

EXECUTIVE SUMMARY

CSR Qingdao Sifang Co., Ltd (CSR Sifang), and CSR America, Inc., (CSR America), a Joint Venture ("CSR Sifang JV") is pleased to provide its proposal in response to RFP No.CAP 27-10 (New Orange & Red Line Cars, Capital Spares, Manuals, Diagnostic Equipment and Training Aids) to be procured by the Massachusetts Bay Transportation Authority (MBTA). CSR Sifang brings 114 years of extensive railcar experience including contract awards for more than 4,000 metro cars used by some of the highest density transit agencies in the world.

In coming to North America, CSR Sifang JV recognizes the following critical success factors that are essential to assure on-time delivery, high-quality production and exceptional lifecycle performance that meets and/or exceeds MBTA expectations:

1. Lessons learned from other first-time carbuilders new to the American market.
2. Importance of system integration oversight & control (especially significant when working with unfamiliar domestic suppliers).
3. Use of local program, supply chain and facility management personnel with strong domestic railcar pedigree and experience working with foreign carbuilders.
4. Local delegation-of-authority where necessary to assure compliance with domestic customs, practices and operating methodologies.
5. Community involvement and support in jobs creation, workforce training and the establishment of long-term industrial relationships necessary to encourage and sustain regional economic growth.

Pursuant to these factors, CSR Sifang JV has developed an organizational structure prioritized along design and implementation activities with responsibility and authority assigned as follows:

1. Engineering, design and development activities including performance modeling, reliability/maintainability calculations and systems assurance done by the Chinese design team.
2. System integration, supply chain management, program & documentation control, testing & commissioning, warranty support and after-sales service done by the American implementation team.
3. Facility setup, recruiting, management and operations done jointly by an integrated Chinese/American team organized accordingly.

In this regard, CSR Sifang JV is able to leverage the strengths and expertise of project participants from both countries (and cultures) in a manner that is "unique" when compared to examples observed from other carbuilders coming to the American market for the first time.

A further distinction is the people selected for the local implementation team who bring many years of railcar experience in their respective areas of expertise. Also unique to this team is the experience the people have had working with each other on past projects and, in particular, the experience they have had working with other foreign railcar builders who followed a more traditional home-country hierarchy that limited and/or excluded local management participation and decision-making.

The approach taken in each of these areas (individually and collectively) underscores the success-orientation of the CSR Sifang JV management culture and way of doing business in new markets with the confidence, determination and commitment necessary to assure on-time delivery, quality production and exceptional lifecycle performance.

CSR Sifang JV Heritage & Background

CSR Corporation Ltd. (CSR Sifang Parent Company) is a global enterprise publically traded on the Hong Kong and Shanghai Exchanges with \$15 Billion in annual sales; twenty subsidiary companies; 90,000 employees and projects around the world in the Middle East, South America, India, Australia and Africa.

CSR Sifang is the technology leader within CSR Corporation Ltd. and the joint venture leader for the MBTA project. The company has annual sales of \$3.9 Billion; more than 17 million square feet of factory space, and 7,800 employees. Its four main product areas include High Speed Trains, Regional Trains, Metro Cars and Maintenance Support Services. Carbody manufacturing includes Stainless Steel, Aluminum and Carbon Steel integrating various composite materials for aesthetics, aerodynamics and weight management.

CSR Sifang has also developed a high degree of product integration through several subsidiary companies of CSR Corporation Ltd. within its own supply chain. Examples include propulsion, braking and network control systems giving the company a more comprehensive understanding of the various interface issues and challenges that can arise especially when working with the number of USA domestic content suppliers applicable to the MBTA program. This should be considered a strength and added value for MBTA not typical of most global carbuilders.

CSR Sifang places considerable emphasis on research and development making sizable annual investments to assure the company stays ahead of global innovation in each of its product areas. The Company has worked with leading railcar suppliers from around the world through several technology-transfer agreements to support the enormous growth of China's railway infrastructure over the last twenty years. In so doing CSR Sifang has been able to evaluate best practices, production techniques, quality management and global engineering standards throughout the entire railcar spectrum. The company employs 1,500 research & development engineers (18 PhDs / 328 Masters) and invests \$210 Million (5.2% of sales) annually in R&D activities. Tools and equipment include 19 state-of-the-art simulation platforms for aerodynamics, structure, welding and computer modeling together with 15 test verification platforms used in conjunction with extensive in-service data analysis to improve quality, safety, reliability/availability and extend overall product lifecycle. Various cultural, demographic and environmental characteristics are also considered together with technical requirements when engineering and designing railcars for export markets around the world.

Wholly owned by CSR Sifang, CSR America was formed in 2010 in order to establish a legal, marketing and operating presence in the United States. The company was initially focused on high speed rail projects in Florida, California, Nevada and the Midwest through a joint venture with the General Electric Company.

CSR Sifang JV was subsequently formed to pursue transit/metro projects in North America beginning with the MBTA Red/Orange Line program and will establish its North American production facility in Massachusetts.

Production Capacity

CSR Sifang has developed significant production capability in order to support enormous home country demand for railcars and trainsets in each product area referenced above. Current annual capacity includes 1,600 EMU cars, 1,000 metro cars and 300 regional coaches. The company also maintains many of the same cars it produces with additional maintenance capacity of 1,200 cars per year. This should also be considered a strength and added value for MBTA in terms of integrating various life cycle parameters into new car design.

Control of Work

CSR Sifang incorporates several levels of planning, scheduling and exception reporting into its overall program management process which is essential in order to control such large capacities of varying car types while assuring high quality production and timely delivery. Assuring each project has its own priority is an integral part of the company's management process, work ethic and culture that will be passed on to CSR Sifang JV in every aspect of this program.

Coming to the American market for the first time represents a significant milestone in the company's long and proud history of accomplishment and taken very seriously at the highest levels of CSR Corporation Ltd. top management in Beijing and CSR Sifang's in Qingdao. Accordingly, there will be significant attention paid to this project throughout the organization that will include selection of senior people, frequent progress reviews and priority consideration applied in all areas of engineering, design and production. Additionally (and noteworthy) this project will be the only project underway at the assembly site when work commences without distraction from other projects. This will command 100% attention from all participants and a level of priority that will assure a smooth steady ramp-up mitigating added risk for MBTA.

Facility Planning & Development

CSR Sifang JV has retained GFI Partners [<http://www.gfipartners.com>] in Boston to identify, evaluate and develop the site for its local Massachusetts assembly facility. GFI is able to secure existing facilities that can be improved or manage new construction built on open land. Several sites, including green field sites and existing facilities, have been evaluated that include both scenarios with current preference for an existing facility near Boston, Massachusetts that will be improved in order to meet all contract assembly requirements and provide expansion for future growth, jobs creation and regional industrial development.

Community Outreach and Partnership

The notion that strong communities are supported by strong companies (and vice versa) is ingrained in the Chinese culture and fundamental to the way of doing business for all CSR Group companies in each home-country region. Programs like the Denver RTD Workforce Initiative Now (WIN) and the East New York High School of Transit Technology (Transit Tech www.transitechhs.org) underscore these basic principles already familiar to the CSR Sifang JV and will be applied accordingly throughout this project. The company has begun this process by identifying important community stakeholders in order to introduce itself, present its localization approach and make acquaintance with potential long-term partners. Some examples are as follows:

1. Massachusetts State Office of Business Development
2. Massachusetts Manufacturing Extension Partnership
3. Central Massachusetts Workforce Investment Board
4. Worcester Chamber of Commerce
5. City of Worcester Office of Economic Development
6. Worcester Technical High School

Localization Approach

Setting up a new railcar facility requires a comprehensive understanding of the following factors:

1. Existing Transportation Infrastructure & Logistics
2. Environmental Conditions
3. Workforce Availability and Continuity

4. Regulatory Permitting Requirements
5. Access to Educational Institutions

CSR Sifang JV has proposed establishing a railcar curriculum at local technical high schools that could migrate through the various phases of this project including procurement, assembly, testing, commissioning, operations and maintenance with the MBTA as its partner. Internships can be established in each of these areas with "hands-on" training at the assembly site in Massachusetts and the design/pilot site in Qingdao, China. Summer jobs can be created in the short term followed by those more permanent over the longer term as the business grows. Greater and more diverse job opportunities would be created from skills acquired in procurement, testing, commissioning and maintenance that would extend beyond the carbuilder's site in Massachusetts to entry level employment at the MBTA (and potentially other transit agencies in the North East) fueled by attrition and proliferation of new technology.

If successful, CSR Sifang JV will create real jobs in Massachusetts. For further details regarding possible job creation, see Part B, Tab I.2 Manufacturing Plan.

Initial (startup) workforce jobs would come directly from the local area, including assembly, administration and supervisory labor followed by skilled trades for production activities encountered throughout the project. Additional technician positions would also be created as subsystem and static testing begins. Longer-term heavier manufacturing jobs could also be created with sufficient increased volumes from other projects that would include carbody and bogie manufacture.

USE of M/WBE

CSR Sifang JV has identified several M/WBE suppliers that are included in this proposal and identified in Part B Tab I.5 of the Technical Proposal. Additional M/WBE suppliers will also be considered as this procurement process evolves.

Commitment to America

CSR Corporation Limited has made a strategic decision to commit to the North American Market and will pursue several projects in all areas that include High Speed Rail, Regional Commuter and other Transit/Metro vehicle projects. Increasing demand for passenger rail at state, regional and national levels will provide an excellent opportunity for increased railcar production in Massachusetts.

Summary

The CSR Sifang JV recognizes and appreciates the MBTA's emphasis on North American experience with regard to risk mitigation and believes its unique organizational approach, local project participants and lessons-learned from other first-time carbuilders will assure on time delivery, high-quality production and exceptional lifecycle performance.

TAB I.1

TAB I.1 TECHNICAL APPROACH

I.1A. PROJECT ORGANIZATION

INTRODUCTION

CSR Sifang JV has earned a solid reputation as a global rail transportation system provider with unmatched performance. Success is reliably achieved through applying and integrating services and technologies designed to exceed customer expectations and requirements. CSR Sifang JV is therefore able to offer only the most reliable, durable, and proven rail vehicles possible with favorable life cycle cost implications. For this MBTA Orange and Red Line rail vehicle project, CSR Sifang JV has assembled the most experienced, knowledgeable, and trained professionals available bringing together proven and capable expertise. All members of the proposed CSR Sifang JV project team is committed to working cooperatively, professionally, and effectively with the MBTA to yield the finest quality of service possible in all project activities delivering the highest quality and performance.

ORGANIZATIONAL STRUCTURE

A project organizational plan has been developed by CSR that outlines the overall project organizational structure which will be implemented for the MBTA Orange and Red Line rail vehicle project. This organizational structure has been designed to provide the most effective means of accomplishing each of the MBTA's goals for this project through the efficient, comprehensive, and organized management of all relevant aspects of the project by CSR Sifang JV. Candidate professionals for specific positions include:

Amanda Creighton will be the Program Manager for this project. She is a mechanical engineer with more than twenty years manufacturing and project/contract management experience in the railcar industry. Specific assignments have included new and overhaul railcar assembly, component manufacturing, facility layout, documentation management, specification development, design/verification management and compliance auditing. Ms. Creighton's career growth from staff engineering to project management and extensive involvement with several domestic and foreign railcar builders provides a solid foundation of experience from which to lead this program making her uniquely qualified for this position.

Laurence W. Gray (PE) will be the System Integrator for this project as identified in Section T21.03 and assume direct responsibility for the system integration plan including those activities referenced in section C5-15. He is a Professional Engineer (PE) with a mechanical engineering background and forty years of experience in the railcar industry with more than twenty-five years in rapid transit/metro applications throughout North America. Areas of expertise include stress analysis, carbody/truck integration, finite element analysis, crash worthiness and experimental structural analysis. Specific assignments have included new and overhaul railcar projects with multiple project engineering, management and manufacturing-related responsibilities. Mr. Gray has worked in various capacities with some of the world's leading railcar manufacturers (Alstom, Bombardier, Siemens) and subsystem suppliers including those for doors, trucks, brakes, propulsion and HVAC bringing unique experience and valuable lessons-learned to this program.

William A. Runner will be the Assembly Plant Manager for this project. He brings more than forty years manufacturing/assembly experience in the railcar industry including procurement, materials management, warehousing, inventory/distribution and final assembly. Specific assignments have included new and overhaul railcar manufacturing with increasing responsibility up the organizational hierarchy from shop floor functional supervision to departmental and general plant management. Mr. Runner began his career at the iconic Budd Company where he spent more than twenty years working on some of the largest railcar projects in North America. Subsequent positions at Sumitomo/Nippon Sharyo, ADtranz and CAF involved bridging several national, cultural and language barriers giving Mr. Runner unique skills for this project.

Allan T. Gilkes will be the Assembly Production Manager for this project. He brings more than 25 years manufacturing/assembly experience in the railcar industry including frontline supervision, staffing, training, safety, scheduling, budgeting, quality assurance and ISO Certification. Specific assignments have included new and overhaul railcar manufacturing with projects of varied size, complexity and challenge. Responsibilities have included workstation planning, personnel management, line balance and electrical/mechanical subsystem integration. Mr. Gilkes' career includes positions at Morrison-Knudsen, Amerail, TTA, American Motive Power and AAI in all phases of railcar retrofit, new build, testing and commissioning also providing a unique set of qualifications for this program.

James A. Gehan will be the Supply Chain Manager for this project. He brings more than 20 years manufacturing/assembly experience in the railcar industry including, procurement, materials management, engineering, employee training and production supervision. Specific assignments have included new and overhaul railcar projects with experience in scheduling, material delivery methodology, discrepancy assessment, problem solving, expediting, benchmarking and warranty management. Responsibilities have also included community outreach to support startup/production activities for a foreign railcar builder newly entering the American market where Mr. Gehan worked with local trade schools, community colleges and other civic organizations to attract, train and qualify a new railcar assembly workforce. As with other members of this project team, these credential will add unique value as we transition from pilot car production to local assembly in Massachusetts.

Stefan Petrov will be the Field Testing & Commissioning Manager. He is an electrical engineer with more than twenty years field service experience in air and ground transportation including the last twelve years testing and commissioning transit railcars in New York, California and Massachusetts. Specific assignments have included new and overhaul railcars with responsibility for complete static & dynamic testing from bench test equipment in the factory to complete data collection/analysis, trouble shooting, training, repair and final commissioning in the field. Mr. Petrov's career experience also includes engineering and maintenance assignments in both domestic and international applications that bring an added level of capability especially noteworthy when working with a foreign railcar builder.

Shengli Bao will be the Warranty Engineer for this project. He brings more than 10 years of warranty administration and quality assurance experience in the railcar industry including carbody process engineering and quality assurance management. Specific assignments have included new railcar manufacturing with projects of varied size, complexity and challenge. Responsibilities have included designing, R&D support, engineering, and management. For this MBTA program, Mr. Bao will be responsible for coordination and management of warranty administration management.

Yuwen Liu will be the Engineering Manager for this project. He brings more than 19 years of electrical engineering experience in the railcar industry including railcar electrical design, process engineering, EMU product development, and R&D. Specific assignments have included new railcar manufacturing with projects of varied size, complexity and challenge. For this MBTA project, Mr. Liu will be responsible for the engineering manager the project.

Huiqing Zhang will be the Lead Electrical Engineer for this project. He brings more than 16 years of electrical engineering experience in the railcar industry including locomotive design, EMU product development, and R&D. Specific assignments have included new railcar manufacturing with projects of varied size, complexity and challenge. For this MBTA project, Mr. Zhang will be responsible for the coordination, design, review and approval of all electrical aspects of the project. He will also develop, review, and approve all test procedures for electrical components and systems.

Tianhao Ren will be the Lead Mechanical Engineer for this project. He brings more than 27 years of design and mechanical engineering experience in the railcar industry including catenary, EMU, locomotive and R&D engineering experience. Specific assignments have included new railcar manufacturing with projects of varied size, complexity and challenge. Responsibilities have included designing, project management, and engineering. For this MBTA project, Mr. Ren will report to the Systems Integrator and Engineering Managers and be in charge of the coordination, design, review and

approval of all mechanical aspects of the project. He will also develop, review, and approve all test procedures for mechanical components and systems.

Zhilong Zhang will be the Reliability Engineer for this project. He brings more than 13 years of design and R&D engineering experience in the railcar industry including EMU and electrical power engineering experience. Specific assignments have included new railcar manufacturing with projects of varied size, complexity and challenge. Responsibilities have included designing, project management, and engineering. For this MBTA project, Mr. Zhang will be responsible for all reliability engineering tasks associated with the project. He will also plan and develop, review, and approve reliability related documentation.

Xishen Zhu will be the Testing and Commissioning Engineer for this project. He brings more than 11 years of development and mechanical commissioning experience in the railcar industry including EMU and metro vehicles. Specific assignments have included new railcar manufacturing with projects of varied size, complexity and challenge. For this MBTA project, Mr. Zhu will be responsible for all testing and commissioning tasks associated with the project. He will also plan and develop, review, and approve testing and commissioning related documentation.

FIGURE I.1A-1: 'CSR Sifang JV Project Organization Chart' provides an outline of the proposed CSR Sifang JV organization and key staff for this project.

**FIGURE I.1A-1
CSR Sifang JV Project Organization Chart**

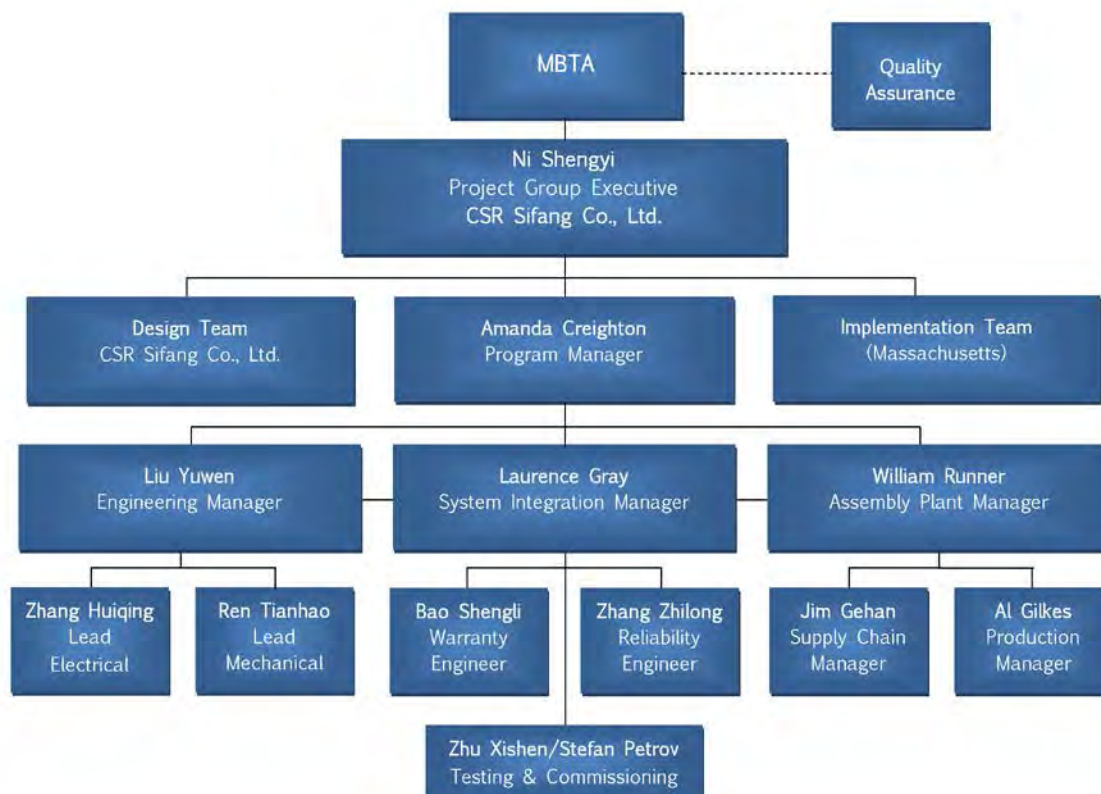


TABLE I.1A-1: 'CSR Sifang JV Proposed Responsibility Matrix' provides an outline of the proposed CSR Sifang JV organization breakdown of staff responsibilities and locations for this project.

