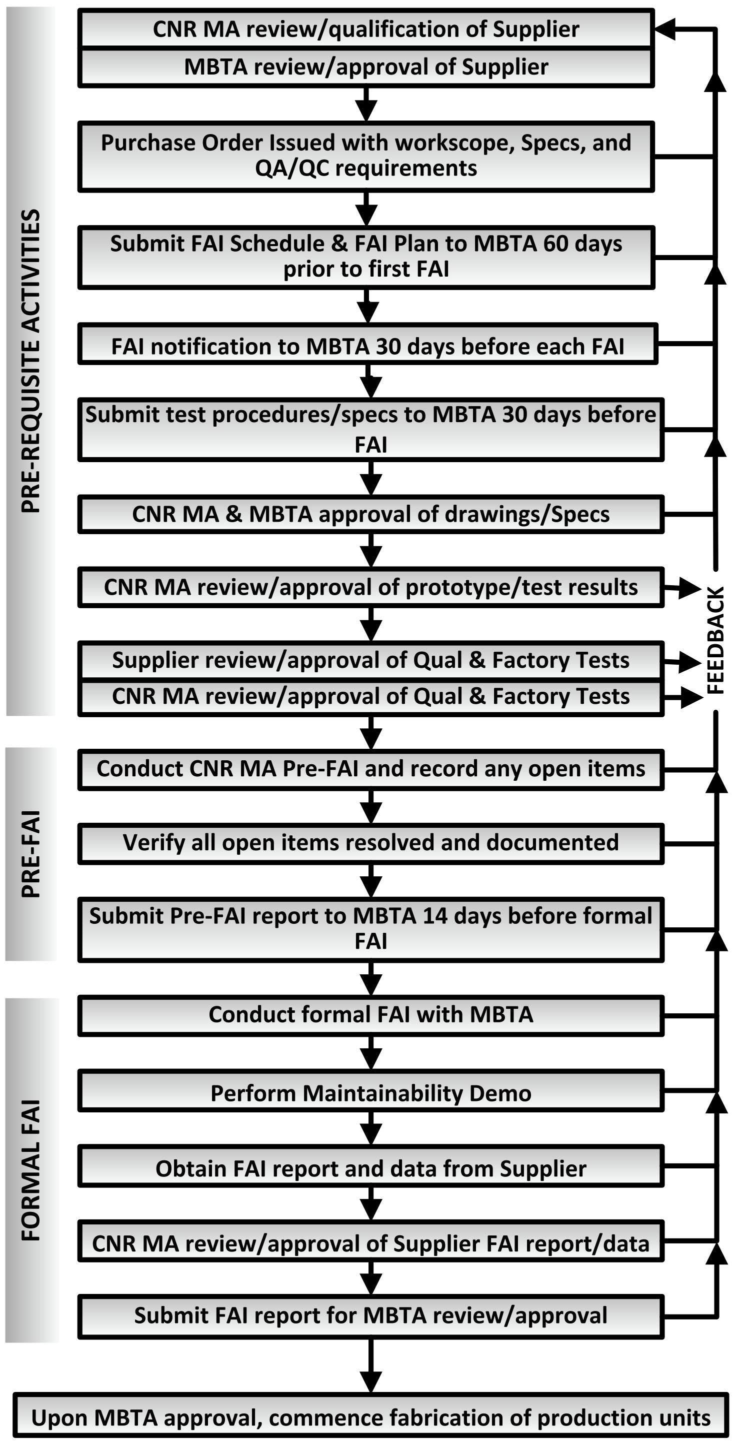
Formal FAI

After all this preparatory work, the formal FAI will be scheduled with MBTA and CNR's Quality team to jointly verify and approve each item/system for the Red and Orange Line vehicles. Production will not be allowed to commence until all open items from the FAI have been satisfactorily resolved and MBTA has reviewed and approved the FAI document submittal.

CNR acknowledges the amount of notice specified in the TP and will plan the project schedule to be able to provide the required notices. This includes submittal of the FAI plan and schedule to MBTA 60 days before the first FAI, 30-day notice of each specific FAI, submittal of test procedures and specifications 30 days before FAI, and submittal of CNR's completed Pre-FAI report with supporting data 14 days before FAI.

A flowchart and description of each step of CNR's FAI process is provided below. This flowchart has added the unique requirements of MBTA's RFP Section C5.19 and TP Section 19.05 to CNR's pre-existing process.

First Article Inspection Process Flowchart
Per RFP Section C5.19 and TP Section 19.05



LIST OF SYSTEMS FOR FAI (re. TS 19.05)

- Propulsion
- Trucks and Major Truck Components
- Auxiliary Inverters
- Low Voltage DC Power
- HVAC
- Carshell
- Couplers / Draft Gear
- Wheel Sets
- Air Brake Equipment and Controls
- ATP/ASR Equipment
- Door Systems
- Seats
- Vehicle Monitoring System
- Network Integration
- Communication Equipment incl LED & LCD Signage
- Lighting

LIST OF REQUIREMENTS FOR FAI PLAN

- Supplier contact information
- Location of FAI
- Date and time of FAI
- Agenda

REQUIRED INFORMATION FOR FAI

- Location of FAI
- Date and time of FAI
- Completed routine test report
- Current configuration data
- Drawing rev. level, ECNs, serial numbers of test equipment, list of material certificates, FAI participants, noncomfomances
- Detailed manufacturing procedures and test specs.

LIST OF DOCUMENTS FOR FAI

- Test and inspection reports
- Lab analysis reports for materials
- Certificates of compliance
- Approved drawings and Bills of Material
- Draft Integrated Parts Catalog
- Draft Running Maintenance Manual
- Draft Heavy Maintenance Manual
- Draft Maintenance Planning Manual
- Conformance to Specification
- All pending Engineering Changes (ECN), approved deviations or waivers

4.5.9.3 Incoming Inspection

CNR routinely conducts inspection to verify that incoming materials comply with Specifications before they are used for production and this same practice will be applied by CNR for this project. The scope of incoming inspection checks the conformity of products including appearance, quantity, critical and interface dimensions, marking, certificate of chemical and physical properties, certificate of compliance and other items as denoted on drawings, technical specifications, procurement contract, Quality documents, or other requirements. Incoming inspection procedures will identify the criticality of inspection and identify items that are required to be inspected 100% and items that are sampled at various frequencies. Occurrence of Quality or performance problems will cause sampled products to move to heavier sampling or to 100% inspection as determined necessary. Incoming inspection records are maintained by the QA Department.

4.5.9.4 Hold Point Inspection

CNR uses hold point inspections to control production work and will establish hold points strategically placed in the production sequence beyond which work cannot proceed without CNR QA approval. This procedure shall specifically ensure that MBTA approval is obtained at those points designated in Section 19.03.02 of the TP.

Already at this preliminary time, CNR has established the following hold points for production of MBTA's vehicles. These inspections include the items specified in MBTA's TP and additional inspections identified by CNR Quality staff. This list will be submitted to MBTA as part of the Quality CDRL items and revised as may be necessary for MBTA approval.

CNR already identified proposed hold points for this Project.

Planned Inspection Hold Points for MBTA Project

At Carshell Site	At U.S. Final Assembly Site
• Prior to release from each Workstation • Carbody structure • Carbody Water-tightness Test • Piping and Wiring • Prior to Installation of Interior Wall Liners, Floor and Ceiling • Carbody Pre-shipment	• Prior to release from each Workstation • Underfloor Equipment Installation • Interior Equipment Installation • Exterior Equipment Installation • Completely Assembled Truck • Truck Installation • Final Car Inspection • Final Car Functional Testing • Final Car Water-tightness Test

Details pertaining to hold point inspections will be included in their respective ITPs to be submitted for MBTA approval. In addition to these, First Article Inspections and qualification tests also represent hold points also enumerated in the ITPs.

4.5.9.5 Source Inspection

CNR verifies and controls the compliance of supplied product by inspecting product at the supplier prior to delivery to CNR as necessary. Source inspection includes thorough physical inspection of the product to specification requirements, static and functional testing if required, and review of supporting documentation including material certifications, certificates of compliance, smoke emission/ flammability test results, and other documents. CNR source inspections will be documented and available to MBTA for review. Source inspection may also include other types of inspection such as FAI, or in-process inspection before a product is ready for shipment.

Items with critical importance are identified as 100% source inspected items and must be inspected and approved by CNR QA at the supplier site before they can be shipped. If products are found with problems at incoming inspection or at other times, CNR may put these products on the 100% source inspection list also. Such items will remain on the 100% source inspection list until a satisfactory performance record is established, at which time CNR will change this designation back to incoming inspection only.

As for all inspections, source inspections are fully documented identifying the item(s) inspected, name of inspector, supplier and MBTA representatives, results of attributes inspected with acceptance criteria, and any findings.

4.5.9.6 Pre-Shipment Inspection

Pre-Shipment Inspection is defined in MBTA's RFP as "Source Inspection of product, parts, components, subsystems and/or systems conducted immediately prior to releasing items for shipment to Contractor or other destination". Procedures for supplied product are described in the preceding item for Source Inspection and procedures for pre-shipment inspection of completed vehicles are explained below.

Prior to releasing cars from CNR's final assembly location to MBTA, CNR will perform a complete pre-shipment inspection of each vehicle. The pre-shipment inspection will be a hold point activity consisting of comprehensive inspection of vehicle undercar, interior and exterior, functional testing, and review of build-up documentation (especially the Car History Book). Any open items will be corrected and verified by CNR before requesting MBTA's pre-shipment inspection and concurrence to release for shipment. Any open items that may still be open at time of shipment will be documented on the vehicle's authorization for shipment form and concurred with by MBTA in order for the car to be released for shipment. Also see QC/QA Role at Final Assembly Site and Hold Point sections above for related details.

4.5.9.7 Receiving Inspection

Vehicles and materials delivered to MBTA will be inspected upon receipt at MBTA delivery location(s). This inspection will include checking of quantity and serial number(s), inspection for damage that may have occurred during transit, removal of any coverings, blocking or packing that may have been applied for shipping, and verification of any documents required to be submitted with the product. Receiving inspections will be documented and identify the date, receiving inspector, MBTA representative and any findings. Findings that require remedial action will be promptly addressed by CNR; if these actions entail supplier responsibility, CNR will coordinate this between the supplier(s), CNR and MBTA.

4.5.9.8 Field Modification Inspection

CNR will ensure that there are written instructions for any modifications to equipment in the field and verify that such procedures are satisfactorily accomplished. Written field modification instructions (FMI) will be submitted to MBTA for approval prior to their implementation. CNR field inspection will be performed for FMI work done by CNR, subcontractors/suppliers, or by MBTA personnel for a warranty claim, and will include review of supporting documents such as material certificates, verification of worker certification such as AWS, verification of equipment certification such as calibration, and inspection and testing of completed work as necessary. Documentation of field modification inspections will be available to MBTA. CNR will work closely with MBTA to obtain safety training, certification or clearance that may be needed for access to equipment that is on MBTA property and CNR will coordinate all field modification work with MBTA including the time, access, escort and other needs.

4.5.9.9 Pre-Acceptance Inspection at Carhouse

CNR will participate in Pre-Acceptance Inspection of each vehicle at MBTA's Carhouse. This inspection will include inspection of each vehicle for damage during transit, removal of any coverings, blocking or packing that may have been applied for shipping, and power-up functional checks and testing for commissioning. Written procedures for Pre-Acceptance Inspection and testing will be submitted to MBTA for approval prior to performance.

4.5.10 Test Procedures

CNR will develop a comprehensive testing program for the MBTA vehicles in accordance with Section 20 of the TP. Testing will consist of qualification tests (to be done on one part/vehicle of each type) and routine tests (to be done on all parts/vehicles) that will be done at the supplier site, CNR, and/or at MBTA as applicable. All required tests will have documented procedures and results and CNR will submit these to MBTA for review and approval. CNR will schedule all testing per the Master Project Schedule, submit prerequisite documents to MBTA for review and approval prior to performance of testing, and notify MBTA of each test for witnessing.

The major controlling documents for the test program include a Master Test Plan identifying every test to be done and Inspection and Test Plans (ITP) indicating the location and sequence of testing. CNR has established the following 5 ITPs organizing these tests:

- Supplied products
- Carbody production
- Truck production
- US final assembly
- Vehicle testing

The test program will cover all areas noted in the RFP including life-cycle testing, material testing, routine testing, system testing, software testing, integration testing, pilot car testing, vehicle testing and acceptance testing, and list the individual tests for each category. The test program will additionally address non-car tests specified in Section 2 of the TP including validation of track conditions/geometry, supply voltage transient studies, and other tests as required. Sample pages showing the test plan matrix from an ITP from a similar project are provided in the appendix to this Section to represent the breadth of testing and detail of tracking.

Each test will have a documented test procedure and report that specifies the purpose of the test, location, required tools, prerequisite tests or activities, acceptance criteria, name and signature of tester, and software and hardware revision level where applicable, following the standard format approved by MBTA. Test reports shall additionally record all measured readings also attaching chart recordings, electronic test data, video/photos, or other supporting media as appropriate. CNR will submit each test procedure to MBTA for approval a minimum of 3 months prior to the planned test date. Notification of test dates will be provided to MBTA at least 30 days prior to the test. Test reports will be submitted to MBTA within 30 days of performing each test. Sample pages from test procedures from a similar project are included in the appendix to this Tab.

4.5.11 Audits

CNR conducts audits of the Project's QA/QC performance on 2 levels.

- Audits of compliance with CNR's corporate Quality Manual. These audits are typically conducted by personnel outside of the project commissioned by the Quality Director.
- Audits of compliance with PQP requirements. These are conducted either by CNR on-site QA or by staff dispatched from Changchun headquarters. These audits include:
    - Audits of compliance of manufacturing at carshell and final assembly plants with project procedures/specifications;
    - Audits of supplier compliance with project procedures/specifications; (also see Procurement and Vendor Quality Procedures Section 4.5.8 herein).

CNR conducts routine internal audits and will adopt these procedures for this project and conduct biannual audits of the PQP in accordance with Section 19.03.01C of the TP.

All audits will be documented with follow-up and verification of satisfactory implementation of corrective actions. Audit documentation will be available to MBTA.

Auditors will be certified as described in Section 4.3 of this document.

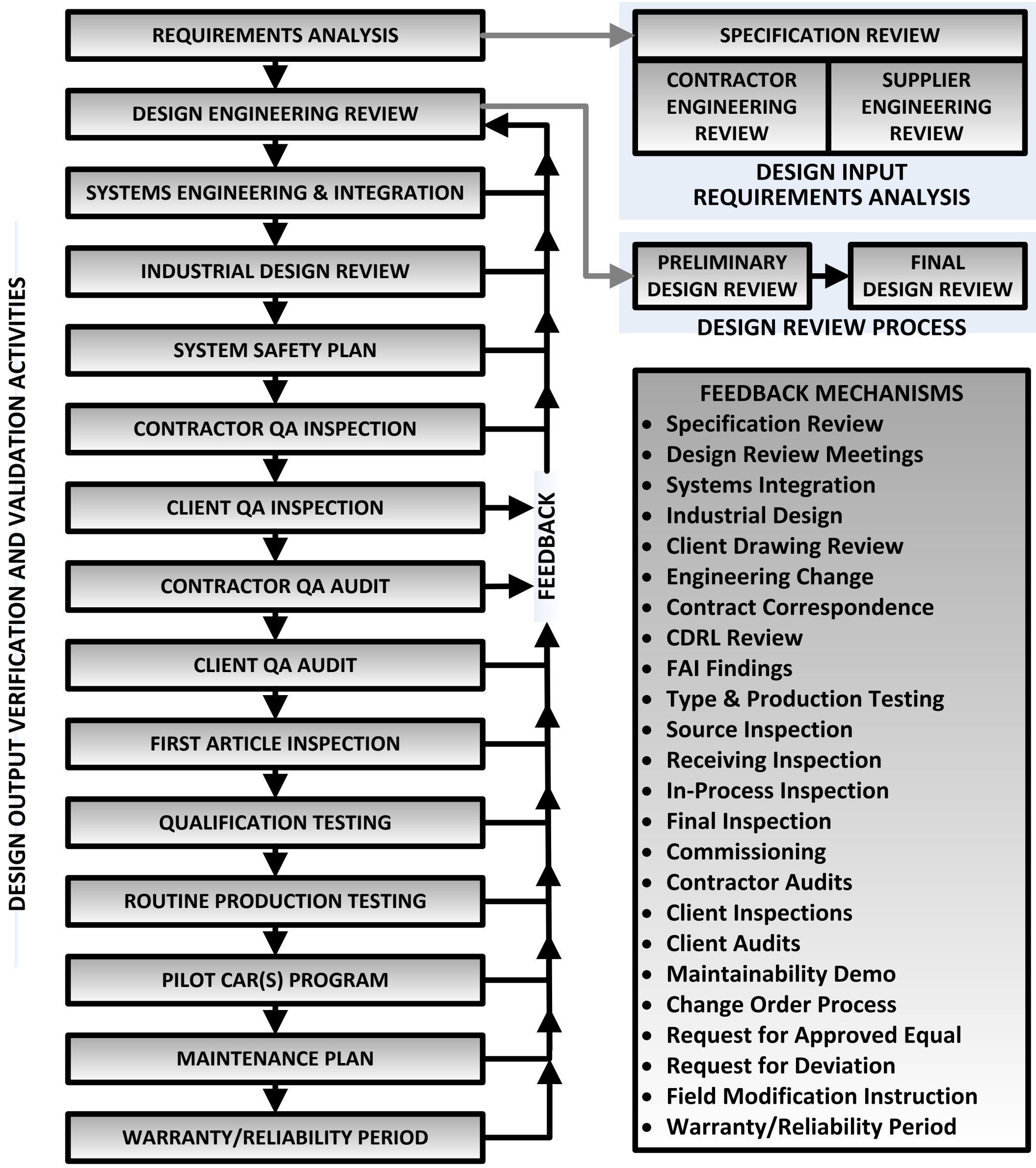
4.5.12 Feedback Mechanisms

CNR processes provide multiple effective opportunities to feed back Quality issues

CNR provides many avenues for feedback to promptly rectify issues affecting quality and compliance through all phases of the project. While procedures for feedback of quality issues are part and parcel of each Quality activity described in the previous sections, a summary of CNR feedback mechanisms for the project is illustrated in the following diagram.

The left side of the diagram lists the major activities that provide the opportunity for feedback. These activities begin with requirements analysis performed immediately upon award of the contract and progress through design review and verification/validation events to the reliability and warranty period. Feedback obtained for any item in this list is carried back to the appropriate previous input point(s) as far back as necessary in order to implement changes/corrections to correct the deficiency and prevent recurrence. This feedback loop would recur until the problem has been verified to be corrected.

The right side of the diagram provides a table showing primary feedback mechanisms naming their activities, forms and processes. Each of these items has an accompanying documented procedure. MBTA is given opportunity to provide Quality feedback at all of these points.



Feedback Mechanisms through All Project Phases

4.5.13 Warranty Management Procedures

CNR will provide continued support to ensure that vehicles perform as intended and achieve the required reliability. CNR will assign a Warranty Coordinator on-site at MBTA for a period of 2 years after Conditional Acceptance of each car. The Warranty Coordinator shall respond to warranty calls within one business day of notification. CNR will carefully track the performance of each car and system and effect reparations as may be needed to achieve reliability requirements. Parts usage will be monitored and adequate inventory levels maintained. CNR standard procedure will be to provide replacement parts within 10 days of each warranty claim notification. In the case that this cannot be achieved due to supplier lead times or other reason, this will be promptly communicated to MBTA for authorization of the best planned replacement date. Documented failure reports will be provided for all repaired parts. There will be a one-year warranty for all warranty replaced or repaired parts. In the event that a warranty claim finds that the equipment had been changed or altered after delivery without CNR's knowledge, CNR will be relieved of warranty obligations for that item. CNR understands that warranty work is to occur on MBTA property and be performed by MBTA personnel whenever possible. MBTA labor necessary to be used in connection with warranty work will be tracked and reimbursable to MBTA by CNR at the Contract agreed rate.

CNR will submit a Warranty Plan for MBTA approval 3 months prior to delivery of the Pilot Cars, (ref. CDRL 21-10). The plan will describe warranty staffing, maintenance of inventory, and procedures for servicing of delivered products. The plan will include procedures for handling ECNs and FMIs and forms for implementation of any changes should they be required after delivery of vehicles. An FMI log listing all FMIs and the status of implementation of each one will be maintained until expiration of the warranty period. The general warranty period will be 2 years for each vehicle, with carbody and truck structures warranted for 5 years.

4.6 SAMPLE PROCEDURES AND DOCUMENTATION

This section contains sample CNR Quality procedures/documents as requested by the RFP. Sample pages from CNR documents demonstrating use and familiarity with Quality procedures from similar projects are included for the following processes:

- List of Quality Procedures
- Project Quality Assurance Plan Table of Contents
- Project Inspection and Test Plan Test Matrix
- Sample Quality Inspection Check Card
- Sample Nonconformity Report
- Sample Test Procedure
- Sample Work Instruction
- Supplier Audit Management Process
- Corrective/Preventive Measures Management Process

MTR	Contract C6554-07E Rolling Stock	CNR 长春轨道客车股份有限公司 中国北车 CHANGCHUN RAILWAY VEHICLES CO., LTD.

Appendix E - List of Quality Procedures

Item 序号	Procedure Ref.	Procedure Name	Review Status
1	QM-A-7035-02-0005	Inspection and test plan (ITP)	Approved
2	Q/CCG-C1-ZL-020C-2009	Design and development procedure	Approved
3	Q/CCG-C2-ZL-037B-2009	Control procedure for customer communication	Approved
4	QA-4B0	Product traceability management process	Approved
5	QA-4E0	Product identification management process	Approved
6	Q/CCG-C1-ZL-024B-2008	Special process control procedure	Approved
7	PMC-400	Product protection and delivery control procedure	Approved
8	SM-A00	Record control procedure	Approved
9	QA-120	Quality system internal audit management pr[illegible]	Approved
10	QA-1C0	Corrective and preventative [illegible] management [illegible]	Approved
11	IN-400	Ha[illegible] process	Ap[illegible]oved
12	IN-Y00	Lo[illegible]ument control process	[illegible]oved
13	Q/CCG-C5-ZL-016C-2009	Da[illegible]analysis management procedure	[illegible]pproved
14	QA-2[illegible]	Supplier quality claim [illegible]	Approved
15	[illegible]	Procured parts in[illegible]min[illegible]nspection process	Approved
16	QA-420	[illegible]uality check process	Approved
17	QA-430	[illegible]tion quality inspection process	Approved
18	Q/CCG-C5-JL-001-2[illegible]	Measurement management manual	Approved
19	[illegible]	Tool management process	Approved
20	S[illegible]20G-001V1.0	Measuring instrument management and calibration process	Approved
21	QA-470	Nonconformity management procedure	Approved
22	QA-320	Procured parts nonconformance process	Approved
23	QA-480	Quality door management process	Approved
24	QA-200	Supplier management process	Approved
25	QA-330	Product FAI process	Approved
26	QA-410	Process FAI process	Approved
27	QA-210	Supplier Quality Assurance capability assessment	Approved
28	QA-230	Supplier process review	Approved
29	QA-240	Supplier quality performance evaluation	Approved
30	QA-310	Discharge inspection process	Approved
31	R-006	Production inspection process	Approved
32	R-010	Quality plan and Quality Control plan process	Approved
33	R-024	Records management specification	Approved
34	R-001	Technical document control	Approved
35	P-007	Production process management process	Approved
36	SM-320BG-001V4.0	International welder qualification test and review process	Approved
37	UT-A00	Urban Transit Business Division after sale service management process	Approved

Sample Document From Similar Project

MTR | Contract C6554-07E Rolling Stock | 长春轨道客车股份有限公司 CHANGCHUN RAILWAY VEHICLES CO., LTD.

Project Quality Plan (SIL)

Table of Contents

DAR No: C655407ESIL-TRN-PL-009C	Quality Plan
Rev No: C	Page 3 of 51

Sample Document From Similar Project

MTR | Contract C6554-07E Rolling Stock

DAR No: C655407ESIL-TRN-PL-009C	Quality Plan
Rev No: C	Page 3 of 51

Attachment to Tab I.4, QA Plan | Sample Documents | 2 of 10

Sample Document From Similar Project

Inspection and Test Plan (ITP)检验试验计划

CNR 长春轨道客车股份有限公司 CHANGCHUN RAILWAY VEHICLES CO., LTD.

Project: Metro Rio Line 1 项目：巴西里约1A线项目	Doc. Title:Commissioning and Inspection, Test Plan 文件名称：调试检验试验计划		ITP ref./Ver.: B ITP号/版本：B	Date of First Issue: 2011-12-31 首次发布日期：2011-12-31	file ref.: QM-A-7035-02-0005 文件编号：QM-A-7035-02-0005
Customer: Rio Metro Co. 客户：里约地铁公司	Prepared: Liu Yubo 编制：刘宇博	Date: 2012-1-9 日期：2012-1-9	Reviewed by: Wang Quan 审核：王权	Date: 2012-1-9 日期：2012-1-9	Approved by 批准者：Liu Zongmin 刘宗民 Date: 2012-1-9 日期：2012-1-9

Item 序号	System 系统	Name of Process 工序名称	Product/Process/ Feature 产品 / 工艺/特性	Specification/ Standard 规范 / 标准	Type of Test 检验类型	Measuring Device 测量装置	Sampling Rate and Frequency 采样大小& 频率	Plan of Response 反应计划	Responsible for Inspection/ Response Plan 检验 / 反应计划负责方	Notice and Checks of Witness Points 见证点的通知&检验	Location 位置	Record Control/ Report Proof 记录控制 / 报告证明	Referenced Specification 参考规程	Notice 注释
1	Commissioning of finished vehicle 整车调试系统	Wiring inspection and continuity test 线束检查与校线试验	Performance, quality 性能质量	Test Procedure: MR1009-1240-DT-001 试验大纲：MR1009-1240-DT-001	Performance test 性能检验	Multimeter, continuity meter, electrician tools 万用表、校线器、电工工具	1 vehicle per train Test Result 1台车/列 试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员，专检	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房	MR1009-1240-DT-001	MR1009-1240-DT-001	
2		Grounding return current test 接地回流试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-006 试验大纲：MR1009-TRN-SP-006	Performance test 性能检验	Multimeter, return testing equipment, electrician tools 万用表、接地回流测试设备、电工工具	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员，专检	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房	MR1009-TRN-SP-006	MR1009-TRN-SP-006	
3		Pneumatic system and leak test 空气系统与气密性试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-007 试验大纲：MR1009-TRN-SP-007	Performance test 性能检验	Multimeter, digital gauge, stopwatch, test connector, fitter's tools 万用表、数字压力表、秒表、测试连接器、钳工工具	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房	MR1009-TRN-SP-007	MR1009-TRN-SP-007	
4		Auxiliary electrical system test 辅助系统试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-010 试验大纲：MR1009-TRN-SP-010	Performance test 性能检验	Multimeter, Plier ammeter, phase sequence meter 万用表、钳型电流表、相序表	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房	MR1009-TRN-SP-010	MR1009-TRN-SP-010	
5		Traction power system test 牵引系统试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-011 试验大纲：MR1009-TRN-SP-011	Performance test 性能检验	Multimeter, electrician's tools 万用表、电工工具	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房	MR1009-TRN-SP-011	MR1009-TRN-SP-011	
6		Brake system test 制动系统试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-023 试验大纲：MR1009-TRN-SP-023	Performance test 性能检验	Digital pressure gauge, test connectors, stopwatch, multimeter, fitter tools, regulating valves, speed sensor simulator, maintenance software 数字压力表、通用测试连接器、秒表、万用表、钳工工具、带有不同规格节流阀的不同节流阀、速度传感器的测试模拟器、维修终端软件ST03A	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检 Supervisor from owner: control point (H point), 业主监理：控制点(H点)	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房	MR1009-TRN-SP-023	MR1009-TRN-SP-023	
7		Gauge test 限界试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-014 试验大纲：MR1009-TRN-SP-014	Performance test 性能检验	to be confirmed by Test Procedure 根据试验大纲确认	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员 Supervisor from owner 业主监理	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检 Supervisor from owner: control point (H point), 业主监理：控制点(H点)	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房	MR1009-TRN-SP-014	MR1009-TRN-SP-014	
8		Water-tightness test 淋雨试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-015 试验大纲：MR1009-TRN-SP-015	Performance test 性能检验	Rain test equipment for vehicles, AC380V power supply equipment, DC72V power supply equipment 车辆淋雨设备、AC380V电源设备、DC72V电源设备	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员 Supervisor from owner 业主监理	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检 Supervisor from owner: control point (H point), 业主监理：控制点(H点)	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房	MR1009-TRN-SP-015	MR1009-TRN-SP-015	
9		Battery start-up test 蓄电池启动试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-017 试验大纲：MR1009-TRN-SP-017	Performance test 性能检验	Multimeter, electrician tools, plier ammeter, external power supply cabinet 万用表、电工工具、钳形直流电流表、外接低压电源…	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480	Operator 操作者 Inspector 检查员	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检	Train Dispatching Building of High-speed Manufacturing Center	MR1009-TRN-SP-017	MR1009-TRN-SP-017	
10		Driver's equipment test 司机室设备试验	Performance, quality 性能质量											
11		Door system test 门系统试验	Performance, quality 性能质量											
12		HVAC test 空调与通风试验	Performance, quality 性能质量											
13		Lighting test 照明试验	Performance, quality 性能质量											
14		CCTV test CCTV试验	Performance, quality 性能质量											
15		DVAS & PA test DVAS&PA试验	Performance, quality 性能质量											

Inspection and Test Plan (ITP)检验试验计划

CNR 长春轨道客车股份有限公司 CHANGCHUN RAILWAY VEHICLES CO., LTD.