**TABLE I.1A-1
CSR Sifang JV Proposed Responsibility Matrix**

Position	Name	Location	Responsibility	Authority
Project Director	Ni Shengyi	Boston/China Project Office	All Activities	Complete
Project Manager	Amanda Creighton	Boston Project Office	Local Project Activities	Complete
System Integration Manager	Laurence Gray	Boston Project Office	Integration Assurance Activities	Complete
Plant Manager	William Runner	Local Assembly Facility	Local Assembly Activities	Complete
Production Manager	Allan Gilkes	Local Assembly Facility	Work Station Management Activities	Complete
Supply Chain Manager	James Gehan	Boston Project Office	Procurement Activities	Complete
Testing & Commissioning Manager	Xishen Zhu	Boston Project Office	Final Acceptance Activities	Complete
Field Support Manager	Stefan Petrov	Boston Project Office	Field Testing Activities	Complete
Engineering Manager	Yuwen Liu	Boston/China Project Office	All Engineering Activities	Complete
Lead Electrical Engineer	Huiqing Zhang	Boston/China Project Office	Electrical Activities	Complete
Lead Mechanical Engineer	Tianhao Ren	Boston/China Project Office	Mechanical Activities	Complete
Reliability Engineer	Zhilong Zhang	Boston/China Project Office	Performance Modeling (MTBF/MTTR)	Complete
Warranty Engineer	Shengli Bao	Boston/China Project Office	Service & Support	Complete

Note: Some position dual location as project transitions from design to implementation phase.

I.1B. CSR SIFANG JV UNDERSTANDING OF MBTA REQUIREMENTS

CSR Sifang JV has thoroughly reviewed, analyzed, and understands the MBTA requirements for this Orange and Red line rail vehicle project. CSR Sifang JV will adhere to the requirements of the technical specification as described throughout this proposal including performance, quality, safety, design and manufacturing standards referenced.

I.1C. PREVIOUS CSR SIFANG JV EXPERIENCE WITH THE DESIGN AND MANUFACTURE OF STAINLESS STEEL CARBODIES

TABLE I.1C-1: 'Stainless Steel Carbody Design and Manufacturing Experience' provides an outline of CSR Sifang JV's previous experience with the design and manufacture of stainless steel carbodies.

CSR Sifang JV understands fully the value of capable and qualified subcontractor support of a project of this magnitude. Hence, CSR Sifang JV has selected only highly accomplished and proven system integration professionals, suppliers, and subcontractors whom meet all specified MBTA goals for the project. All subcontractors used will have fully-satisfied CSR Sifang JV's stringent criteria based upon proven performance, quality, and experience. All subcontractors will also be required to fully demonstrate their proven capacity to deliver products and services within a specified budget and schedule.

For potential subcontractor information please see Section I.2H, Table I.2H-1: 'Potential Supplier Scope, Location, Capacity and Experience'.

**TABLE I.1C-1
Stainless Steel Carbody Design and Manufacturing Experience**

Transit Property	Number of Cars	Date(s) of Contract	Carbody Manufacturer
Beijing Subway Operation Co., Ltd (Beijing Metro Line 1)	120	05/25/2006-06/2008	CSR Sifang
Beijing MTR Corporation (Beijing Metro Line 4)	240	05/26/2006-09/2009	CSR Sifang
Chengdu Metro Co., Ltd (Chengdu Metro Line 1)	102	10/12/2007-05/2010	CSR Sifang
Shenyang Metro Co., Ltd (Shenyang Metro Line 2)	120	02/29/2008-07/2011	CSR Sifang
Tianjin Metro Group Co., Ltd (Tianjin Metro Line 3)	162	09/01/2008-10/2011	CSR Sifang
Beijing Rail Transit Construction & Management Co., Ltd (Beijing Metro Line 8)	198	07/29/2009-10/2012	CSR Sifang
Beijing Rail Transit Construction & Management Co., Ltd (Beijing Metro Daxing Line)	198	07/29/2009-12/2010	CSR Sifang
Beijing Rail Transit Construction & Management Co., Ltd (Beijing Metro Changping Line)	162	12/29/2009-12/2010	CSR Sifang
Chengdu Metro Co., Ltd (Chengdu Metro Line 2)	138	03/23/2010-05/2012	CSR Sifang
Chengdu Metro Co., Ltd (Chengdu Metro Line 2)	114	01/28/2011-12/2013	CSR Sifang
Beijing Subway Operation Co., Ltd (Beijing Metro Line 1)	114	04/27/2011-02/2012	CSR Sifang
Beijing Rail Transit Construction & Management Co., Ltd (Beijing Metro Line 14)	150	03/23/2012-2014	CSR Sifang
Beijing MTR Corporation (Beijing Metro Line 4)	78	09/24/2012-11/2013	CSR Sifang
Beijing Rail Transit Construction & Management Co., Ltd (Beijing Metro Line 8)	36	11/21/2012-08/2013	CSR Sifang
Shenyang Metro Co., Ltd (Shenyang-Tieling Intercity Railway Project)	66	09/27/2013-2014	CSR Sifang

I.1D. TRUCKS

CSR Sifang JV's principal objective for this project is to provide reliable, durable, and optimum value to the MBTA. CSR Sifang JV therefore currently has proposed a cast truck frame design for this project. Further, CSR Sifang JV is actively engaged in the development and evaluation of further progressive systems, technologies and alternatives in the field of truck frame design thereby allowing alternate solutions and suppliers to be offered to the MBTA.

The truck design proposed for MBTA Red/Orange Line is similar to the design previously applied to the MBTA Orange Line. These truck designs are a service proven arrangement providing safe and comfortable operation on existing MBTA equipment. CSR Sifang has provided trucks to SEPTA, LIRR, MBTA, METRA, NYCT, and others. The trucks are characterized by the high and wide bolster spring location with the car body resting directly on the secondary suspension springs. These springs, in turn, are supported by the truck bolster. The bolster is connected to the car body through two longitudinal anchors. The truck bolster and car body, therefore, can move vertically, transversely, and pitch and roll relative to each other but not longitudinally or in yaw swivel. The truck bolster, in turn, pivots in yaw above a one-piece, cast steel truck frame.

The truck design will accommodate two traction motors and gear units in compliance with the specified requirements. The proposed truck design will accommodate four tread brake units per truck. The tread brakes would be mounted directly to the side of the truck frame with the mounting designed to meet the specified requirements.

The truck frame, bolster, journal boxes and other major components will be manufactured and assembled in the United States. Bradken or Columbus Castings will be selected to provide truck frames with assembly occurring at Transair.

STRUCTURAL MATERIAL DESCRIPTION

Castings will be produced from A.A.R. M-201, Grade B, plus 2 percent nickel or C-4 alloy steel, minimum. This low alloy nickel steel is in widespread use in many thousands of rapid transit, commuter and main line trucks. Its ductility, good impact properties, and good weldability in the field are well known to many railroads throughout the country. Seldom are cast steel products damaged beyond repair. The cast steel frame, bolster, and journal boxes are designed conservatively for long service life. The proposed cast steel design will meet the specified requirements.

PRIMARY SUSPENSION DESCRIPTION

Truck framing and frame mounted components, such as motors, are protected from direct road shocks through the use of rubber chevron springs at the journal boxes. As speed increases, this design feature assumes greater importance due to the greater vertical accelerations that can be anticipated at the rail. Additionally, minimizing the unsprung weight of the trucks will result in less impact damage to the trackwork and roadbed, and the equipped truck frame and bolster above.

The primary springs consist of two rubber chevron multi-layered sandwiches at each journal box supporting the truck frame. The springs are relatively soft vertically since they operate primarily in shear in the vertical direction. The lateral rate is about three times the vertical rate and the longitudinal rate about nine times the vertical rate. These rates permit adequate vertical springing while still providing a limited amount of "self-steering" in order to minimize wheel flange and rail wear. In addition to providing vibration protection for all frame-mounted components, the chevron springs provide excellent wheel load equalization. Rail irregularities are accommodated by the chevron spring deflections and the pitch and roll of the truck frame on the four point elastomeric support. The use of chevrons is a service-proven feature and meets the specified requirements. The chevron life will be greater than the 7 years specified.

SECONDARY SUSPENSION

Bolster air springs will be provided primarily for the comfort of the passenger and to maintain proper floor height relative to the station platforms. There will be four (4) airsprings (two (2) at each bolster). Three (3) leveling valves will be used per car to control car floor height through the air supply to the springs to adjust for passenger load. The air springs will be augmented with internal elastomeric stops to support the carbody in the event of air spring failure. Each trucks' pair of air springs will be cross-connected by means of a differential pressure valve so that the rupture of one spring will deflate the other to prevent excessive carbody roll. The bolster will be used as an air reservoir for the air springs. The design is

arranged for the conventional two convolution bellows as shown on the truck assembly drawing. Air spring rate at AW0 will be 1980 lbs. per inch at 65 psig and at AW3 will be 3,350 lbs. per inch at 113 psig. Air gap for secondary suspension motion to contact with the internal air spring rubber stop is 1.25 inches. AW3 deflection of the rubber bumper is estimated at 0.75 inches for a total deflection of 2.00 inches.

ALLOWABLE STATIC AND DYNAMIC MOVEMENT

The proposed Orange Line vehicle AW0 and AW3 weights are 75,125 lbs. and 110,000 lbs. respectively. The proposed Red Line vehicle AW0 and AW3 weights are 83,150 lbs. and 125,000 lbs. respectively. The assumed journal rate is 7,150 lbs./in. The estimated truck assembly weight (per car) is 12,128 lbs./5,508 kg. The allowable static and dynamic movement is provided in TABLE I.1D-1: 'Allowable Static and Dynamic Truck Movement'.

TABLE I.1D-1
Allowable Static and Dynamic Truck Movement

Orange Line				Red Line			
PRIMARY DEFLECTION (inches)							
	Vertical		Stop Clearance		Vertical		Stop Clearance
	AW0	AW3			AW0	AW3	
Static	1.31	1.92	3.31	Static	1.45	2.18	3.45
Static Deflection from AW0	0.00	0.61	2.00	Static Deflection from AW0	0.00	0.73	2.00
Dynamic	0.50	0.58	N/A	Dynamic	0.54	0.61	N/A
Lateral	0.13	0.25	N/A	Lateral	0.13	0.25	N/A
SECONDARY DEFLECTION (inches)							
	AW0	AW3	Stop Clearance		AW0	AW3	Stop Clearance
Vertical Static	0.00	0.13	1.25	Vertical Static	0.00	0.13	1.25
Vertical Dynamic	0.32	0.31	2.00	Vertical Dynamic	0.32	0.31	2.00
Lateral Static	0.38	0.38	0.50	Lateral Static	0.38	0.38	0.50
Lateral Dynamic	1.50	1.50	2.00	Lateral Dynamic	1.50	1.50	2.00

The lateral motion of the carbody with respect to the truck bolster will be accomplished through transverse deflection of the secondary double convoluted air springs. Rubber bumper stops will be provided to limit infrequent excessive lateral movements. Vertical loads will be supported by non-metallic side bearings on the truck frame. No lubrication or maintenance is required.

The structural reliability of the trucks with cast steel framing will be a matter of record based upon railroading experience. One piece cast steel structural members will be of high integrity with joints and discontinuities being eliminated. Smooth transitions will be integrated between members thereby reducing stress concentrations and increasing the potential for a trouble free service life with minimal maintenance.

Vertical adjustments for wheel wear will be accomplished by applying shims beneath the loaded side bearing assembly. The installation of truck accessories will include a wheel flange lubrication device, truck piping, and truck wiring. In addition, an ATP antenna will be installed on the number 1 truck of the cab car and a mounting seat will be provided for the snow plow.

PAST EXPERIENCE OF THE BASIC DESIGNS OF THE TRUCKS

Columbus Castings and Bradken are the candidate truck system and bolster providers for this project. Both of these truck systems and bolsters are well known throughout the transit industry for their reliability and dependability. Programs where Columbus Castings truck systems and bolsters continue to provide extended years of truck service include transit authorities in Denver (Eagle cars, 2013), Amtrak (Viewliner LDSL, 2012), SEPTA (Silverliner V, 2010), NJDOT (Comet V, 2005), Amtrak (Surfliner, 2000), MBTA (#3

Red Line, 1992), and several others. Similarly, programs where Bradken truck systems and bolsters continue to provide extended years of truck service include transit authorities in Chicago (METRA), Virginia Rail, SCCRA, SFMTA, and others.

I.1E. WEIGHT CONTROL

The CSR Sifang JV weight control management program will ensure that the weights of the proposed vehicles do not exceed the limits defined by the MBTA. The following discussion defines the proposed CSR Sifang JV approach to weight management.

WEIGHT MANAGEMENT PLAN (WMP)

CSR Sifang JV will ensure that the vehicle design and integrated subsystems meet or exceed MBTA specification requirements inclusive of weight limitations assigned to various subsystems. CSR Sifang JV will undertake this analysis on a subsystem basis down to the Line Replaceable Unit (LRU) level. The proposed WMP will be designed to ensure that both CSR Sifang JV and its subcontractors have a documented plan and methodology by which to meet defined target weight limits. The WMP will further ensure that a commitment is applied to develop the optimum mass design weights while meeting both MBTA and CSR Sifang JV requirements. The WMP will further define processes for the project weight monitoring program, mass accounting, reporting, recovery and verification.

WEIGHT MANAGEMENT APPROACH

CSR Sifang JV has already undertaken a preliminary weight control program integrating initial weight and balance estimates based upon MBTA specification requirements, knowledge of existing designs, and engineering estimates. The input weight data has been compiled from preliminary data provided by CSR Sifang JV and potential subsuppliers and subcontractors.

After contract award, CSR Sifang JV will initiate a comprehensive weight management control program. As directed by the CSR Sifang JV Project Engineer, the project team will administer and control the program as applicable from the design phase thru vehicle final assembly. All systems and subsystems will be closely monitored during the design and manufacturing stages to identify problem areas and ensure compliance with the detail and overall weight and balance. Larger mass components will be controlled and considered critical for their effect upon weight critical variables. CSR Sifang JV will design equipment installation and integration to achieve the required balancing limit and axle load distribution as defined within the MBTA technical specification. At the conclusion of the contract, CSR Sifang JV will complete the weight management program and ensure that the weight of the finished vehicles does not exceed the maximum guaranteed weight in the technical proposal.

DESIGN PHASE WEIGHT MANAGEMENT PROGRAM

During the project design phase, CSR Sifang JV will conduct regular weight monitoring activities. Foremost among these will be the vehicle preliminary design phase, which in accordance with the technical specification, will predict the vehicle mass. Subsystem functional groups will be closely monitored utilizing the drawings, bill of materials (BoM), and equipment specification data to accurately describe the mass and distribution of the vehicle weight. A structural model of the carshell and truck utilizing CAD/CAE will be analyzed. The subcontractor and subsupplier weights will be evaluated for mass properties and when meeting the targets included into the combined vehicle configured arrangement and then included into the solved summary listing of weight characteristics and data. If an overweight condition is identified, a weight reduction plan will be immediately enacted, executed, and reported. An iterative process will be introduced as necessary to bring the mass distribution and weight levels within acceptable parameters.

BUILD PHASE WEIGHT MANAGEMENT PROGRAM

During the actual build phase, the weight control program will migrate to a weighing and recording approach to confirm the achieved weight targets are realized. A weight record of subsystems and large equipment systems will be created and integrated into the vehicle weight record. Further weight recovery plans will be initiated as necessary should deviations from the designed conditions occur. Total vehicle weights and distributions will be recorded and documented within the car history book.

I.1F. SAFETY APPROACH

CSR Sifang JV has created a comprehensive internal and supplier safety approach program and methodology designed to deliver the safest product possible to the MBTA. The following outlines the stages of this program.

HAZARD ANALYSIS

During the project design phase, designers and engineers associated with each subsystem will systematically analyze relevant hazards, estimate potential risks, propose and integrate measures to avoid/mitigate risks, and document analysis results within a dedicated hazard log document. Hazard identification activities will consider known hazards and specific elements of the anticipated operating and maintenance environment at MBTA. A risk matrix will be created to evaluate defined and reviewed hazards and further include potential mitigation measures.

Preliminary Hazard Analysis (PHA)

Serving as a foundation for subsequent hazard analysis activities, a PHA will be conducted taking the form of a Hazard and Operability Study (HAZOP). The HAZOP will:

- To identify high level risks relevant to the design, operation and maintenance of electrical vehicle subsystems in the early contract phases
- To estimate the dangers and risks related to the vehicle system in the early contract phases and eliminate the risks identified; or,
- To provide guidance to control the other associated risks within acceptable levels

Subsystem Hazard Analysis (SSHA)

The Subsystem Hazard Analysis (SSHA) will be conducted after the PHA on a subsystem level. In addition to compliance confirmation between subsystem and SA requirements, the SSHA will also be conducted to identify and estimate the hazards relevant to the subsystem and proper risk mitigation measures to be implemented. Applicable subsystems include:

- Carshell system
- Bogie and suspension systems
- Coupler and draw gear (buffer damper) systems
- Traction equipment system
- Braking equipment system
- Auxiliary Power Supply (APS) equipment system
- Door systems
- Heat and air conditioning and ventilation system
- Pneumatic control and air supply system
- Train control system
- Communication system

Operation and Support Hazard Analysis (O&SHA)

The O&SHA will be created and developed from the PHA to provide further analysis of relevant operation and support procedures which may adversely impact system safety. Operation and support procedures relevant to the development of the overall proposed system will be evaluated to identify potential hazards introduced to operations and support systems. Strategies will be developed to mitigate potential hazard exposure.

RISK LEVEL EVALUATION

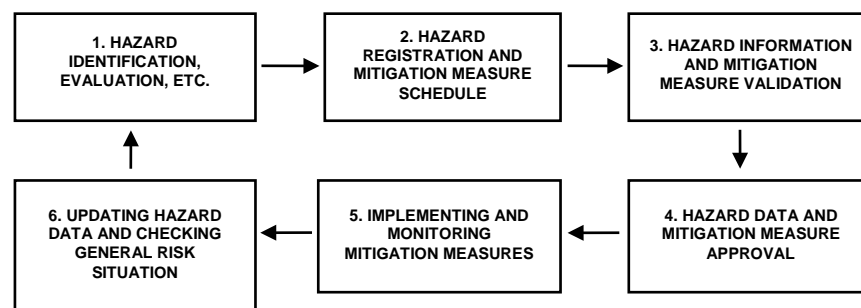
Identified hazards will be assessed for relative risk level and identified in the risk matrix. Resolution and mitigation of risk elements will consider:

- For hazard items considered a risk level R1 or R2, design methods will attempt to mitigate to a risk level R3 or R4. Where design methods may not be realistic to reduce risk, other strategies may include operation, maintenance procedure or training approaches.
- In general, hazards identified as risk level R3 can often be considered acceptable and will be mitigated to risk level R4 is technical and economically feasible. If risk level R3 hazards are considered to have special considerations, particular measures will be applied. Initial risk level R4 hazards will not be further mitigated.

HAZARD ANALYSIS PROCEDURE

CSR Sifang JV has established risk management procedures and relevant system assurance management procedures per established national standards to ensure that system assurance activities can be fully integrated into design, manufacturing, and testing functions. To further assist in hazard identification activities, any hazards created by a single point fault coupled with being a critical safety circuit (such as door control, door and braking loop, propulsion control and other) will be closely considered. FIGURE I.1F-1: 'Risk Management Flow Diagram' illustrates the basic approach process adopted by CSR Sifang JV for this program.

**FIGURE I.1F-1
Risk Management Flow Diagram**



HAZARD RESOLUTION AND REDUCTION

For hazard mitigation measures related to design or installation activities, CSR Sifang JV will periodically inspect the progress of hazard resolution in accordance to the following principals:

- Resolve hazards which can be mitigated or resolved through a design change prior to completion of the design
- Resolve hazard risk level R1 and R2 issues prior to manufacturing phase
- Conduct mitigation of hazards associated with installation prior to executing those activities which may adversely impact system and equipment installation activities.

The proposed hierarchy of hazard reduction measures will first focus on design related solutions then those associated with construction and finally those associated with operations and maintenance. For process control mitigation measures, CSR Sifang JV will mitigate operational hazard issues which may require specific operation and maintenance process control through proper procedures prior to the preliminary operation phase.

For hazard mitigation measures conducted/performed by the MBTA, such as changes to train operator procedures for evacuating passengers during an emergency or fire events, CSR Sifang JV will request clarification and resolution of procedures from the MBTA prior to actual vehicle operations.

DETERMINISTIC SAFETY ASSESSMENT AND VALIDATION

Prior to completing the design, designers will identify respective potential hazards and define the design, operating safety principles, and industrial rules or regulations to evaluate whether the system complies with identified safety requirements. System designers will complete a defined safety assessment according an established protocol and submit written reports ultimately as part of a safety analysis report. For identified safety requirements, designers will conduct safety verification during testing to demonstrate compliance with defined standards and procedures.

SAFETY ANALYSIS AND SYSTEM REPORTS

The CSR Sifang JV safety analysis report will consist of a defined safety assessment (part 1) and a fault tree analysis/quantified risk assessment (part 2) report. The proposed safety system report will document and confirm whether the system is under safe operation and identify how the system realizes the RAMS target as specified in the contract.