Project: Metro Rio Line 1 项目：巴西里约1A线项目	Doc. Title:Commissioning and Inspection, Test Plan 文件名称：调试检验试验计划		ITP ref./Ver.: B ITP号/版本：B	Date of First Issue: 2011-12-31 首次发布日期：2011-12-31	
Customer: Rio Metro Co. 客户：里约地铁公司	Prepared: Liu Yubo 编制：刘宇博	Date: 2012-1-9 日期：2012-1-9	Reviewed by: Wang Quan 审核：王权	Date: 2012-1-9 日期：2012-1-9	Approved by 批准者：

Item 序号	System 系统	Name of Process 工序名称	Product/Process/ Feature 产品 / 工艺/特性	Specification/ Standard 规范 / 标准	Type of Test 检验类型	Measuring Device 测量装置	Sampling Rate and Frequency 采样大小& 频率	Plan of Response 反应计划	Responsible for Inspection/ Response Plan 检验 / 反应计划负责方	Notice and Checks of Witness Points 见证点的通知&检验	Location 位置
16		PIS test PIS试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-034 试验大纲：MR1009-TRN-SP-034	Performance test 性能检验	Digital multimeter, electrician tools, driver's key, maintenance terminations 数字万用表、电工工具、司机钥匙、维护终端	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房
17		Fire detection system test 烟火检测试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-036 试验大纲：MR1009-TRN-SP-036	Performance test 性能检验	Multimeter, electrician tools, fire/smoke pen 万用表、电工工具、烟雾笔	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房
18		Shunting mode test 调车模式试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-044 试验大纲：MR1009-TRN-SP-044	Performance test 性能检验	Mulimeter, electrician tools 万用表、电工工具	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房
19		400km operation test 400公里运行试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-058 试验大纲：MR1009-TRN-SP-058	Performance test 性能检验	to be confirmed by Test Procedure 根据试验大纲确认	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房
20		Flange lubrication test 轮缘润滑试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-063 试验大纲：MR1009-TRN-SP-063	Performance test 性能检验	Square, tape measure, triangle 直角尺、卷尺、三角板	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房
21		Test for edition check of software 软件版本检查试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-064 试验大纲：MR1009-TRN-SP-064	Performance test 性能检验	to be confirmed by Test Procedure 根据试验大纲确认	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检	Train Dispatching Building of High-speed Manufacturing Center 高速制造中心列调厂房
22		Dielectric test 绝缘耐压试验	Performance, quality 性能质量	Test Procedure: temporarily none 试验大纲：暂无 Unmentioned tolerance: ISO13964A 未注公差：ISO13964A	Performance test 性能检验	Di-electricity Equipment 耐压设备 Flashlight 手电筒 Multimeter 万用表	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员 Supervisor from owner 业主监理	Inspector: specific inspeciton 检查员：专检 Supervisor from owner: control point (H point), 业主监理：控制点(H点) (the first vehicle only) (仅首台车)	Fitting Workshop 1 Manufacturing Center for Passenger Coach 客车制造中心装配一车间
23		Weighing 称重试验	Performance, quality 性能质量	Test Procedure: MR1009-TRN-SP-003 试验大纲：MR1009-TRN-SP-003	Performance test 性能检验	to be confirmed by Test Procedure 根据试验大纲确认	100% Test Result 100%试验结果	Process not in compliance with Flow Chart of Management QA-480, the NCR procedure will be implemented according to the quality requirements of the Rewoking Process for nonconformities. 工序不符合管理流程QA-480 如出现不合格项，根据返修质量要求，按NCR程序执行	Operator 操作者 Inspector 检查员 Supervisor from owner 业主监理	Operator: self and inter-inspection 操作者：自、互检 Inspector: specific inspeciton 检查员：专检 Supervisor from owner: control point (H point), select 1 vehicle per train	Fitting Workshop 1 Manufacturing Center for Passenger Coach 客车制造中心装配一车间

Attachment to Tab I.4, QA Plan Sample Documents 3 of 10

MTR	Contract C6554-07E Rolling Stock	CNR 长春轨道客车股份有限公司 CHANGCHUN RAILWAY VEHICLES CO., LTD.

1 Test Objective 试验目的

This document stipulates the test procedures for the installation tests which shall be carried out on a routine test basis for each train.
该文件规定了下列设备的例行试验规范内容：

The saloon air conditioning system test is intended to verify the integrity of functions of air conditioning equipment in the saloon and confirm that technical requirements of the contract are met. (Refer to PS/15.2)
客室空调试验是为了确认客室空调设备功能的完整性以及是否满足合同的技术要求。(根据 PS/15.2)

The driver's cab air conditioning system test is intended to verify the integrity of functions of air conditioning equipment in the driver's cab and confirm that technical requirements of the contract are met. (Refer to PS/15.21)
司机室空调试验是为了确认司机室空调设备功能的完整性以及是否满足合同的技术要求。(根据 PS/15.21)

The linear fan test is intended to verify the functional performance of the ventilation fan and swinging mechanism. (Refer to PS/15.22)
幅流风机试验为了确认风扇及摆动机构的工作性能。(根据 PS/15.22)

2 Applicable Documents 参考文件

IEC 61133:2006 - Railway applications – Rolling stock – Testing of rolling stock on completion of construction and before entry into service
IEC 61133:2006 - 铁路应用-铁道车辆-完成后和投入运营前铁道车辆的测试

Contract C6554-07E Rolling Stock Specification – Clause 15
合同 C6554-07E 全部车辆规格书-条款 15

3 List of Test Equipment, Instruments, Jigs and Tools 试验设备、仪表、工装和工具清单

No.	Required Test Equipment, Instruments, Jigs and Tools	Quantity
1	Digital multimeter 数字万用表	1 piece/person 1 个/人
2	Electrician tools 电工工具	1 set 1 套
3	Phase-sequence meter 相序表	1 piece 1 块
4	Clamp-on amperemeter 钳形电流表	1 piece 1 块
5	Vane Anemometer 风速仪	1 piece 1 块

4 Safety Requirements 安全规章

1) Before any work takes place on the vehicle roof, ensure that catenary power is turned off and locked out. 上车顶作业前，需确认接触网无电

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Sample Document
From Similar Project

MTR	Contract C6554-07E Rolling Stock	CNR 长春轨道客车股份有限公司 CHANGCHUN RAILWAY VEHICLES CO., LTD.

2) Safety belt must be used while working on vehicle roof. 在车顶作业，必须佩带安全带
3) Safety appliances needed for this work. 安全用品

5 Commissioning Conditions 试验条件

The following conditions must be fulfilled before carrying out the test.
该试验开始前需要满足下列条件：

No.	Test Conditions
1	Insulation and voltage resistance tests are completed. 绝缘耐压试验完成 Vehicle wiring continuity test is completed. 车辆布线连续性试验完成
2	DC110V circuit of the vehicle works properly. 车辆 DC110V 电压电路工作正常
3	AC415V circuit of the vehicle works properly. 车辆 AC415V 电压电路工作正常

6 Implementation of Test 试验执行

The test records herein are to be valid documents to demonstrate that the required routine tests have been successfully performed. The check boxes in the records indicate verification of test progress by test personnel. Check boxes in the records should be marked with "X".
本规程中的试验记录是用于证明例行试验成功完成的有效文件。记录中的选项框便于使试验人员能够核实试验进度。记录中的选项框建议用"×"进行标记。

All test steps must be successfully completed. For a failed test, the cause must be determined and restoration made so that a proper result may be achieved in a subsequent test for the same test item.
所有的试验步骤必须成功完成。如果某一试验步骤不成功，必须确认原因并且必须进行修复，以便该试验项目随后进行试验能够得到正确的结果。

The test result for any incomplete test item in the test must be left blank in the test record. Marking in the record is allowed only after successful completion of the test.
如果在试验环节中，某一试验项目未完成，试验记录中相应的结果必须保留空白。试验成功完成后方可在记录中进行标记。

7 Saloon A/C test 客室空调试验

7.1 Circuit breaker test 空气开关断路器检查

This test will be conducted in Changchun only. 本试验仅在长春确认。
Check that the model number of the vehicle circuit breaker complies with drawing and circuit breaker functions properly. 检查车辆空气开关断路器型号是否符合图纸，动作是否良好

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Sample Document
From Similar Project

MTR	Contract C6554-07E Rolling Stock	CNR 中国北车 长春轨道客车股份有限公司 CHANGCHUN RAILWAY VEHICLES CO., LTD.

7.2 Check circuit breaker voltage 空气开关断路器电压检查

This test will be conducted in Changchun only. 本试验仅在长春确认。

Use a digital multimeter to measure the circuit breaker voltage according to the annex and record the measurements in the record. The range of voltage tolerance is ±5% .使用数字万用表按照附件测量车辆空气开关电压，并记录在附件中 ，电压公差范围是±5%.

Use a phase-sequence meter to verify that circuit breaker of the vehicle has correct phase sequence according to the annex.使用相序表按照附件确认车辆空气开关断路器相序正确

7.3 Function test 功能检查

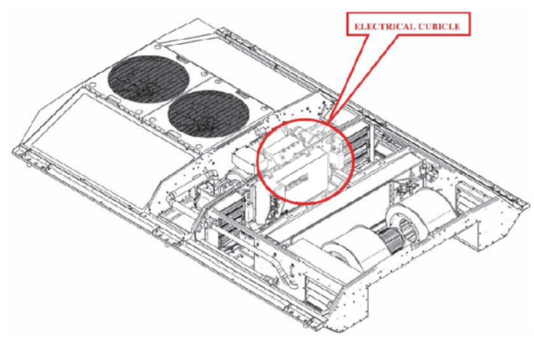
7.3.1 A/C function 空调功能

The following will be conducted in Changchun and Hong Kong.以下试验需在长春和香港确认。

Close circuit breaker CMB inside air conditioning unit (supply for compres[illegible]or)
闭合空调机组内部断路器 CMB（压缩器供电）
Close circuit breaker SFB inside air conditioning unit (suppl[illegible]an)
闭合空调机组内部断路器 SFB（供风风扇供电）
Close circuit breaker CFB1 inside air conditio[illegible]pply for condenser 1)
闭合空调机组内部断路器 CFB1 [illegible]
Close circuit breaker C[illegible]B2 inside [illegible]tioning unit (supply fo[illegible]se[illegible]
闭合空调机组内部[illegible]2 [illegible]凝器 2 供电）
Switch the [illegible](master control) inside air [illegible] to "ON".
[illegible]开关 DCB（总控制）至"O[illegible]位
[illegible]breaker location from left t[illegible], SF[illegible], CFB1, CFB2, DCB, EIVIB
从左至右依次为 CM[illegible]B2、DCB、EIVIB

The follo[illegible] will [illegible]onducted in Changchun only.以下试验仅在长春确认。
[illegible]ultimeter to verify that the resistance difference between all phases of [illegible] circuit breakers should not be greater than 10% of the average value of phases; (to indicate that shorting does not exist between phases).使用数字万用表按照附件确认车辆空气开关各相间电阻值差应不大于相间阻值平均值的 10%，以此确定各相间无短路现象

Sample Document
From Similar Project



DAR No.: C655407E-VAC-SP-018	Test Specification for Ventilation/ Air Conditioning System
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CNR 长春轨道客车股份有限公司 中国北车 CHANGCHUN RAILWAY VEHICLES CO., LTD.	Inspection Process Check Card	接轨世界 牵引未来 Join the World Drawing the Future
Project: Rio Line 1A Project, Brazil	**Installation of door mechanism**	**Doc. No. QM-A-7035-04-4035**
Customer: Metro Rio		**Rev. A**

Applicable car type: DK136, DK137, DK138 and DK138A			**Trainset No.**		**Car No.**
Steel grade of car body:			**Car type/number of cars:**		
Drawing	DK136-35-00-000	**Rev.**	**Technical doc.**	客装 692(DK136-138)-007	**Rev.**

No.	Check item	Quality criteria/record of measured value	Confirmation by inspector ☒
1	Review of Self Check Record	The content of record, operator's signature and date are filled in completely and correctly.	☐
2	Self Check Record includes at least	Height of door opening: 1960.5 (-2, +3) mm; Width of door opening: 1900 (0, +4) mm; Difference of diagonal lines ≤1mm; By measuring with plumb line, check that differenc[illegible]n between both sides of steel structure doo[illegible]m.	☐
3	Check of mechanism installation dimension	The height of the lowest mounti[illegible]or level may not be less than 2164[illegible]	☐
		The h[illegible]ight of doo[illegible] guide rail center above the refe[illegible] point [illegible]m [illegible]he distance of door mechanism [illegible] the reference point in lat[illegible]dy is [illegible]mm.	☐
4	Check o[illegible]	The installed mec[illegible]e lev[illegible].	☐
5	Installation of door mechanism	M1[illegible] are tightened to 45 N.m.; [illegible] socket center-low head cap screws are tightened t[illegible]N.m.	☐
		After adjustment, thread locker LT243 is applied on the connecting bolts for fixing purpose.	☐
6	L[illegible]king paint	Locking paint is well defined and regular without any gaps. (For the application standard, refer to document 客装通 011.)	☐
7	Installation of hair brush	The upper sealing brush is affixed properly.	☐
		The lower surface of brush assembly is flush with that of car body mounting seat.	☐
8	Check of spacers	Spacers are applied properly and securely.	☐
9	Surface quality inspection	There is no scuffing or damage.	☐

10	Serial No. of door mechanism	1		2		3	
		4		5		6	

Final inspection conclusion	☐ The process is up to standard, allow change to the next process. ☐ The process is conditionally up to standard, allow change to the next process.	Remarks: The quoted document number and explanation for conditional change of process:

Signature of leading official of operators	**Date**	**Signature and stamp of inspector**	**Date**

Prepared by: Wang Quan	**Checked by: Quan Dongji**	**Approved by: Liu Zongmin**
Date: 2011-08-25	**Date: 2011-9-2**	**Date: 2011-9-16**

QM-A-7035-04-3035 A Page 1 of 1

Sample Document From Similar Project

Document No.: BG-0B5100-003-2009

CNR 长春轨道客车股份有限公司 中国北车 CHANGCHUN RAILWAY VEHICLES CO., LTD.	**PURCHASED PART NONCONFORMITY REPORT**	**Project Description:** A-3003/CRH380BL High-speed EMU Manufacturing

NCR NO.: NCR-A-3003-PA-1139/6000004427

Supplier/Description: 70002122/Merak Jinxin Air Conditioning Systems (Wuxi) Co., Ltd.

Nonconformity item: 225996 saloon air conditioning unit

Drawing No: CCD00000028714_A

Quantity and Series Number: 400.000/ Purchase order: 4900061410 project

Train-Set No: **Vehicle No.:**

Description of Nonconformity

2010.08.07 14:09:13 Li Fenghua, Quality Management Office of the Quality Assurance Department (CRC13353)

SAP: 225996 air conditioning unit side cover plate; quantity of 24. The problems of the part are as follows:

1. The positions of the earth blocks are not uniform; 2. Some internal and external rivets are spread with glue but some are not; 3. The cover plate end has a gap; 4. Some welded reinforced rib ends are opened and [illegible]me are closed; 5. Some sponge rubber strips are separated. (See the appendix)

Record of Responses

2010.08.07 14:10:41 Li Fenghua, Quality Management Office of the Qu[illegible] Department (CRC13353)
2 blocks (to be returned) for the assembly procedure are [illegible] inspected.

2010.08.09 13:46:43 Li Fenghua, Quality M[illegible]the Quality Assurance [illegible]13353)
The quantity is changed from 24 to 32 (th[illegible] are [illegible]ed on the workshop site).

2010.09.01 08:15:18 Lin Ge, [illegible]urchase Office of the Purc[illegible] (CRC19002)
The supplier has [illegible]g and please close the notice.

2010.09.19 17:53[illegible]e, General Assets Purchase [illegible] Purchase Department (CRC19002)
This NCR includes the quality problem[illegible] of Merak for the 1st train and all have been handled now and please confirm the s[illegible] rectification, Ms. Cao.

2010.10.05 14:50:35 Du [illegible] (D[illegible]001)
After the su[illegible] of the 1st train, the subsequent supply should be the qualified products according to the requi[illegible] Cao Yanhua.

2010.10.22 [illegible]1:38:34 Liu Mingyan, Quality Management Office of the Quality Assurance Department (CRC13302) It is required that the subsequent products should be supplied by the supplier according to the documents issued in the design.

2010.10.23 07:51:43 Wang Enhui, No. 2 Quality Inspection Office of the Quality Assurance Department (CRC02952), approved, and please close notice.

Customer or Customer Deputy decision

Signature: **Date:**

Is it necessary to raise a corrective action? Yes √ No

Corrective Action No.:

Quality team signature/stamp: Liu Mingyan CRC13302 **Date:** 2010.10.22

Follow up and validation

Validated by signature/stamp: Li Fenghua CRC13353 **Date:** 2010.10.23

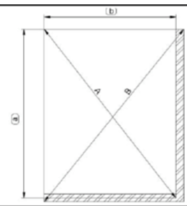
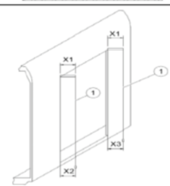
Sample Document From Similar Project

Sample Document From Similar Project

Work Process Sheet

CCY-061-029-2008

Document Name	Technical Specification of Saloon Side Door Installation	Document No.	SSDI 692（DK136-138）-007

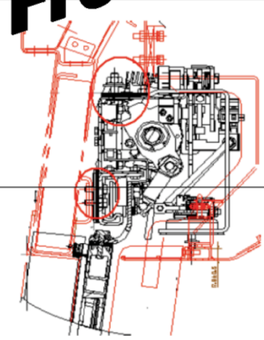
Procedure No.	Picture/Sketch	Operating Instruction	Man Hour (Minute)
10		10. Inspect the dimensions of the steel-structure doorway before the installation: 10.1 (1) Height a：1960.5（-2，+3）mm； (2) Width b：1900（0，+4）mm； (3) Diagonal difference：-1≤A-B≤1mm	
10		10.2 Use plumb line ① to measure the parallelism of the steel-structure doorway, -3≤X2-X3≤3mm.	

			Prepared	Zhang Yun	Page
Change Log	Signed	Date	Checked	Zhang Hongjun	7/23

Work Process Sheet

CCY-061-029-2008

Document Name	Technical Specification of Saloon Side Door Installation	Document No.	SSDI 692（DK136-138）-007

Procedure No.	Picture/Sketch	Operating Instruction	Man Hour (Minute)
20		20. Installation of the door mechanism: 20.1 Use aluminum profile scale bar to inspect the flatness of the mechanism mounting seat. If it is not flat, take the lowest mounting seat as the reference (attention: the height of the lowest mounting seat from the floor surface should not be less than 2164mm), and use the sign pen to mark the thickness of the adjustment shim(s) to be added to the other mounting seats.	
20		20.2 Use lift truck to lift the mechanism to the mounting height and use bolts to preliminarily fix the door mechanism.	

			Prepared	Zhang Yun	Page
Change Log	Signed	Date	Checked	Zhang Hongjun	8/23

Attachment to Tab I.4, QA Plan　　Sample Documents　　8 of 10

CNR 长春轨道客车股份有限公司 中国北车 CHANGCHUN RAILWAY VEHICLES CO., LTD.	Supplier Audit Management Process		Document No.: SM-320BG-001V3.0	
	Date Revised: 2012-7-16	Revised by: Zhuo Xianzhi	Date approved: 2012-10-30	Approved by: Lu Xiwei

D. Description of Activities

Activity	Objective of activity	When performed	Responsible person	Responsible department
QA-230-010 Planning of process audit	Collect information about quality problems from source inspection, incoming inspection and/or installation for any product used for construction of the vehicles, or to plan supplier process audit when supplier's performance is rated as level C or D.	In case of serious or mass quality problems in any supplied product	Quality engineer	Quality Assurance Dept.
QA-230-020 Preparation for process audit	Develop a plan for supplier process audit for the supplier to prepare relevant materials in advance as required by the plan.	After confirmation of quality problems	Supplier's quality leader	Supplier
QA-230-030 Kickoff meeting	Specify the reason(s), purpose, schedule and agenda for the supplier process audit.	Before starting supplier process audit	Quality engineer	Quality Assurance Dept.
QA-230-040 Document audit	Audit whether the technical and quality documents related to the supplier's product are ready and adequate and whether the field record is complete in order to verify the effectiveness of the documents. Any nonconformity problems shall be recorded.	During supplier process audit	Quality engineer	Quality Assurance Dept.
QA-230-050 Field audit	Audit supplier's product realization process in order to verify whether or not its quality assurance capability and execution is adequate and effective to meet project requirements. Any nonconformity problems shall be recorded.	During supplier process audit	Qu[illegible]y [illegible]eer	Quality Assurance Dept.
QA-230-060 Closing meeting	Collect and summarize problems found from the process audit and communicate them to the supplier clause by clause to confirm any nonconformity that requires rectification.	Aft[illegible] s[illegible] audit [illegible]	Quality engineer	Quality Assurance Dept.
QA-230-070 Issuing audit report	Issue the supplier process audit report and determine [illegible]	On completion of supplier process audit	Qu[illegible]	Quality Assurance Dept.
QA-230-080 Address open items	Identify any open item[illegible] [illegible]o be rectified) from the proces[illegible] [illegible]p actions.	On c[illegible] proc[illegible]	Quality engineer	Quality Assurance Dept.
QA-230-090 Assess impact to supplier qualification status	Decid[illegible] open items and process audit results [illegible] suppli[illegible] qualification to be suspended [illegible]	On completion of supplier process audit	Deputy chief quality engineer	Quality Assurance Dept.

Sample Document From Similar Project

CNR 长春轨道客车股份有限公司 中国北车 CHANGCHUN RAILWAY VEHICLES CO., LTD.	Supplier Audit Management Process		Document No.: SM-320BG-001V3.0	
	Date Revised: 2012-7-16	Revised by: Zhuo Xianzhi	Date approved: 2012-10-30	Approved by: Lu Xiwei

QA-230-100 Rectification	Supplier shall submit specific rectification measures according to the nonconformity put forward in the process audit and carry out rectification as approved by the quality engineer.	On receiving the audit report	Supplier's person in charge of quality	Supplier
QA-230-110 Verification of rectification	Verify whether the supplier's rectification results in meeting the project requirements.	On completion of rectification by supplier	Quality engineer	Quality Assurance Dept.
QA-230-120 Archiving of materials	After satisfactory verification of the supplier's rectification, the quality engineer shall archive the supplier rectification verification materials and the process audit report.	On completion of verification of rectification	Quality engineer	Quality Assurance Dept.

Miscellaneous provisions	
Fundamental assumptions	
Notes for special situations	
Details of support management	
Competence management	1. Name of post 2. Authorization 3. Certifications, qualifications and training
Required report forms	1. Process audit report 2. Nonconformity rectification verification materials

Attachment to Tab I.4, QA Plan Sample Documents 9 of 10

CNR 长春轨道客车股份有限公司 中国北车 CHANGCHUN RAILWAY VEHICLES CO., LTD.	Corrective/Preventive Measures Management Process		Document No.: SM-320BG-001V2.0	
	Date Issued: 2010-8-21	Checked by: Cai Ruiming	Date approved: 2010-8-28	Approved by: Lu Xiwei

D. Description of Activities

Activity	Objective of activity	When performed	Responsible person	Responsible department
QA-1C0-010 Review information on nonconformity	Review information on nonconformity (received data or potential nonconformity is identified), to determine appropriate investigation and corrective and/or preventive measures to be carried out.	On receipt of nonconformity information	Person in charge	Unit responsible for subject
QA-1C0-020 Coordination	Obtain the cooperation and coordination of the unit responsible for the subject of the problem in investigating the nonconformity.	As required by the unit responsible for the subject	Person in charge of relevant unit	Relevant unit
QA-1C0-030 Root cause analysis and analysis meeting	Conduct investigation and analysis to determine and verify the root cause of the problem. Involve relevant departments and personnel as necessary; when necessary, a problem analysis meeting may be held to facilitate interdepartmental analysis of the nonconformity's causes.	Within 3 days after receiving nonconformity information	Person in charge	Unit responsible for subject
QA-1C0-040 Problem analysis meeting	Hold problem analysis meeting with the participation of the unit responsible for the subject of the problem and other relevant departments to analyze the cause(s) of the problem.	As required by responsible unit	Person in charge	Relevant unit
QA-1C0-050 Establish corrective and/or preventive measures	Evaluate the need for corrective and preventive measures based on the nonconformity and causes identified; consider the necessity and feasibility of proposed corrective and preventive measures, and risk, balancing benefit and cost and make decision of which corrective and preventive measures should be taken.	Within 2 working days of receiving nonconformity information or problem analysis results	Per[illegible]n in [illegible]	Unit responsible for subject
QA-1C0-060 Audit by department chief	Audit the accuracy of cause analysis and effectiveness of corrective and preventive measures.	W[illegible] days of re[illegible] corrective/ preventive measures	Department chief or design[illegible]	Unit responsible for subject
QA-1C0-070 Acceptability of corrective/preventive measures	Determine whether the corrective/p[illegible] acceptable as checked by the de[illegible] aud[illegible]	On conclusion of depa[illegible] chief audit	D[illegible] designee	Unit responsible for subject
QA-1C0-080 Approval of company leader	De[illegible]ve/preventive measures [illegible]ed to be sub[illegible]ompany-level chief for approval.	Wi[illegible] 3 w[illegible]king days of rec[illegible]ing corrective/ preventive measures	Person in charge of relevant unit	Unit responsible for subject
QA-1C0-090 Approval	Approve corrective/preventive [illegible] unit or company-level chief if determined to be needed,	Within 3 working days of receiving corrective/ preventive measures	Person in charge of relevant unit	Unit responsible for subject

CNR 长春轨道客车股份有限公司 中国北车 CHANGCHUN R[illegible]	Co[illegible]/Preventive Measures Management Process		Document No.: SM-320BG-001V2.0	
	Date Issued: 2010-8-21	Checked by: Cai Ruiming	Date approved: 2010-8-28	Approved by: Lu Xiwei

Activity	Objective of activity	When performed	Responsible person	Responsible department
QA-1C0-100 Organize implementation	Organize relevant departments to implement corrective and/or preventive measures.	According to the corrective and preventive measures	Person in charge of relevant unit	Unit responsible for subject
QA-1C0-110 Coordination	Obtain the cooperation and coordination of the unit responsible for the problem in order to implement the corrective and/or preventive measures.	As required by corrective/ preventive measures	Person in charge of relevant unit	Relevant unit
QA-1C0-120 Implement corrective/preventive measures	Implement the specified corrective and preventive measures.	As required by corrective/ preventive measures	Person in charge	Relevant unit
QA-1C0-130 Verify implementation of corrective/preventive measures	Verify that corrective and preventive measures have been implemented as specified.	As required by corrective/ preventive measures	Person in charge	Unit responsible for subject
QA-1C0-140 Acceptability of implementation of corrective/preventive measures	Determine whether implementation of corrective and/or preventive measures was effective or additional actions are needed.	According to the conclusion of verification.	Person in charge of relevant unit	Unit responsible for subject

Miscellaneous provisions	
Fundamental assumptions	
Notes for special situations	
Details of support management	Corrective and Preventive Measures Management Specification
Competence management	1. Name of post 2. Authorization 3. Certifications, qualifications and training
Required report forms	

Sample Document From Similar Project

5 M/WBE PARTICIPATION

5.1 COMPLETED M/WBE UTILIZATION FORM

Tab I.5 (a) Completed M/WBE Utilization Form
The Offeror shall provide a completed M/WBE Utilization Form indicating the percentage of the Base Award Price and Total Proposal Price to be supplied by qualified M/WBEs under the Contract. For purposes of this requirement, the MBTA will only accept M/WBEs that are certified, at the time of proposal opening by the Massachusetts Supplier Diversity Office formerly known as the State Office of Minority and Women Business Assistance.