RISK LEVEL EVALUATION

All identified hazards will be evaluated for their corresponding risk level utilizing the risk matrix. Hazard severity will be determined in accordance to the hazard consequence. To properly evaluate the hazard frequency, CSR Sifang JV may utilize fault tree analysis, event tree analysis, other. Practical experience will also be applied from prior similar projects.

HAZARD MONITORING

CSR Sifang JV will closely review the system safety issues with respect to engineering, operation and maintenance to ensure sufficient safety consideration of the design on a regular basis. CSR Sifang JV will further evaluate and review identified hazards and record the potential hazards within the hazard log document to ensure that hazard identification and recommended mitigation measures are appropriately documented. If a safety related design deficiency is discovered, associated hazards will be further identified and the hazard item recorded in the Hazard Log.

I.1G. VEHICLE PERFORMANCE

CSR Sifang JV has completed and compiled comprehensive vehicle performance simulations as requested by the MBTA for each the proposed Red and Orange Line vehicles. The following description and results document these simulations in full compliance with MBTA requirements.

RED LINE VEHICLE PERFORMANCE

To initiate vehicle performance verification, several assumptions have been made. FIGURE I.1G-1: 'Vehicle Configuration' defines the proposed vehicle configuration. TABLE I.1G-1: 'Red Line Vehicle Load' describes the proposed loading configuration used for subsequent analysis.

FIGURE I.1G-1
Vehicle Configuration

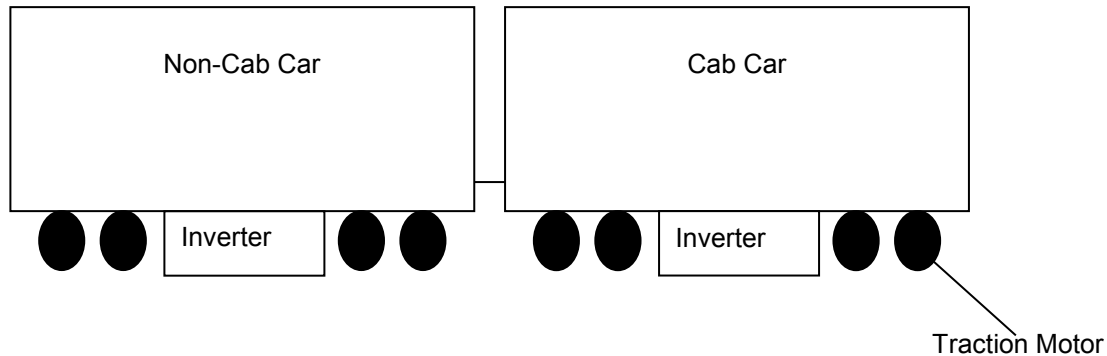


TABLE I.1G-1
Red Line Vehicle Load

RED LINE CAB CAR				RED LINE NON CAB CAR			
Load	Car Weight (lb(kg))	Load Weight	Total Weight (lb(kg))	Load	Car Weight (lb(kg))	Load Weight	Total Weight (lb(kg))
AW0	83,150 (37,716)	0 (0)	83,150 (37,716)	AW0	80,205 (36,380)	0 (0)	80,205 (36,380)
AW1	83,150 (37,716)	5,735 (2,601)	88,885 (40,318)	AW1	80,205 (36,380)	6,820 (3094)	87,025 (39474)
AW2	83,150 (37,716)	23,870 (10,827)	107,020 (48,543)	AW2	80,205 (36,380)	25,730 (11,671)	105,935 (48,051)
AW3	83,150 (37,716)	41,850 (18,982)	125,000 (56,699)	AW3	80,205 (36,380)	44,795 (20,319)	125,000 (56,699)

Motoring

CSR Sifang JV has utilized the following motoring characteristics in the determination of vehicle performance, including:

- Wheel Diameter – 28 inches
- Gear Ratio – 6.133
- Acceleration at Starting – 2.75 mphps
- Train Resistance at Starting – 39.2 N/ton
- Car Formation – 3 married pairs

Performance Calculation for Propulsion System (RED Line). The following Figures define the motor characteristics at various loading and voltage levels, including:

- FIGURE I.1G-2: 'Motor Characteristics at Powering (530 VDC, AW2)
- FIGURE I.1G-3: 'Motor Characteristics at Powering (530 VDC, AW3)
- FIGURE I.1G-4: 'Motor Characteristics at Powering (600 VDC, AW2)
- FIGURE I.1G-5: 'Motor Characteristics at Powering (600 VDC, AW3)
- FIGURE I.1G-6: 'Motor Characteristics at Powering (700 VDC, AW2)

- FIGURE I.1G-7: 'Motor Characteristics at Powering (700 VDC, AW3)

The acceleration rate between 530 and 700 VDC and loading at AW2 maintains 2.75 +/- 5% mphps from 0 to 16.3 +/- 0.2 mph as described in the aforementioned Figures. The acceleration rate of 2.75 mphps is available to at least 16.3 mph. Adhesion level was set at 14%.

Braking

CSR Sifang JV has utilized the following motoring characteristics at braking in the determination of vehicle performance for the RED Line, including:

- Wheel Diameter – 28 inches
- Gear Ratio – 6.133
- Deceleration – 3.00 mphps
- Car formation – 3 married pairs (6 cars)
- Loading at AW2, and AW3

The following Figures define the braking characteristics at various loading and voltage levels, including:

- FIGURE I.1G-8: 'Motor Characteristics at Braking (600 VDC, AW2)'
- FIGURE I.1G-9: 'Motor Characteristics at Braking (600 VDC, AW3)'
- FIGURE I.1G-10: 'Motor Characteristics at Braking (660 VDC, AW2)'
- FIGURE I.1G-11: 'Motor Characteristics at Braking (660 VDC, AW3)'
- FIGURE I.1G-12: 'Motor Characteristics at Braking (700 VDC, AW2)'
- FIGURE I.1G-13: 'Motor Characteristics at Braking (700 VDC, AW3)'

FIGURE I.1G-2
Motor Characteristics at Powering (530 VDC, AW2)

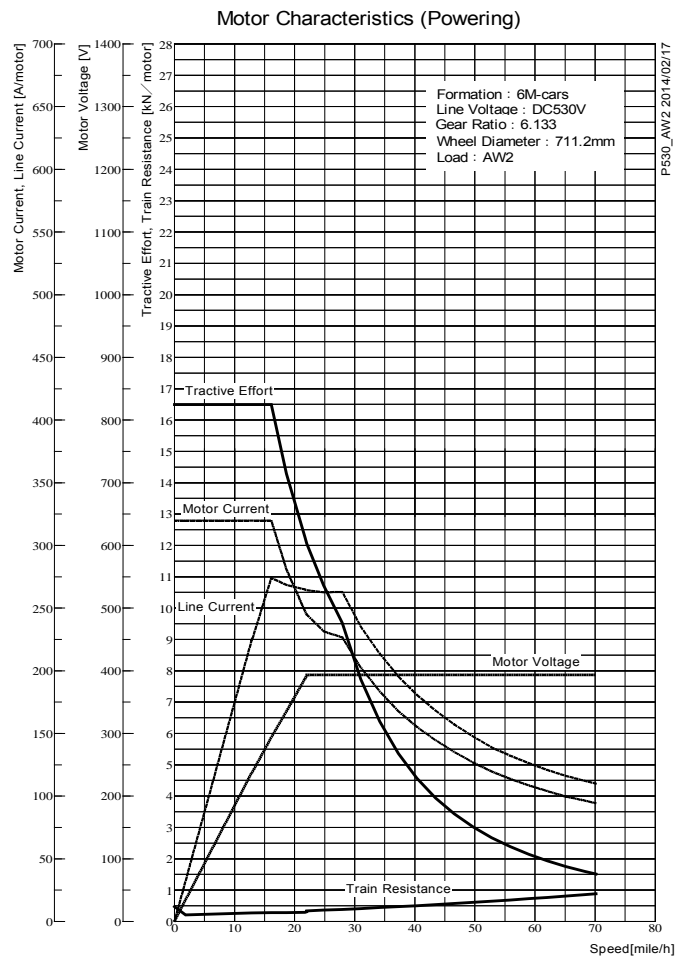


FIGURE I.1G-3
Motor Characteristics at Powering (530 VDC, AW3)

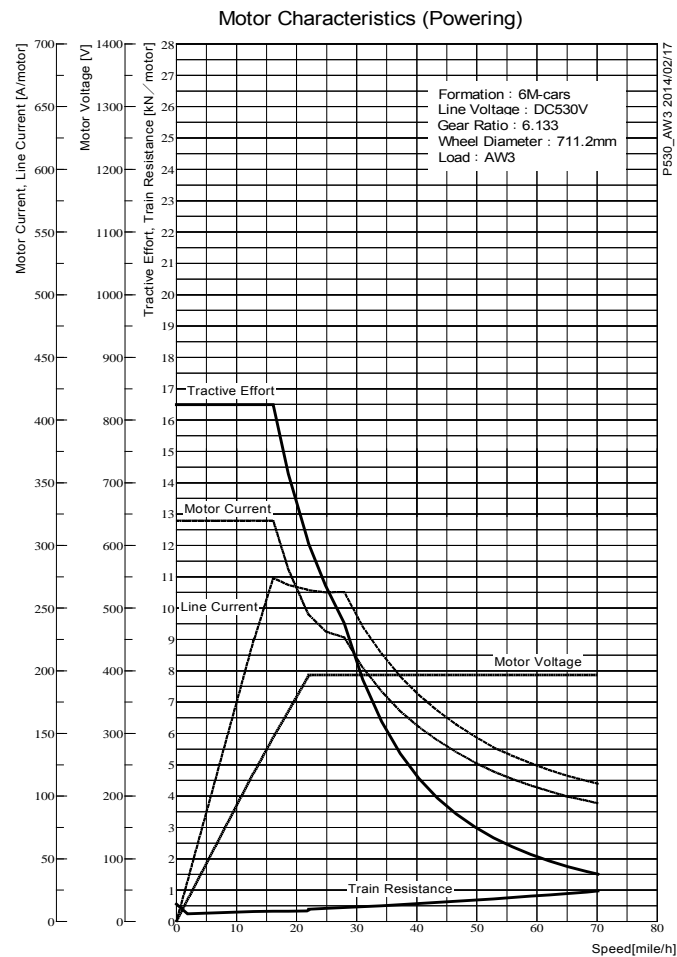


FIGURE I.1G-4
Motor Characteristics at Powering (600 VDC, AW2)

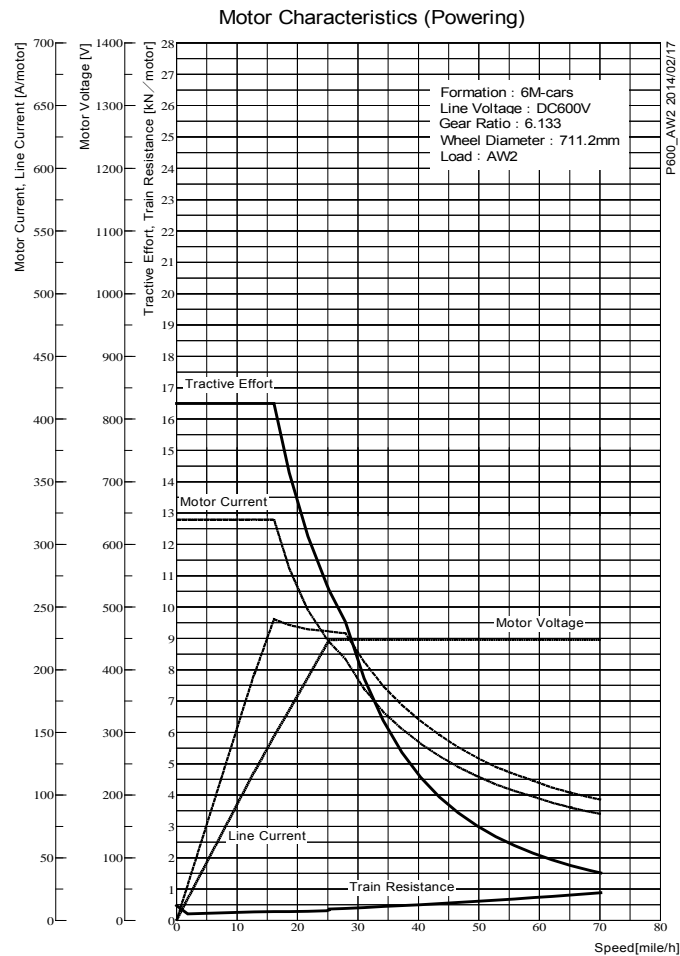


FIGURE I.1G-5
Motor Characteristics at Powering (600 VDC, AW3)

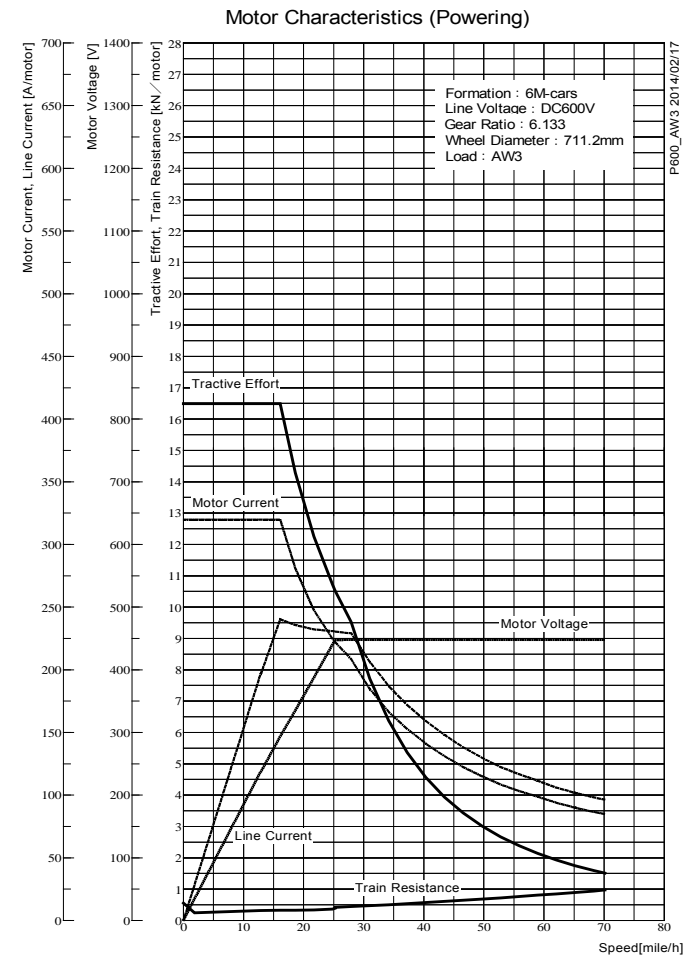


FIGURE I.1G-6
Motor Characteristics at Powering (700 VDC, AW2)

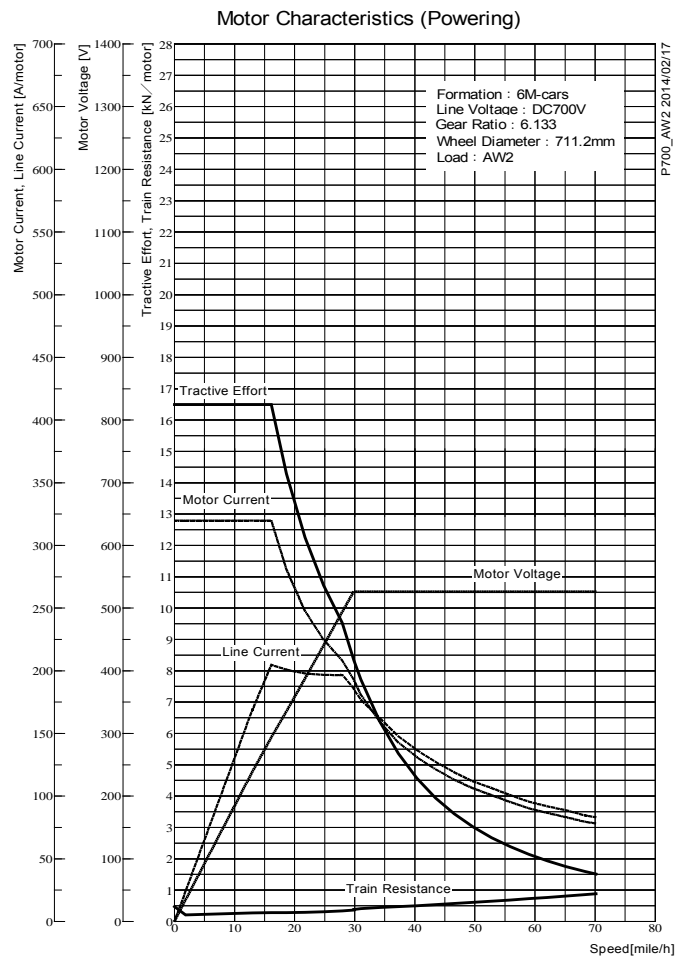


FIGURE I.1G-7
Motor Characteristics at Powering (700 VDC, AW3)

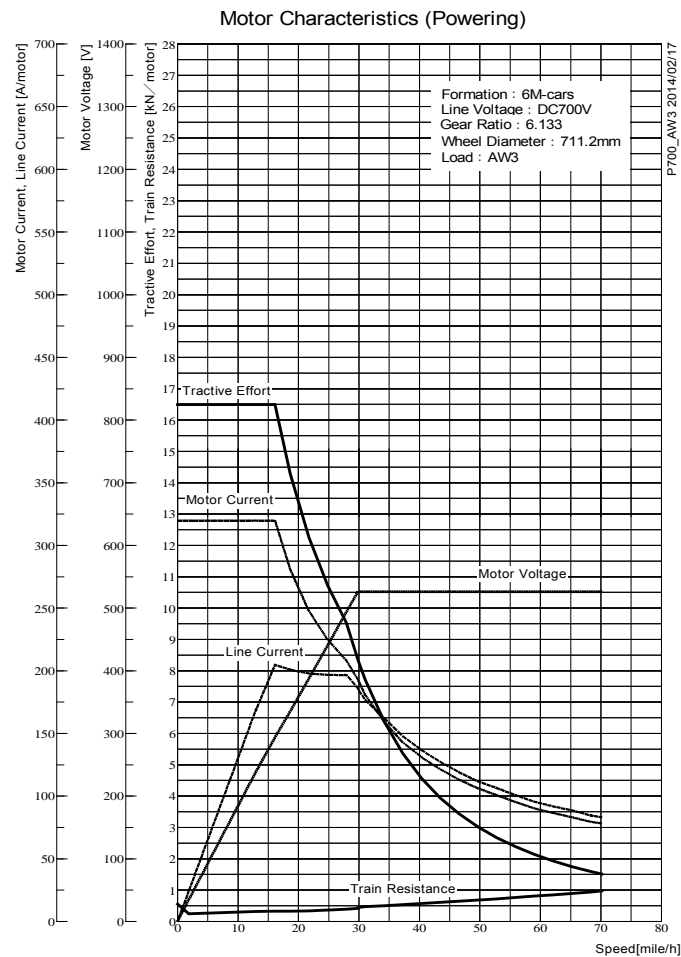


FIGURE I.1G-8
Motor Characteristics at Braking (600 VDC, AW2)

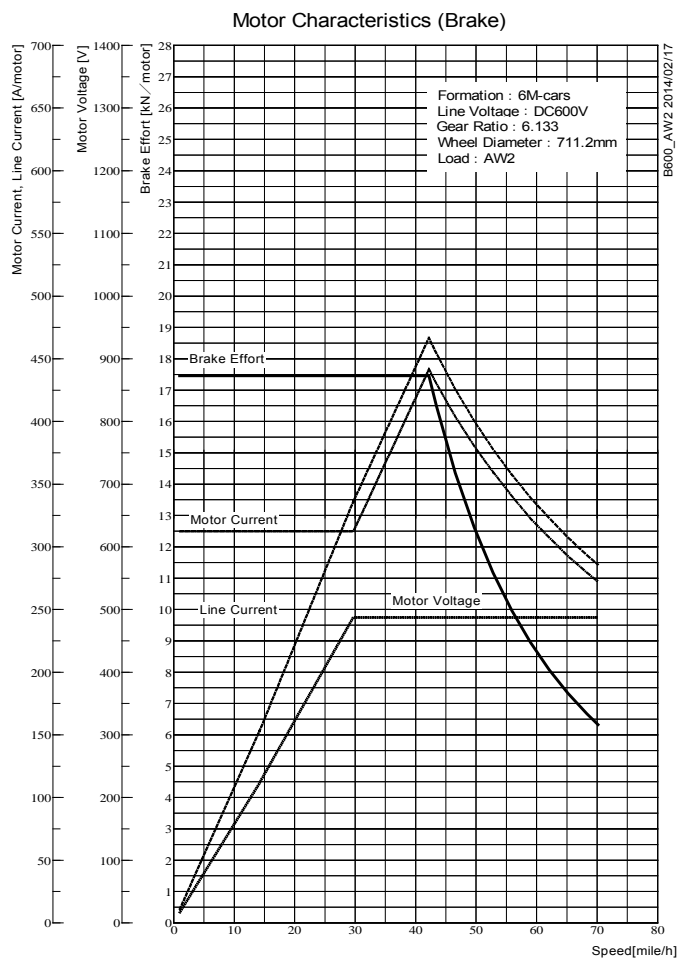


FIGURE I.1G-9
Motor Characteristics at Braking (600 VDC, AW3)