M/WBE UTILIZATION FORM SUPPLEMENTARY DOCUMENT

As stated on our M/WBE Utilization form, CNR MA Corporation ("CNR MA") is committed to contract 16% of the Total Base Award Price and 15% of the Total Proposal Price to be performed or supplied by certified M/WBE firms for this project. We will continue our collaboration with the MBTA Outreach, Supplier Diversity & Development Office, and the Massachusetts Supplier Diversity Office (SDO).

Our Participation Plan, which is attached, attests to the actions successfully taken, which have already allowed us to secure 7.79% of the Base Award Price and 8.88% of Total Proposal Price for M/WBEs as attested to by the attached Letters of Intent. Additional suppliers have been contacted, and we are currently under discussion and clarification on the detailed Scope of Work with these firms. Until finalization of design and workscope, it would be premature to engage in signed Letters of Intent. We indicate in our proposal the efforts that shall continue to ensure this commitment. We repeat part of Attachment B, which is provided in our Participation Plan, to demonstrate the areas where we are certain that these commitments can be fulfilled.

CNR MA has calculated and projects the following percentages of M/WBE content for the base order and total proposal.

Content	Base Award	Total Proposal
Secured Content		
Vehicle Components		
Secured through agreements and through expectations from primary vendor submittals.		
Trucking		
Technical Consulting		
Total Secured Content	**7.79%**	**8.88%**
Unsecured but Anticipated Contracts		
General Construction & Facility Setup		
Human Resources		
Visa Applications		
Vehicle Components		
Metal Fabrication		
	8.21%	**6.12%**
Total Secured and Unsecured Content*	**16.00%**	**15.00%**

We will continue to work with potential suppliers that will allow us to meet our M/WBE goal. **Additional outreach programs, working with sub-suppliers, and the efforts of our M/WBE consultants allow us to believe these goals to be both credible and attainable.** Our analysis of our facility setup and investment in our manufacturing operation will allow us to reach this M/WBE goal.

5.2 M/WBE PARTICIPATION SCHEDULE

Tab I.5 (b) M/WBE Participation Schedule
The Offeror shall provide an M/WBE Participation Schedule identifying those qualified M/WBEs with whom the Oferor intends to contract for the performance of the portions of the work under the Contract, the work to be performed by each qualified M/WBE, a proposed timetable for the performance or delivery of the Contract item, and other information as required by the M/WBE Participation Schedule form annexed to this Section. No work shall be included in the Schedule that the Offeror has reason to believe the listed M/WBE will subcontract, at any tier, to other than another M/WBE.

Name of Supplier or Subcontractor and Category (Indicate MBE or WBE)	Address and Contact Information	Description and Type of Service to be Performed or Material to be Supplied	Beginning / Duration	Percent of M/WBE Participation
Raul V.BRAVO + ASSOCIATES, INC MBE	1889 Preston White Drive, Suite 202, Reston VA, 20191 Claudio R. Bravo Tel:703-326-9092	Technical Support	RFP/ contract execution	Base Contract:0.50% Total Proposal:0.39%
LydRiv Communications WBE	11 Hallet Street, Dorchester, Ma,02122 Lydia M. Rivera , Principal Tel: 617-851-1095	MWBE outreach consultant	RFP/NTP	Base Contract:0.01% Total Proposal:0.01%
RL Controls WBE	10-V Gill St. Woburn, MA 01801 Lena Walsh Principal Tel:781-932-3349	Passenger Information System	Contract execution	Base Contract:2.34% Total Proposal:2.97%
RL Controls WBE	10-V Gill St. Woburn MA 01801 Lena Walsh Principal Tel:781-932-3349	Electrical cabinet assembly; Wire Harness	Contract execution	Base Contract:1.33% Total Proposal:1.33%
UTCRAS, Inc. WBE	501 Highland Avenue, Morton, PA 19070 Ms. Betty A. Scott Tel: 610-983-0102	Wheels and Axle assembly	Contract execution	Base Contract 1.5:% Total Proposal: 2.0%
MRI WBE	228 East 45th Street, Suite 1801 NewYork,NY 10017 Ms.Gayle Bernstein Tel: （212）867-9600	Inland and sea transportation	Contract execution	Base Contract:2.11% Total Proposal:2.18%

Unsecured but Anticipated Contractors		General Consutruction, Facility Setup, Human Reeources, Visa Applications, Vehicle Components, Metal Fabircation	Contract Execution	Base Contract: 8.21% Total Proposal: 6.12%

Proposer name: CNR MA Corporation
Name of Contact Person: Mr. Dai Iwama Telephone: 212-704-6776

5.3 M/WBE LETTER OF INTENT AND CERTIFICATION FORMS

Tab I.5 (c) M/WBE Letter of Intent
The Offeror shall provide a completed M/WBE Letter of Intent from each M/WBE listed in the M/WBE Participation Schedule using the form annexed to this Section, and a copy of the most recent certification letter or other documentation establishing the M/WBE certification of each M/WBE listed on the M/WBE Participation Schedule, and an M/WBE Affidavit executed by each M/WBE listed in the M/WBE Participation Schedule stating that there has not been any change in its status since the date of its last certification.

The M/WBE Letter of Intent and Certification Forms are included in Section 6 Appendix, as per Addendum No. 1.

5.4 MINORITY AND WOMEN OWNED BUSINESS ENTERPRISES (M/WBE) PARTICIPATION PLAN

Tab I.5 (d) Ensuring Overall Compliance
The Offeror shall provide a narrative explaining how the Offeror intends to ensure overall compliance with the MBTA's policy of promoting equity and opportunity for M/WBEs and the good faith efforts it has made to obtain M/WBE participation. The Offeror shall include in the narrative the strategies it has and will use to obtain subcontractors and suppliers, including but not limited to documented communication with the Authority's Office of Diversity and Civil Rights, use of information concerning M/WBE subcontracting opportunities provided by the MBTA during the pre-proposal conference and/or through other means, the Offeror's solicitations to obtain M/WBE involvement in general circulation media, trade association publications, minority-focused media and other reasonable and available means within sufficient time to allow M/WBEs to respond to the solicitation, written notification to M/WBEs encouraging participation in the proposed Contract, and efforts made to identify specific portions of the work that might be peformed by M/WBEs. At a minimum, the Offerors should provide the names, addresses, telephone numbers of M/WBEs that were contacted, a description of the information provided to targeted M/WBEs regarding RFP's work requirements, and efforts made to assist M/WBEs contacted in obtaining bonding or insurance required by the Offeror or by the Auhtority. Offerors are referred 49 to CFR Part 26 and OSD Construction Reform Program, Attachment C (Municipal Contracts State-Assisted Building Projects), Section A, 4-10 for additional guidance concerning actions that are commonly considered good faith efforts to obtain M/WBE participation.

5.4.1 Overview and Plan Type

CNR is pleased to submit this Minority and Women Owned Business Enterprises (M/WBE) Participation Plan in accordance with the Request for Proposal No. CAP 27-10 for the MBTA New Orange and Red Line Vehicles. CNR has prepared this plan to provide M/WBE business participation to meet the percentage attested to on our M/WBE Utilization Certificate. CNR is committed in its management plans to develop increased participation for M/WBE companies in all levels of its procurement practices and policies.

CNR's M/WBE plan commits to grow M/WBE participation beyond this contract.

While this plan has been developed to respond to MBTA's formal RFP requirements, it has been established as an ongoing plan adopted by CNR to develop and expand the use of M/WBE firms beyond the period of this contract. As CNR will be establishing a significant facility in Massachusetts and this will be the only manufacturing facility CNR is planning in the United States, we envision this as an opportunity to expand employment opportunities and maximize M/WBE work within the State of Massachusetts. This M/WBE utilization plan has been designed to remain a dynamic process to enhance and expand prospects for M/WBE firms to grow to become partners with CNR. The plan creates mutual opportunities for CNR to expand its vendor base, while allowing for industry growth, expansion into new markets, and emergence of new companies with new talents.

5.4.2 Goals

CNR has established this M/WBE Plan to ensure that the company will develop and implement business practices and procedures to foster the use of M/WBE businesses in all of our contractual dealings. It is our goal that M/WBE businesses will be provided the maximum opportunities to participate in all contracts and awards. This will be accomplished by folding M/WBE initiatives into our normal business practices in obtaining bids or quotes for orders at all levels of our operation. We will further extend these methods to include outreach programs to M/WBE firms, establish mentoring programs, and look to subcontract work that would normally be performed in-house to reach the minority goals established either directly by the company or through contractual obligations.

CNR is giving the highest priority to M/WBE businesses with which we have attached the Letters of Intent and estimated contractual value. We have also developed relationships with several firms with whom we are prepared to contract for this program, which could not be listed at this stage of the project. We do offer their amount of content in what we have determined to be our committed M/WBE content. Understanding that Letters of Intent cannot be issued with many of the firms with whom we have had contact at the pre-award stage due to the fact that design is not finalized to levels to provide detailed opportunities for bid, we have, nonetheless, extended opportunities with M/WBEs to participate in the design process to afford equal opportunities for award in many of the areas requiring contracted services.

Results to date indicate CNR CAN MEET ITS M/WBE GOAL OF 16%!

CNR continues to work with suppliers to meet and potentially exceed our goal of 16%, and discussions are continuing with suppliers providing them guidance and clarification on the detailed scopes of work. We are working directly with M/WBE firms to provide a clear understanding of scope of work, expectations, and offering assistance, both technically and commercially, to ensure participation. CNR continues to work throughout the proposal and bid process with potential suppliers that will allow us to meet our M/WBE goal. **<u>Additional outreach programs, working with sub-suppliers, and the ongoing efforts of our M/WBE consultants allow us to believe these goals to be both credible and attainable.</u>** Additionally, our analysis of our facility setup and our significant investment in our manufacturing operation will allow us to reach this M/WBE goal.

5.4.2.1 Methods Used to Develop the Subcontracting Goals

Committed to maximizing utilization of Disadvantaged, Minority and Women Owned Business Enterprises (DBE/MBE/WBE) for MBTA's Orange and Red Line Car Procurement, CNR initiated an aggressive outreach effort to DBE/MBE/WBE businesses within Massachusetts prior to RFP submittal to share various subcontracting opportunities available to them pertaining to this procurement. CNR listed the following subcontractor/vendor opportunities:

Construction:	Facility Design, General Construction, Electrical Contractor, Plumbing, Painting, Irrigation Systems
Material Supply:	Rolling Stock, Electrical/Mechanical/Fabricated components, Manufacturing Equipment
Services:	Technical/Construction/Environmental Consultant Services, Labor Management Services, Transportation, Cleaning Services, Safety Management Services

Utilizing this format, CNR introduced itself to the M/WBE community and clarified the potential opportunities and methods for doing business together. CNR has established a baseline for possible work that can be performed on this contract by certified firms. Our goal has been established following discussions with major suppliers, who determine a significant portion of our capability to provide M/WBE content, along with our own activities to promote understanding of possible opportunities within the certified vendor community, discussions with several of these suppliers, and discussions with the Massachusetts Office of Diversity. Major suppliers provide systems and materials to the railcar builder that establishes much of the total costs for the procurement. CNR is working with these suppliers to expand their own M/WBE base of Massachusetts certified sub-suppliers and increase their utilization of these companies.

CNR performed the following additional activities in developing its plan and implementing it prior to bid submittal:

- Reviewed contract specifications for definitions and direction;
- Reviewed 49 CFR Part 26 for guidance in establishing its plan and for methods in expanding its search efforts;

CNR engaged professional U.S. consulting firms to develop its M/WBE program.

- Reviewed MBTA website and Massachusetts SOMWBA websites for M/WBE information;
- Contacted the Massachusetts Office of Diversity for clarification and assistance;
- Solicited assistance from certified minorities and consulting firms;
- Contracted with Raul V. Bravo + Associates, Inc. to assist in preparation of goals, assist CNR to develop their plan for participation, assist in defining parts and materials that could be successfully used in set-aside programs, and assist in contacting M/WBE firms;
- Contracted with Lydia M. Rivera of LydRiv Communications to assist with the development of the workshops, coordination of workshop activities, and overall M/WBE outreach;
- Worked with primary rail component subcontractors to develop input and information regarding M/WBE firms.

5.4.2.2 Methods Used to Identify Potential Sources

CNR solicited 873 M/WBE companies for participation in this project.

To engage the interest of businesses, two four-hour MBE/WBE workshops were held – one in Springfield on Tuesday, March18 at the Springfield Marriott, and another in Quincy on Wednesday, March 19 at the Quincy Marriott.

Advance outreach efforts included:

- Coordination with the MBTA Outreach, Supplier Diversity & Development Office to solicit their database of DBE/MBE/WBE businesses consisting of 873 companies.
- Mail and email to each business a personal letter detailing CNR goal to pursue the Red and Orange Line Procurement, and further information of two upcoming workshops scheduled to share subcontracting opportunities. (A listing of companies contacted is too extensive to include herein, but would be provided upon request.)
- Partnered with the Massachusetts Office of Supplier Diversity (SDO) and the following minority organizations to share workshop(s) information via their member database:
  - ✓ Massachusetts Small Business Association (SBA)
  - ✓ Massachusetts Minority Contractors' Association
  - ✓ Boston Worker's Alliance
  - ✓ Urban League of Eastern Massachusetts
  - ✓ Center for Women & Enterprise

CNR further identified potential sources for subcontracting opportunities by:

- Reviewing source lists from major suppliers
- Consulting SOMWBA, as noted above, along with M/WBE websites
- Meetings with and visiting potential M/WBE suppliers who could qualify to work on this proposal prior to the workshops
- Sending direct email solicitation to various SOMWBA certified firms requesting their interest in working on this proposal prior to our workshop to initiate contract possibilities as early as possible
- Working with M/WBE certified firms in locating acceptable assembly manufacturing locations
- Tracking vendor referrals
- Performing Internet searches
- Consulting with the Commerce Department's Small Business Utilization Specialist
- Consulting the National Minority Supplier Development Council Web Site
- Contacting Small Business Trade Associations
- Using M/WBE directories from other transit authorities and census information

To maximize workshop participation in Western Massachusetts and Quincy, the workshops were advertised in the following newspapers/publications:

Publication	Period Advertised
Boston Globe	Wednesday, March 12, 2014
Boston Herald	Wednesday, March 12, 2014
Bay State Banner (Minority)	Thursday, March 13, 2014
Patriot Ledger	Saturday, March 15, 2014
Holyoke Sun	Week of March 10, 2014
Wilbraham Hamden Times	Week of March 10, 2014
Chicopee Register	Week of March 10, 2014
Agawam Advertiser	Week of March 10, 2014
Hadley Town Reminder	Week of March 10, 2014
Springfield Republican	Thursday, March 13, 2014
Westfield News	Wednesday, March 12, 2014

5.4.2.3 Workshop Overview

CNR already conducted two successful M/WBE Workshops in Massachusetts.

On Tuesday, March 18, an M/WBE Workshop was held at the Springfield Marriott Hotel attended by 22 individuals representing 22 businesses.

On Wednesday, March 19, an M/WBE Workshop was held at the Quincy Marriott Hotel attended by 50 individuals representing 45 businesses.

Total Workshop(s) Attendance: 72 individuals from 67 businesses

The businesses who attended the M/WBE workshops participated in the following activities:

- Registration including sharing of personal information, address, phone, email
- Continental Breakfast
- Business Profile form
- Video Introduction of CNR
- PowerPoint Introduction of CNR
- M/WBE Outreach Plan
- Overview of Business Profile form
- Question & Answer Period
- Lunch
- Access to three (3) sub-groups staffed by CNR representatives for work-specific questions pertaining to Rolling Stock Subcontracting, Services, and Facility and Construction.

Thirteen (13) people who were unable to attend either workshop requested further information. These individuals were added to the contact list database as well bringing the total number of contacts from the workshops to 80.

Another 19 companies were contacted after the workshops, and we are currently in discussions with these companies.

In total as of this date, ninety-nine (99) businesses are included in CNR's M/WBE contact database from this outreach. (See Attachment A for the list of the 99 suppliers.)

5.4.2.4 Post Workshop Communication

To ensure M/WBE businesses remain informed of potential subcontracting opportunities relating to the Orange and Red Line Car Procurement, CNR is doing and will do the following:

- Create, maintain, and add to M/WBE contact list data base;
- Provide periodic updates to subcontractors relating to work opportunities;
- Respond to subcontractor inquiries in timely manner via phone, email, or one on one;
- Partner with MBTA Outreach, Supplier Diversity & Development Office to create processes to further identify and promote M/WBE participation;
- Continue relationship with minority organizations for outreach to businesses yet to be informed of subcontracting opportunities;
- Coordinate additional informational workshops as necessary.

5.4.3 Minority/Women Owned Business Enterprise Liaison Officer

A CNR Liaison Officer will be the point of contact for all M/WBE matters.

We have created a new position in our organization for a dedicated Minority/Women Owned Business Enterprise Liaison Officer. This person will be directly involved in all aspects of M/WBE performance. The M/WBE Officer will have direct, independent access to the Chief Executive Officer of the company on all matters related to M/WBE programs. Our workshops have been attended by senior procurement and contracts personnel, who have begun the process of working with these firms. They have been complemented by the use of consultants who have brought new firms into the conversation and acted as an intermediary to provide needed direction for expanding opportunities for participation.

Through the use of these personnel, CNR will expand the use of M/WBEs in its purchases and contracts. As we have done in our workshops, we will invite certified M/WBEs to visit our facility, once it is established, to review the products we are purchasing and manufacturing to explore contracting opportunities. We will also utilize the various directories of certified businesses, both locally and nationally, to develop and expand our vendor data base.

We recognize that the development of a successful program requires more than training and naming a few individuals. Staff training will occur in Procurement and to some degree in Engineering to allow for a better understanding of possible vendor capabilities and equipment. Most design engineering for manufacturing completed in-house is developed around equipment and processes with which we have familiarity. We recognize that understanding the skills and equipment capabilities of other suppliers is necessary in obtaining competitive bids.

We recognize that working with our major systems suppliers is a necessary and requisite part of establishing and meeting our M/WBE goal. The Liaison Officer will also:

CNR requested major U.S. suppliers to maximize use of M/WBE sub-suppliers.

- Work directly with MBTA in identifying, developing and expanding the base of certified M/WBE businesses as it relates to the passenger rail industry;
- Gather and report statistical data and other information as required by MBTA;
- Review third party contracts and purchase requisitions for compliance with this program;

- Ensure that bid notices and requests for proposals are available to M/WBE's in a timely manner;
- Identify contracts and procurements so that M/WBE goals are included in solicitations;
- Analyze our progress toward attainment and identify ways to improve progress;
- Participate in pre-bid meetings;
- Provide M/WBEs with information and assistance in preparing bids, obtaining bonding and insurance;
- Plan and participate in M/WBE training seminars;
- Maintain the company's updated directory on certified M/WBEs;
- Maintain and update a listing of qualified M/WBEs that can be solicited for construction equipment, services and supplies;
- Maintain a list of minority and women business focused publications that may be utilized to solicit M/WBEs;
- Coordinate additional ongoing M/WBE workshops and outreach events;
- Continue relationship building with minority organizations to assist with M/WBE recruitment and participation including National Association of Women in Construction (NAWIC) and Mass Minority Contractors Association (MMCA);
- Engage collaborative approaches through one-on-one meetings with M/WBE's to identify and evaluate project opportunities;
- Provide manufacturing floor space and logistics support to enhance M/WBEs participation through mentoring and training sessions whenever feasible.

5.4.4 Equitable Opportunity

CNR will take the following actions to ensure that M/WBE concerns will have an equitable opportunity to compete for subcontracts. These efforts include, but are not limited to, the following activities:

Outreach Efforts to Obtain Sources

- Utilize the SOMWBA database to contact potential and probable suppliers;
- Contacting minority and small business trade associations;
- Contacting business development organizations and local chambers of commerce;
- Attending M/WBE procurement conferences and trade fairs for rail and transit agencies;
- Requesting sources from the Small Business Administration's (SBA) CCR Small Business Site and other Federal agency resources;
- Conducting market surveys to identify new sources.

Internal Efforts to Guide and Encourage Purchasing Personnel

- Conducting workshops, seminars, and training programs;
- Establishing, maintaining, and utilizing M/WBE and source lists, guides, and other data for soliciting subcontractors;
- Monitoring activities to evaluate compliance with the subcontracting plan;

- Establish and chair an M/WBE Advisory Committee to expand opportunities for M/WBE involvement.

5.4.5 Flow-Down Clause

CNR agrees to include the provisions under FAR 52.219-8, "Utilization of Small Business Concerns," in all major subcontracts, which will require suppliers to make timely payments to M/WBEs and provide equal opportunities for contract awards.

5.5 PRESERVE AND ENHANCE M/WBE PARTICIPATION

Tab I.5 (e) Preserve and Enhance M/WBE Participation
The Offeror shall provide a narrative explaining how during performance of the Contract it will maintain continued efforts to preserve and enhance M/WBE participation. Included within this narrative should be a description as to how the Offeror will interface with MBTA for outreach and assistance generally and with respect to the specific issues below. The narrative should describe how the Offeror will abide by the monitoring and reporting requirements in Section C7.16 of the Contract. Moreover, the narrative should describe dispute resolution procedures the Offeror will institute under its subcontracts with M/WBEs to encourage amicable resolution of disputes and continued performance by the M/WBEs. Finally, the narrative should describe procedures and guidelines for the termination of M/WBEs as well as for the identification and selection of substitutes.

Based on the duties of the Liaison Officer and the work outlined to be done directly with MBTA, CNR will continue to preserve and expand its efforts in developing M/WBEs in all contract work. As CNR will be establishing their manufacturing operation in the United States in Massachusetts, we are committed to expanding the role of all local and M/WBE businesses in the State. We are further committed to expand the capabilities and roles of these businesses as they relate to our scope of supply. It is equally our need to have an experienced supplier base to draw on as this and other contracts develop.

5.5.1 Reporting and Cooperation

CNR gives assurance of cooperation in any studies or surveys that may be required including:

- Submission of periodic reports that show compliance with the subcontracting plan;
- Submission of quarterly reports indicating funds expended with M/WBE's during the quarter and cumulative contract values with comparisons to goals;
- Maintenance of documents concerning solicitations, efforts to expand opportunities for M/WBE's, and award data.

5.5.2 Recordkeeping

CNR will maintain the following types of records to demonstrate the procedures adopted to comply with the requirements and goals in the sub-contracting plan.

- Records to support other outreach efforts, e.g. contacts with minority and small business trade associations and attendance at small and minority business procurement conferences and trade fairs;

- Records to support internal guidance and encouragement provided to buyers through workshops, seminars, training programs, and incentive awards;
- Monitoring CNR performance to evaluate compliance with the program and requirements.

5.5.3 Timely Payments to Subcontractors

CNR uses established procedures to ensure timely payments of amounts due pursuant to the terms of subcontracts with all small business concerns. Specifically, CNR follows standard payment practices and extends accelerated terms on a case-by-case basis to subcontractors requiring accelerated terms or assistance. Understanding the cash flow needs that are often unique to M/WBE firms, CNR will take actions to ensure participation, survival and expansion of opportunities to these firms.

In our workshops, we became keenly aware of the difficulties associated with contracts that extend over a period of years and start-up requirements that may not be consistent with adequate cash flow for new businesses entering this market. CNR will take appropriate actions to offset these difficulties wherever practical.

5.5.4 Termination of M/WBE Contractor Disputes Clauses

CNR agrees that it will not terminate an M/WBE contractor for convenience. Should a termination of contract be required either because of default of the M/WBE or the M/WBE business suspending or closing its operations, CNR will make every good faith effort to find another M/WBE subcontractor to substitute for the original M/WBE and immediately notify MBTA in writing of its intent to terminate and its efforts to replace the original M/WBE.

CNR will provide language in its contracts regarding the amicable resolution of disputes with M/WBE firms in its own contracts with M/WBE firms and foster similar terms in the contracts of its suppliers.

5.5.5 Proposed Small Business Subcontracting Agreements

CNR has engaged and has teaming agreements with industry experts that have prior M/WBE contracting experience. It is our intention to continue to use these subcontractors for specific areas of the solicitation.

CNR M/WBE subcontracting goals for both products and services are detailed in Attachment B. These are intended to serve as areas under discussion with capable, certified firms. They are included as part of our evaluation with regard to committed numbers and serve to support the establishment, integrity and validity of our stated goal.

5.5.6 Efforts Made to Assist M/WBES

The CNR team's proactive approach to identify and secure M/WBE participation through "Pre-Award" outreach workshops has proven successful. The CNR team has fostered relationships with potential suppliers promoting active dialogue and sharing of necessary information to ensure suppliers' understanding of participation requirements. Through these efforts, CNR has identified several M/WBE firms to participate in this contract with agreements already reached to secure more than 6% of the total Base Award Price of the 16% goal (as shown in the M/WBE Participation Schedule).

CNR has a Checklist to maximize the success of M/WBE efforts.

CNR has developed the following checklist to evaluate the efforts it has made, and will continue to make, on behalf of M/WBEs. This checklist provides critical questions to ensure that M/WBE initiatives are sincere and effective for increasing M/WBE content.

CNR M/WBE PROGRAM CHECKLIST

1) Have we solicited invitations to involve M/WBEs in this procurement?
2) Have we arranged solicitations, times for presentations of bids, quantities, and delivery in ways that facilitate participation by M/WBEs?
3) Have we selected portions of the work which can possibly be used for M/WBE participation?
4) Have we unbundled work assignments in a manner that might include greater M/WBE participation?
5) Have we provided adequate information to interested M/WBEs to quote?
6) Have we negotiated with M/WBEs in good faith?
7) Have we rejected M/WBEs as unqualified without sound reasons and without an investigation of their capabilities?
8) Have we made efforts to assist M/WBEs in technical and commercial matters where practical?
9) Have we provided services to help M/WBEs improve long-term development, increase opportunities to participate in a variety of kinds of work, handle increasingly significant projects, and achieve eventual self-sufficiency?
10) Have we assisted M/WBEs to develop their capability to utilize emerging technology and conduct business through electronic media?
11) Have we made effective use of the services and sources available to us to locate, recruit, and, if needed, replace M/WBEs?