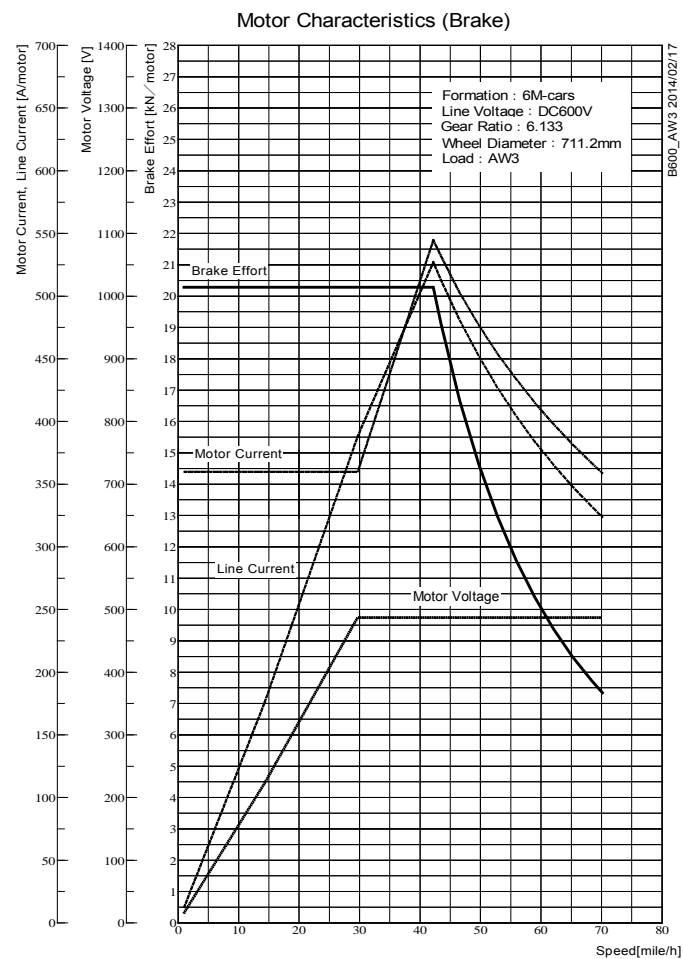


FIGURE I.1G-10
Motor Characteristics at Braking (660 VDC, AW2)

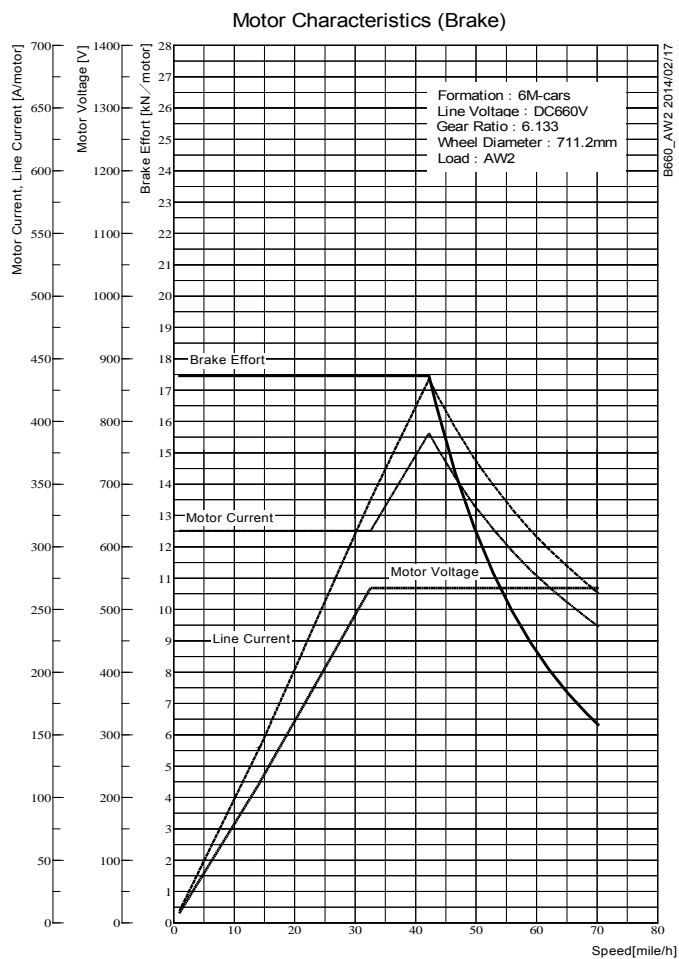


FIGURE I.1G-11
Motor Characteristics at Braking (660 VDC, AW3)

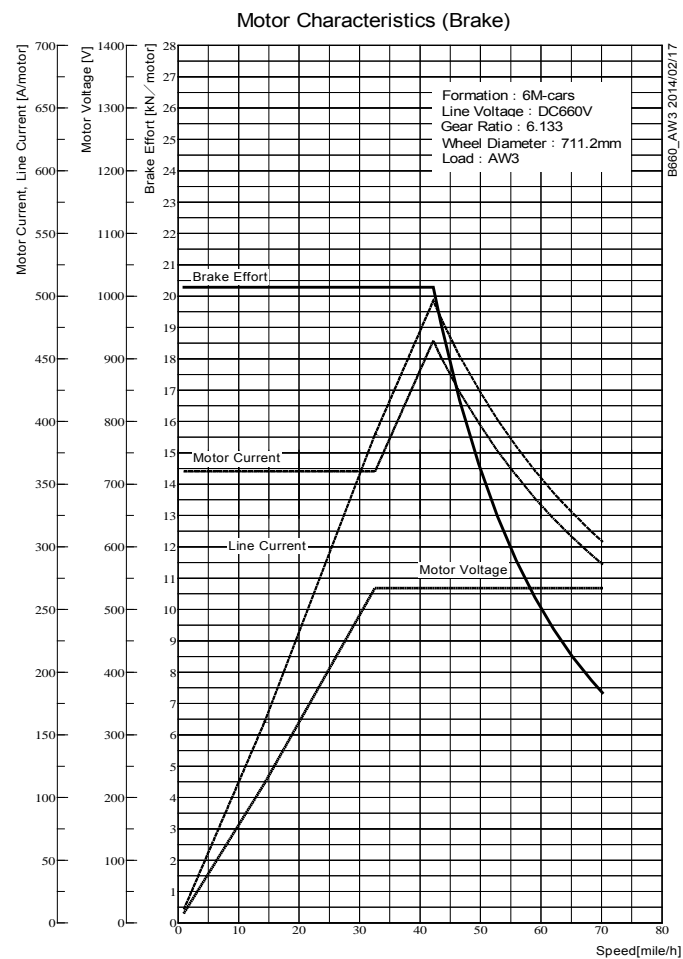


FIGURE I.1G-12
Motor Characteristics at Braking (700 VDC, AW2)

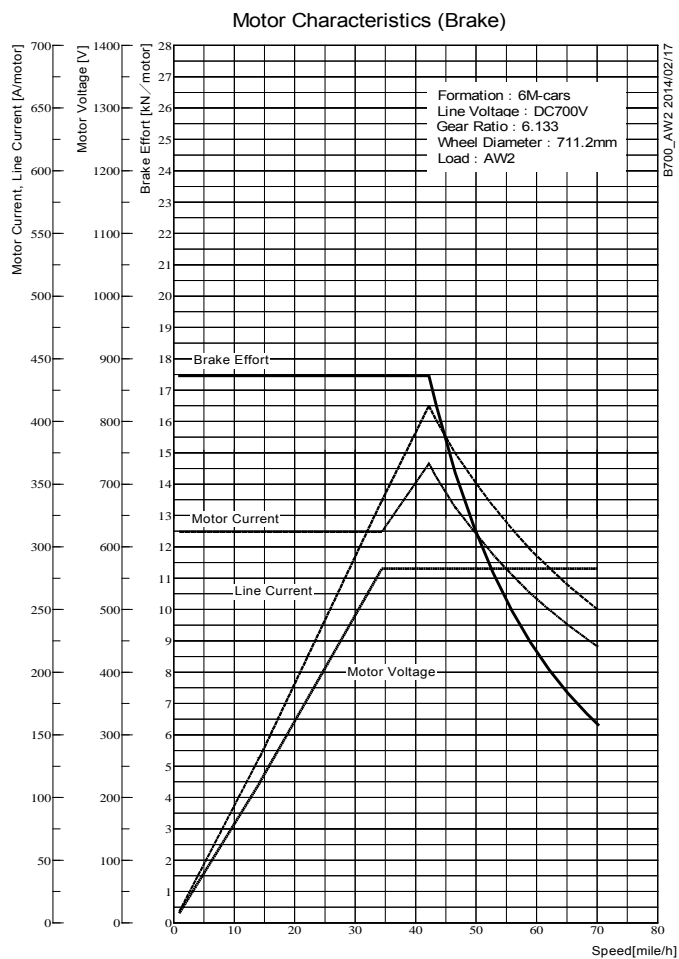
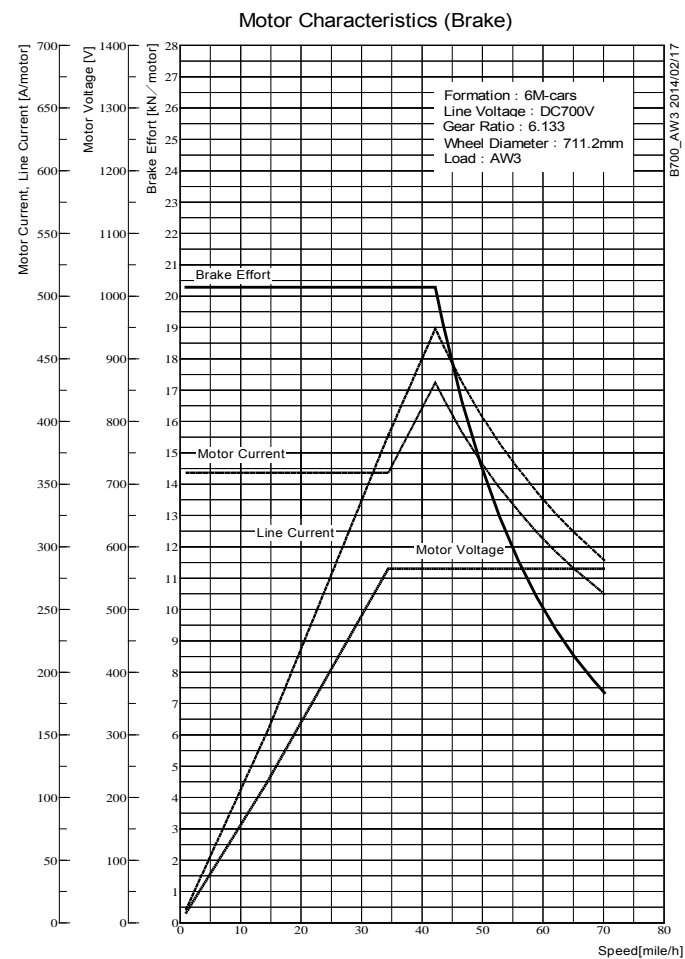


FIGURE I.1G-13
Motor Characteristics at Braking (700 VDC, AW3)



The deceleration rate at 600 VDC to 700 VDC and AW3 maintains 3.0 mphps from 0 to 42 mph in accordance with the MBTA technical specification by means of dynamic brake only. For train speeds above 42 mph, a blending of both the friction and dynamic brakes maintain the required deceleration rate. At very low velocities, the friction brake only is required. Adhesion level was set at 14%.

Travel Time and Average Speed (Normal Conditions)

CSR Sifang JV has calculated travel time and average speed under normal conditions as a result of the aforementioned simulation. TABLE I.1G-2: 'Travel Times and Average Speeds in Each Direction' documents these results.

**TABLE I.1G-2
Travel Times and Average Speeds in Each Direction**

Direction	Travel Time	Average Speed
	[second]	[mph]
ASHMONT→ALEWIFE (INBOUND) (Not include the dwell time at each station.)	1790	23.7
ASHMONT→ALEWIFE (INBOUND) (Include the dwell time at each station.)	2420	17.6
ALEWIFE→ASHMONT (OUTBOUND) (Not include the dwell time at each station.)	1874	22.7
ALEWIFE→ASHMONT (OUTBOUND) (Include the dwell time at each station.)	2504	17.0
BRAINTREE→ALEWIFE (INBOUND) (Not include the dwell time at each station.)	2168	29.3
BRAINTREE→ALEWIFE (INBOUND) (Include the dwell time at each station.)	2828	24.0
ALEWIFE→BRAINTREE (OUTBOUND) (Not include the dwell time at each station.)	2240	28.4
ALEWIFE→BRAINTREE (OUTBOUND) (Include the dwell time at each station.)	2900	21.9

Rated Motor Current and Motor Capacity (Normal Conditions)

CSR Sifang JV has calculated rated motor current and motor capacity under normal conditions as a result of the aforementioned simulation. Calculation conditions include a motor voltage of 440 VDC, a power factor of 0.785, and an efficiency of 0.930. Values cited below include dwell time considerations at each station. The motor capacity at the duty cycle rating is 90 KW. TABLE I.1G-3: 'Rated Motor Current and Motor Capacity' documents these results.

**TABLE I.1G-3
Rated Motor Current and Motor Capacity**

Direction	Rated Motor Current	Motor Capacity (Continuance)
	[Arms]	[kW]
Red Line round trip	160.5	89.3

Equipment Thermal Capacities (Normal Conditions)

CSR Sifang JV has calculated equipment thermal capacities under normal conditions as a result of the aforementioned simulation. Calculation conditions consider an ambient temperature of 49 degrees C. Operationally, round trips are considered continuous at normal duty cycle for each route. TABLE I.1G-4: 'Maximum Temperature of Equipment' documents these results.

FIGURE I.1G- 14
Running Simulation Results for Powering @ 530 VDC and braking at 660 VDC (ASHMONT – ALEWIFE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
01:ASHMONT	0.62	92.3	0	198.6	172.4	1.027	-0.640	0.386
02:SHAWMUT	0.58	94.2	30	187.8	151.6	0.803	-0.564	0.239
03:FIELDS CORNER	1.00	144.4	30	166.5	142.9	1.179	-0.680	0.498
04:SAVIN HILLS	0.71	100.4	30	194.3	169.2	1.106	-0.668	0.437
05:COLUMBIA	0.74	125.8	30	140.4	91.2	0.378	-0.366	0.012
06:ANDREW SQ.	0.83	90.0	30	220.2	199.9	1.373	-0.860	0.513
07:BROADWAY	0.83	120.8	30	194.1	175.5	1.253	-0.879	0.374
08:SOUTH STATION	0.27	50.8	30	210.7	150.6	0.597	-0.165	0.432
09:WASHINGTON	0.21	41.9	30	227.1	156.6	0.522	-0.169	0.354
10:PARK ST.	0.56	81.1	30	207.4	179.3	1.195	-0.448	0.747
11:CHARLES	0.72	86.2	30	244.3	227.5	1.411	-1.116	0.295
12:KENDALL	0.95	103.1	30	196.8	175.5	1.345	-0.691	0.654
13:CENTRAL SQ.	1.07	211.0	30	141.7	113.1	1.176	-0.595	0.581
14:HARVARD SQ.	1.09	214.1	30	170.0	130.2	1.159	-1.099	0.060
15:PORTER SQ	0.67	100.5	30	201.7	182.1	1.708	-0.366	1.341
16:DAVIS SQ	0.97	133.9	30	179.2	157.4	1.185	-0.831	0.354
17:ALEWIFE	0	0	180	0	0	0	0	0
Total	11.81	1790.6	630	186.1	157.6	17.415	-10.138	7.277

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

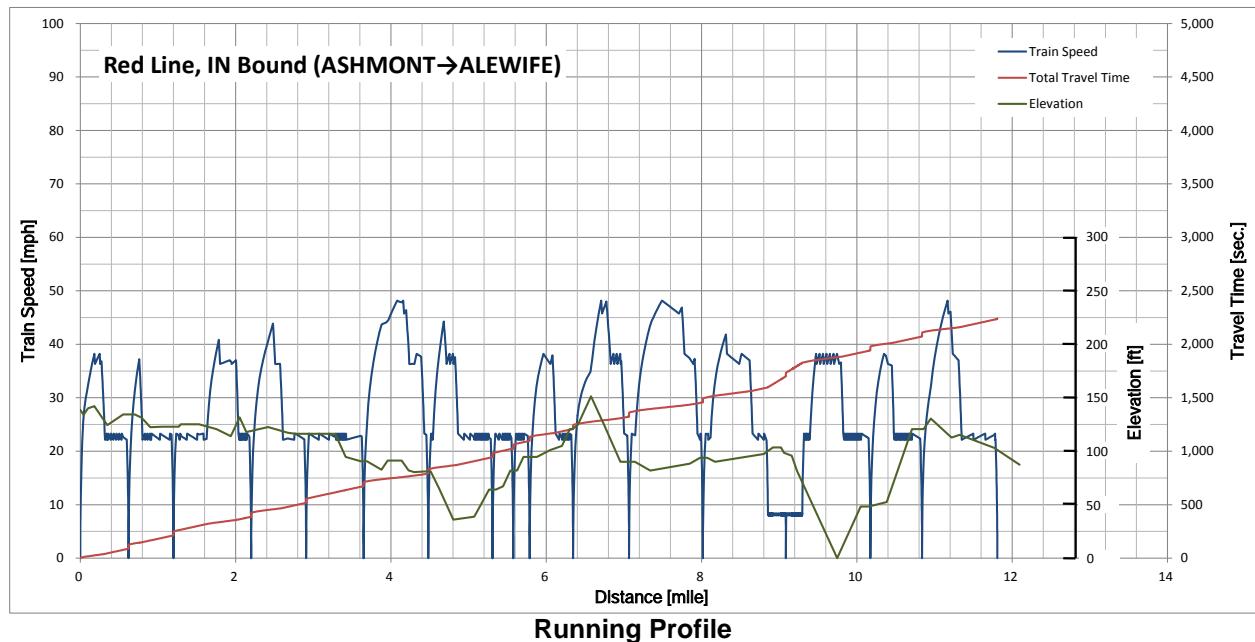


FIGURE I.1G- 15
Running Simulation Results for Powering @ 530 VDC and braking at 660 VDC (ALEWIFE - ASHMONT)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
17:ALEWIFE	0.97	120.5	0	174.3	147.1	1.251	-0.494	0.757
16:DAVIS SQ	0.67	110.9	30	199.9	149.4	0.636	-1.019	-0.384
15:PORTER SQ	1.09	239.5	30	184.9	140.7	2.237	-0.809	1.428
14:HARVARD SQ.	1.07	119.8	30	185.5	165.9	1.306	-0.721	0.585
13:CENTRAL SQ.	0.95	110.4	30	189.4	168.9	1.252	-0.705	0.547
12:KENDALL	0.72	99.9	30	213.1	184.8	1.622	-0.686	0.936
11:CHARLES	0.56	92.6	30	188.5	146.2	0.667	-0.611	0.056
10:PARK ST.	0.21	41.9	30	227.2	140.3	0.324	-0.278	0.046
09:WASHINGTON	0.27	50.9	30	211.3	131.7	0.324	-0.319	0.005
08:SOUTH STATION	0.83	111.5	30	198.3	171.4	1.465	-0.700	0.765
07:BROADWAY	0.83	95.6	30	201.9	180.0	1.312	-0.658	0.654
06:ANDREW SQ.	0.74	117.3	30	178.2	155.2	1.244	-0.484	0.760
05:COLUMBIA	0.71	98.6	30	176.7	144.2	0.881	-0.450	0.432
04:SAVIN HILLS	1.00	138.9	30	164.2	143.8	1.187	-0.593	0.594
03:FIELDS CORNER	0.58	143.5	30	152.7	105.6	0.788	-0.299	0.489
02:SHAWMUT	0.62	182.8	30	142.1	81.1	0.666	-0.276	0.390
01:ASHMONT	0	0	180	0	0	0	0	0
Total	11.81	1874.4	630	182.6	146.6	17.163	-9.103	8.060