Attachment A

Minority/Women Owned Business Enterprise (M/WBE)
Outreach Workshop(s) Attendees

	Company	Contact	Address	Phone	Email
1	Precision Engineering	Liora Stone	29 Industrial Drive PO Box 546 Uxbridge MA, 01569	508-278-5700	lstone@precisionengineering.com
2	PowerFab Inc.	Mary Robinson	P.O. Box130 Merrimack, NH 03054	603-424-3900	mrobinston@powerfab.com wmanning@powerfab.com
3	DGF Industrial Innovations Group	John Makowski	PO Box 7532 Gilford, NH 03247	603-528-6591	jmakowski@dgfindustrial.com
4	Sourcing Opportunities Inc.	Susan Ondovic	775 Hartford T-Pike Shrewsbury, MA 01545	508-845-3330	sue@sourcing-opps.com
5	Care Technology LLC	Chon Meng Wong	42 Moshassuck Road Lincoln, RI 02865	401-728-3235	wong@caretechnology.biz bwong@caretechnology.biz
6	Resource Management Inc.	Larry Herman	281 Main St.Suite 5 Fitchburg, MA 01420	617-429-8135	Larry@rmi-solutions.com
7	Fusion Services, LLC	Ann LeDang-Sheehan	550 Raymond Road Plymouth, MA 02360	617-433-7195	betterlife0127@gmail.com
8	Metrick Manufacturing Co	Marlene J. Metrick	142 Bedford Road Woburn, MA 01801	781-935-1331	marlene.metrick@metrickmfg.com
9	ABC Soils	Daniel Carvalho	111 Boston Post Road Sudbury, MA 01776	781-577-2770	dcarvalho@abcsoils.com
10	Chapman Construction Group, Inc.	Vicki Chapman	17 Jan Sebastian Drive Sandwich, MA 02563	508-989-7643	jrchapmanvicki@comcast.net
11	Blue Sage Consulting, Inc.	Jeff Lovelace	PO Box 554 Hopkinton, MA 01748	423-435-1781	jeffreyl@bluesageconsulting.com
12	Triunity Engineering & Management	Russ Deanson	60 Thoreau St, Suite 239 Concord, MA 01742	617-388-5036	russ.deason@triunityeng.com
13	Green International Affiliates, Inc.	Marvin Miller	239 Littleton Road Westford, MA 01886	978-923-0400	mwmiller@greenintl.com
14	Pacific Drywall	Michael Ware	PO Box 255302 Dorchester, MA 02125	617-825-2371	michael.ware@pacificdrywall.org
15	ATAP Mechanical Solutions	Roscoe Gay		617-548-7692	atap.ms1@gmail.com
16	Matrix New World	Kevin Scully	7 Wildwood Lane Nashua, NH 03060	978-835-1556	kscully@matrixneworld.com
17	Lamson Engineering Corp	Kin Lan	437 Cherry St Newton, MA 02465	617-558-0101	lamsoneng@msn.com
18	Associated Subcontractors of Massachusetts	Scott Szycher	31 State Street, 4th floor Boston, MA 02109	(617) 742-3412	sszycher@associatedsubs.com
19	Simos Consulting	Michele Simos	73 Chelsea Street, Suite 308, Boston MA 02129	781-844-4916	msimos@rcn.com
20	Landstar Global Logistics	Maureen Powers	41 Highland Avenue Randolph, MA 02368	781-986-3832	maureen.power@landstarmail.com
21	EnviroPike, LLC	Carolyn Matthews	79 E. Haynes Dr., Townsend, MA 01469	978-597-3163	enviropike@gmail.com
22	NIR Sales	Nanette Lula	PO Box 54 Kingston, MA 02364	508-275-0295	n.lula@yahoo.com
23	CodeRed Business Solution	John Lewis	34 East Vanston Road Stoughton, MA 02072	314-241-4217	jlewis@coderedbs.com
24	Green Castle Business Solutions, LLC	Keith Castle	PO Box 160 Boston, MA 02131	617-307-4461	kcastle@greencastlebusiness.com
25	Evermore Light and Power, Inc.	Ada Alfonso	143 Mishawum Road Woburn, MA 01801	(508)345-5530	aalfonso@elpelec.com
26	MLD Services, Inc.	Marion L. Driscoll	40 Margaret Road Milton, MA 02186	617-529-4876	MLDservices@comcast.net

	Company	Contact	Address	Phone	Email
27	Encore Images, Inc.	Paul Mervis	21 Lime Street Marblehead, MA 01945	781- 631- 4568	paul.mervis@encoreimages.com
28	Metro Equipment Corp.	Ann Sullivan	27 Dixwell Street Roxbury, MA 02119	617-524-0414	
29	Horizon Services Corporation	Theodore Hsu	250 Governor Street E. Hartford, CT 06108	860-291-9111	thsu@horizonsvcs.com
30	Arch Professional Corp	Charles Bradley	260 Blue Hill Parkway Milton, MA 02186	617-538-1515	cwb@archprofgrp.com
31	RL Controls, LLC	Lena Walsh	10-V Gill Street Woburn, MA 01801	781-932-3349	lena@rlcontrols.com
32	Interconnect Computer Cabling Services, Inc.	Michael Moreau	406 Libbey Industrial Parkway, Weymouth 02189	603-778-1950	mike@ccsiinc.com
33	Parrish Painting Development & Construction Inc (PPDC)	John Lee	6 Fayston Street Dorchester, MA 02121	617-445-4920	parrislee@peoplepc.com
34	High Level Cleaning Services, Inc	Steven Encarnacion	1106 Main Street Brockton MA 02301	508-513-5382	highlevelcleaningservices@gmail.com
35	Albanese Brothers, Inc.	Marcella Albanese	28 Loon Hill Rd. Dracut, MA 01826	978-454-8850	marcella@albanesebros.com
36	TFJ Management Services	Johnny Tamba	36 Mclellan St. Dorchester, MA 02121	617-230-4903	tfjmanagement@msn.com
37	Mass Construction & Management Inc	Maxime Charles	34 Cedar Street Mattapan, MA 02126	617-470-8028	mcharles@masscontruct.com
38	CDW Consultants, Inc.	Yee Cho	40 Speen Street Framingham, MA 01701	508-875-2657 x 18	ycho@cdwconsultants.com
39	Adrian Name Plates	Madeline Albani	8 Pine Ridge Road Essex, MA 01929	978-768-7977	sales@adriannameplates.com
40	General Safety Services, Corp	Nardine Bellew	80 Hudson Rd, Suite 100 Canton, MA 02021	781- 381- 2835	nbellew3@netscape.net
41	Shekar & Associates, Inc.	Sharmila Bail	775 Pleasant Street Weymouth, MA 02129	781-337-8347	shekarco@verizon.net
42	Boyle Services	Terry Boyle	110 Watson Rd Belmont, MA 02478	617-484-3036	terryboyle@comcast.net
43	SAK Environmental, LLC	Maureen Sakakeeny	231 Sutton Street N. Andover, MA 01845	978-688-7804	msakakeeny@sakenvironmental.com
44	Coastal Construction & Management Co.	Charles Lucner	P O Box 186 Mattapan MA 02126	617-990-6507	lcharles@coastalcm.com
45	Garg Consulting	Mark Neri	2096 A Silas Deane HW Rocky Hill, CT 06067	860-563-0582	mneri@gargengineering.com
46	Merrimak Capital	Jeanne Gorham	27 Steeple Chase Circle Westford, MA 01886	415-475-7352	jgorham@merrimak.com
47	Palmer Trailer Sales (PTS)	Guy Lucia	1158 Park Street Palmer, MA 01069	(413) 283-3773	pts01069@yahoo.com
48	Transitair	Dhruv Sharma	One William K Jackson Lane, Hornell NY 14843	607-324-7860	dsharma@transitairusa.com
49	ADG Enterprises	Diana Patterson	3772 Satellite Blvd, Suite 103 Duluth, GA 30096	770-662-8393	dpatterson@adgenterprises.net
50	Martinez Couch (MCA)	Ariel Martinez	1084 Cromwell Avenue Rocky Hill, CT 06067	860-436-4364	ariel.martinez@martinezcouch.com
51	Innovations	Winsor Cho	7 Fox Run Sturbridge, MA 01566	774-230-2920	winsorcho@gmail.com
52	Vikam Associates, Inc.	Timothy Fountain	46 Whitmun Road Longmeadow, MA 01106	413-567-8474	Tfoun36400@aol.com
53	Boulevard Machine	Susan Kasa	785 Page Boulevard Springfield, MA 01104	413-788-6466	skasa@boulevardmachine.com
54	Creative Futures LLC	Lucie Lewis	P. O. Box 482 Longmeadow,MA 01028	866-818-9918	luciek@creativefuturesllc.com
55	Westcarb	Donald Smith	109A Mill Street Springfield, MA 01108	866-507-1576	dsmith@westcarb.com

	Company	Contact	Address	Phone	Email
56	Walker International	Donald Laghezza	70 East Sunrise Highway Valley Stream, NY 11581	516-568-2080	dlaghezza@walkerscm.com
57	Atlantic Fasteners	John Kraus	49 Heywood Ave. Springfield, MA 01090	413-241-2225	jkraus@atlanticfasteners.com
58	American Systems & Equipment Corp.	Mark Barowsky	66 Industry Ave. Springfield, MA 01104	413-739-8170	info@maerican-sys.com
59	Dynamic Dock & Door	Bret Leveillee	64 Lowell Street Springfield, MA 01089	413-731-1114	bret@dynamic-dock-door.com
60	Cross-Spectrum Acoustics	Herb Singleton	P.O. Box 90842 Springfield, MA 01139	413- 315-5770	hsingleton@csacoustics.com
61	Carpenters Union	Jason Garand	29 Oakland St. Springfield, MA 01108	413-736-2878 781-321-6282	jgarand@nercc.org
62	Younger Brothers, Const.	Clyde L. Younger Kenneth Bedrosian	44 Bedford Rd. Carlisle, MA 01741	617-512-9477 978-371-7797	cyounger@youngercorp.com kgbprojectservices@comcast.com
63	KeeClean Management	Tom Elliot	2 Corporate Drive Shelton, CT 06484	203-397-2532	tom.elliot@keeclean.com
64	L.P. Consultant	Kiran Niajmudar		860-558-9887	lpconsultants@snet.net
65	Advanced Architectural Metal Specialties Corp.	Diane Johanson	15 4th St. Taunton, MA 02780	508-824-8333	djoh@aams-corp.com
66	Atlantic Fasteners	John Kraus	49 Heywood Ave. W.Springfield, MA 01090	413-241-2225	jkraus@atlanticfasteners.com
67	InOrder Business Solutions	Shelley Webster	7 Crickett Lane Randolph, MA 02368	617-719-7869	shelleywebster@comcast.net

Minority/Women Owned Business Enterprise (M/WBE) POST Workshop(s) Outreach

	Company	Contact	Address	Phone	Email
1	Atlantic Bay Contracting Co., Inc.	Shaunda O'Neal	100 Hano Street, Suite 22, Allston, MA 02134	617-782-4986	shaunda.atlanticbay@gmail.com
2	ABLE Associates	Eileen Wheeler	315 Pleasant Street Fall River, MA 02721	508-673-3979	eileen@able.jobs
3	Benchmark Office Systems	Cheryl Jens	58 Range Road Windham, NH 03087	603-890-2474	cheryl.jens@benchmark-office.com
4	US Eco Products, Corp.	Doreen Blades	P.O. Box 213 W. Newbury, MA 01985	978-457-9229	doreen@usecoproducts.com
5	Checks and Balances, Inc	April Pessaud	10550 Linden Lake Plza Manassas, VA 20109	703-345-0731	apessaud@eeihr.com
6	Heritage Construction & Supply	Bernadette Carroll	239 Dorchester Street Boston, MA 02127	617-269-3430	Berna002@yahoo.com
7	Tantara Associates Corp	Dawn Dearborn	54 Mason Street Worcester, MA 01610	508-752-5599	ddearborn@tantaracorp.com
8	Dnutch Associates, Inc.	Denise Jones	13 Branch Street Methuen, MA 01844	978-687-1500	Djones@dnutch.com
9	Quabbin Healthcare Consulting, Inc.	Lynn Shaw	30 Barre Road Petersham, MA 01366	978-724-0040	quabbinhcc@gmail.com
10	Simco Engineering PC	Muhammad Siddiqui	80 Maiden Ln, New York, NY 10038	212- 385-8100	msiddiqui@simcopc.com
11	LPI East, LLC	Kevin Bell	100 Pearl Street Hartford, CT 06103	888-842-0561 x 103	kbell@lpieast.com
12	Cygnus, LLC	Gabriela Naydenov	510 E 41st Street Paterson, NJ 07504	973-523-0668	gabriela@cygnusnj.com
13	MRI USA Inc	Stephen Bernstein Gayle Bernstein	228 East 45 Street, Suite 1801, NY NY 10017	212-867-9600	stephen.bernstein@mriusa.biz

	Company	Contact	Address	Phone	Email
14	Premier Paint Finishes Inc.	Alvera Payne	34 Mallon Road Dorchester, MA 02121	617-533-8367	alverapaynejones@hotmail.com
15	Success Strategies, Inc (DBA Docwhiz)	Paula Stanziani	94 Merrymount Rd. Quincy, MA 02169	617-240-8825	paula@docwhiz.biz
16	Security Construction Services Inc	Janet Ceddia	59 Apsley Street Hudson, MA 01749	978-562-0770	jceddia@security-construction.com
17	Matrix Railway	Nelson Rivas	69 Nancy Street West Babylon,NY 11704	516-351-2861	nrivas@matrixrailway.com
18	Ritronics	Steven Cobb	60 U.S. 1 Warwick, RI 02886	401-732-8175	steve.cobb@ritronics.com
19	BSV Metal Finisher	Benjamin Vasquez	750 St. Paul Street Rochester, NY 14605	585- 454-0550	bvasquez001@hotmail.com
20	Ferreira Towing, Inc	Mary Jo Glynn	293 Littleton Road Chelmsford, MA 01824	978-454-7914	maryjo@ferreiratowing.net
21	The Cruz Companies	Lisa Barros	One John Eliot Sq Roxbury, MA 02119	617-442-2496	lauriesnow@cruzcompanies.com
22	JP and Concept Co. JPCO	JoAnn Forance	9060 Paseo De Valencia St., Fort Myers, 33908	239-437-3108	jpforance@jpco-dbe.com
23	The Fairland Company	William Walker		978-658-5800	wew@fairland.biz
24	JFK Environmental Services LLC	Jayne Knott	115 Glen Avenue Upton, MA 01568	508-344-2831	jfknott@jfkenviroserv.com
25	Corporate Environmental Advisors	Kristy Fitzpatrick	127 Hartwell St. Suite 2 West Boylston, MA 01583	800-358-7960	kfitzpatrick@cea-inc.com
26	Samiotes Consulting	Chuck Samiotes PE	20 A. Street Framingham, MA 01701	508-877-6688	csamiotes@samiotes.com
27	Contine Corporation		1820 Wagle Road Erie, PA 16510	814-899-0006	
28	Goyal Enterprises	Joy Goyal	382 Park Ave East Mansfield,Ohio, 44905	419-522-7099	
29	Altech Services, Inc.	Kenneth Isaacs	P.O. Box 3456 Wayne, NJ 07474	973-541-9898	
30	Savin Engineers PC	Dr.R.Srinivasaraghava	3 Campus Drive, Pleasantville, NY 10570	914-769-3200	info@savinengineers.com
31	Lin Industries,Inc. (LECIP)	Stuart Crust	6314 Ice House Road Hornell, NY 14843	631-249-2070	scrust@lecipinc.com
32	NEDC Sealing Solutions	Kimberly Abare	42 Newark Street Haverhill, MA 01832	978.374.0789	kabare@nedc.com

Attachment B

M/WBE Participation Summary	
ATTACHMENT B	
CNR has committed to the following Percentages	
M/WBE Content for Base Contract	**16.00%**
152 Orange Line Cars	
74 Red Line Cars	
Capital Spares	
Manuals and Training	
Ancillary Materials and Services	
Manufacturing and Facility Set-up	
M/WBE Content for Total Base and Option Contract	**15.00%**

CNR has calculated and projects the following percentages of M/WBE content for the Base Award and Total Proposal.

Content	Base Award	Total Proposal
Secured Content		
Vehicle Components		
Secured through agreements and through expectations from primary vendor submittals.		
Trucking		
Technical Consulting		
Total Secured Content	**7.79%**	**8.88%**
Unsecured but Anticipated Contracts	**8.21%**	**6.12%**
General Construction & Facility Setup		
Human Resources		
Visa Applications		
Metal Fabrication		
Vehicle Components		
Total Secured and Unsecured Content*	**16.00%**	**15.00%**

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6 APPENDIX – ADDITIONAL DOCUMENTATION

6.1 CONCEPTUAL DESIGN DRAWINGS

Below is the RFP requirement for the Conceptual Design Drawings:

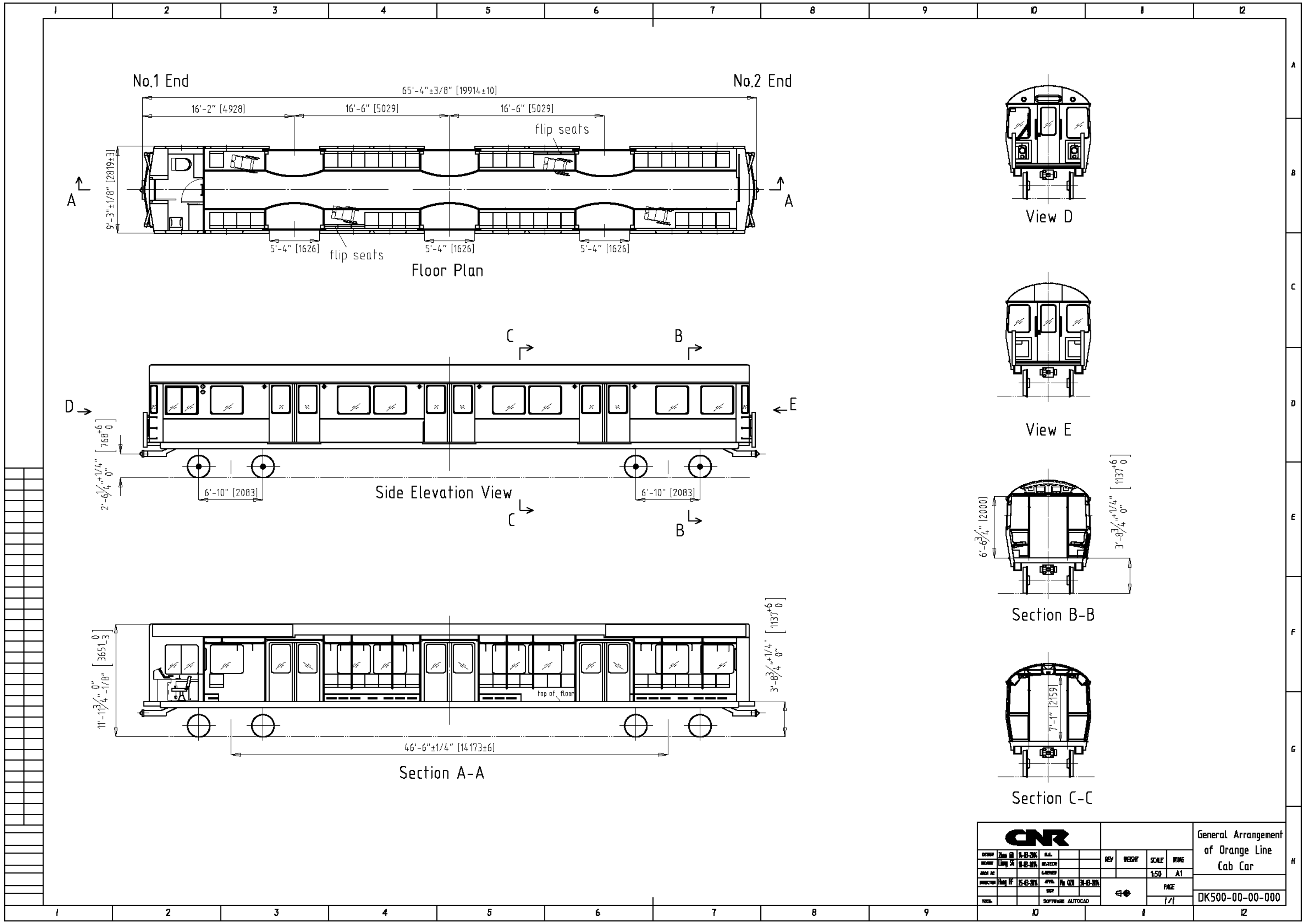
Tab I.1 (m) Organization Chart, Resume and Responsibilities of Key Staff
Provide one (1) print each of the following conceptual designs for each car type (Orange, Red, Cab Car, Non-Cab Car): General Arrangement Drawings (Interior and Exterior); Floor Plans; Equipment Arrangement; Carbody structural Diagram; Truck General Arrangement Drawing; and Cab and Console Layout.

The drawings provided in this section are list below in the order in which they appear:

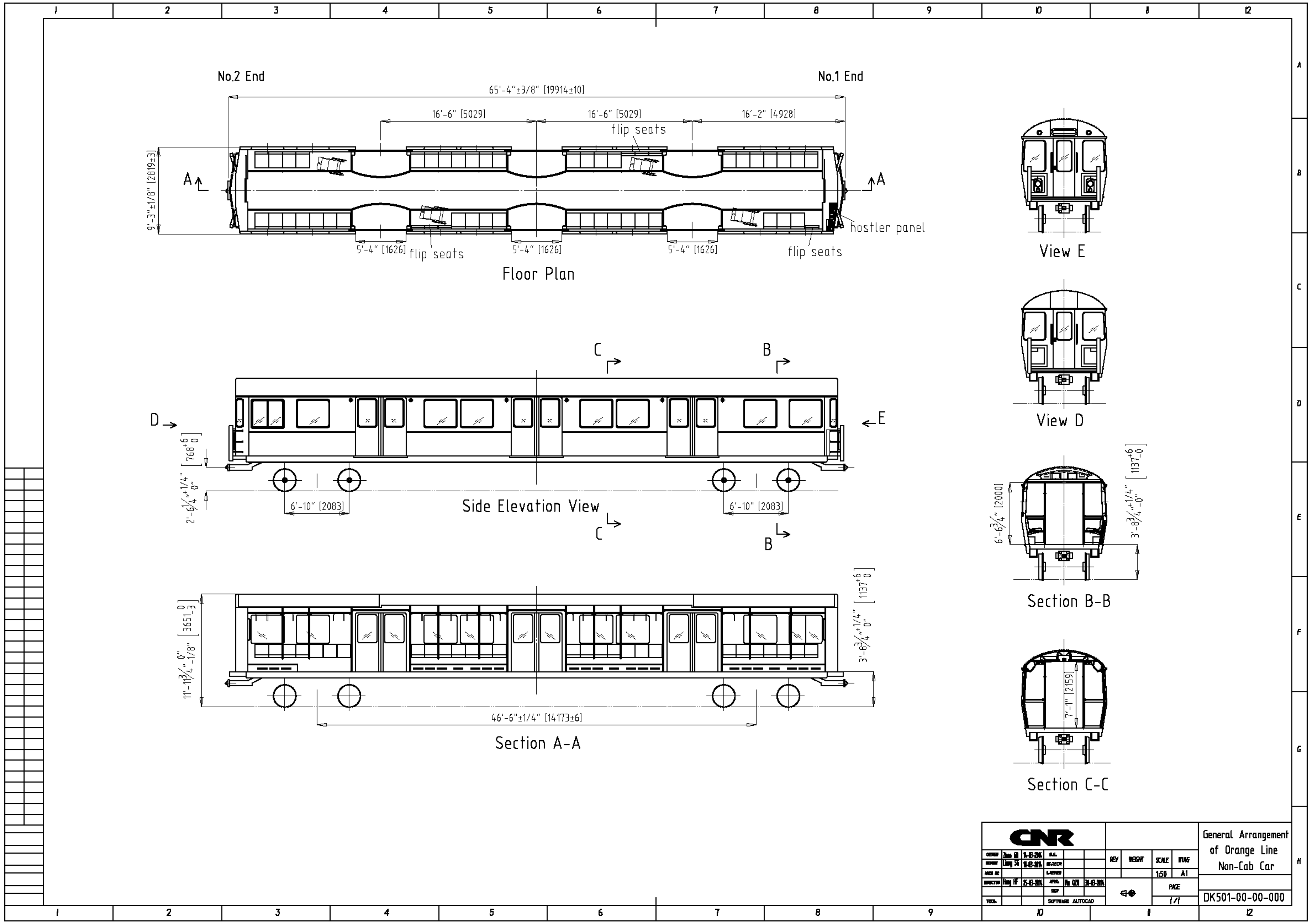
- General Arrangement (Interior and Exterior)
    - Orange Line, Cab Car
    - Orange Line, Non-Cab Car
    - Red Line, Cab Car
    - Red Line, Non-Cab Car
- Floor Plans
    - Floor Plan of Orange Line Cab Car
    - Floor Plan of Orange Line Non-Cab Car
    - Floor Plan of Red Line Cab Car
    - Floor Plan of Red Line Non-Cab Car
- Underfloor Equipment Arrangement
    - Layout of Underfloor Equipment of Orange Line Cab Car
    - Layout of Underfloor Equipment of Orange Line Non-Cab Car
    - Layout of Underfloor Equipment of Red Line Cab Car
    - Layout of Underfloor Equipment of Red Line Non-Cab Car
- Carbody Structural Diagrams
    - Structural Arrangement of Orange Line Cab Car
    - Structural Arrangement of Orange Line Non-Cab Car
    - Structural Arrangement of Red Line Cab Car
    - Structural Arrangement of Red Line Non-Cab Car
- Truck General Arrangement
    - No. 1 End Truck Assembly
    - No. 2 End Truck Assembly
- Cab and Console Layouts
    - Cab and Console Layout of Orange Line Car
    - Cab and Console Layout of Red Line Car

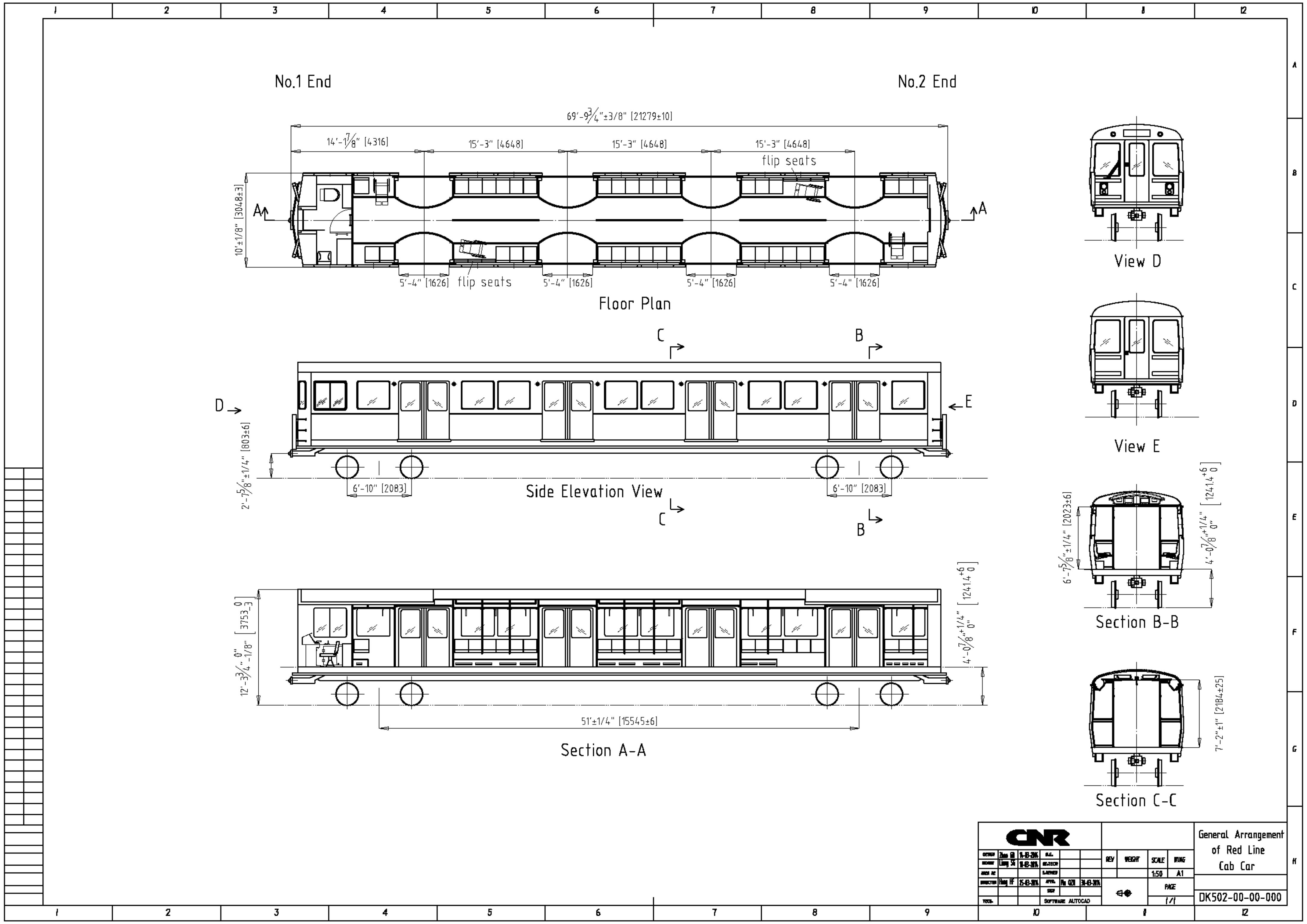
6.1.1 General Arrangements – Interior and Exterior