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

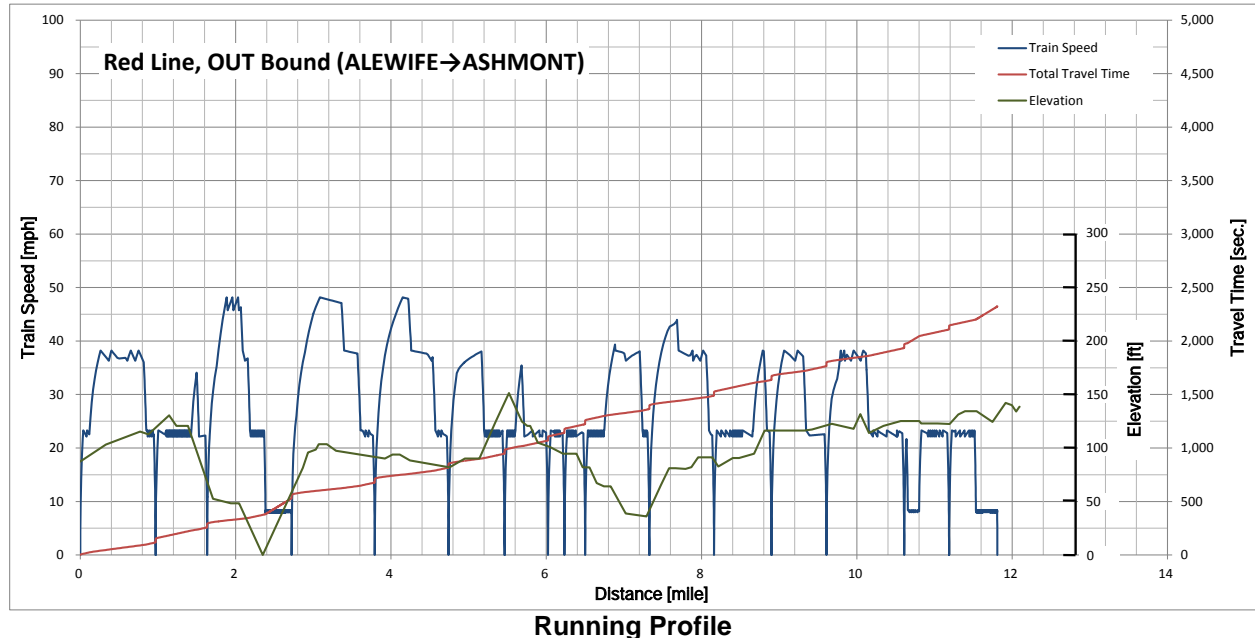


FIGURE I.1G- 16
Running Simulation Results for Powering @ 530 VDC and braking at 660 VDC (BRAINTREE – ALEWIFE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
01:BRAINTREE	1.87	168.8	0	169.8	157.7	1.457	-1.058	0.399
02:QUINCY ADAMS	1.34	129.6	30	186.9	172.8	1.456	-0.898	0.557
03:QUINCY CENTER	1.26	122.7	30	194.2	179.7	1.666	-0.830	0.837
04:WOLLASTON	0.79	87.4	30	214.3	188.5	1.176	-0.746	0.430
05:NORTH QUINCY	3.52	298.9	30	151.0	151.1	3.104	-1.410	1.694
06:COLUMBIA	0.74	125.8	30	161.7	126.9	0.924	-0.368	0.555
07:ANDREW SQ.	0.83	90.0	30	220.0	199.7	1.374	-0.859	0.515
08:BROADWAY	0.83	120.8	30	189.5	169.5	1.164	-0.828	0.336
09:SOUTH STATION	0.27	50.8	30	212.4	152.5	0.606	-0.172	0.435
10:WASHINGTON	0.21	42.0	30	225.4	154.5	0.513	-0.163	0.350
11:PARK ST.	0.56	81.1	30	205.3	177.8	1.178	-0.432	0.746
12:CHARLES	0.72	86.1	30	242.4	224.8	1.360	-1.090	0.270
13:KENDALL	0.95	103.4	30	197.0	175.7	1.353	-0.698	0.655
14:CENTRAL SQ.	1.07	211.0	30	141.4	114.0	1.186	-0.604	0.582
15:HARVARD SQ.	1.09	214.2	30	172.6	131.4	1.208	-1.124	0.085
16:PORTER SQ	0.67	100.6	30	200.5	180.8	1.698	-0.363	1.335
17:DAVIS SQ	0.97	134.8	30	180.9	156.5	1.181	-0.832	0.349
18:ALEWIFE	0	0	180	0	0	0	0	0
Total	17.68	2167.9	660	183.3	161.2	22.605	-12.474	10.131

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

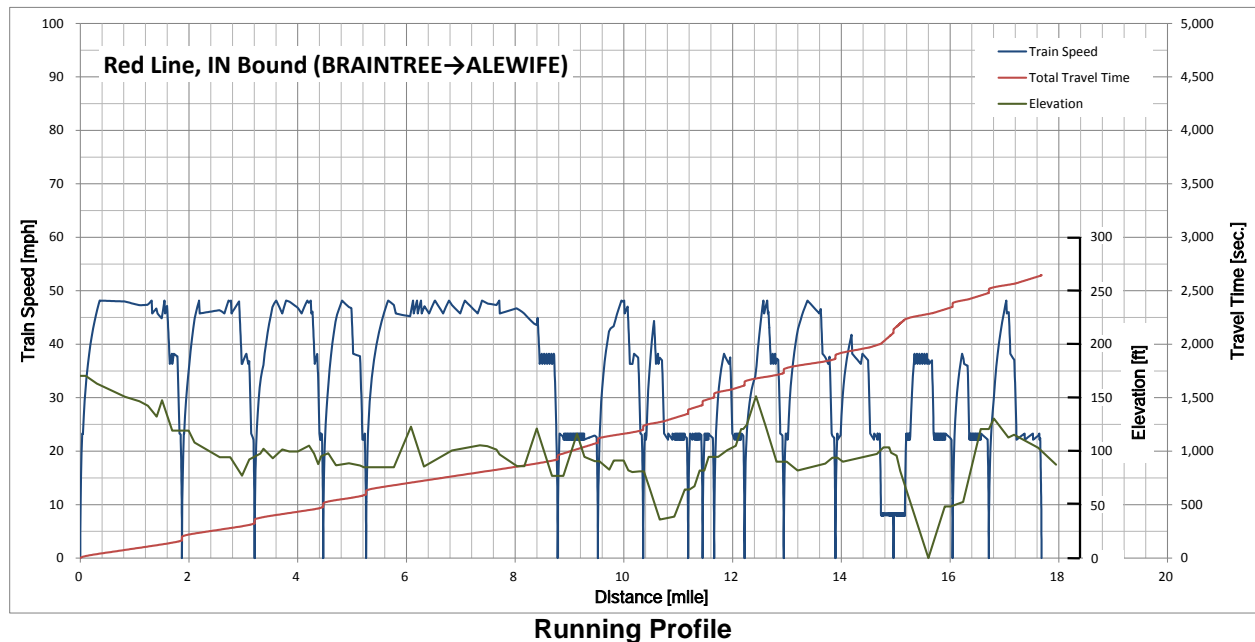


FIGURE I.1G- 17
Running Simulation Results for Powering @ 530 VDC and braking at 660 VDC (ALEWIFE – BRAINTREE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
18:ALEWIFE	0.97	121.3	0	177.6	148.9	1.284	-0.512	0.772
17:DAVIS SQ	0.67	110.8	30	198.9	148.5	0.625	-1.011	-0.385
16:PORTER SQ	1.09	239.6	30	188.3	143.5	2.295	-0.859	1.436
15:HARVARD SQ.	1.07	163.5	30	166.7	141.4	1.325	-0.736	0.589
14:CENTRAL SQ.	0.95	110.2	30	190.0	168.9	1.250	-0.702	0.548
13:KENDALL	0.72	99.6	30	211.6	182.2	1.588	-0.660	0.928
12:CHARLES	0.56	92.5	30	186.4	144.5	0.643	-0.606	0.037
11:PARK ST.	0.21	41.9	30	227.6	140.7	0.324	-0.280	0.043
10:WASHINGTON	0.27	50.8	30	211.6	131.9	0.324	-0.319	0.005
09:SOUTH STATION	0.83	111.4	30	193.2	166.6	1.391	-0.651	0.740
08:BROADWAY	0.83	95.5	30	204.1	182.0	1.338	-0.674	0.664
07:ANDREW SQ.	0.74	102.9	30	199.7	178.2	1.111	-0.771	0.340
06:COLUMBIA	3.52	303.5	30	143.7	143.0	2.975	-1.135	1.840
05:NORTH QUINCY	0.79	124.3	30	163.9	136.8	1.027	-0.464	0.563
04:WOLLASTON	1.26	126.7	30	189.0	173.4	1.595	-0.836	0.759
03:QUINCY CENTER	1.34	130.6	30	179.7	164.5	1.721	-0.674	1.047
02:QUINCY ADAMS	1.87	214.4	30	153.3	145.4	2.343	-0.739	1.604
01:BRAINTREE	0	0	180	0	0	0	0	0
Total	17.68	2239.6	660	180.5	154.4	23.159	-11.628	11.530

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

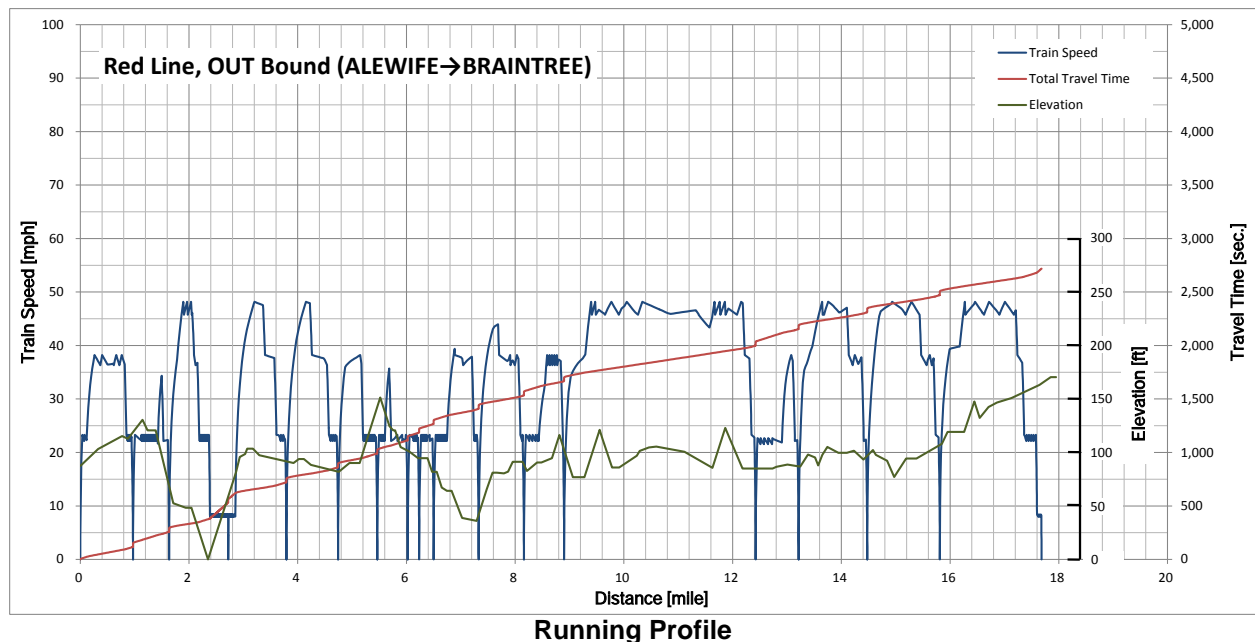


FIGURE I.1G- 18
Running Simulation Results for Powering @ 600 VDC and braking at 700 VDC (ASHMONT – ALEWIFE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
01:ASHMONT	0.62	92.3	0	194.1	156.0	1.019	-0.642	0.377
02:SHAWMUT	0.58	94.2	30	185.0	137.2	0.797	-0.565	0.232
03:FIELDS CORNER	1.00	144.4	30	162.7	129.2	1.171	-0.682	0.489
04:SAVIN HILLS	0.71	100.4	30	189.0	153.8	1.099	-0.671	0.428
05:COLUMBIA	0.74	125.8	30	140.2	82.6	0.376	-0.367	0.009
06:ANDREW SQ.	0.83	90.0	30	212.2	182.7	1.365	-0.865	0.500
07:BROADWAY	0.83	120.8	30	189.2	160.0	1.244	-0.883	0.361
08:SOUTH STATION	0.27	50.8	30	210.1	133.5	0.592	-0.165	0.427
09:WASHINGTON	0.21	41.8	30	226.5	139.0	0.518	-0.169	0.350
10:PARK ST.	0.56	81.1	30	203.3	160.7	1.186	-0.449	0.738
11:CHARLES	0.72	86.2	30	234.8	208.4	1.400	-1.124	0.276
12:KENDALL	0.95	103.1	30	190.4	159.5	1.337	-0.695	0.643
13:CENTRAL SQ.	1.07	211.0	30	138.8	102.2	1.168	-0.597	0.571
14:HARVARD SQ.	1.09	214.1	30	167.4	118.7	1.151	-1.103	0.048
15:PORTER SQ.	0.67	100.5	30	197.9	161.9	1.698	-0.367	1.331
16:DAVIS SQ.	0.97	133.9	30	173.9	143.6	1.177	-0.836	0.342
17:ALEWIFE	0	0	180	0	0	0	0	0
Total	11.81	1790.5	630	181.9	142.9	17.299	-10.178	7.121

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

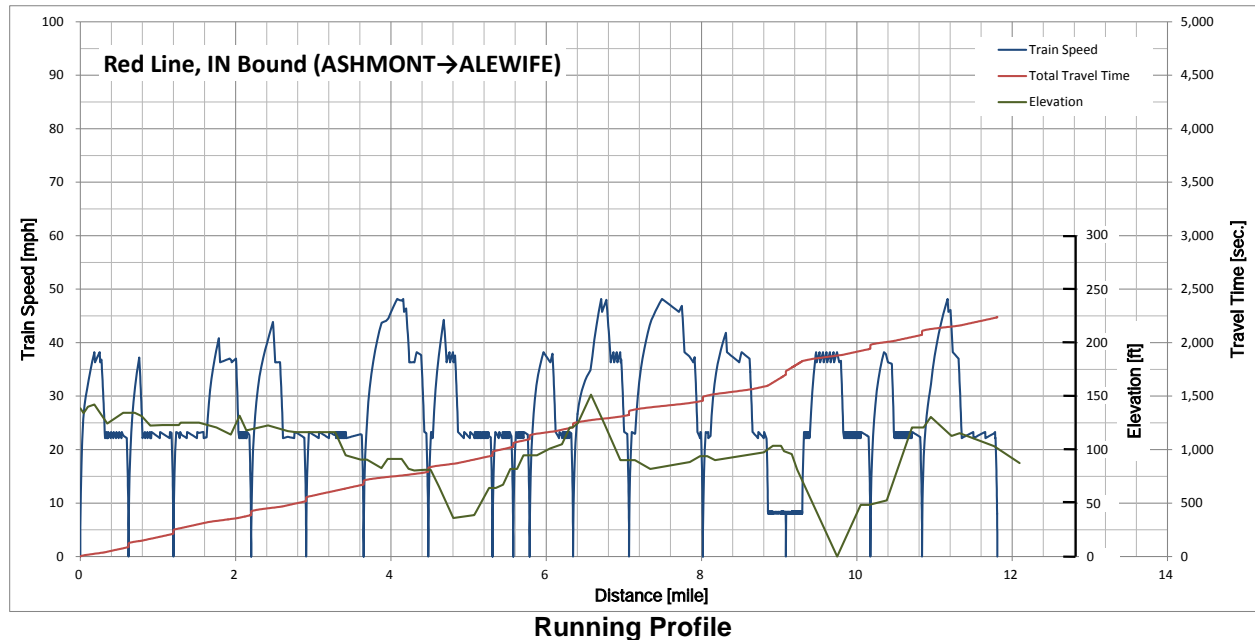


FIGURE I.1G- 19
Running Simulation Results for Powering @ 600 VDC and braking at 700 VDC (ALEWIFE - ASHMONT)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
17:ALEWIFE	0.97	120.5	0	170.3	131.9	1.243	-0.494	0.748
16:DAVIS SQ	0.67	110.9	30	198.3	136.9	0.631	-1.020	-0.389
15:PORTER SQ	1.09	239.5	30	181.5	127.2	2.221	-0.814	1.406
14:HARVARD SQ.	1.07	119.8	30	179.8	150.8	1.298	-0.725	0.573
13:CENTRAL SQ.	0.95	110.4	30	183.4	153.7	1.245	-0.709	0.536
12:KENDALL	0.72	99.9	30	207.3	166.0	1.612	-0.687	0.925
11:CHARLES	0.56	92.6	30	186.4	132.7	0.662	-0.612	0.050
10:PARK ST.	0.21	41.9	30	226.9	126.7	0.322	-0.278	0.044
09:WASHINGTON	0.27	50.9	30	211.1	119.3	0.322	-0.319	0.002
08:SOUTH STATION	0.83	111.5	30	193.4	154.4	1.456	-0.702	0.755
07:BROADWAY	0.83	95.6	30	195.4	163.2	1.304	-0.661	0.643
06:ANDREW SQ.	0.74	117.3	30	175.0	139.1	1.235	-0.485	0.749
05:COLUMBIA	0.71	98.6	30	173.2	129.9	0.875	-0.450	0.425
04:SAVIN HILLS	1.00	138.9	30	159.9	129.8	1.179	-0.595	0.584
03:FIELDS CORNER	0.58	143.5	30	152.4	94.0	0.783	-0.299	0.484
02:SHAWMUT	0.62	182.8	30	141.9	72.4	0.662	-0.277	0.385
01:ASHMONT	0	0	180	0	0	0	0	0
Total	11.81	1874.4	630	179.2	132.4	17.048	-9.128	7.920

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

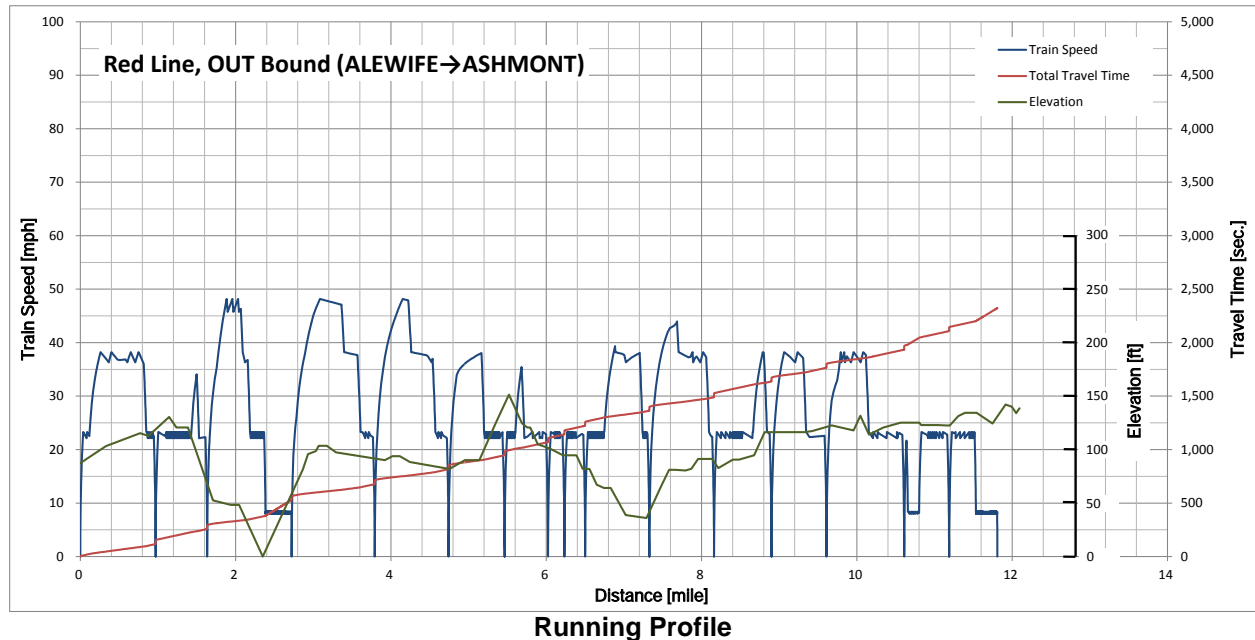


FIGURE I.1G- 20
Running Simulation Results for Powering @ 600 VDC and braking at 700 VDC (BRAINTREE – ALEWIFE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
01:BRAINTREE	1.87	168.8	0	163.1	144.7	1.449	-1.065	0.384
02:QUINCY ADAMS	1.34	129.6	30	179.6	157.9	1.448	-0.905	0.543
03:QUINCY CENTER	1.26	122.7	30	186.8	163.4	1.657	-0.835	0.821
04:WOLLASTON	0.79	87.4	30	208.0	171.7	1.169	-0.750	0.419
05:NORTH QUINCY	3.52	298.9	30	143.1	137.8	3.090	-1.421	1.669
06:COLUMBIA	0.74	125.8	30	160.7	113.0	0.916	-0.365	0.551
07:ANDREW SQ.	0.83	90.0	30	212.0	182.5	1.366	-0.864	0.502
08:BROADWAY	0.83	120.8	30	184.9	154.4	1.155	-0.833	0.323
09:SOUTH STATION	0.27	50.8	30	211.8	135.2	0.602	-0.172	0.430
10:WASHINGTON	0.21	42.0	30	224.9	137.1	0.509	-0.163	0.346
11:PARK ST.	0.56	81.3	30	201.8	159.6	1.173	-0.440	0.733
12:CHARLES	0.72	86.1	30	233.2	206.0	1.350	-1.098	0.252
13:KENDALL	0.95	103.4	30	190.6	159.6	1.346	-0.702	0.644
14:CENTRAL SQ.	1.07	211.0	30	138.4	102.9	1.179	-0.606	0.573
15:HARVARD SQ.	1.09	214.2	30	169.8	119.7	1.199	-1.128	0.071
16:PORTER SQ	0.67	100.6	30	196.3	160.5	1.684	-0.363	1.320
17:DAVIS SQ	0.97	134.8	30	175.9	142.7	1.173	-0.836	0.337
18:ALEWIFE	0	0	180	0	0	0	0	0
Total	17.68	2168.1	660	178.0	146.5	22.464	-12.545	9.919