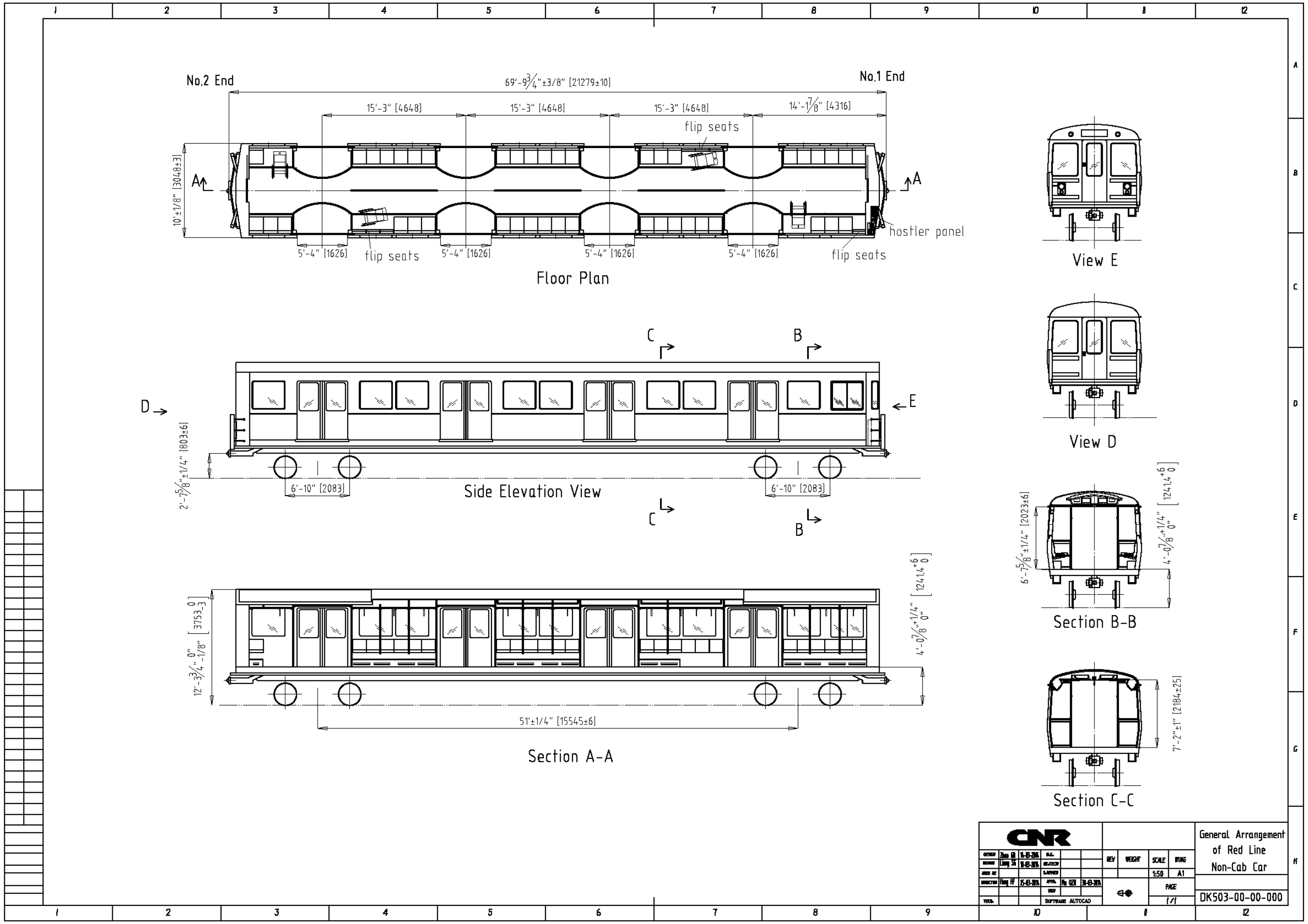
General Arrangements – Interior and Exterior: Orange Line, Cab Car



General Arrangements – Interior and Exterior: Orange Line, Non-Cab Car

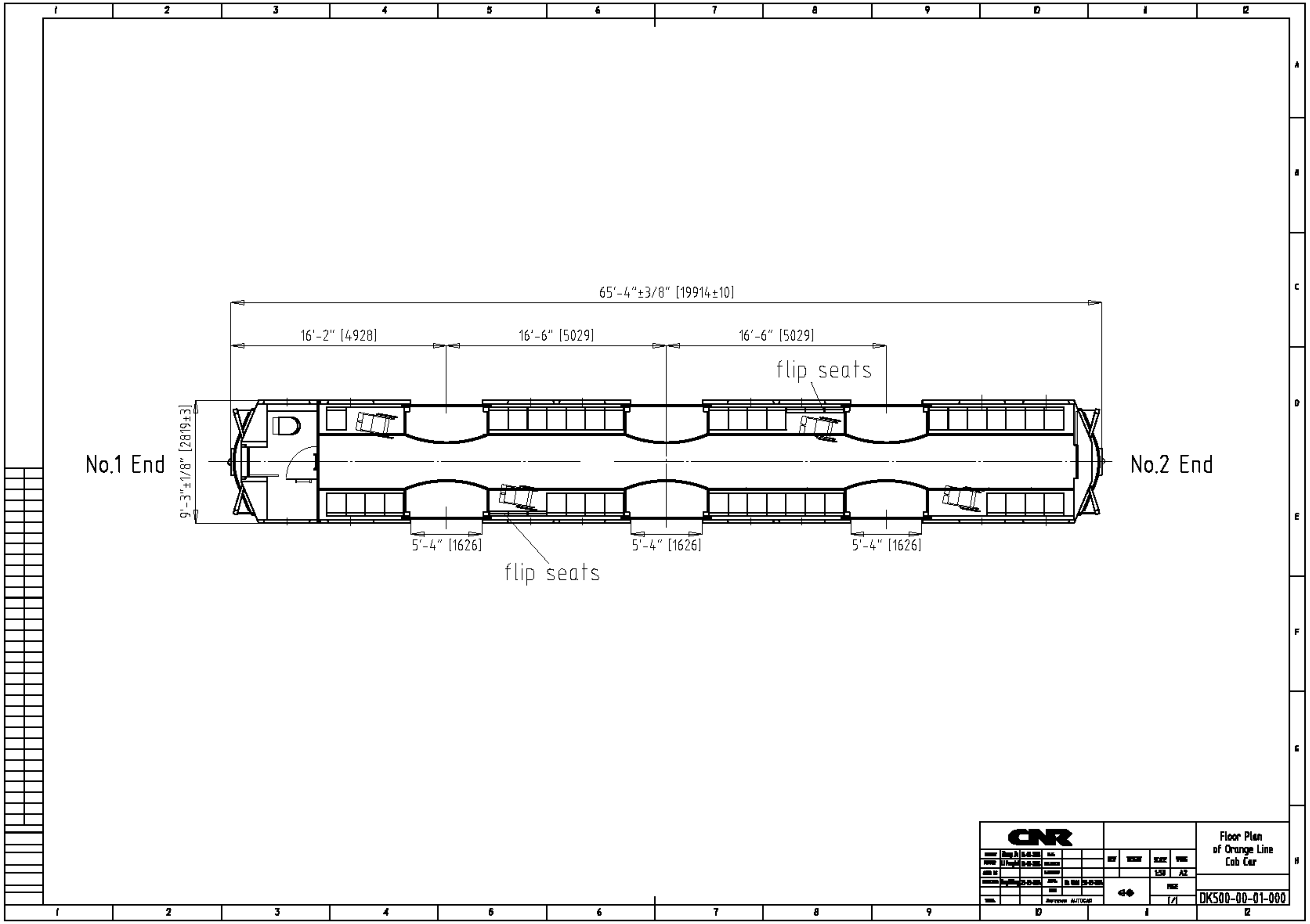


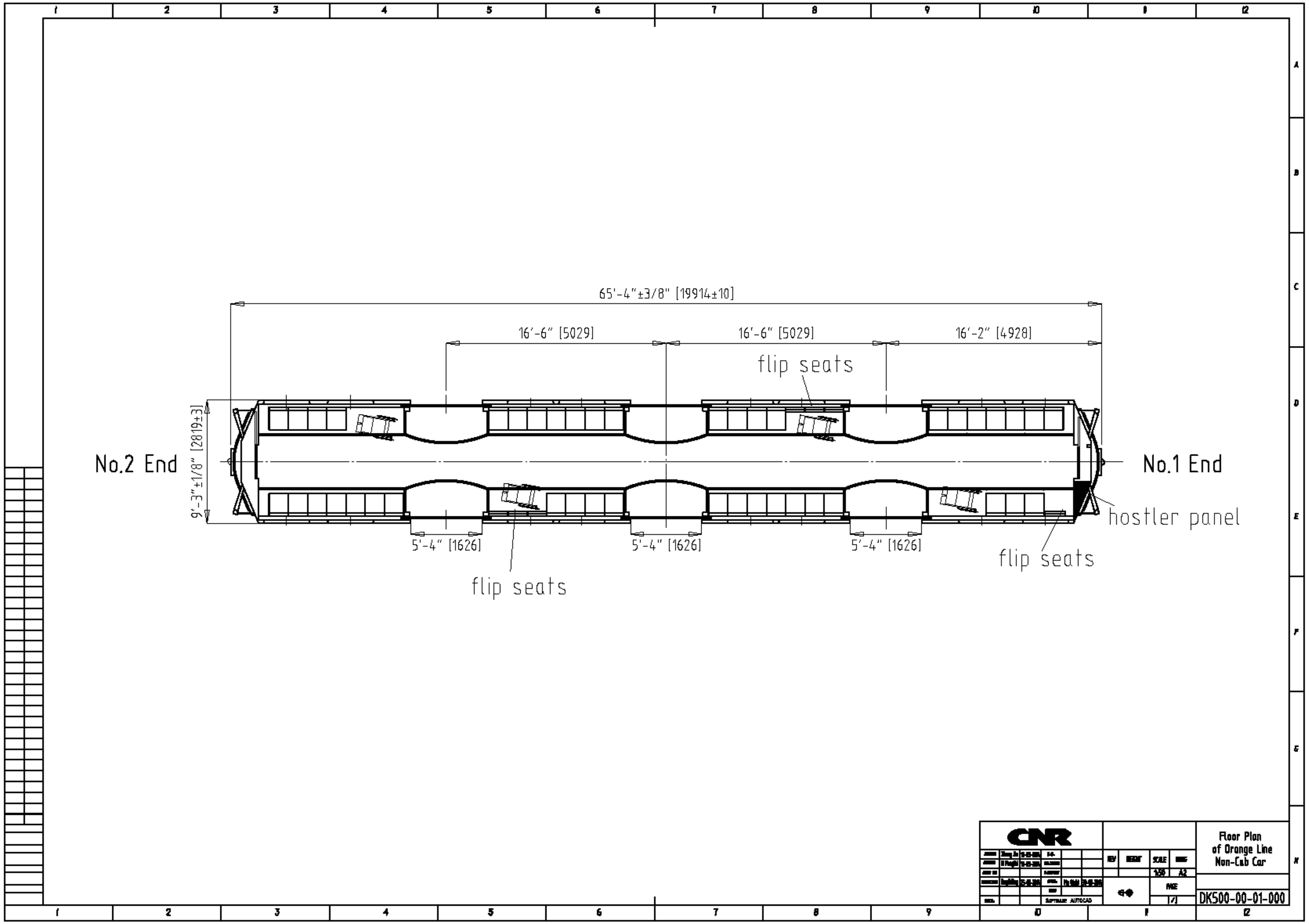

No.1 End
No.2 End
flip seats
Floor Plan
Side Elevation View
Section A-A
View D
View E
Section B-B
Section C-C
General Arrangement of Red Line Cab Car
DK502-00-00-000


No.2 End
No.1 End
69'-9 3/4"±3/8" [21279±10]
15'-3" [4648]
14'-1/8" [4316]
flip seats
hostler panel
5'-4" [1626]
10'±1/8" [3048±3]
Floor Plan
Side Elevation View
6'-10" [2083]
Section A-A
51'±1/4" [15545±6]
View E
View D
Section B-B
Section C-C
7'-2"±1" [2184±25]
General Arrangement of Red Line Non-Cab Car
DK503-00-00-000

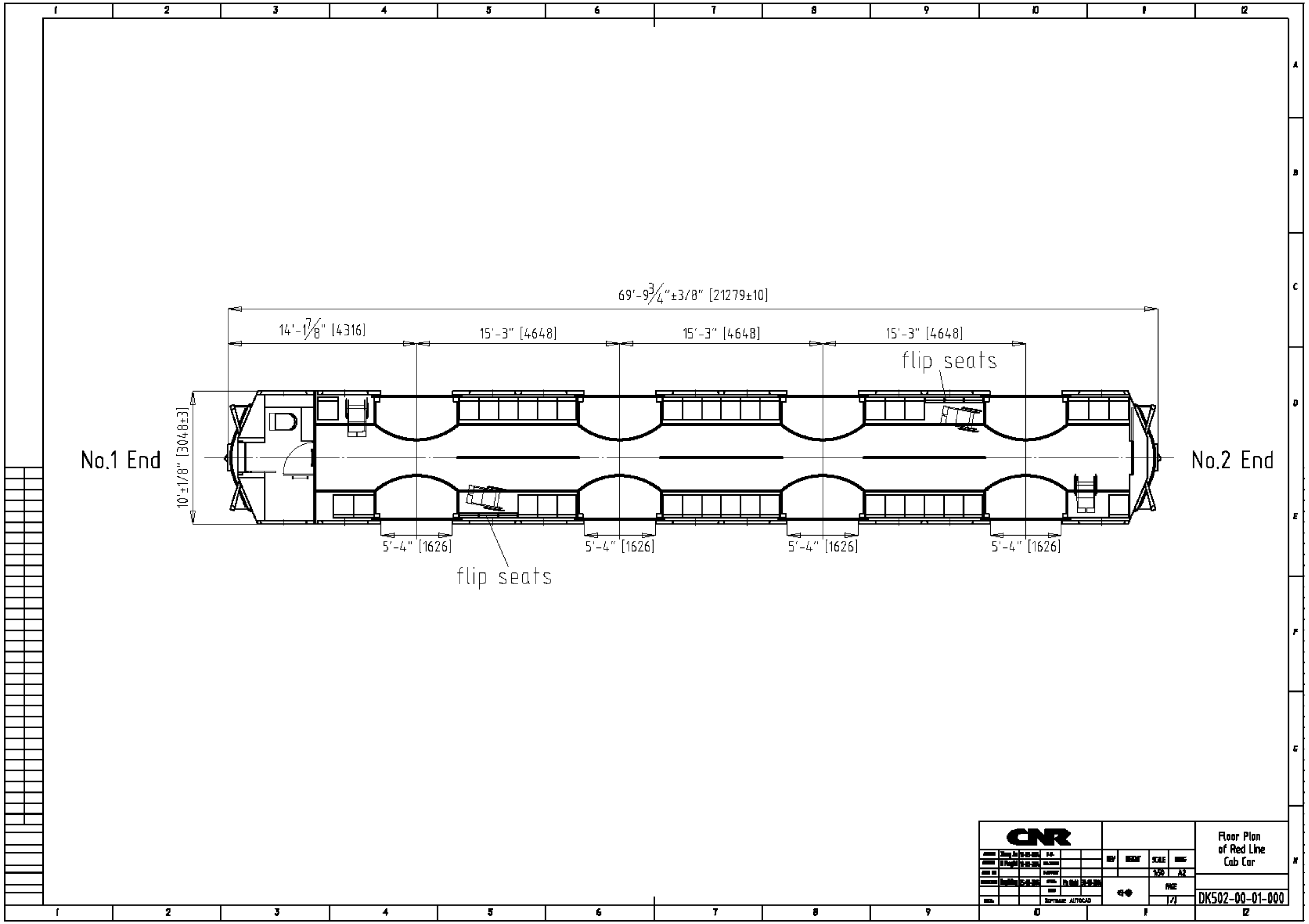
6.1.2 Floor Plans

Floor Plans: Orange Line, Cab Car

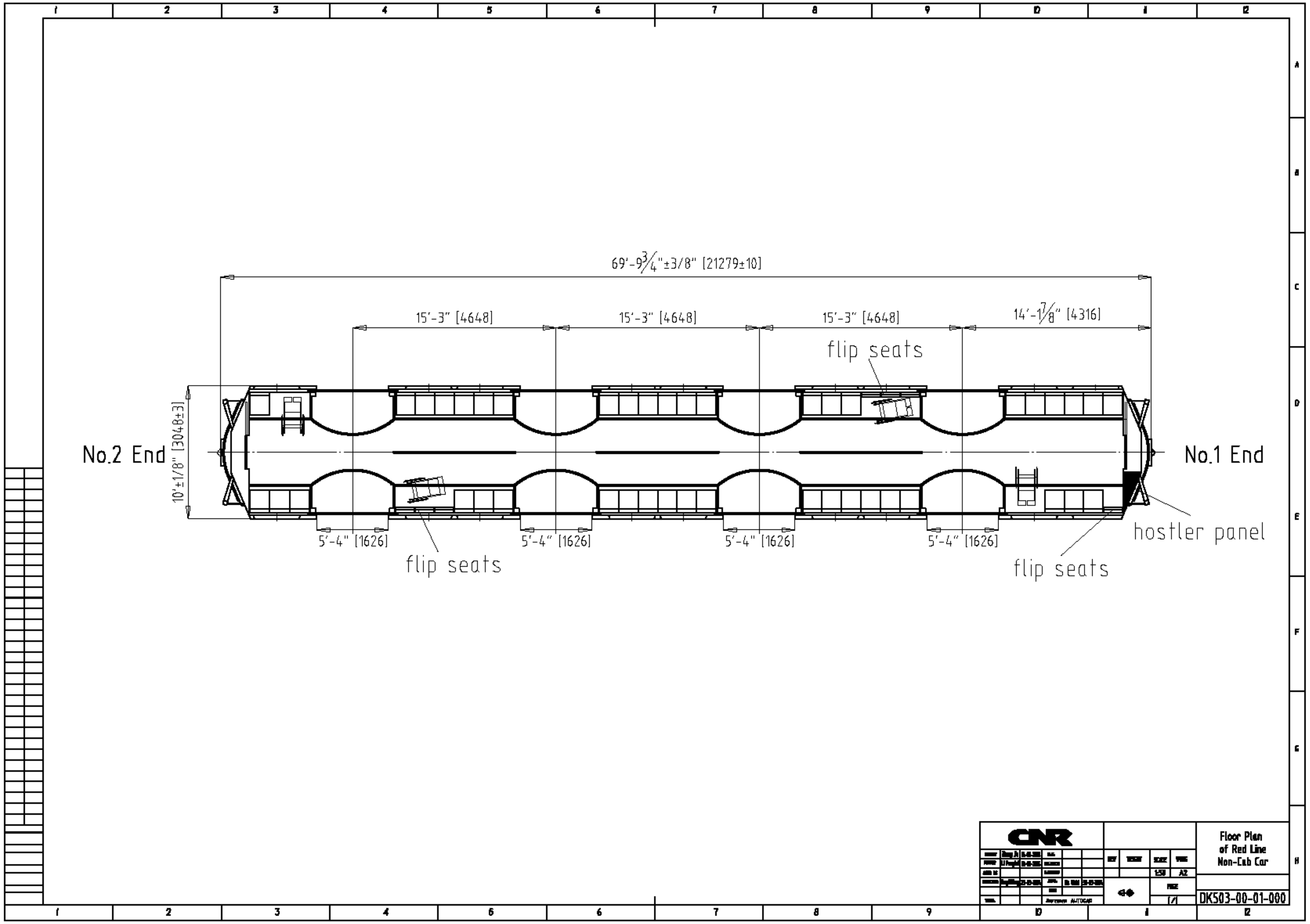



65'-4"±3/8" [19914±10]
16'-6" [5029]
16'-6" [5029]
16'-2" [4928]
flip seats
No.2 End
9'-3"±1/8" [2819±3]
No.1 End
hostler panel
5'-4" [1626]
5'-4" [1626]
5'-4" [1626]
flip seats
flip seats
Floor Plan of Orange Line Non-Cab Car
DK500-00-01-000

Floor Plans: Red Line, Cab Car

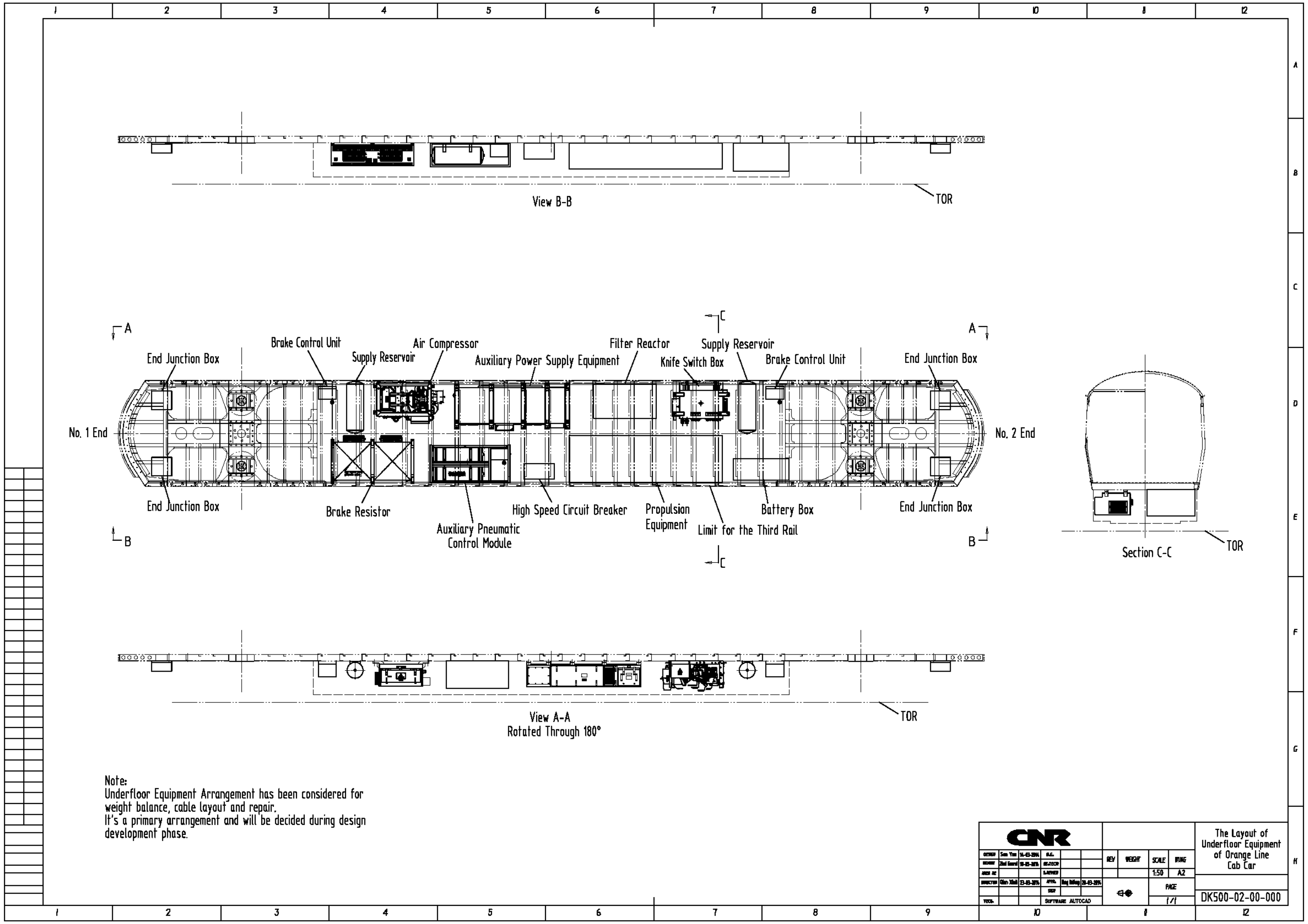


Floor Plans: Red Line, Non-Cab Car

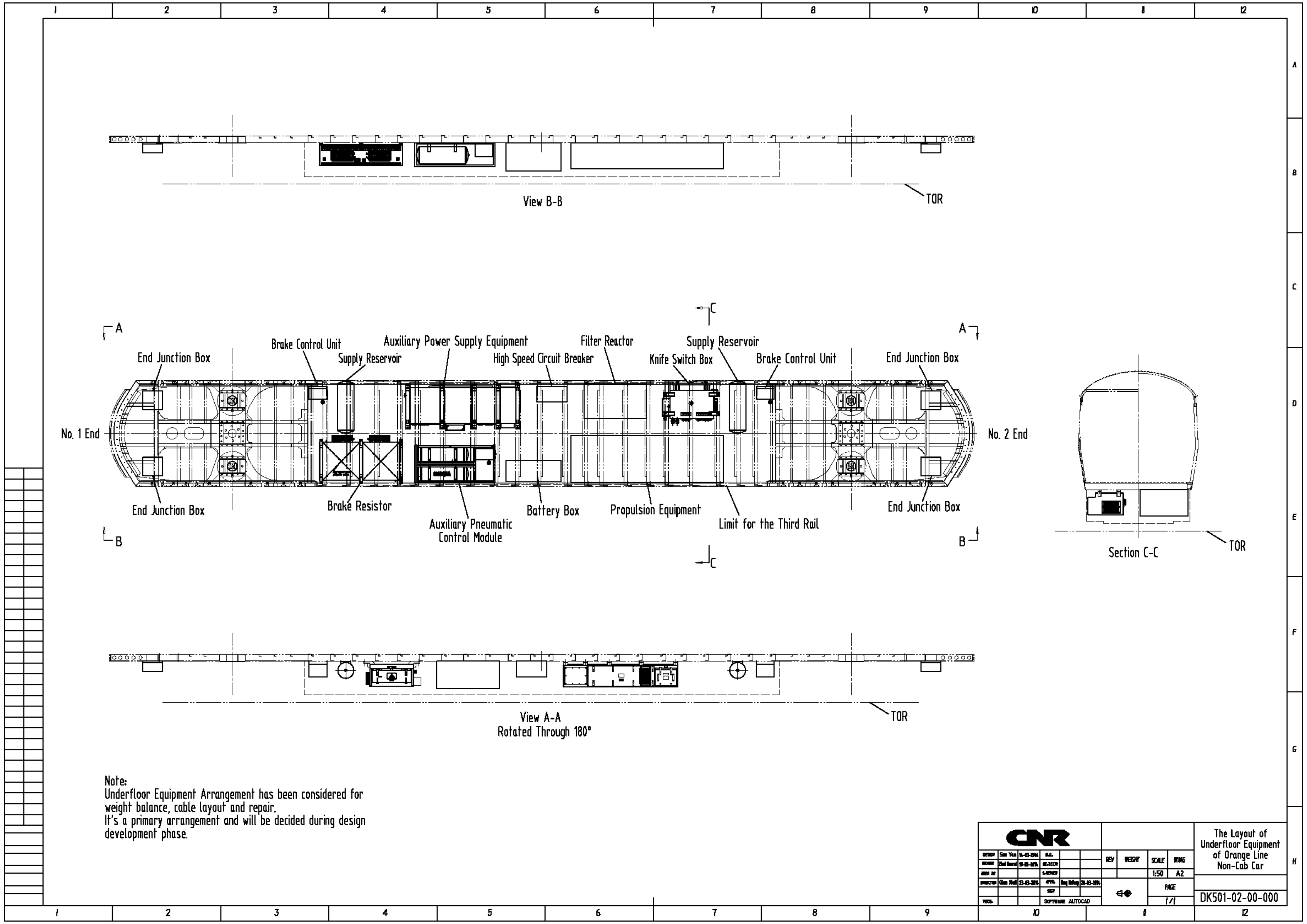


6.1.3 Equipment Arrangement

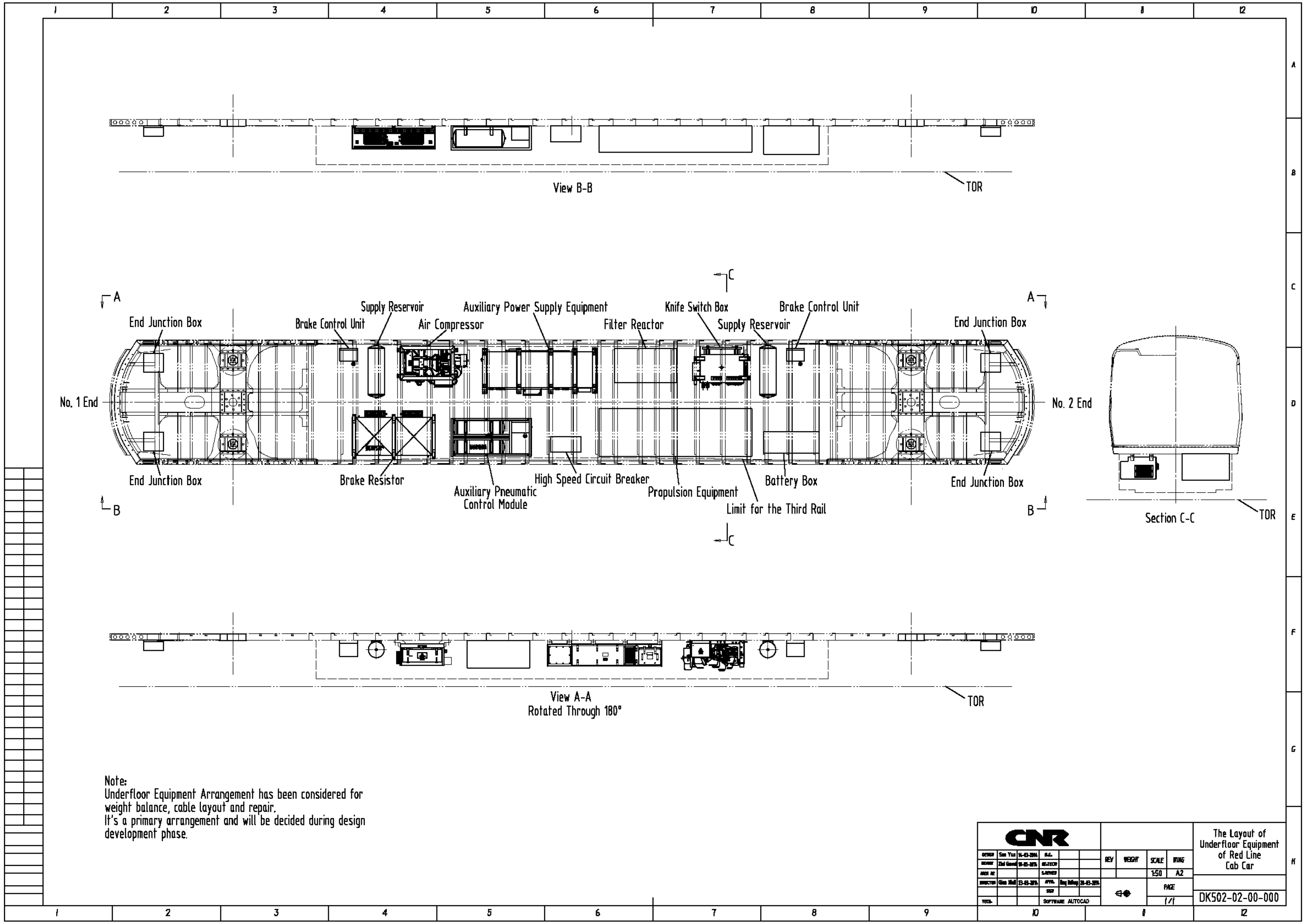
Equipment Arrangement: Orange Line, Cab Car



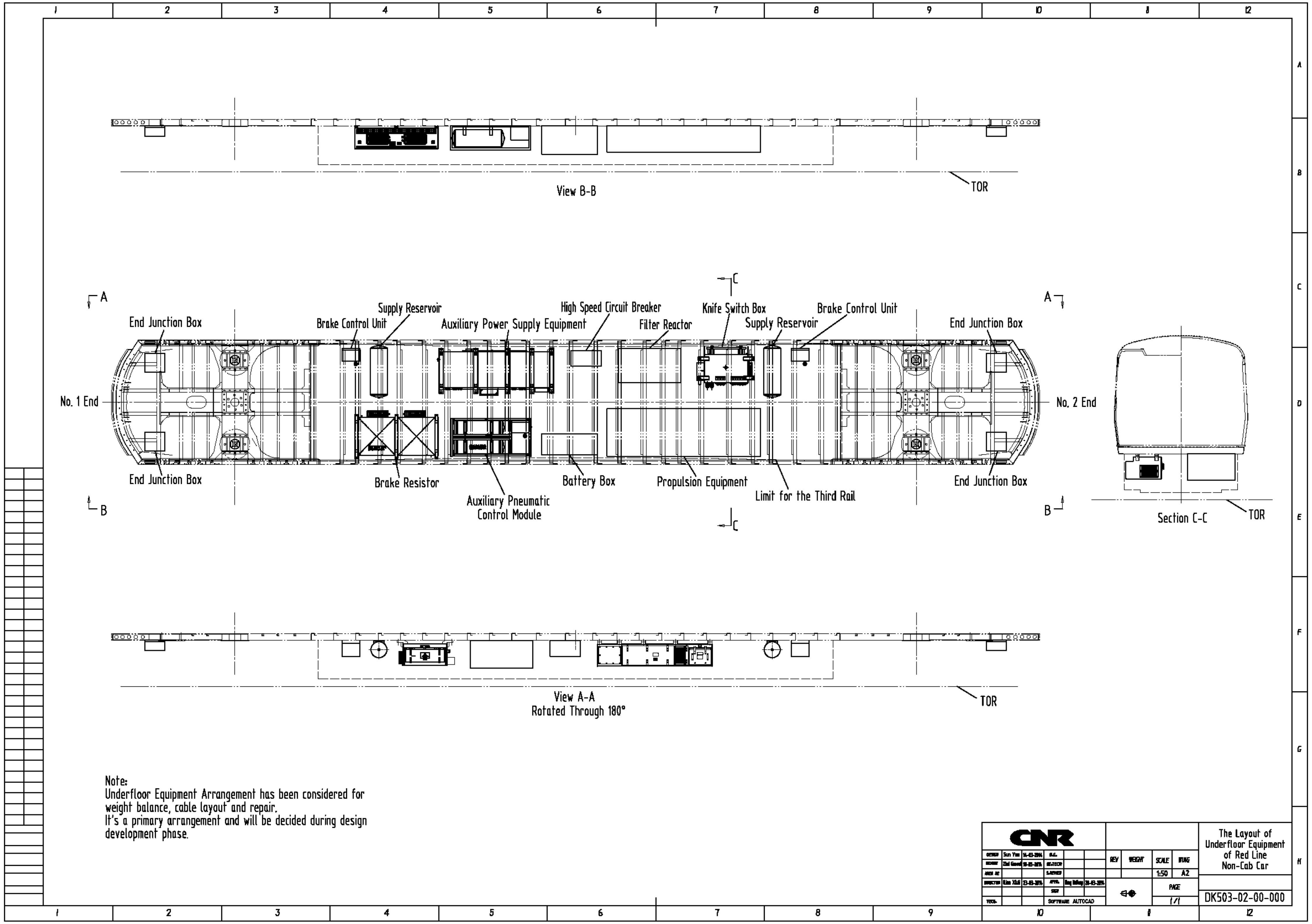
Equipment Arrangement: Orange Line, Non-Cab Car



Equipment Arrangement: Red Line, Cab Car

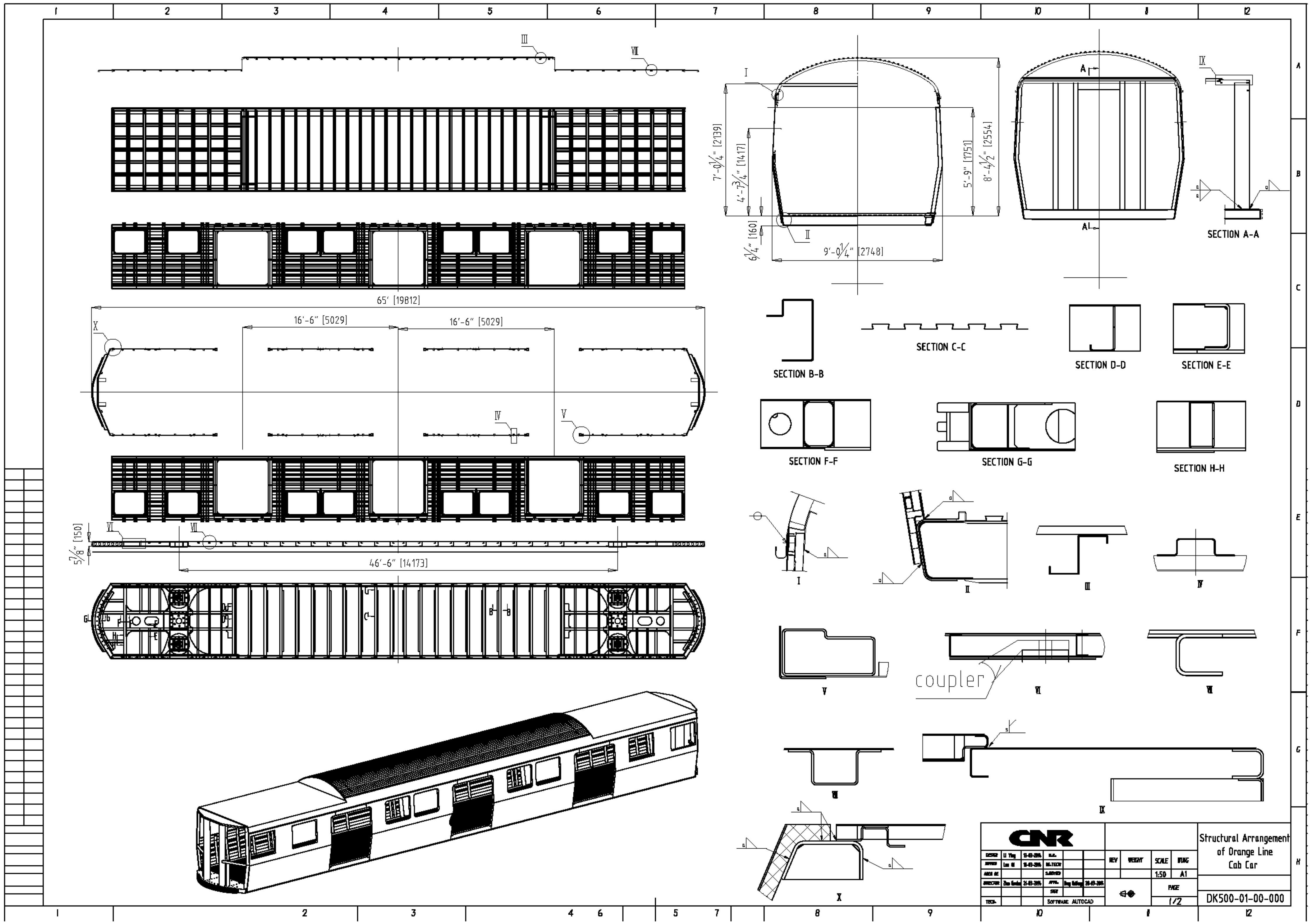


Equipment Arrangement: Red Line, Non-Cab Car

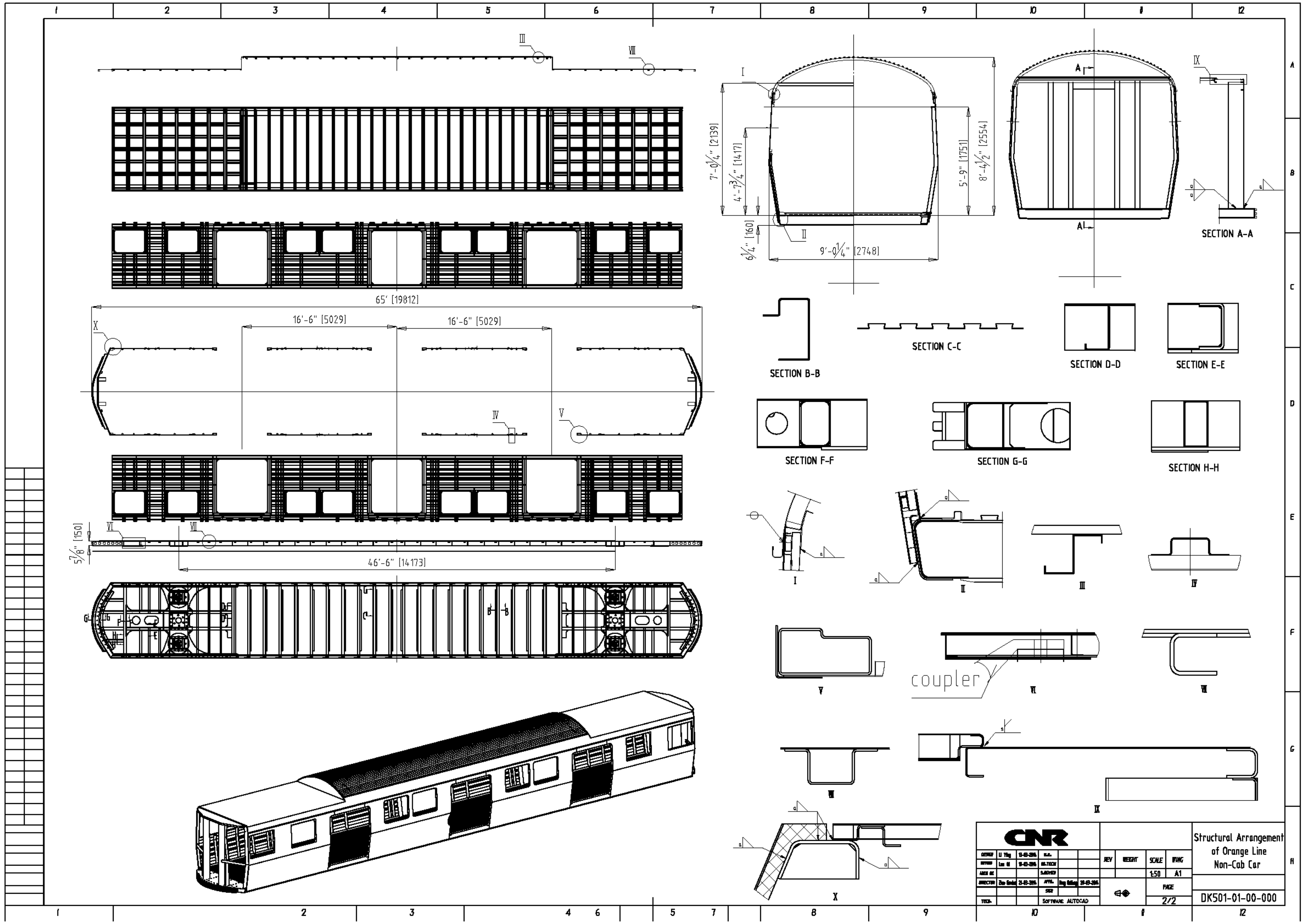


6.1.4 Carbody structural Diagrams

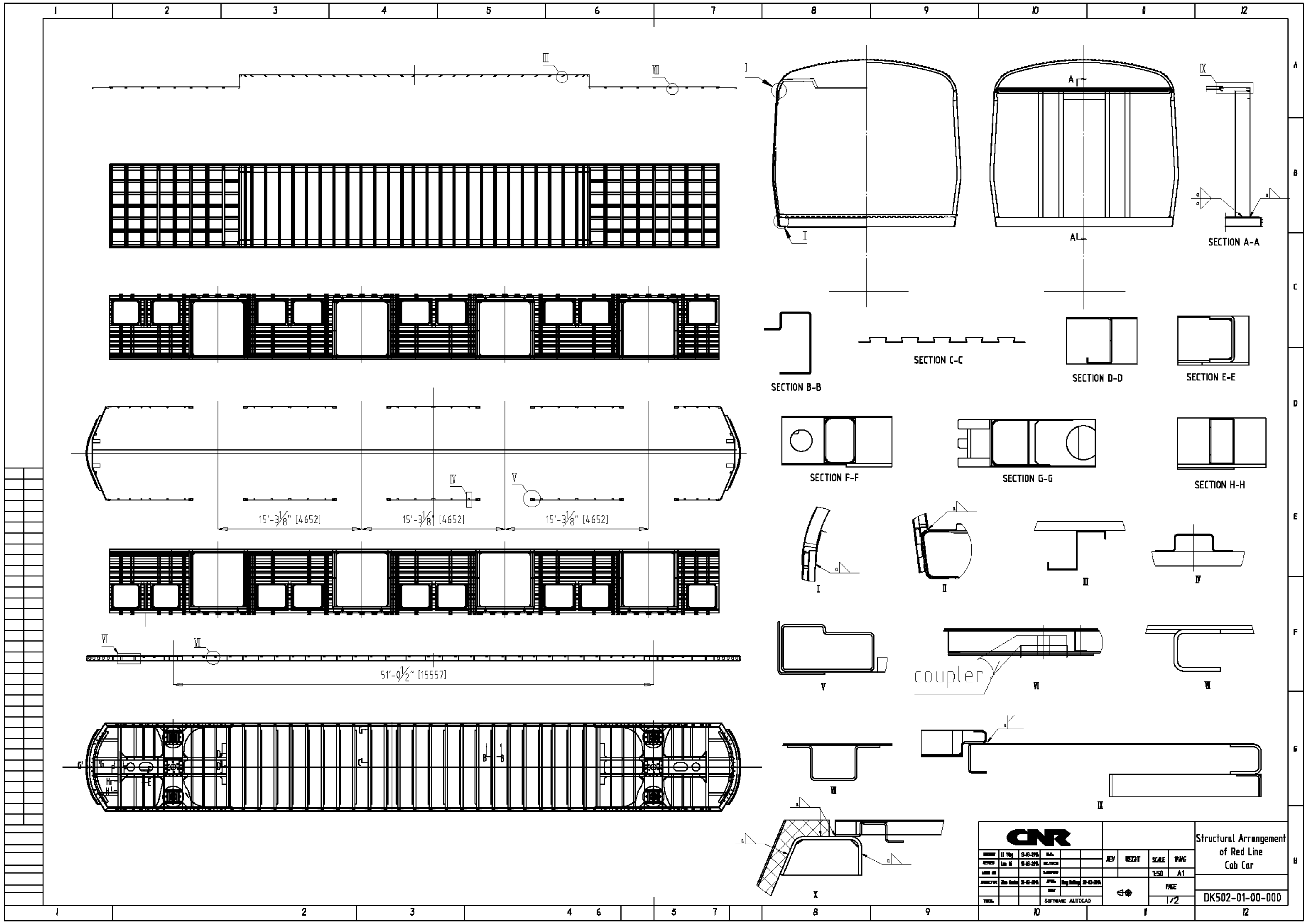
Carbody structural Diagrams: Orange Line, Cab Car



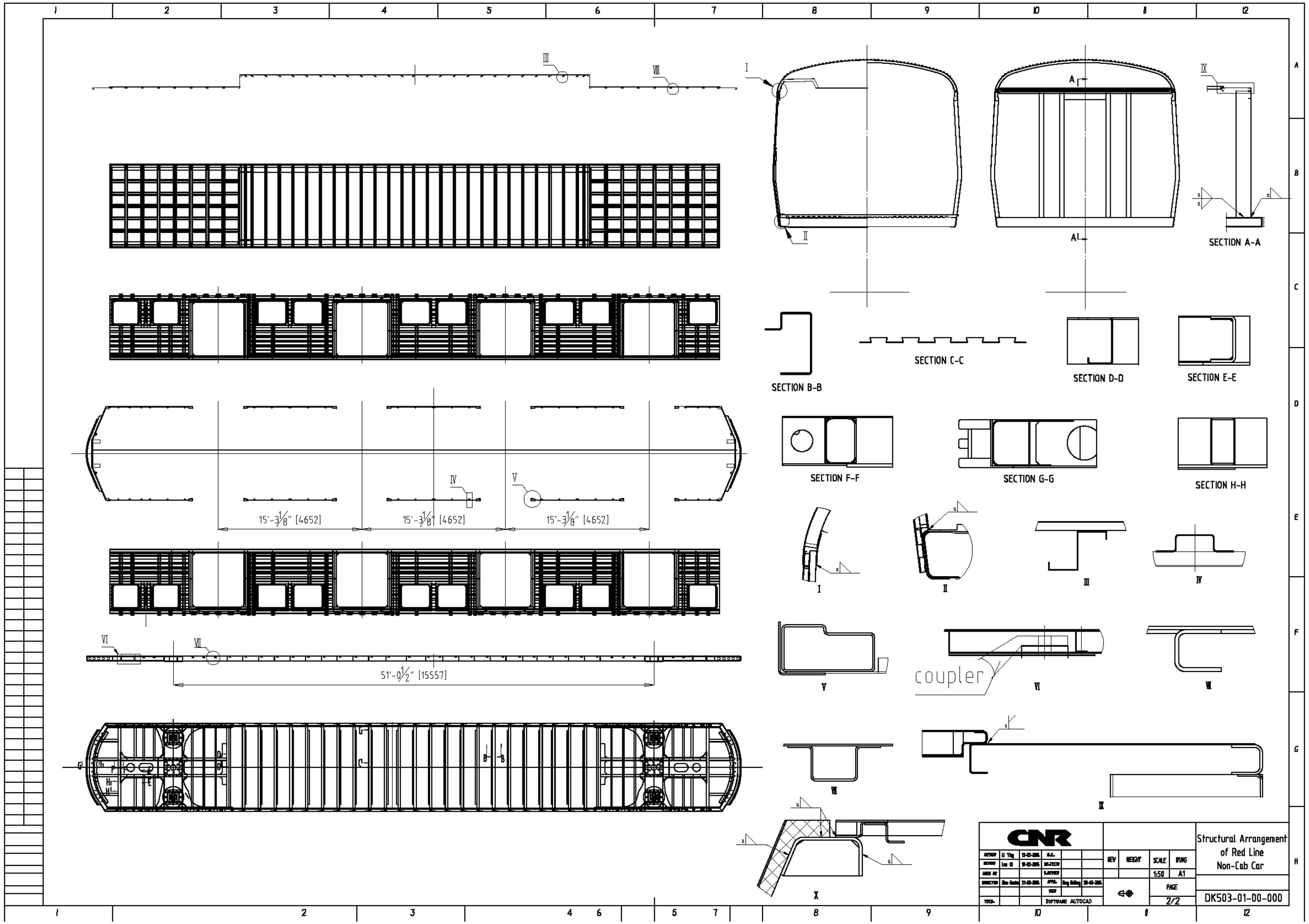
Carbody structural Diagrams: Orange Line, Non-Cab Car



Carbody structural Diagrams: Red Line, Cab Car

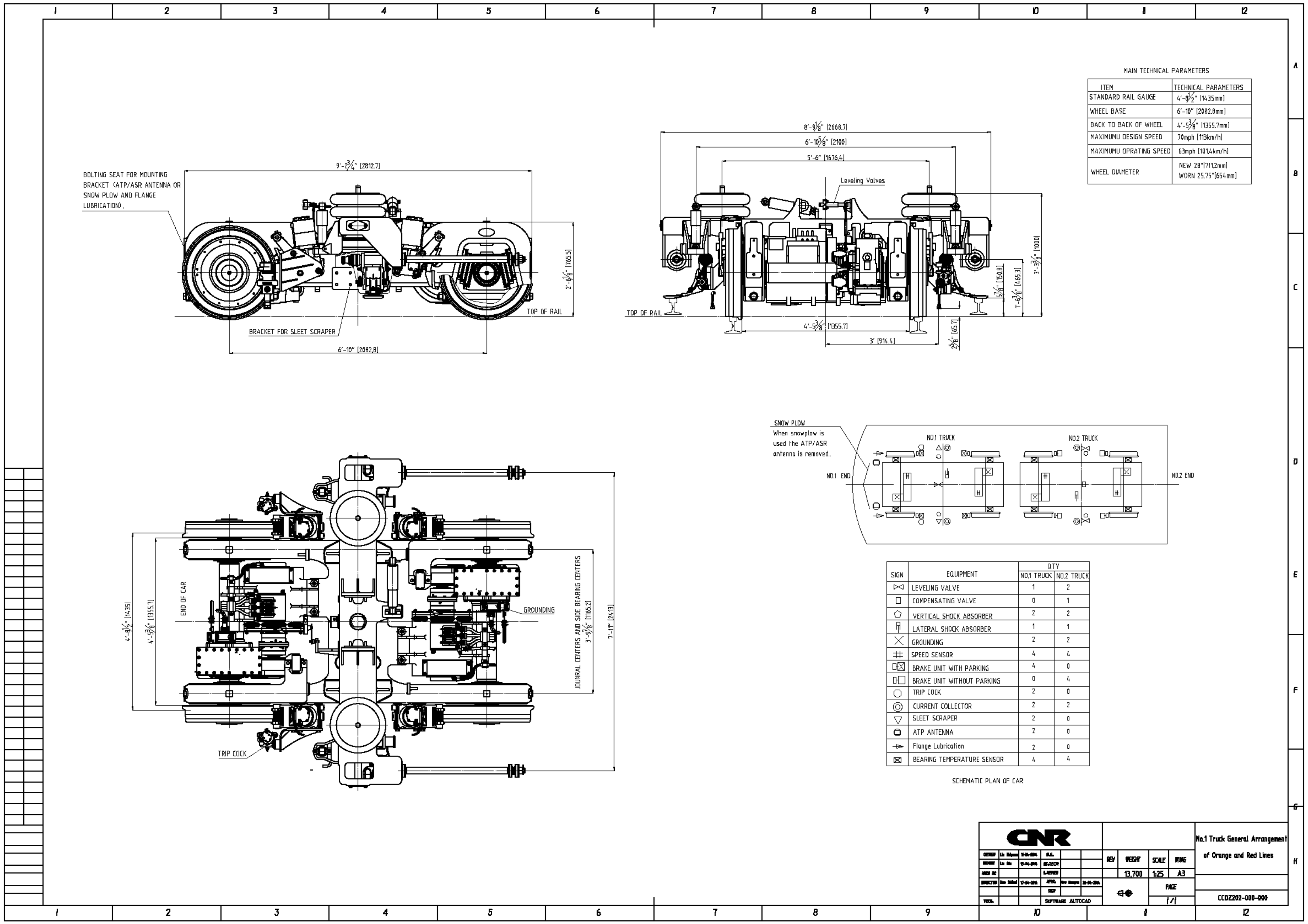


Carbody structural Diagrams: Red Line, Non-Cab Car

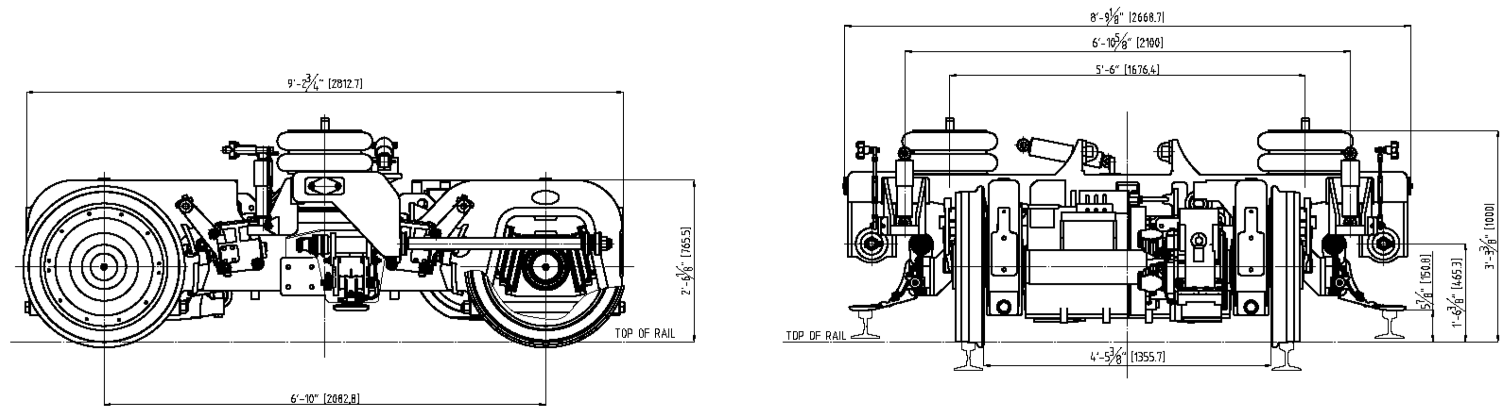


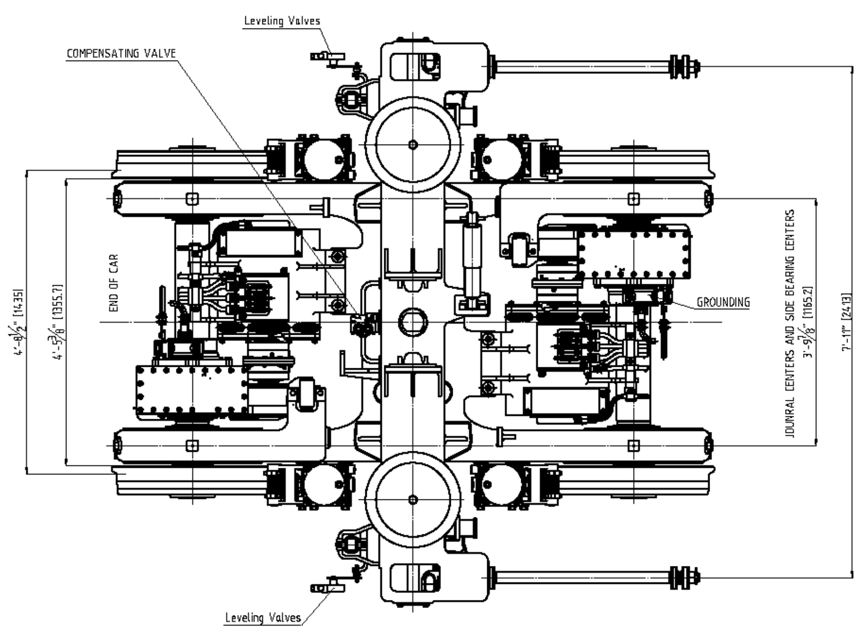
6.1.5 Truck General Arrangement Drawings