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

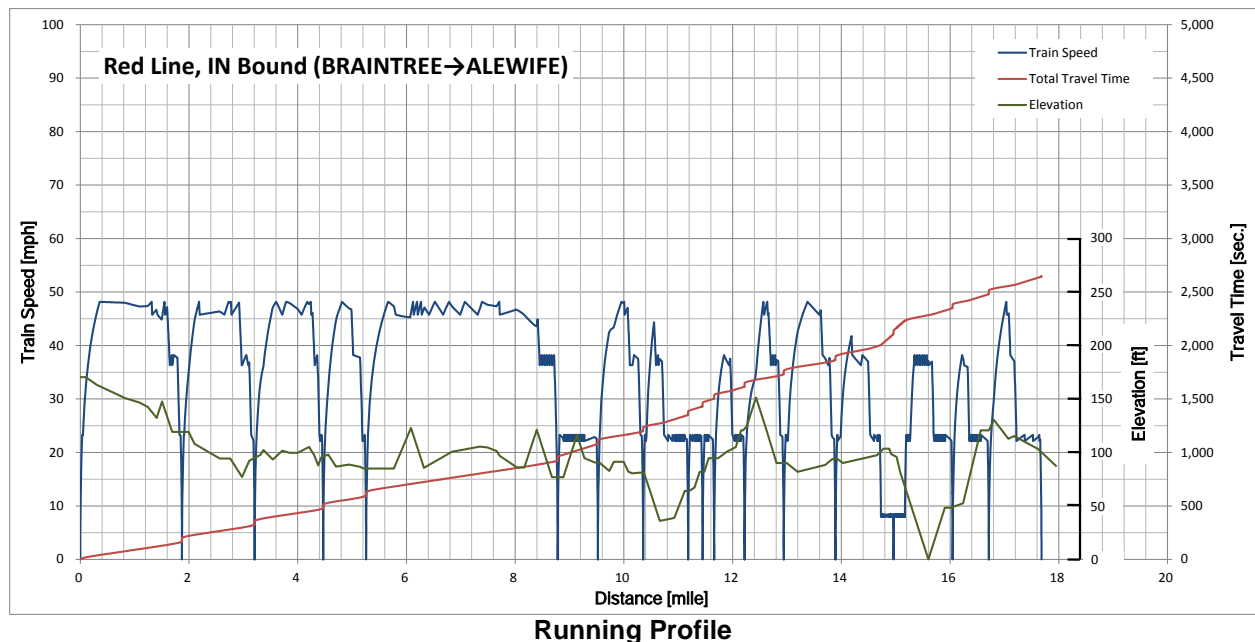
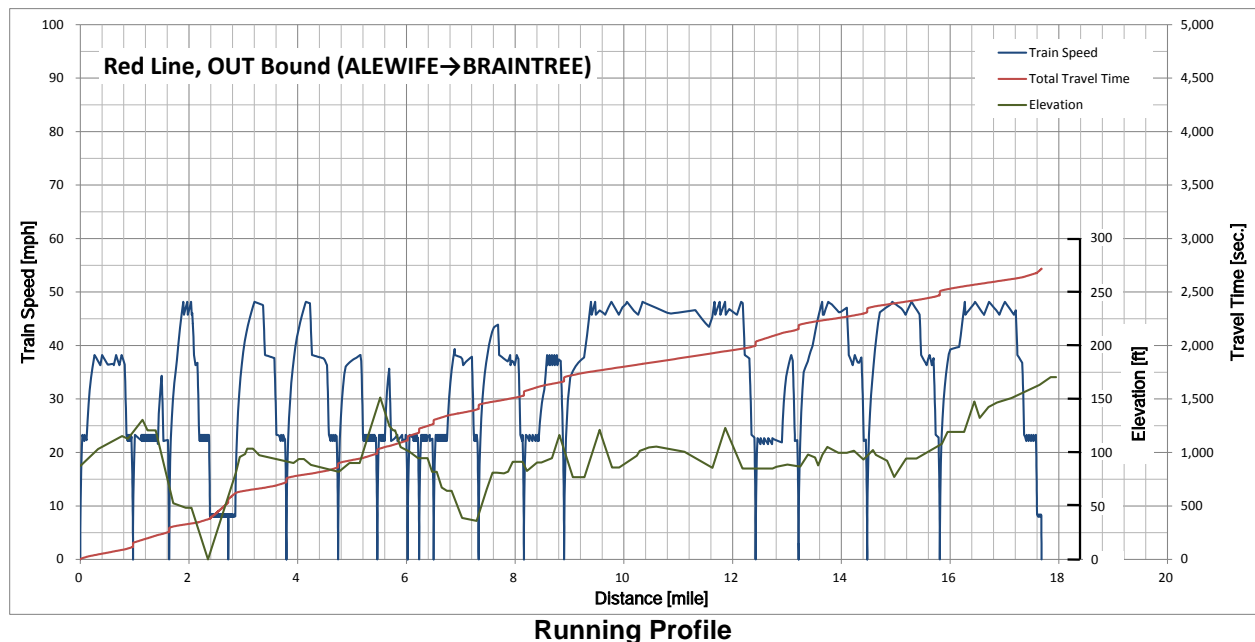


FIGURE I.1G- 21
Running Simulation Results for Powering @ 600 VDC and braking at 700 VDC (ALEWIFE - BRAINTREE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
18:ALEWIFE	0.97	121.1	0	173.0	133.3	1.284	-0.497	0.786
17:DAVIS SQ	0.67	110.8	30	197.0	136.0	0.624	-1.008	-0.384
16:PORTER SQ	1.09	239.3	30	184.8	129.9	2.280	-0.866	1.414
15:HARVARD SQ.	1.07	163.4	30	161.6	128.2	1.318	-0.731	0.587
14:CENTRAL SQ.	0.95	110.1	30	183.0	152.5	1.247	-0.686	0.561
13:KENDALL	0.72	99.8	30	206.4	164.3	1.594	-0.668	0.926
12:CHARLES	0.56	92.5	30	183.5	130.9	0.641	-0.602	0.039
11:PARK ST.	0.21	41.9	30	226.5	127.4	0.327	-0.278	0.049
10:WASHINGTON	0.27	50.8	30	210.5	119.7	0.327	-0.317	0.010
09:SOUTH STATION	0.83	111.5	30	187.7	149.7	1.382	-0.646	0.735
08:BROADWAY	0.83	95.4	30	196.4	164.4	1.335	-0.661	0.674
07:ANDREW SQ.	0.74	102.9	30	193.9	161.7	1.105	-0.770	0.335
06:COLUMBIA	3.52	303.3	30	135.3	129.4	2.957	-1.129	1.829
05:NORTH QUINCY	0.79	124.3	30	160.3	122.6	1.022	-0.461	0.561
04:WOLLASTON	1.26	126.6	30	181.0	157.5	1.590	-0.832	0.758
03:QUINCY CENTER	1.34	130.5	30	171.9	147.9	1.717	-0.661	1.056
02:QUINCY ADAMS	1.87	214.2	30	146.1	130.7	2.338	-0.720	1.618
01:BRAINTREE	0	0	180	0	0	0	0	0
Total	17.68	2238.2	660	175.1	139.5	23.088	-11.535	11.554

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.



**TABLE I.1G-4
Maximum Temperature of Equipment**

Equipment	Specified limit	Estimated temperature
Traction Motor winding	220°C	204°C
IGBT junction in Inverter	150°C	103.9°C
IGBT junction in Brake Chopper	150°C	126.2°C

Simulation Results (Abnormal Conditions)

CSR Sifang JV is pleased to provide the following running simulation results under abnormal conditions. Assumptions utilized in this simulation include:

- Line Voltage: Powering 530 VDC/Braking 660 VDC
Powering 600 VDC/Braking 700 VDC
- Car Formation – 3 married pairs (6 cars)
- Train Load – AW3
- Wheel Diameter – 28 inches
- 16% propulsion system cut out
- Operating Section – Red Line round trip

Results are summarized within the following Figures:

- FIGURE I.1G- 22: 'Running Simulation Results (Abnormal) for Powering @ 530 VDC and braking at 660 VDC (ASHMONT – ALEWIFE)'
- FIGURE I.1G- 23: 'Running Simulation Results (Abnormal) for Powering @ 530 VDC and braking at 660 VDC (ALEWIFE - ASHMONT)'
- FIGURE I.1G- 24: 'Running Simulation Results (Abnormal) for Powering @ 530 VDC and braking at 660 VDC (BRAINTREE – ALEWIFE)'
- FIGURE I.1G- 25: 'Running Simulation Results (Abnormal) for Powering @ 530 VDC and braking at 660 VDC (ALEWIFE - BRAINTREE)'
- FIGURE I.1G- 26: 'Running Simulation Results (Abnormal) for Powering @ 600 VDC and braking at 700 VDC (ASHMONT – ALEWIFE)'
- FIGURE I.1G- 27: 'Running Simulation Results (Abnormal) for Powering @ 600 VDC and braking at 700 VDC (ALEWIFE - ASHMONT)'
- FIGURE I.1G- 28: 'Running Simulation Results (Abnormal) for Powering @ 600 VDC and braking at 700 VDC (BRAINTREE – ALEWIFE)'
- FIGURE I.1G- 29: 'Running Simulation Results (Abnormal) for Powering @ 600 VDC and braking at 700 VDC (ALEWIFE - BRAINTREE)'

FIGURE I.1G- 22
Running Simulation Results (Abnormal) for Powering @ 530 VDC and braking at 660 VDC
(ASHMONT – ALEWIFE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
01:ASHMONT	0.62	93.9	0	204.9	178.9	1.197	-0.628	0.569
02:SHAWMUT	0.58	96.0	30	191.0	152.6	0.894	-0.525	0.369
03:FIELDS CORNER	1.00	146.3	30	166.5	140.4	1.258	-0.586	0.672
04:SAVIN HILLS	0.71	109.8	30	181.0	150.0	1.052	-0.510	0.542
05:COLUMBIA	0.74	126.8	30	145.9	95.6	0.448	-0.367	0.081
06:ANDREW SQ.	0.83	94.2	30	212.0	187.6	1.360	-0.720	0.641
07:BROADWAY	0.83	133.1	30	187.1	160.3	1.291	-0.777	0.514
08:SOUTH STATION	0.27	51.8	30	223.3	163.2	0.724	-0.175	0.549
09:WASHINGTON	0.21	42.9	30	236.8	165.5	0.614	-0.167	0.448
10:PARK ST.	0.56	83.3	30	214.3	185.8	1.371	-0.435	0.936
11:CHARLES	0.72	90.6	30	243.1	223.9	1.506	-1.042	0.464
12:KENDALL	0.95	107.8	30	189.9	164.5	1.350	-0.554	0.796
13:CENTRAL SQ.	1.07	213.2	30	141.2	108.9	1.219	-0.480	0.739
14:HARVARD SQ.	1.09	214.9	30	173.7	135.7	1.366	-1.087	0.279
15:PORTER SQ.	0.67	102.4	30	214.2	195.8	2.060	-0.376	1.684
16:DAVIS SQ.	0.97	137.3	30	176.8	151.7	1.206	-0.722	0.484
17:ALEWIFE	0	0	180	0	0	0	0	0
Total	11.81	1844.4	630	187.0	156.1	18.918	-9.150	9.768

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

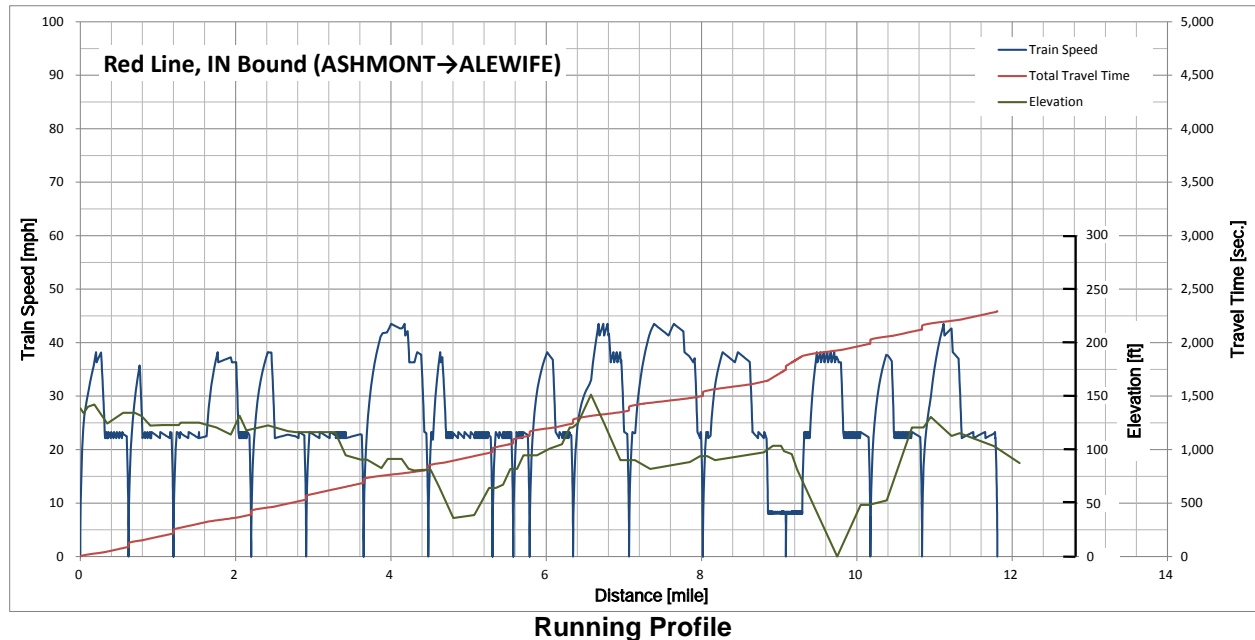


FIGURE I.1G- 23
Running Simulation Results (Abnormal) for Powering @ 530 VDC and braking at 660 VDC
(ALEWIFE - ASHMONT)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
17:ALEWIFE	0.97	121.4	0	185.6	160.1	1.581	-0.502	1.078
16:DAVIS SQ	0.67	114.5	30	180.1	119.2	0.388	-0.778	-0.390
15:PORTER SQ	1.09	241.8	30	197.5	149.3	2.663	-0.843	1.819
14:HARVARD SQ.	1.07	167.4	30	162.6	132.7	1.313	-0.590	0.723
13:CENTRAL SQ.	0.95	113.8	30	182.8	157.9	1.236	-0.560	0.676
12:KENDALL	0.72	104.0	30	215.1	187.6	1.819	-0.623	1.195
11:CHARLES	0.56	94.0	30	193.4	149.8	0.773	-0.593	0.180
10:PAK ST.	0.21	42.9	30	234.4	146.9	0.388	-0.278	0.110
09:WASHINGTON	0.27	51.9	30	216.0	135.2	0.376	-0.310	0.066
08:SOUTH STATION	0.83	113.8	30	201.4	173.9	1.655	-0.638	1.017
07:BROADWAY	0.83	99.7	30	192.8	166.2	1.302	-0.493	0.808
06:ANDREW SQ.	0.74	120.2	30	170.0	141.1	1.189	-0.295	0.894
05:COLUMBIA	0.71	100.6	30	184.9	153.7	1.079	-0.460	0.619
04:SAVIN HILLS	1.00	141.0	30	169.2	149.7	1.373	-0.579	0.794
03:FIELDS CORNER	0.58	144.8	30	158.6	111.6	0.929	-0.281	0.648
02:SHAWMUT	0.62	184.0	30	149.1	85.8	0.782	-0.274	0.509
01:ASHMONT	0	0	180	0	0	0	0	0
Total	11.81	1955.9	630	183.2	144.5	18.846	-8.098	10.747

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

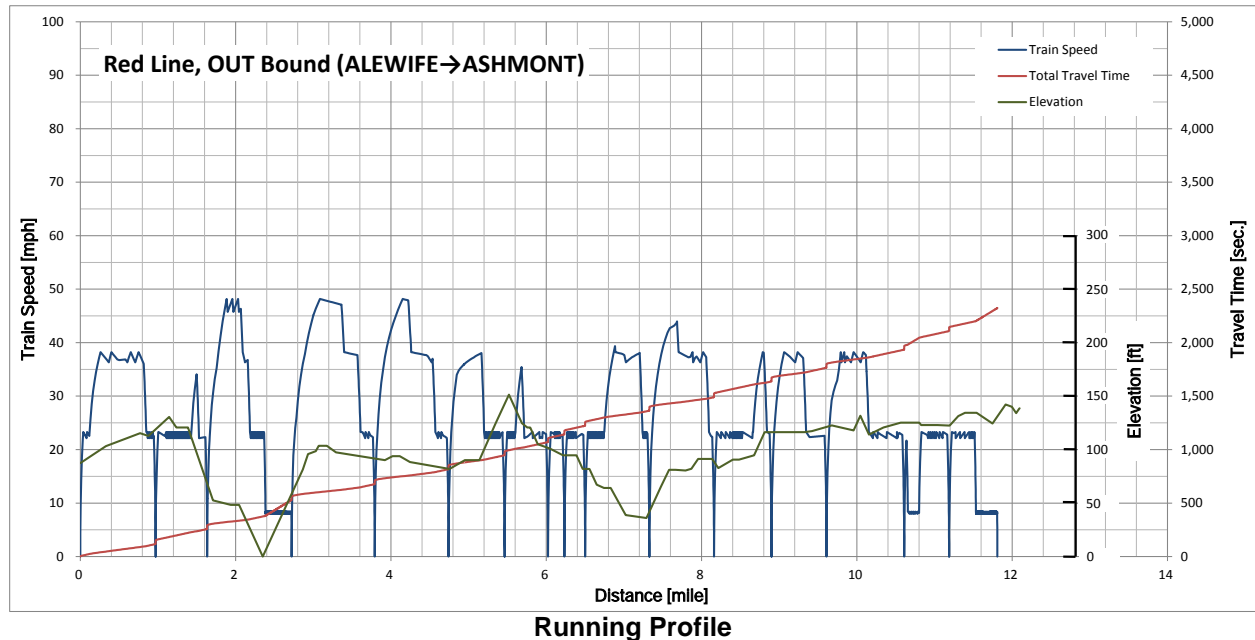


FIGURE I.1G- 24
Running Simulation Results (Abnormal) for Powering @ 530 VDC and braking at 660 VDC
(BRAINTREE – ALEWIFE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
01:BRAINTREE	1.87	183.6	0	168.8	157.2	1.644	-1.049	0.595
02:QUINCY ADAMS	1.34	138.5	30	182.4	166.9	1.503	-0.825	0.678
03:QUINCY CENTER	1.26	131.9	30	192.4	177.9	1.859	-0.766	1.093
04:WOLLASTON	0.79	91.5	30	207.5	177.7	1.234	-0.607	0.627
05:NORTH QUINCY	3.52	324.6	30	151.1	152.1	3.476	-1.374	2.102
06:COLUMBIA	0.74	126.7	30	168.7	134.8	1.094	-0.359	0.736
07:ANDREW SQ.	0.83	94.1	30	211.4	187.2	1.371	-0.708	0.663
08:BROADWAY	0.83	122.8	30	186.6	163.8	1.211	-0.716	0.496
09:SOUTH STATION	0.27	51.8	30	222.0	162.4	0.721	-0.169	0.552
10:WASHINGTON	0.21	42.9	30	235.7	165.3	0.617	-0.163	0.455
11:PARK ST.	0.56	87.1	30	192.9	159.2	1.124	-0.266	0.858
12:CHARLES	0.72	90.7	30	240.9	221.2	1.462	-1.014	0.449
13:KENDALL	0.95	108.1	30	190.8	166.1	1.386	-0.571	0.816
14:CENTRAL SQ.	1.07	213.1	30	141.4	110.4	1.244	-0.496	0.748
15:HARVARD SQ.	1.09	215.0	30	177.4	137.5	1.456	-1.104	0.352
16:PORTER SQ	0.67	105.2	30	203.2	183.3	1.910	-0.248	1.662
17:DAVIS SQ	0.97	140.9	30	173.4	143.2	1.126	-0.673	0.453
18:ALEWIFE	0	0	180	0	0	0	0	0
Total	17.68	2268.6	660	182.0	158.7	24.440	-11.106	13.334