Truck General Arrangement Drawings: No.1 Truck Orange and Red Lines car



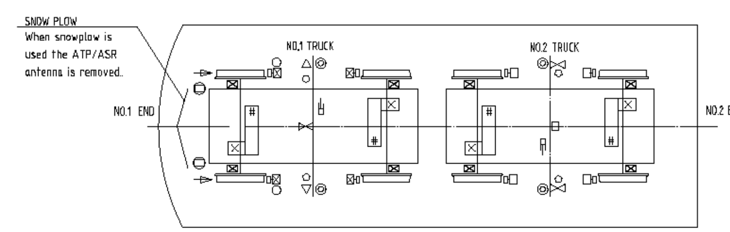
Truck General Arrangement Drawings: No.2 Truck Orange and Red Lines car





MAIN TECHNICAL PARAMETERS

ITEM	TECHNICAL PARAMETERS
STANDARD RAIL GAUGE	4'-8½" [1435mm]
WHEEL BASE	6'-10" [2082.8mm]
BACK TO BACK OF WHEEL	4'-5⅜" [1355.7mm]
MAXIMUMU DESIGN SPEED	70mph [113km/h]
MAXIMUMU OPRATING SPEED	63mph [101.4km/h]
WHEEL DIAMETER	NEW 28" [711.2mm] WORN 25.75" [654mm]



SIGN	EQUIPMENT	QTY NO.1 TRUCK	QTY NO.2 TRUCK
⋈	LEVELING VALVE	1	2
▯	COMPENSATING VALVE	0	1
⬠	VERTICAL SHOCK ABSORBER	2	2
	LATERAL SHOCK ABSORBER	1	1
╳	GROUNDING	2	2
#	SPEED SENSOR	4	4
	BRAKE UNIT WITH PARKING	4	0
	BRAKE UNIT WITHOUT PARKING	0	4
○	TRIP COCK	2	0
◎	CURRENT COLLECTOR	2	2
▽	SLEET SCRAPER	2	0
⊖	ATP ANTENNA	2	0
	Flange Lubrication	2	0
⊠	BEARING TEMPERATURE SENSOR	4	4

SCHEMATIC PLAN OF CAR

CNR

REV	WEIGHT	SCALE	DWG
	13,200	1:25	A3

PAGE 1/1

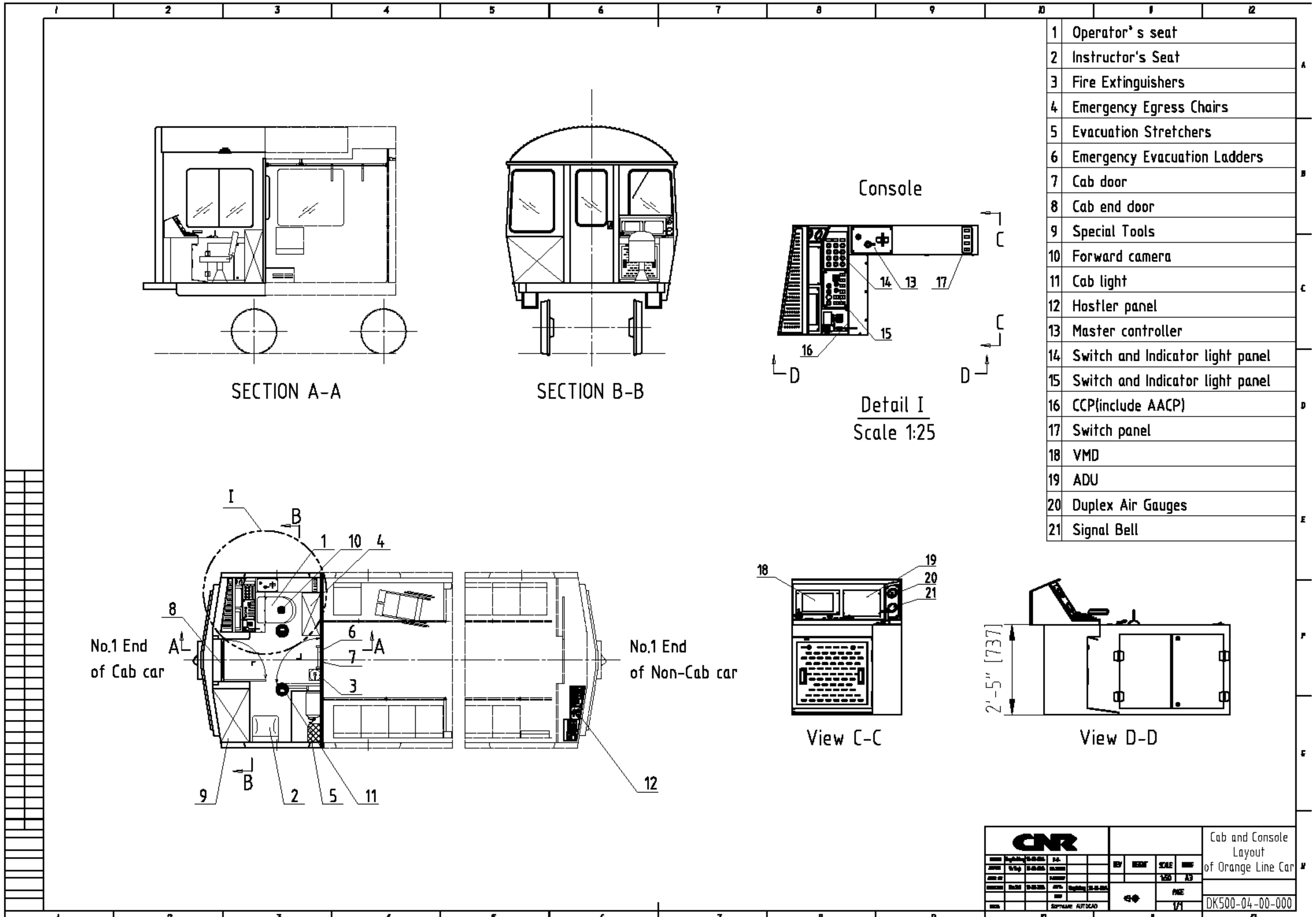
SOFTWARE AUTOCAD

No.2 Truck General Arrangement of Orange and Red Lines

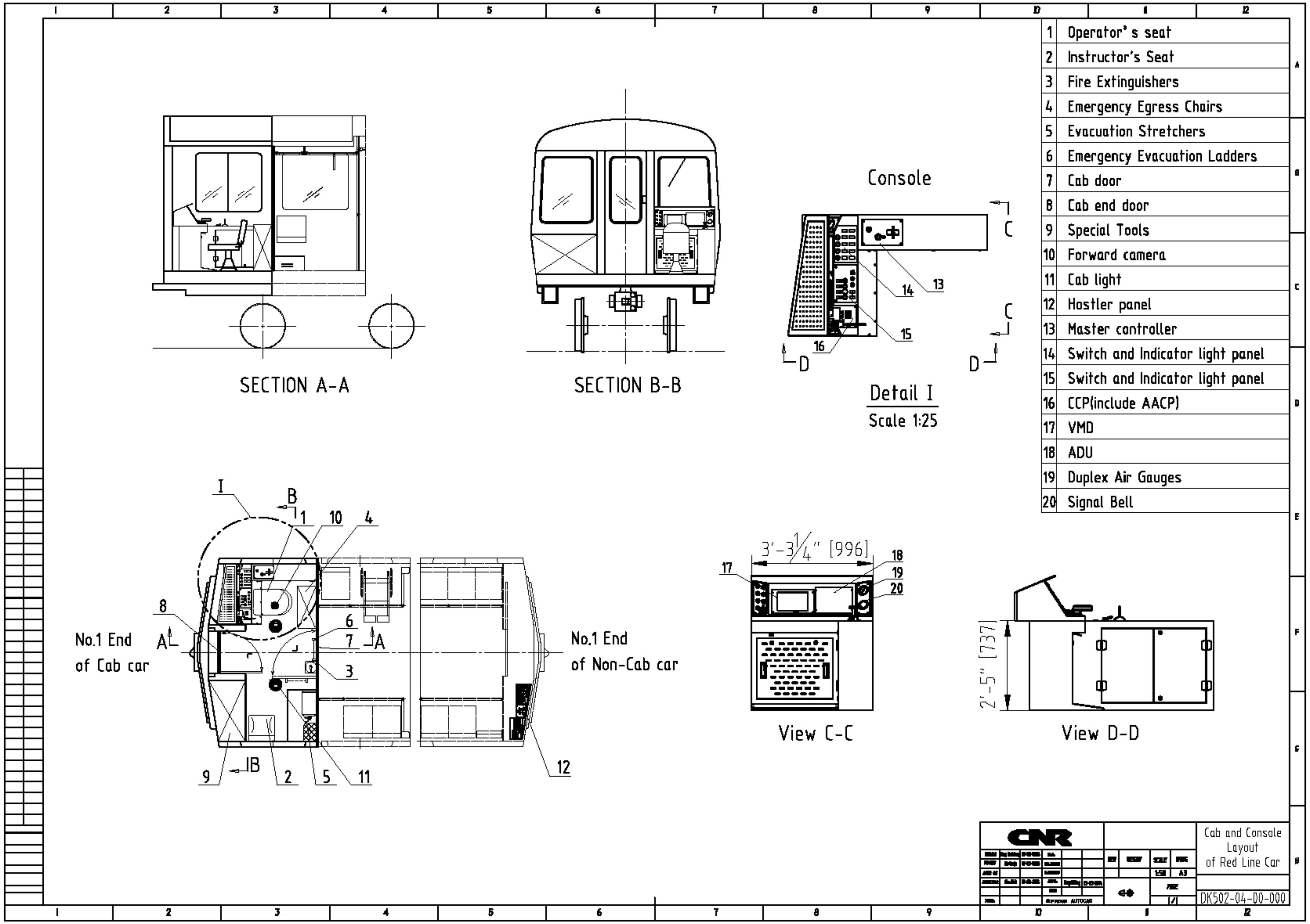
CCDZ203-000-000

6.1.6 Cab and Console Layout:

Cab and Console Layout: Orange Line Car



Cab and Console Layout: Red Line car



6.2 M/WBE LETTER OF INTENT AND CERTIFICATION FORMS

SECTION B
PART B TECHNICAL PROPOSAL AND STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE LETTER OF INTENT
(TO BE COMPLETED BY M/WBE FIRM)

Name of Offeror Firm: CNR MA Corporation
Address: 111 Huntington Avenue
City: Boston State: MA Zip: 02199

Name of M/WBE Firm: RL Controls, LLC
Address: 10 - V Gill St
City: Woburn State: MA Zip: 01801
Telephone: 781-932-3349

Description of work to be performed by M/WBE firm:
Harness assembly - build, spool, install + fasten into vehicle

The Offeror is committed to utilizing the above-named M/WBE firm for the work described above.

The above work will not be sublet to a non-disadvantaged business enterprise at any tier. The undersigned will enter into a formal contract for the above work with the Offeror conditioned upon the Offeror's award and execution of a Contract with the MBTA.

Affirmation

The above-named M/WBE firm affirms that it will perform the portion of the Agreement as stated above.

By: Rena R. Walsh Principal/Owner
(Signature and Title of Authorized Official)

Date: 5/1/14

If the Offeror does not receive award of the prime Agreement, any and all representations in this Letter of Intent and Affirmations shall be null and void.

(Offeror shall submit this page for each M/WBE subcontractor.)

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE LETTER OF INTENT
(TO BE COMPLETED BY M/WBE FIRM)

Name of Offeror Firm: CNR MA Corporation

Address: 111 Huntington Avenue

City: Boston State: Ma Zip: 02199

Name of M/WBE Firm: RL Controls, LLC
Address: 10-V Gill St
City: WOBURN State: MA Zip: 01801
Telephone: 781-932-3349

Description of work to be performed by M/WBE firm:
Electrical Cabinet Assembly

The Offeror is committed to utilizing the above-named M/WBE firm for the work described above.

The above work will not be sublet to a non-disadvantaged business enterprise at any tier. The undersigned will enter into a formal contract for the above work with the Offeror conditioned upon the Offeror's award and execution of a Contract with the MBTA

Affirmation

The above-named M/WBE firm affirms that it will perform the portion of the Agreement as stated above.

By: Rene R. Walsh Principal/Owner
(Signature and Title of Authorized Official)

Date: 5/1/14

If the Offeror does not receive award of the prime Agreement, any and all representations in this Letter of Intent and Affirmations shall be null and void.

(Offeror shall submit this page for each M/WBE subcontractor.)

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE LETTER OF INTENT
(TO BE COMPLETED BY M/WBE FIRM)

Name of Offeror Firm: CNR MA Corporation

Address: 111 Huntington Avenue

City: Boston State: MA Zip: 02199

Name of M/WBE Firm: RL Controls, LLC

Address: 10-V Gill Street

City: Woburn State: MA Zip: 01801

Telephone: 781-932-3349

Description of work to be performed by M/WBE firm:

As per RLC-ISC-1333 TP R02-MBTA Red-OR-CNR-140418

The Offeror is committed to utilizing the above-named M/WBE firm for the work described above.

The above work will not be sublet to a non-disadvantaged business enterprise at any tier. The undersigned will enter into a formal contract for the above work with the Offeror conditioned upon the Offeror's award and execution of a Contract with the MBTA.

Affirmation

The above-named M/WBE firm affirms that it will perform the portion of the Agreement as stated above.

By: Elena R. Walsh Principal/Owner
(Signature and Title of Authorized Official)

Date: 4/21/14

If the Offeror does not receive award of the prime Agreement, any and all representations in this Letter of Intent and Affirmations shall be null and void.

(Offeror shall submit this page for each M/WBE subcontractor.)

SECTION B
PART B TECHNICAL PROPOSAL AND STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE LETTER OF INTENT (TO BE COMPLETED BY M/WBE FIRM)

Name of Offeror Firm: CNR MA Corporation

Address: 111 Huntington Avenue

City: Boston State: MA Zip: 02199

Name of M/WBE Firm: LydRiv Communications (LRC)

Address: 11 Hallet Street

City: Boston State: MA Zip: 02122

Telephone: 617-851-1095

Description of work to be performed by M/WBE firm:

LRC will work collaboratively with CNR MA, the MBTA office of Outreach and Supplier Diversity, and the Massachusetts Diversity Office to enhance M/WBE participation for the Orange/Red Line Car Procurement LRC will provide Public Relations and Community Outreach services including meeting coordination and participation, and media and social media outreach coordination.

The Offeror is committed to utilizing the above-named M/WBE firm for the work described above.

The above work will not be sublet to a non-disadvantaged business enterprise at any tier. The undersigned will enter into a formal contract for the above work with the Offeror conditioned upon the Offeror's award and execution of a Contract with the MBTA.

Affirmation

The above-named M/WBE firm affirms that it will perform the portion of the Agreement as stated above.

By: Lydia M Rivera, Principal
(Signature and Title of Authorized Official)

Date April 29, 2014

If the Offeror does not receive award of the prime Agreement, any and all representations in this Letter of Intent and Affirmations shall be null and void.

(Offeror shall submit this page for each M/WBE subcontractor.)

SECTION B
PART B TECHNICAL PROPOSAL AND STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE LETTER OF INTENT (TO BE COMPLETED BY M/WBE FIRM)

Name of Offeror Firm: CNR MA Corporation

Address: 111 Huntington Avenue

City: Boston State. MA Zip: 02199

Name of M/WBE Firm: Raul V Bravo + Associates, Inc.

Address: 1889 Preston White Drive, Suite 202

City Reston State: VA Zip 20191

Telephone. ____________

Description of work to be performed by M/WBE firm:

Engineering Consulting, Design Assistance, Purchasing, DWBE and Buy America Consulting Services, Manuals and Training, Industrial Design

The Offeror is committed to utilizing the above-named M/WBE firm for the work described above.

The above work will not be sublet to a non-disadvantaged business enterprise at any tier. The undersigned will enter into a formal contract for the above work with the Offeror conditioned upon the Offeror's award and execution of a Contract with the MBTA

Affirmation

The above-named M/WBE firm affirms that it will perform the portion of the Agreement as stated above.

By: Vice President
(Signature and Title of Authorized Official)

Date: April 24, 2014

If the Offeror does not receive award of the prime Agreement, any and all representations in this Letter of Intent and Affirmations shall be null and void.

(Offeror shall submit this page for each M/WBE subcontractor.)

SECTION B
PART B TECHNICAL PROPOSAL AND STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE LETTER OF INTENT (TO BE COMPLETED BY M/WBE FIRM)

Name of Offeror Firm: CNR MA Corporation

Address: 111 Huntington Avenue

City: Boston State: MA Zip: 02199

Name of M/WBE Firm: MRI USA, Inc.

Address: 228 East 45TH St ~~[illegible]~~ Suite 1801

City: NEW YORK State: NY Zip: 10017

Telephone: 212-867-9600

Description of work to be performed by M/WBE firm:

TRANSPORTATION OF CAR SHELLS AND COMPLETE CARS

The Offeror is committed to utilizing the above-named M/WBE firm for the work described above.

The above work will not be sublet to a non-disadvantaged business enterprise at any tier. The undersigned will enter into a formal contract for the above work with the Offeror conditioned upon the Offeror's award and execution of a Contract with the MBTA.

Affirmation

The above-named M/WBE firm affirms that it will perform the portion of the Agreement as stated above.

By: Gayle Bernstein, President GAYLE BERNSTEIN, PRESIDENT
(Signature and Title of Authorized Official)

Date: APRIL 25, 2014

If the Offeror does not receive award of the prime Agreement, any and all representations in this Letter of Intent and Affirmations shall be null and void.

(Offeror shall submit this page for each M/WBE subcontractor.)

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF Massachusetts Date: 5/1/14

COUNTY OF Middlesex S.S.

The undersigned being duly sworn, deposes and says that he/she is the
Principal/Owner
(Sole Owner; Partner. President. Treasurer. or Other Duty Authorized Official of a Corporation)

of RL Controls LLC
(name of M/WBE)

and certifies that since the date of its certification by
SDO
(SDO)

the certification has not been revoked nor has it expired nor has there been any change in the minority status of RL Controls, LLC
(Name of M/WBE)

Principal/Owner
(Signature and Title of Person Making Affidavit)

Sworn to before me this 1st day of May, 2014

Notary Public:

My commission expires: 8/10/18

COLLEEN FONSECA
Notary Public
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires
August 10, 2018

NOTE The Offeror must attach the M/WBE's most recent certification letter or other documentation establishing M/WBE cetification to this affidavit.

OPERATIONAL SERVICES DIVISION
SUPPLIER DIVERSITY OFFICE

Reginald Nunnally
Executive Director

THE COMMONWEALTH OF MASSACHUSETTS
Executive Office for Administration and Finance
OPERATIONAL SERVICES DIVISION
One Ashburton Place, Suite 1017
Boston, MA 02108-1552

Deval L. Patrick
Governor
Glen Shor
Secretary
Gary J. Lambert
Assistant Secretary for
Operational Services

August 9, 2013

Ms. Lena Walsh
RL Controls, LLC
10-V Gill Street
Woburn, MA 01801

Dear Ms. Walsh:

The Supplier Diversity Office (SDO) is pleased to notify you that your category expansion request has been granted. Your company's current certified business description now reads, COMPONENT LEVEL REPAIR BACK SHOP THAT FOCUSES ON TRANSIT VEHICLE SYSTEMS, INFRASTRUCTURE, AND RIGHT OF WAY TO INCLUDE POWER, TELEMATICS, COMMUNICATION, INFORMATION SOLUTIONS AND LEGACY OR OBSOLETE EQUIPMENT. ADDITIONAL SERVICES INCLUDES ENGINEERING, REPAIR, INSTALLATION, MANUFACTURE AND SUPPORT OF THESE SYSTEMS AND LVPS , PROPULSION &CONTROL, HVAC, VITAL & SIGNAL EQUIPMENT , CONTROL, COMMUNICATION AND WAP REQUIREMENTS; BROKERS OF MRO MATERIAL.

Your category expansion will be listed in both the SDO Certified Business Directory and in the Massachusetts Central Register, which are published at regular intervals. The SDO Directory is sent to other state agencies and private organizations that seek to fulfill WBE utilization requirements.

Furthermore, you have a continuing duty to notify SDO of a change in any information that is relevant to the firm's certification eligibility and to ensure that the information and documentation relied upon by SDO to certify or to maintain the certification of the business enterprise is accurate, complete and not misleading. You are required to notify SDO in writing of any change of such information or documentation within thirty calendar days. By way of example and not limitation, any change in ownership, control, investment, ongoing or independence may be considered material. Failure to abide by the continuing duty requirements shall constitute grounds for the business entity's decertification

Certification is not a fixed designation and SDO reserves the right to monitor your company, do random spot checks, site visits and to conduct periodic reviews of your company's books, contracts, company structure, facilities, job locations; to seek other relevant information and documentation; and to revoke certification of your firm should this become necessary.

Your company's certification automatically will expire two years from the date of certification If your company continues to meet all applicable certification criteria, no later than thirty (30) business days before your firm's certification renewal date of August 24, 2014, and every two years thereafter, please send SDO the following documents to renew your certification:

1) All company financial statements since the date of the company's then most recent SDO certification;

2) A signed copy of all U.S. Tax Returns and Schedules since the date of the company's then most recent SDO renewal;

3) Corporations must submit all Annual Reports/Letters of Good Standing filed with the Secretary of (YOUR) State since the date of the company's then most recent renewal; and

PLEASE NOTE THAT ITEMS 4-6 CAN BE COMBINED ON ONE NOTARIZED STATEMENT

4) A notarized statement that indicates:
A. "I certify under the pains and penalties of perjury that no significant changes affecting eligibility as a certified Minority/Minority-Women/Woman business enterprise have occurred since the date of the company's then most recent date of SDO certification as defined in State regulations 425 CMR 2.00 The Massachusetts Supplier Diversity Office."

5) A notarized statement that indicates either "A or B" as referenced below.
A. "I certify under the pains and penalties of perjury that (Insert your Company Name) has not received any contract(s) as a result of having been SDO certified."
B. "I certify under the pains and penalties of perjury that: (Insert your Company Name) has received a contract(s) as a result of having been SDO certified." List all contract names, contract amounts and the names of the agencies with which you have contracted from the date of your last SDO renewal."

6) A notarized statement that indicates:
A. "I certify under the pains and penalties of perjury that (Insert your Company Name) has (number) of employees for each year end given; include owner(s)."

Additionally, every six years, certified companies that wish to remain certified must undergo a substantive review of their certification status with a SDO certification specialist who will re-evaluate the company to determine whether it continues to meet the applicable certification criteria. If you wish to recertify your company when it becomes due for a substantive review, you will have to submit the applicable recertification application and all required information and documentation to SDO no later than forty-five (45) business days prior to the date of certification expiration (i. e , the recertification date) At that time, a certification specialist will be assigned to evaluate your company and will make a report and recommendation to the Certification Committee (CC) on whether or not the company continues to meet the applicable certification criteria.

As provided above in 425 CMR 2 00, if your company has a change of address or telephone number, please send a signed letter within thirty days of the change on company letterhead to notify SDO of the new address or telephone number.

During the period of your certification, if you have any further questions regarding renewals, please feel free to contact Ms. Nedra D. White, SDO/DBE Director of Certification, at (617) 502-8852.

Very truly yours,

Reginald A Nunnally
Executive Director

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF Massachusetts Date: 4/21/14

COUNTY OF Middlesex S.S.

The undersigned being duly sworn, deposes and says that he/she is the
Principal/Owner
(Sole Owner, Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)

of RL Controls, LLC
(name of M/WBE)

and certifies that since the date of its certification by
SDO
(SDO)

the certification has not been revoked nor has it expired nor has there been any change in the minority status of RL Controls, LLC
(Name of M/WBE)

[signature] Principal/Owner
(Signature and Title of Person Making Affidavit)

Sworn to before me this 21st day of April, 2014

Notary Public: [signature]

My commission expires: 8/10/18

COLLEEN FONSECA
Notary Public
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires
August 10, 2018

NOTE: The Offeror must attach the M/WBE's most recent certification letter or other documentation establishing M/WBE cetification to this affidavit.

OPERATIONAL SERVICES DIVISION
SUPPLIER DIVERSITY OFFICE
Reginald Nunnally
Executive Director

THE COMMONWEALTH OF MASSACHUSETTS
Executive Office for Administration and Finance
OPERATIONAL SERVICES DIVISION
One Ashburton Place, Suite 1017
Boston, MA 02108-1552

Deval L. Patrick
Governor
Glen Shor
Secretary
Gary J. Lambert
Assistant Secretary for
Operational Services

August 9, 2013

Ms. Lena Walsh
RL Controls, LLC
10-V Gill Street
Woburn, MA 01801

Dear Ms. Walsh:

The Supplier Diversity Office (SDO) is pleased to notify you that your category expansion request has been granted. Your company's current certified business description now reads, COMPONENT LEVEL REPAIR BACK SHOP THAT FOCUSES ON TRANSIT VEHICLE SYSTEMS, INFRASTRUCTURE, AND RIGHT OF WAY TO INCLUDE POWER, TELEMATICS, COMMUNICATION, INFORMATION SOLUTIONS AND LEGACY OR OBSOLETE EQUIPMENT. ADDITIONAL SERVICES INCLUDES ENGINEERING, REPAIR, INSTALLATION, MANUFACTURE AND SUPPORT OF THESE SYSTEMS AND LVPS , PROPULSION &CONTROL, HVAC, VITAL & SIGNAL EQUIPMENT , CONTROL, COMMUNICATION AND WAP REQUIREMENTS; BROKERS OF MRO MATERIAL.

Your category expansion will be listed in both the SDO Certified Business Directory and in the Massachusetts Central Register, which are published at regular intervals. The SDO Directory is sent to other state agencies and private organizations that seek to fulfill WBE utilization requirements

Furthermore, you have a continuing duty to notify SDO of a change in any information that is relevant to the firm's certification eligibility and to ensure that the information and documentation relied upon by SDO to certify or to maintain the certification of the business enterprise is accurate, complete and not misleading. You are required to notify SDO in writing of any change of such information or documentation within thirty calendar days. By way of example and not limitation, any change in ownership, control, investment, ongoing or independence may be considered material Failure to abide by the continuing duty requirements shall constitute grounds for the business entity's decertification.

Certification is not a fixed designation and SDO reserves the right to monitor your company, do random spot checks, site visits and to conduct periodic reviews of your company's books, contracts, company structure, facilities, job locations; to seek other relevant information and documentation; and to revoke certification of your firm should this become necessary.

Your company's certification automatically will expire two years from the date of certification. If your company continues to meet all applicable certification criteria, no later than thirty (30) business days before your firm's certification renewal date of August 24, 2014, and every two years thereafter, please send SDO the following documents to renew your certification:

1) All company financial statements since the date of the company's then most recent SDO certification;

2) A signed copy of all U.S. Tax Returns and Schedules since the date of the company's then most recent SDO renewal;

3) Corporations must submit all Annual Reports/Letters of Good Standing filed with the Secretary of (YOUR) State since the date of the company's then most recent renewal; and

PLEASE NOTE THAT ITEMS 4-6 CAN BE COMBINED ON ONE NOTARIZED STATEMENT

4) A notarized statement that indicates:
A. "I certify under the pains and penalties of perjury that no significant changes affecting eligibility as a certified Minority/Minority-Women/Woman business enterprise have occurred since the date of the company's then most recent date of SDO certification as defined in State regulations 425 CMR 2 00 The Massachusetts Supplier Diversity Office."