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

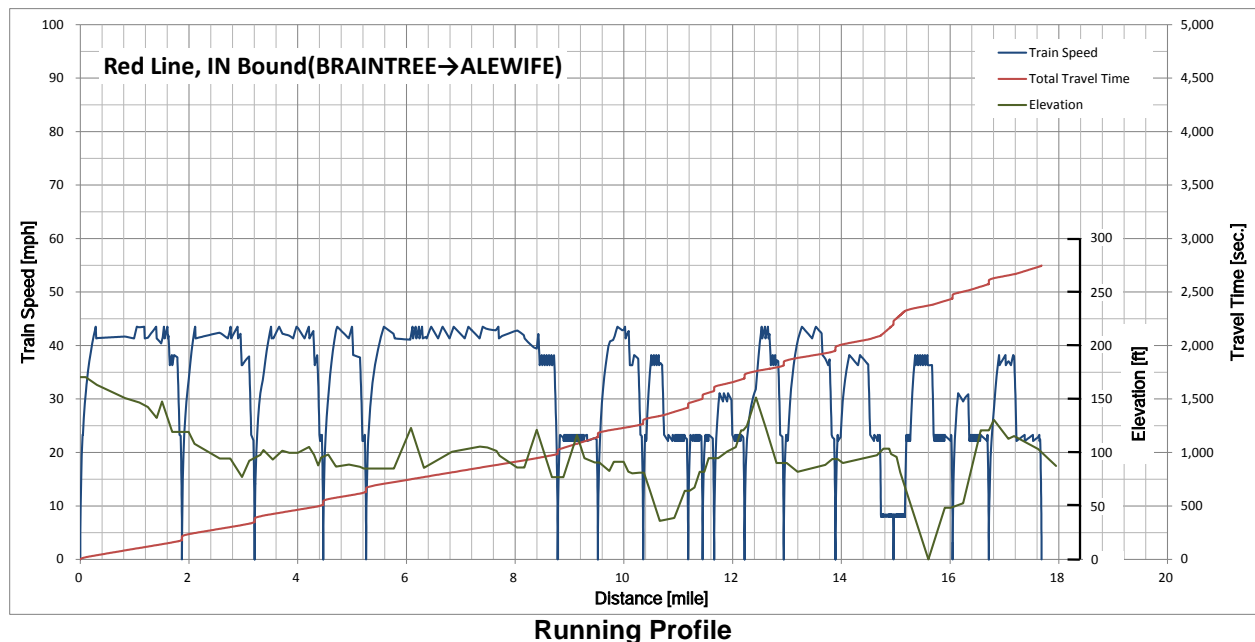


FIGURE I.1G- 25
Running Simulation Results (Abnormal) for Powering @ 530 VDC and braking at 660 VDC
(ALEWIFE - BRAINTREE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
18:ALEWIFE	0.97	122.3	0	187.8	160.6	1.598	-0.511	1.086
17:DAVIS SQ	0.67	115.1	30	180.0	119.2	0.388	-0.785	-0.397
16:PORTER SQ	1.09	243.3	30	198.5	148.5	2.620	-0.833	1.787
15:HARVARD SQ.	1.07	167.4	30	163.6	133.2	1.324	-0.592	0.732
14:CENTRAL SQ.	0.95	113.7	30	183.2	158.0	1.237	-0.554	0.682
13:KENDALL	0.72	103.1	30	215.6	188.4	1.838	-0.608	1.231
12:CHARLES	0.56	97.5	30	159.0	101.5	0.365	-0.355	0.010
11:PARK ST.	0.21	42.9	30	234.1	146.6	0.388	-0.276	0.112
10:WASHINGTON	0.27	51.8	30	217.6	137.3	0.388	-0.315	0.073
09:SOUTH STATION	0.83	113.3	30	197.2	169.8	1.576	-0.593	0.983
08:BROADWAY	0.83	99.6	30	195.8	169.9	1.349	-0.513	0.836
07:ANDREW SQ.	0.74	105.0	30	208.4	187.8	1.360	-0.784	0.576
06:COLUMBIA	3.52	306.3	30	149.6	150.0	3.531	-1.098	2.433
05:NORTH QUINCY	0.79	134.7	30	140.4	104.0	0.765	-0.180	0.585
04:WOLLASTON	1.26	129.6	30	190.4	174.3	1.784	-0.761	1.022
03:QUINCY CENTER	1.34	133.2	30	188.9	175.5	2.124	-0.698	1.426
02:QUINCY ADAMS	1.87	217.8	30	156.9	149.2	2.684	-0.658	2.025
01:BRAINTREE	0	0	180	0	0	0	0	0
Total	17.68	2296.5	660	180.8	152.8	25.318	-10.116	15.202

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

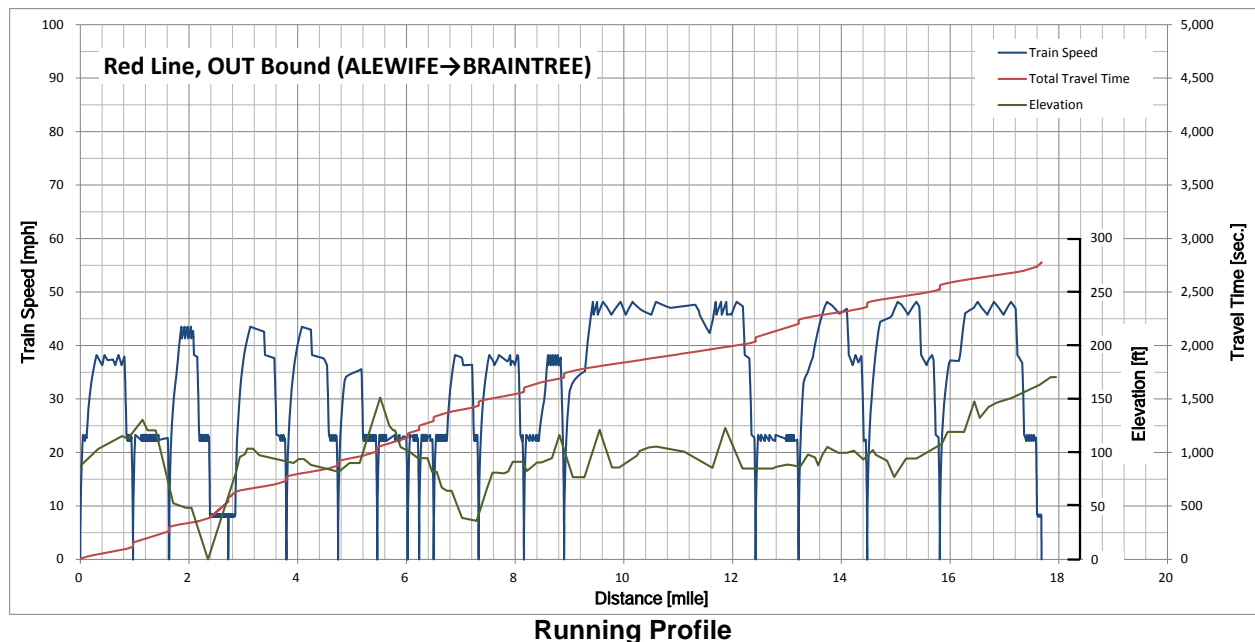


FIGURE I.1G- 26
Running Simulation Results (Abnormal) for Powering @ 600 VDC and braking at 700 VDC
(ASHMONT – ALEWIFE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
01:ASHMONT	0.62	93.9	0	199.8	160.9	1.194	-0.619	0.575
02:SHAWMUT	0.58	95.9	30	187.8	137.3	0.892	-0.520	0.372
03:FIELDS CORNER	1.00	146.0	30	162.5	125.9	1.253	-0.575	0.678
04:SAVIN HILLS	0.71	109.3	30	175.5	132.4	1.049	-0.469	0.580
05:COLUMBIA	0.74	126.8	30	145.3	86.5	0.450	-0.365	0.085
06:ANDREW SQ.	0.83	94.1	30	204.5	169.4	1.358	-0.707	0.651
07:BROADWAY	0.83	133.0	30	183.7	144.4	1.279	-0.771	0.507
08:SOUTH STATION	0.27	51.8	30	221.8	144.7	0.723	-0.173	0.550
09:WASHINGTON	0.21	42.9	30	235.2	146.7	0.613	-0.165	0.448
10:PARK ST.	0.56	83.2	30	209.2	165.7	1.366	-0.424	0.942
11:CHARLES	0.72	90.6	30	234.2	204.4	1.499	-1.046	0.453
12:KENDALL	0.95	107.8	30	184.1	148.0	1.344	-0.552	0.792
13:CENTRAL SQ.	1.07	213.2	30	138.5	97.4	1.214	-0.477	0.736
14:HARVARD SQ.	1.09	215.1	30	171.5	123.2	1.372	-1.086	0.286
15:PORTER SQ.	0.67	102.5	30	209.2	173.6	2.050	-0.372	1.678
16:DAVIS SQ.	0.97	137.3	30	172.1	137.3	1.201	-0.721	0.480
17:ALEWIFE	0	0	180	0	0	0	0	0
Total	11.81	1843.4	630	182.8	140.3	18.857	-9.041	9.816

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

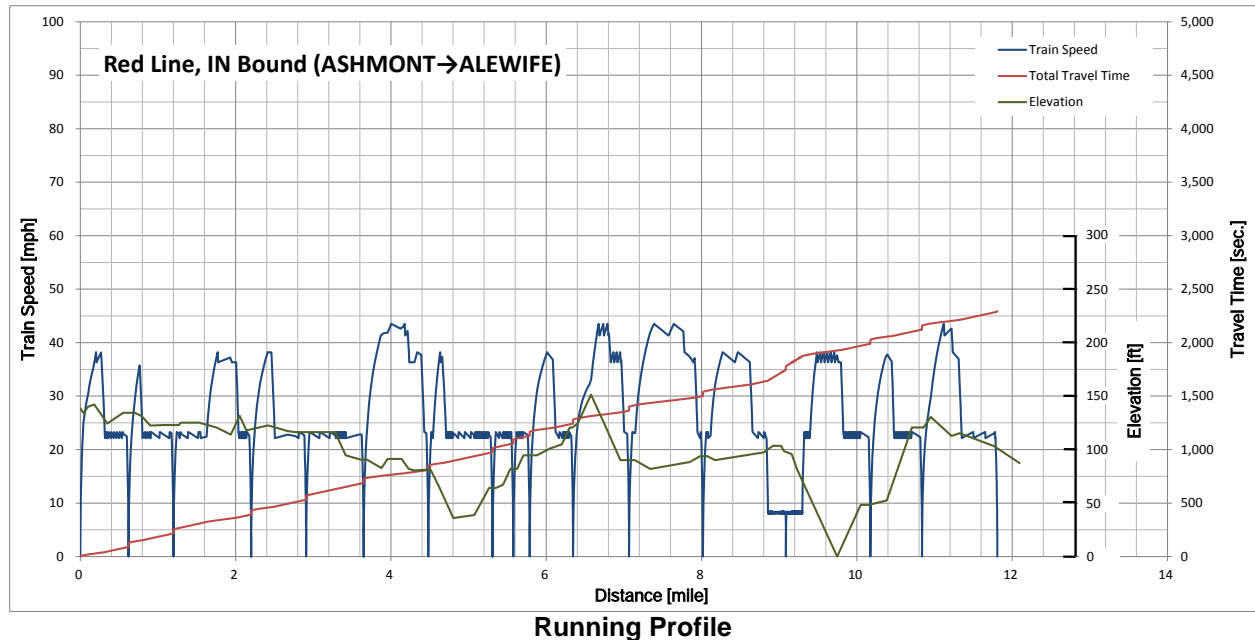


FIGURE I.1G- 27
Running Simulation Results (Abnormal) for Powering @ 600 VDC and braking at 700 VDC
(ALEWIFE - ASHMONT)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
17:ALEWIFE	0.97	121.4	0	180.8	143.1	1.571	-0.503	1.068
16:DAVIS SQ	0.67	114.5	30	179.9	109.6	0.385	-0.779	-0.394
15:PORTER SQ	1.09	241.8	30	194.1	134.7	2.646	-0.847	1.799
14:HARVARD SQ.	1.07	167.4	30	159.1	119.9	1.304	-0.592	0.712
13:CENTRAL SQ.	0.95	113.8	30	178.0	142.6	1.229	-0.562	0.666
12:KENDALL	0.72	104.0	30	209.0	167.4	1.803	-0.624	1.179
11:CHARLES	0.56	94.0	30	191.3	135.5	0.767	-0.594	0.173
10:PARK ST.	0.21	42.9	30	234.1	132.2	0.385	-0.278	0.107
09:WASHINGTON	0.27	51.9	30	215.8	122.1	0.374	-0.310	0.063
08:SOUTH STATION	0.83	113.8	30	196.6	155.8	1.644	-0.638	1.005
07:BROADWAY	0.83	99.7	30	187.7	149.3	1.294	-0.494	0.799
06:ANDREW SQ.	0.74	120.2	30	168.2	125.3	1.179	-0.295	0.884
05:COLUMBIA	0.71	100.6	30	180.9	138.1	1.072	-0.461	0.610
04:SAVIN HILLS	1.00	141.0	30	164.6	134.7	1.363	-0.581	0.782
03:FIELDS CORNER	0.58	144.8	30	158.3	99.1	0.922	-0.281	0.641
02:SHAWMUT	0.62	184.0	30	149.0	76.5	0.777	-0.274	0.503
01:ASHMONT	0	0	180	0	0	0	0	0
Total	11.81	1955.8	630	180.2	129.8	18.715	-8.115	10.600

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

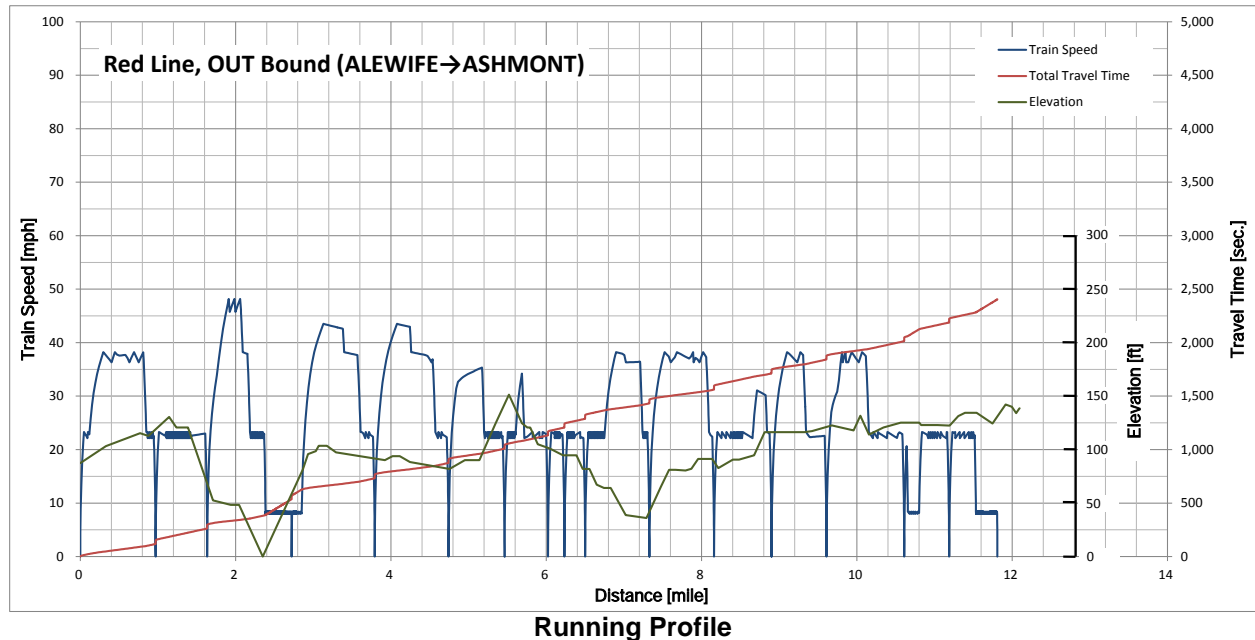


FIGURE I.1G- 28
Running Simulation Results (Abnormal) for Powering @ 600 VDC and braking at 700 VDC
(BRAINTREE – ALEWIFE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
01:BRAINTREE	1.87	183.6	0	162.2	143.7	1.634	-1.056	0.578
02:QUINCY ADAMS	1.34	138.5	30	175.8	151.9	1.494	-0.830	0.664
03:QUINCY CENTER	1.26	131.9	30	185.4	161.0	1.848	-0.770	1.078
04:WOLLASTON	0.79	91.5	30	202.4	160.6	1.226	-0.609	0.618
05:NORTH QUINCY	3.52	324.6	30	143.0	138.1	3.460	-1.384	2.076
06:COLUMBIA	0.74	126.7	30	167.9	119.9	1.085	-0.359	0.726
07:ANDREW SQ.	0.83	94.1	30	204.7	169.9	1.363	-0.712	0.652
08:BROADWAY	0.83	122.8	30	183.1	148.3	1.202	-0.718	0.483
09:SOUTH STATION	0.27	51.8	30	221.4	144.0	0.717	-0.169	0.548
10:WASHINGTON	0.21	42.9	30	235.2	146.4	0.613	-0.163	0.450
11:PARK ST.	0.56	87.1	30	190.2	141.3	1.114	-0.267	0.848
12:CHARLES	0.72	90.7	30	232.7	201.8	1.451	-1.020	0.431
13:KENDALL	0.95	108.1	30	185.3	149.8	1.378	-0.573	0.805
14:CENTRAL SQ.	1.07	213.1	30	139.0	98.9	1.236	-0.497	0.739
15:HARVARD SQ.	1.09	215.0	30	174.5	124.7	1.444	-1.108	0.336
16:PORTER SQ	0.67	105.2	30	199.4	161.9	1.899	-0.248	1.651
17:DAVIS SQ	0.97	140.9	30	170.1	129.6	1.119	-0.675	0.444
18:ALEWIFE	0	0	180	0	0	0	0	0
Total	17.68	2268.6	660	177.3	143.3	24.284	-11.159	13.125