5) A notarized statement that indicates either "A or B" as referenced below.
A "I certify under the pains and penalties of perjury that (Insert your Company Name) has not received any contract(s) as a result of having been SDO certified."
B. "I certify under the pains and penalties of perjury that (Insert your Company Name) has received a contract(s) as a result of having been SDO certified." List all contract names, contract amounts and the names of the agencies with which you have contracted from the date of your last SDO renewal."

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During the period of your certification, if you have any further questions regarding renewals, please feel free to contact Ms. Nedra D. White, SDO/DBE Director of Certification, at (617) 502-8852.

Very truly yours,

Reginald A Nunnally
Executive Director

SECTION B

PART B TECHNICAL PROPOSAL AND STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF Massachusetts Date: 5/1/17

COUNTY OF Middlesex S.S.

The undersigned being duly sworn, deposes and says that he/she is the
Principal/owner
(Sole Owner, Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)

of RL Controls, LLC
(name of M/WBE)

and certifies that since the date of its certification by
SDO
(SDO)

the certification has not been revoked nor has it expired nor has there been any change in the minority status of RL Controls, LLC
(Name of M/WBE)

Principal/owner
(Signature and Title of Person Making Affidavit)

COLLEEN FONSECA
Notary Public
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires
August 10, 2018

Sworn to before me this 1st day of May, 2017

Notary Public: ______________________

My commission expires: 8/10/18

NOTE. The Offeror must attach the M/WBE's most recent certification letter or other documentation establishing M/WBE cetification to this affidavit.

OSD
OPERATIONAL SERVICES DIVISION
SUPPLIER DIVERSITY OFFICE

Reginald Nunnally
Executive Director

THE COMMONWEALTH OF MASSACHUSETTS
Executive Office for Administration and Finance
OPERATIONAL SERVICES DIVISION
One Ashburton Place, Suite 1017
Boston, MA 02108-1552

Deval L. Patrick
Governor
Glen Shor
Secretary
Gary J. Lambert
Assistant Secretary for
Operational Services

August 9, 2013

Ms. Lena Walsh
RL Controls, LLC
10-V Gill Street
Woburn, MA 01801

Dear Ms. Walsh:

The Supplier Diversity Office (SDO) is pleased to notify you that your category expansion request has been granted. Your company's current certified business description now reads, COMPONENT LEVEL REPAIR BACK SHOP THAT FOCUSES ON TRANSIT VEHICLE SYSTEMS, INFRASTRUCTURE, AND RIGHT OF WAY TO INCLUDE POWER, TELEMATICS, COMMUNICATION, INFORMATION SOLUTIONS AND LEGACY OR OBSOLETE EQUIPMENT. ADDITIONAL SERVICES INCLUDES ENGINEERING, REPAIR, INSTALLATION, MANUFACTURE AND SUPPORT OF THESE SYSTEMS AND LVPS , PROPULSION &CONTROL, HVAC, VITAL & SIGNAL EQUIPMENT , CONTROL, COMMUNICATION AND WAP REQUIREMENTS; BROKERS OF MRO MATERIAL.

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Certification is not a fixed designation and SDO reserves the right to monitor your company, do random spot checks, site visits and to conduct periodic reviews of your company's books, contracts, company structure, facilities, job locations; to seek other relevant information and documentation; and to revoke certification of your firm should this become necessary.

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3) Corporations must submit all Annual Reports/Letters of Good Standing filed with the Secretary of (YOUR) State since the date of the company's then most recent renewal; and

PLEASE NOTE THAT ITEMS 4-6 CAN BE COMBINED ON ONE NOTARIZED STATEMENT

4) A notarized statement that indicates:
A. "I certify under the pains and penalties of perjury that no significant changes affecting eligibility as a certified Minority/Minority-Women/Woman business enterprise have occurred since the date of the company's then most recent date of SDO certification as defined in State regulations 425 CMR 2.00 The Massachusetts Supplier Diversity Office "

5) A notarized statement that indicates either "A or B" as referenced below.
A. "I certify under the pains and penalties of perjury that (Insert your Company Name) has not received any contract(s) as a result of having been SDO certified."
B "I certify under the pains and penalties of perjury that: (Insert your Company Name) has received a contract(s) as a result of having been SDO certified " List all contract names, contract amounts and the names of the agencies with which you have contracted from the date of your last SDO renewal."

6) A notarized statement that indicates:
A. "I certify under the pains and penalties of perjury that (Insert your Company Name) has (number) of employees for each year end given; include owner(s)."

Additionally, every six years, certified companies that wish to remain certified must undergo a substantive review of their certification status with a SDO certification specialist who will re-evaluate the company to determine whether it continues to meet the applicable certification criteria. If you wish to recertify your company when it becomes due for a substantive review, you will have to submit the applicable recertification application and all required information and documentation to SDO no later than forty-five (45) business days prior to the date of certification expiration (i e., the recertification date). At that time, a certification specialist will be assigned to evaluate your company and will make a report and recommendation to the Certification Committee (CC) on whether or not the company continues to meet the applicable certification criteria.

As provided above in 425 CMR 2.00, if your company has a change of address or telephone number, please send a signed letter within thirty days of the change on company letterhead to notify SDO of the new address or telephone number.

During the period of your certification, if you have any further questions regarding renewals, please feel free to contact Ms. Nedra D. White, SDO/DBE Director of Certification, at (617) 502-8852.

Very truly yours,

Reginald A Nunnally
Executive Director

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF Massachusetts Date April 29, 2014

COUNTY OF ~~Suffolk~~ S S.

The undersigned being duly sworn, deposes and says that he/she is the
Principal
(Sole Owner, Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)

of LydRiv Communications
(name of M/WBE)

and certifies that since the date of its certification by
Massachusetts Office of Supplier Diversity
(SDO)

the certification has not been revoked nor has it expired nor has there been any change in the minority status of LydRiv Communications
(Name of M/WBE)

(Signature and Title of Person Making Affidavit)
Lydia Rivera, Principal

Sworn to before me this 29th day of April . 2014

Notary Public. Lauretta A. Butler
Lauretta A. Butler

My commission expires: August 29, 2019

LAURETTA A. BUTLER
Notary Public
Commonwealth of Massachusetts
My Commission Expires August 29, 2019

NOTE The Offeror must attach the M/WBE's most recent certification letter or other documentation establishing M/WBE cetification to this affidavit.

OPERATIONAL SERVICES DIVISION

SUPPLIER DIVERSITY OFFICE

Reginald Nunnally
Executive Director

THE COMMONWEALTH OF MASSACHUSETTS
Executive Office for Administration and Finance
OPERATIONAL SERVICES DIVISION
One Ashburton Place, Suite 1017
Boston, MA 02108-1552

Deval L. Patrick
Governor

Timothy P. Murray
Lieutenant Governor

Glen Shor
Secretary

Gary J. Lambert
Assistant Secretary for Operational Services

March 25, 2013

Ms. Lydia M. Rivera
LydRiv Communications
11 Hallet Street
Dorchester, MA 02122

Dear Ms. Rivera:

Congratulations on your certification! The Supplier Diversity Office (SDO) is pleased to notify you that your firm was certified as a minority and woman-owned business enterprise (MBE and WBE) with the certified business description, CONSULTING IN COMMUNICATIONS/PUBLIC RELATIONS AND COMMUNITY OUTREACH **This letter serves as sole and exclusive proof of your firm's SDO certification.**

Your company will be listed in both the SDO Directory and in the Massachusetts Central Register, which are published at regular intervals. The SDO Directory is sent to other state agencies and private organizations that seek to fulfill MBE and WBE utilization requirements.

Furthermore, you have a continuing duty to notify SDO of a change in any information that is relevant to the firm's certification eligibility and to ensure that the information and documentation relied upon by SDO to certify or to maintain the certification of the business enterprise is accurate, complete and not misleading You are required to notify SDO in writing of any change of such information or documentation within thirty calendar days. By way of example and not limitation, any change in ownership, control, investment, ongoing or independence may be considered material. Failure to abide by the continuing duty requirements shall constitute grounds for the business entity's decertification.

Certification is not a fixed designation and SDO reserves the right to monitor your company, do random spot checks, site visits and to conduct periodic reviews of your company's books, contracts, company structure, facilities, job locations, to seek other relevant information and documentation; and to revoke certification of your firm should this become necessary.

Your company's certification will automatically expire two years from the date of certification. If your company continues to meet all applicable certification criteria, no later than thirty (30) business days before your firm's certification renewal date of March 21, 2015, and every two years thereafter, please send SDO the following documents to renew your certification.

1) All company financial statements since the date of the company's then most recent SDO certification,

2) A signed copy of all U S. Tax Returns and Schedules since the date of the company's then most recent SDO renewal;
3) Corporations must submit all Annual Reports/Letters of Good Standing filed with the Secretary of (YOUR) State since the date of the company's then most recent renewal; and

PLEASE NOTE THAT THE FOLLOWING ITEMS 4-6 CAN BE COMBINED ON ONE NOTARIZED STATEMENT.

4) A notarized statement that indicates.
"I certify under the pains and penalties of perjury that no significant changes affecting eligibility as a certified Minority/Minority-Women/Woman business enterprise have occurred since the date of the company's then most recent date of SDO certification as defined in State regulations 425 CMR 2 00 The Supplier Diversity Office "
5) A notarized statement that indicates either "A or B" as referenced below
A "I certify under the pains and penalties of perjury that (Insert your Company Name) has not received any contract(s) as a result of having been SDO certified."
B. "I certify under the pains and penalties of perjury that (Insert your Company Name) has received a contract(s) as a result of having been SDO certified." List all contract names, contract amounts and the names of the agencies with which you have contracted from the date of your last SDO renewal "
6) A notarized statement that indicates·
"I certify under the pains and penalties of perjury that (Insert your Company Name) has (number) of employees for each year end given; include owner(s) "

Additionally, every six years, certified companies that wish to remain certified must undergo a substantive review of their certification status with a SDO certification specialist who will re-evaluate the company to determine whether it continues to meet the applicable certification criteria. If you wish to recertify your company when it becomes due for substantive review, you will need to submit the applicable recertification application and all required information and documentation to SDO no later than forty-five (45) business days prior to the date of certification expiration (i.e., the recertification date) At that time, a certification specialist will be assigned to evaluate your company and will make a report and recommendation to the Certification Committee (CC) on whether or not the company continues to meet the applicable certification criteria

As provided above in 425 CMR 2.00, if your company has a change of company name, address or telephone number, please send a signed letter within thirty days of the change on company letterhead to notify SDO of the change. Please be sure to inform the agency or awarding authority you are contracting with of this change for proper payment.

Very truly yours,

Reginald A. Nunnally
Executive Director

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF New York Date. April 24, 2014

COUNTY OF New York S S.

The undersigned being duly sworn, deposes and says that he/she is the
Vice President
(Sole Owner, Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)

of Raul V. Bravo + Associates, Inc.
(name of M/WBE)

and certifies that since the date of its certification by
Supplier Diversity Office/Massachusetts Unified Certification Program
(SDO)

the certification has not been revoked nor has it expired nor has there been any change in the minority status of Raul V. Bravo + Associates, Inc.
(Name of M/WBE)

(Signature and Title of Person Making Affidavit)

Sworn to before me this 24 day of April, 20 14

Notary Public. Helen L Respass

My commission expires: May 20, 2014

HELEN L. RESPASS
Notary Public, State of New York
No. [illegible]
Qualified in New York County
Commission Expires May 20, 20 14

NOTE. The Offeror must attach the M/WBE's most recent certification letter or other documentation establishing M/WBE cetification to this affidavit.

OSD
OPERATIONAL SERVICES DIVISION
SUPPLIER DIVERSITY OFFICE
Reginald Nunnally
Executive Director

THE COMMONWEALTH OF MASSACHUSETTS
Executive Office for Administration and Finance
OPERATIONAL SERVICES DIVISION
One Ashburton Place, Suite 1017
Boston, MA 02108-1552

RECEIVED
JUN 10 2013
BY:

Deval L. Patrick
Governor
Timothy P. Murray
Lieutenant Governor
Glen Shor
Secretary
Gary J. Lambert
Assistant Secretary for Operational Services

June 4, 2013

Mr. Raul V. Bravo
Raul V Bravo & Associates, Inc.
1889 Preston White Drive, Suite 202
Reston, VA 20191

Dear Mr. Bravo:

The Supplier Diversity Office (SDO) is in receipt of your certification renewal information (application). This consists of your request to renew the certification of Raul V Bravo & Associates, Inc. and the required certification renewal information and documentation. Accordingly, SDO has updated your file with this information and documentation. No substantive review of your company was done at this time. **This letter serves as sole and exclusive proof of your firm's SDO certification.**

Based on your certification renewal information (application), the certification of Raul V Bravo & Associates, Inc. as a minority-owned business enterprise (MBE) with the business description of TRANSPORTATION CONSULTANT; CONSULTING IN MASS TRANSIT, PLANNING AND DEVELOPMENT OF VEHICLE AND SYSTEMS has been renewed effective the date of this letter. The company will remain listed in the SDO Directory of certified businesses and The Massachusetts Central Register, which is published by the Office of the Secretary of State unless its certification is revoked. Unless revoked, this certification will last for a period of two years and will automatically expire as of June 28, 2015, unless by that date, the certification of the company is renewed again or the company is recertified.

To renew the company's certification at that time, you will need to submit the following information to SDO no later than 30 business days prior to June 28, 2015.

1) All company financial statements since the date of the company's then most recent SDO certification;
2) A signed copy of all U.S. Tax Returns and Schedules since the date of the company's then most recent SDO renewal;
3) Corporations must submit all Annual Reports/Letters of Good Standing filed with the Secretary of (YOUR) State since the date of the company's then most recent renewal; and

PLEASE NOTE THAT THE FOLLOWING ITEMS 4-6 CAN BE COMBINED ON ONE NOTARIZED STATEMENT

4) A notarized statement that indicates:

"I certify under the pains and penalties of perjury that no significant changes affecting eligibility as a certified Minority/Minority-Women/Woman business enterprise have occurred since the date of the company's then most recent date of SDO certification as defined in State regulations 425 CMR 2.00 The Massachusetts Supplier Diversity Office."

5) A notarized statement that indicates either "A or B" as referenced below.

A. "I certify under the pains and penalties of perjury that (Insert your Company Name) has not received any contract(s) as a result of having been SDO certified."

B. "I certify under the pains and penalties of perjury that: (Insert your Company Name) has received a contract(s) as a result of having been SDO certified." List all contract names, contract amounts and the names of the agencies with which you have contracted from the date of your last SDO renewal."

6) A notarized statement that indicates:

"I certify under the pains and penalties of perjury that (Insert your Company Name) has (number) of employees for each year end given; include owner(s)."

Furthermore, you have a continuing duty to notify SDO of a change in any information that is relevant to the firm's certification eligibility and to ensure that the information and documentation relied upon by SDO to certify or to maintain the certification of the business enterprise is accurate, complete and not misleading. You are required to notify SDO in writing of any change of such information or documentation within thirty calendar days. By way of example and not limitation, any change in ownership, control, investment, ongoing or independence may be considered material. Failure to abide by the continuing duty requirements shall constitute grounds for the business entity's decertification.

Additionally, every six years, certified companies that wish to remain certified must undergo a substantive review of their certification status with a SDO certification specialist who will re-evaluate the company to determine whether it continues to meet the applicable certification criteria. If you wish to recertify your company when it becomes due for substantive review, you will need to submit the applicable recertification application and all required information and documentation to SDO no later than forty-five (45) business days prior to the date of certification expiration (i.e., the recertification date). At that time, a certification specialist will be assigned to evaluate your company and will make a report and recommendation to the Certification Committee (CC) on whether or not the company continues to meet the applicable certification criteria.

As provided above in 425 CMR 2.00, if your company has a change of address or telephone number, please send a signed letter within thirty days of the change on company letterhead to notify SDO of the new address or telephone number.

During the period of your certification, if you have any further questions regarding your certification renewal, please direct them to Ms. Nedra D. White, Director of Certification, at (617) 502-8852.

Very truly yours,

Reginald A. Nunnally
Executive Director

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF New York Date: 4/25/14

COUNTY OF New York S.S.

The undersigned being duly sworn, deposes and says that he/she is the
PRESIDENT
(Sole Owner, Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)

of MRI USA Inc.
(name of M/WBE)

and certifies that since the date of its certification by
SDO
(SDO)

the certification has not been revoked nor has it expired nor has there been any change in the minority status of MRI USA Inc.
(Name of M/WBE)

GAYLE BERNSTEIN
(Signature and Title of Person Making Affidavit)

Sworn to before me this 25 day of April, 2014

Notary Public. Crystal Rodriguez

My commission expires: April 23, 2015

CRYSTAL RODRIGUEZ
Notary Public, State of New York
No. 01RO6164417
Qualified in Bronx County
Commission Expires April 23, 2015

NOTE: The Offeror must attach the M/WBE's most recent certification letter or other documentation establishing M/WBE cetification to this affidavit.

OSD
OPERATIONAL SERVICES DIVISION
SUPPLIER DIVERSITY OFFICE
Reginald Nunnally
Executive Director

THE COMMONWEALTH OF MASSACHUSETTS
Executive Office for Administration and Finance
OPERATIONAL SERVICES DIVISION
One Ashburton Place, Suite 1017
Boston, MA 02108-1552

Deval L. Patrick
Governor
Glen Shor
Secretary
Gary J. Lambert
Assistant Secretary for
Operational Services

March 10, 2014

Ms. Gayle Bernstein
MRI USA, Inc.
228 East 45th Street, Suite 1801
New York, NY 10017

Dear Ms. Bernstein:

The Supplier Diversity Office (SDO) is in receipt of your certification renewal information (application). This consists of your request to renew the certification of MRI USA, Inc. and the required certification renewal information and documentation. Accordingly, SDO has updated your file with this information and documentation. No substantive review of your company was done at this time. **This letter serves as sole and exclusive proof of your firm's SDO certification.**

Based on your certification renewal information (application), the certification of MRI USA, Inc. as a woman-owned business enterprise (WBE) with the business description of **LOGISTICS CONSULTING AND INLAND TRANSPORTATION OF MASS TRANSIT RAIL VEHICLES AND PARTS** has been renewed effective the date of this letter. The company will remain listed in the SDO Directory of certified businesses and The Massachusetts Central Register, which is published by the Office of the Secretary of State unless its certification is revoked. Unless revoked, this certification will last for a period of two years and will automatically expire as of March 11, 2016, unless by that date, the certification of the company is renewed again or the company is recertified.

To renew the company's certification at that time, you will need to submit the following information to SDO no later than 30 business days prior to March 11, 2016.

1) All company financial statements since the date of the company's then most recent SDO certification;
2) A signed copy of all U.S. Tax Returns and Schedules since the date of the company's then most recent SDO renewal;
3) Corporations must submit all Annual Reports/Letters of Good Standing filed with the Secretary of (YOUR) State since the date of the company's then most recent renewal; and

PLEASE NOTE THAT THE FOLLOWING ITEMS 4-6 CAN BE COMBINED ON ONE NOTARIZED STATEMENT

4) A notarized statement that indicates:

"I certify under the pains and penalties of perjury that no significant changes affecting eligibility as a certified Minority/Minority-Woman/Woman business enterprise have occurred since the date of the company's then most recent date of SDO certification as defined in State regulations 425 CMR 2.00 The Massachusetts Supplier Diversity Office."

5) A notarized statement that indicates either "A or B" as referenced below.

A. "I certify under the pains and penalties of perjury that (Insert your Company Name) has not received any contract(s) as a result of having been SDO certified."

B. "I certify under the pains and penalties of perjury that: (Insert your Company Name) has received a contract(s) as a result of having been SDO certified." List all contract names, contract amounts and the names of the agencies with which you have contracted from the date of your last SDO renewal."

6) A notarized statement that indicates:

"I certify under the pains and penalties of perjury that (Insert your Company Name) has (number) of employees for each year end given; include owner(s)."

Furthermore, you have a continuing duty to notify SDO of a change in any information that is relevant to the firm's certification eligibility and to ensure that the information and documentation relied upon by SDO to certify or to maintain the certification of the business enterprise is accurate, complete and not misleading. You are required to notify SDO in writing of any change of such information or documentation within thirty calendar days. By way of example and not limitation, any change in ownership, control, investment, ongoing or independence may be considered material. Failure to abide by the continuing duty requirements shall constitute grounds for the business entity's decertification.

Additionally, every six years, certified companies that wish to remain certified must undergo a substantive review of their certification status with a SDO certification specialist who will re-evaluate the company to determine whether it continues to meet the applicable certification criteria. If you wish to recertify your company when it becomes due for substantive review, you will need to submit the applicable recertification application and all required information and documentation to SDO no later than forty-five (45) business days prior to the date of certification expiration (i.e., the recertification date). At that time, a certification specialist will be assigned to evaluate your company and will make a report and recommendation to the Certification Committee (CC) on whether or not the company continues to meet the applicable certification criteria.

As provided above in 425 CMR 2.00, if your company has a change of address or telephone number, please send a signed letter within thirty days of the change on company letterhead to notify SDO of the new address or telephone number.

During the period of your certification, if you have any further questions regarding your certification renewal, please direct them to Ms. Nedra D. White, Director of Certification, at (617) 502-8852.

Very truly yours,

Reginald A. Nunnally
Executive Director

SECTION B
PART B TECHNICAL PROPOSAL AND STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE LETTER OF INTENT
(TO BE COMPLETED BY M/WBE FIRM)

Name of Offeror Firm: CNR MA CORPORATION
Address: 111 HUNTINGTON AVE
City: State: Zip: BOSTON, MA 02119

Name of M/WBE Firm: UTCRAS INC
Address: 501 HIGHLAND AVE
City: State: Zip: MORTON, PA 19070
Telephone: 610-328-1100

Description of work to be performed by M/WBE firm:
MANUFACTURING OF WHEELS AND AXEL ASSEMBLY

The Offeror is committed to utilizing the above-named M/WBE firm for the work described above.

The above work will not be sublet to a non-disadvantaged business enterprise at any tier. The undersigned will enter into a formal contract for the above work with the Offeror conditioned upon the Offeror's award and execution of a Contract with the MBTA.

Affirmation
The above-named M/WBE firm affirms that it will perform the portion of the Agreement as stated above.

By: [signature] CEO/PRESIDENT
(Signature and Title of Authorized Official)

Date: 10-12-2014

If the Offeror does not receive award of the prime Agreement, any and all representations in this Letter of Intent and Affirmations shall be null and void.

(Offeror shall submit this page for each M/WBE subcontractor.)

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF PENNSYLVANIA Date: 5/10/2014

COUNTY OF DELAWARE S.S.

The undersigned being duly sworn, deposes and says that he/she is the

BETTY A. SCOTT CEO/PRESIDENT
(Sole Owner; Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)

of UTCRAS INC
(name of M/WBE)

and certifies that since the date of its certification by
COMMONWEALTH OF MA
(SDO)

the certification has not been revoked nor has it expired nor has there been any change in the minority status of UTCRAS INC
(Name of M/WBE)

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
JAMES F CHARLIER
Notary Public
SPRINGFIELD TWP., DELAWARE COUNTY
My Commission Expires July 27, 2014

Betty A Scott CEO/PRESIDENT
(Signature and Title of Person Making Affidavit)

Sworn to before me this 10 day of MAY, 2014

Notary Public: James F Charlier

My commission expires: JULY 27, 2014

NOTE: The Offeror must attach the M/WBE's most recent certification letter or other documentation establishing M/WBE certification to this affidavit.

OPERATIONAL SERVICES DIVISION
SUPPLIER DIVERSITY OFFICE
Reginald Nunnally
Executive Director

THE COMMONWEALTH OF MASSACHUSETTS
Executive Office for Administration and Finance
OPERATIONAL SERVICES DIVISION
One Ashburton Place, Suite 1017
Boston, MA 02108-1552

Deval L. Patrick
Governor
Glen Shor
Secretary
Gary J. Lambert
Assistant Secretary for
Operational Services

May 12, 2014

Ms. Betty Scott
UTCRAS, Inc. fka: UTC/Rail & Airsources, Inc.
17 Country Lane
Malvern, PA 19355

Dear Ms. Scott:

Congratulations on your certification! The Supplier Diversity Office (SDO) is pleased to notify you that your firm was certified as a woman-owned business enterprise (WBE) with the certified business description, **PRECISION MACHINE AND SHEET METAL FABRICATORS: SPECIALIZING IN RAILROAD WHEELS AND AXLE SETS, TRUCK ASSEMBLY, REMANUFACTURE ROLLER BEARINGS, TRAINLINE JUMPERS AND OTHER METAL COMPONENT RAILROAD TRAIN CAR ASSEMBLIES, BUILT TO PRINT, ALSO HEAVY STRUCTURAL STEEL INFRASTRUCTURE FABRICATORS FOR BRIDGE WORK, DISTRIBUTORS OF ALP DISC BRAKE. This letter serves as sole and exclusive proof of your firm's SDO certification.**

Your company will be listed in both the SDO Directory and in the Massachusetts Central Register, which are published at regular intervals. The SDO Directory is sent to other state agencies and private organizations that seek to fulfill WBE utilization requirements.

Furthermore, you have a continuing duty to notify SDO of a change in any information that is relevant to the firm's certification eligibility and to ensure that the information and documentation relied upon by SDO to certify or to maintain the certification of the business enterprise is accurate, complete and not misleading. You are required to notify SDO in writing of any change of such information or documentation within thirty calendar days. By way of example and not limitation, any change in ownership, control, investment, ongoing or independence may be considered material. Failure to abide by the continuing duty requirements shall constitute grounds for the business entity's decertification.

Certification is not a fixed designation and SDO reserves the right to monitor your company, do random spot checks, site visits and to conduct periodic reviews of your company's books, contracts, company structure, facilities, job locations; to seek other relevant information and documentation; and to revoke certification of your firm should this become necessary.

Your company's certification will automatically expire two years from the date of certification. If your company continues to meet all applicable certification criteria, no later than thirty (30) business days before your firm's certification renewal date of May 9, 2016, and every two years thereafter, please send SDO the following documents to renew your certification:

1) All company financial statements since the date of the company's then most recent SDO certification;

2) A <u>signed</u> copy of all U.S. Tax Returns and Schedules since the date of the company's then most recent SDO renewal;
3) Corporations must submit all Annual Reports/Letters of Good Standing filed with the Secretary of (YOUR) State since the date of the company's then most recent renewal; and

<u>PLEASE NOTE THAT THE FOLLOWING ITEMS 4-6 CAN BE COMBINED ON ONE NOTARIZED STATEMENT:</u>

4) <u>A notarized statement that indicates:</u>
"I certify under the pains and penalties of perjury that no significant changes affecting eligibility as a certified Minority/Minority-Woman/Woman business enterprise have occurred since the date of the company's then most recent date of SDO certification as defined in State regulations 425 CMR 2.00 The Supplier Diversity Office."
5) <u>A notarized statement that indicates either "A or B" as referenced below.</u>
A. "I certify under the pains and penalties of perjury that (Insert your Company Name) has not received any contract(s) as a result of having been SDO certified."
B. "I certify under the pains and penalties of perjury that: (Insert your Company Name) has received a contract(s) as a result of having been SDO certified." List all contract names, contract amounts and the names of the agencies with which you have contracted from the date of your last SDO renewal."
6) <u>A notarized statement that indicates:</u>
"I certify under the pains and penalties of perjury that (Insert your Company Name) has (number) of employees for each year end given; include owner(s)."

Additionally, every six years, certified companies that wish to remain certified must undergo a substantive review of their certification status with a SDO certification specialist who will re-evaluate the company to determine whether it continues to meet the applicable certification criteria. If you wish to recertify your company when it becomes due for substantive review, you will need to submit the applicable recertification application and all required information and documentation to SDO no later than forty-five (45) business days prior to the date of certification expiration (i.e., the recertification date). At that time, a certification specialist will be assigned to evaluate your company and will make a report and recommendation to the Certification Committee (CC) on whether or not the company continues to meet the applicable certification criteria.

As provided above in 425 CMR 2.00, if your company has a change of company name, address or telephone number, please send a signed letter within thirty days of the change on company letterhead to notify SDO of the change. Please be sure to inform the agency or awarding authority you are contracting with of this change for proper payment.

Very truly yours,

Reginald A. Nunnally
Executive Director