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

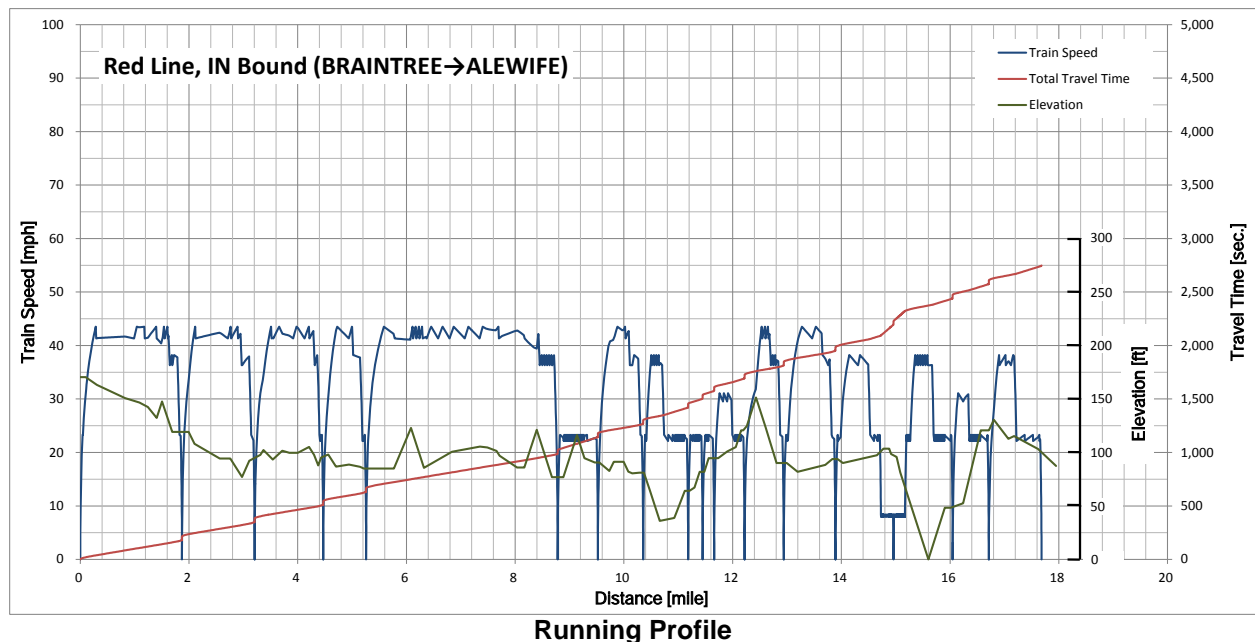
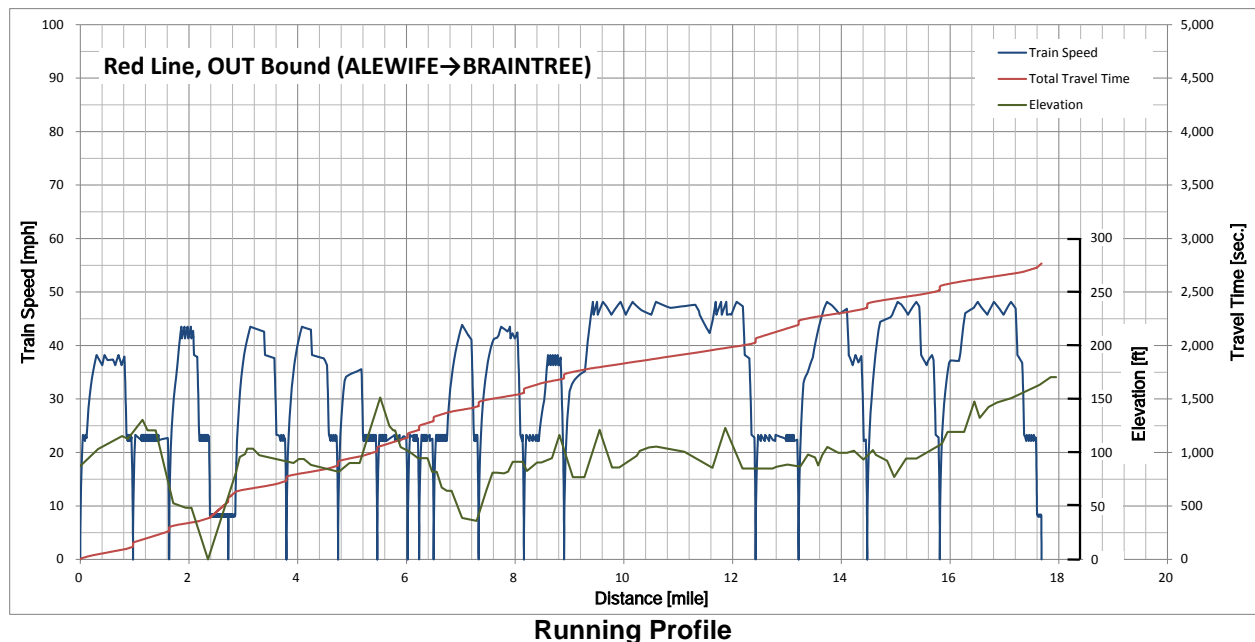


FIGURE I.1G- 29
Running Simulation Results (Abnormal) for Powering @ 600 VDC and braking at 700 VDC
(ALEWIFE - BRAINTREE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
18:ALEWIFE	0.97	122.3	0	183.2	143.5	1.587	-0.512	1.075
17:DAVIS SQ	0.67	115.1	30	179.8	109.6	0.385	-0.785	-0.400
16:PORTER SQ	1.09	243.3	30	195.3	134.1	2.603	-0.839	1.763
15:HARVARD SQ.	1.07	167.4	30	160.1	120.3	1.315	-0.594	0.721
14:CENTRAL SQ.	0.95	113.7	30	178.7	142.5	1.229	-0.556	0.672
13:KENDALL	0.72	103.1	30	209.5	168.2	1.823	-0.608	1.215
12:CHARLES	0.56	97.5	30	158.9	91.9	0.362	-0.355	0.007
11:PARK ST.	0.21	42.9	30	233.8	132.0	0.385	-0.277	0.109
10:WASHINGTON	0.27	51.8	30	217.5	124.1	0.385	-0.317	0.069
09:SOUTH STATION	0.83	109.8	30	201.8	163.9	1.748	-0.699	1.048
08:BROADWAY	0.83	94.1	30	207.2	173.9	1.581	-0.653	0.928
07:ANDREW SQ.	0.74	105.0	30	203.0	170.1	1.351	-0.788	0.563
06:COLUMBIA	3.52	306.3	30	141.4	135.6	3.511	-1.107	2.404
05:NORTH QUINCY	0.79	134.8	30	140.1	92.4	0.761	-0.183	0.578
04:WOLLASTON	1.26	129.6	30	183.2	157.8	1.773	-0.766	1.008
03:QUINCY CENTER	1.34	133.2	30	181.4	158.4	2.113	-0.702	1.411
02:QUINCY ADAMS	1.87	217.8	30	150.5	133.9	2.670	-0.662	2.008
01:BRAINTREE	0	0	180	0	0	0	0	0
Total	17.68	2287.6	660	177.5	139.3	25.583	-10.403	15.180

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.



Travel Time and Average Speed (Abnormal Conditions)

CSR Sifang JV has calculated travel time and average speed under abnormal conditions as a result of the aforementioned simulation. TABLE I.1G-5: 'Travel Times and Average Speeds (Abnormal Conditions) in Each Direction' documents these results.

**TABLE I.1G-5
Travel Times and Average Speeds (Abnormal Conditions) in Each Direction**

Direction	Travel Time	Average Speed
	[second]	[mph]
ASHMONT→ALEWIFE (INBOUND) (Not include the dwell time at each station.)	1844	23.1
ASHMONT→ALEWIFE (INBOUND) (Include the dwell time at each station.)	2474	18.5
ALEWIFE→ASHMONT (OUTBOUND) (Not include the dwell time at each station.)	1956	21.7
ALEWIFE→ASHMONT (OUTBOUND) (Include the dwell time at each station.)	2586	17.6
BRAINTREE→ALEWIFE (INBOUND) (Not include the dwell time at each station.)	2269	28.0
BRAINTREE→ALEWIFE (INBOUND) (Include the dwell time at each station.)	2929	23.2
ALEWIFE→BRAINTREE (OUTBOUND) (Not include the dwell time at each station.)	2297	27.7
ALEWIFE→BRAINTREE (OUTBOUND) (Include the dwell time at each station.)	3575	22.9

Rated Motor Current and Motor Capacity (Abnormal Conditions)

CSR Sifang JV has calculated rated motor current and motor capacity under abnormal conditions as a result of the aforementioned simulation. Calculation conditions include a motor voltage of 440 VDC, a power factor of 0.785, and an efficiency of 0.930. Values cited below include dwell time considerations at each station. The motor capacity at the duty cycle rating is 90 KW. TABLE I.1G-6: 'Rated Motor Current and Motor Capacity (Abnormal Conditions)' documents these results.

**TABLE I.1G-6
Rated Motor Current and Motor Capacity (Abnormal Conditions)**

Condition	Direction	Rated Motor Current	Motor Capacity (Continuance)
		[Amps]	[kW]
Abnormal operation	Red Line round trip	161.4	89.8

Equipment Thermal Capacities (Abnormal Conditions)

CSR Sifang JV has calculated equipment thermal capacities under abnormal conditions as a result of the aforementioned simulation. Calculation conditions consider an ambient temperature of 49 degrees C. Operationally, round trips are considered continuous at a 16% cut out in duty cycle for each route. TABLE I.1G-7: 'Maximum Temperature of Equipment (Abnormal Conditions)' documents these results.

**TABLE I.1G-7
Maximum Temperature of Equipment (Abnormal Conditions)**

Equipment	Specified limit	Estimated temperature
Traction Motor winding	220°C	214.2°C
IGBT junction in Inverter	150°C	104.4°C
IGBT junction in Brake Chopper	150°C	125.9°C

Towing Operations

CSR Sifang JV has calculated towing condition impacts at the maximum gradient with good results. The assumptions used for calculation include:

- Train configuration: 1 normal condition vehicle (AW3) + 1 dead vehicle (AW3)
1 normal condition vehicle (AW0) + 1 dead vehicle (AW0)
- Maximum vertical grade: 4% (Red Line)
- Train resistance at starting: 39.2 N/ton
- Uphill acceleration: 0.19 mphps

TABLE I.1G-8: 'Towing Operation Performance' documents these results.

**TABLE I.1G-8
Towing Operation Performance**

	Load	Acceleration [mphps]	Result
Red Line 4 %	AW0	0.54	Enable
	AW3	0.52	Enable

Regenerative Rate Operations

CSR Sifang JV has calculated regenerative rate impacts with good results. The assumptions used for calculation include:

- Line voltage: Braking at 660 VDC
- Car formation: 3 married pairs (6 cars)
- Train load: AW3
- Wheel diameter: 28 inches
- Operation section: Straight, level tangent and dry track

TABLE I.1G-9: 'Regenerative Rate Performance' documents these results.

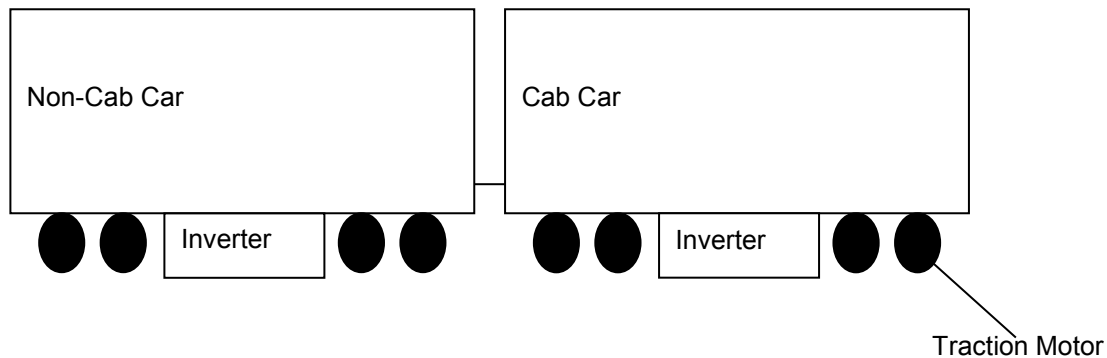
**TABLE I.1G-9
Regenerative Rate Performance**

Speed	Regenerative rate required	Regenerative rate at simulation	Result
42→5 mph (67.6→8 km/h)	Above 72 %	87 %	Pass
50→5 mph (80.5→8 km/h)	Above 65 %	83 %	Pass

ORANGE LINE VEHICLE PERFORMANCE

To initiate vehicle performance verification, several assumptions have been made. FIGURE I.1G-36: 'Vehicle Configuration' defines the proposed vehicle configuration. TABLE I.1G-10: 'Orange Line Vehicle Load' describes the proposed loading configuration used for subsequent analysis.

**FIGURE I.1G-30
Vehicle Configuration**



**TABLE I.1G-10
Orange Line Vehicle Load**

ORANGE LINE CAB CAR				ORANGE LINE NON CAB CAR			
Load	Car Weight	Car Load	Total Weight	Load	Car Weight	Load Weight	Total Weight
AW0	75,125 (34,076)	0 (0)	75,125 (34,076)	AW0	72,800 (33,021)	0 (0)	72,800 (33,021)
AW1	75,125 (34,076)	5,890 (2,672)	81,015 (36,748)	AW1	72,800 (33,021)	6,820 (3,094)	79,620 (36,115)
AW2	75,125 (34,076)	20,460 (9,281)	95,585 (43,357)	AW2	72,800 (33,021)	22,010 (9,984)	94,810 (43,005)
AW3	75,125 (34,076)	34,875 (15,819)	110,000 (49,895)	AW3	72,800 (33,021)	37,200 (16,874)	110,000 (49,895)

Motoring

CSR Sifang JV has utilized the following motoring characteristics in the determination of Orange Line vehicle performance, including:

- Wheel Diameter – 28 inches
- Gear Ratio – 6.133
- Acceleration at Starting – 2.75 mphps
- Train Resistance at Starting – 39.2 N/ton
- Car Formation – 3 married pairs

The following Figures define the motor characteristics at various loading and voltage levels, including:

- FIGURE I.1G-31: 'Motor Characteristics at Powering (530 VDC, AW2)
- FIGURE I.1G-32: 'Motor Characteristics at Powering (530 VDC, AW3)

- FIGURE I.1G-33: 'Motor Characteristics at Powering (600 VDC, AW2)
- FIGURE I.1G-34: 'Motor Characteristics at Powering (600 VDC, AW3)
- FIGURE I.1G-35: 'Motor Characteristics at Powering (700 VDC, AW2)

The acceleration rate between 530 and 700 VDC and loading at AW2 maintains 2.75 +/- 5% mphps from 0 to 16.3 +/- 0.2 as described in the aforementioned Figures. The acceleration rate of 2.75 mphps is available to at least 16.3 mph. Adhesion level was adjusted to become approximately 14%.

**FIGURE I.1G-31
Motor Characteristics at Powering (530 VDC, AW2)**

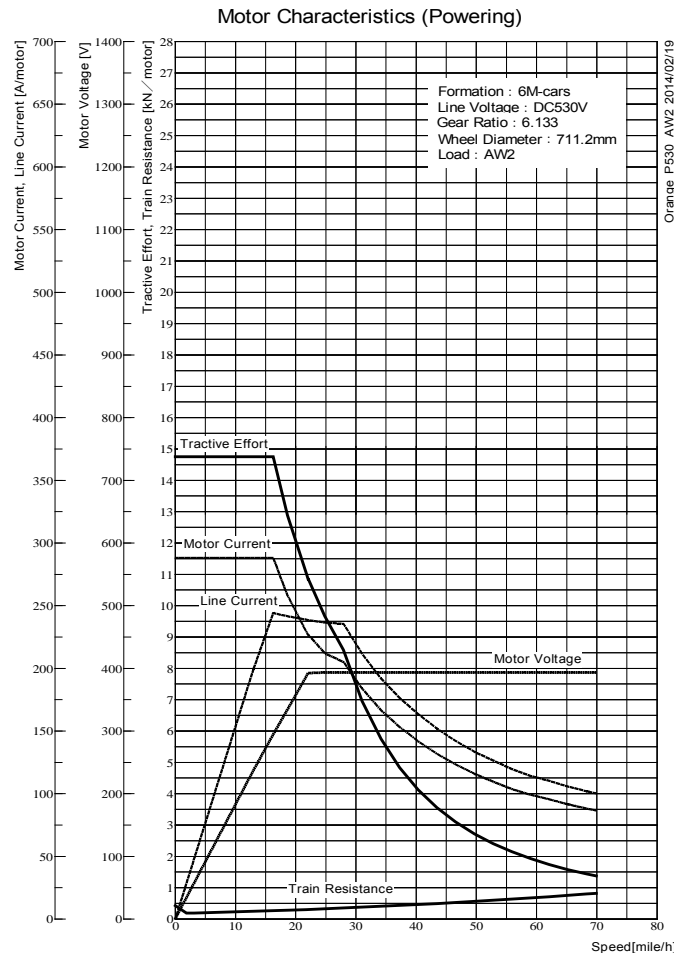


FIGURE I.1G-32
Motor Characteristics at Powering (530 VDC, AW3)

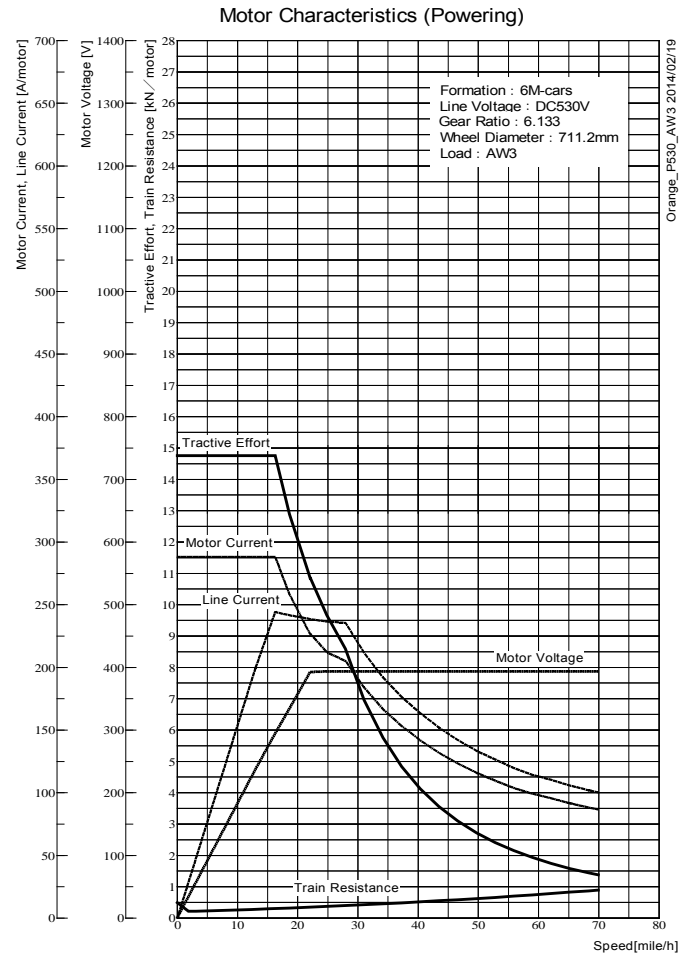
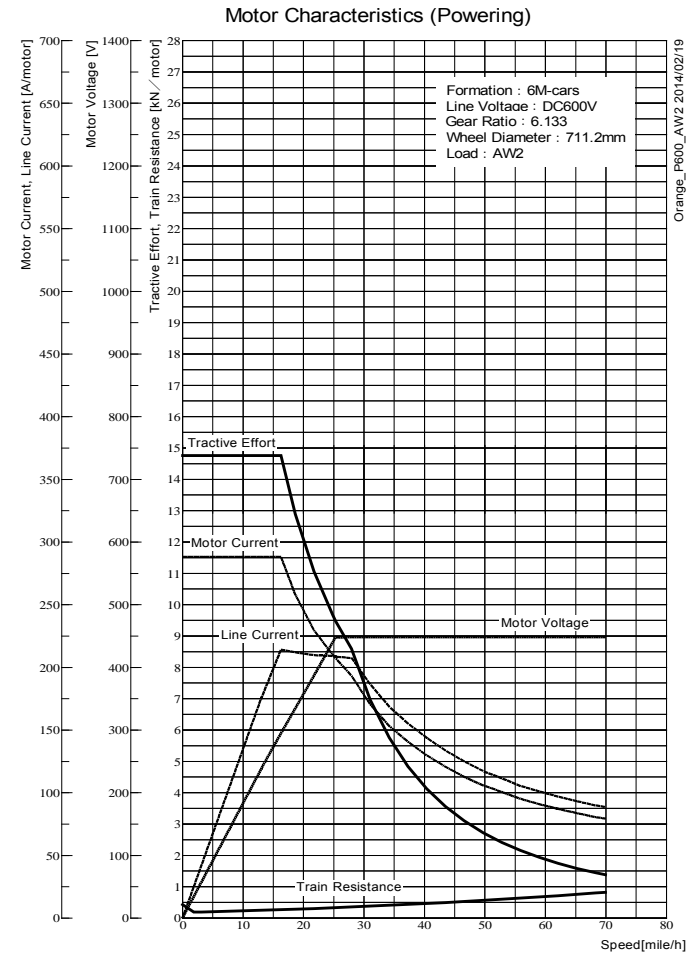
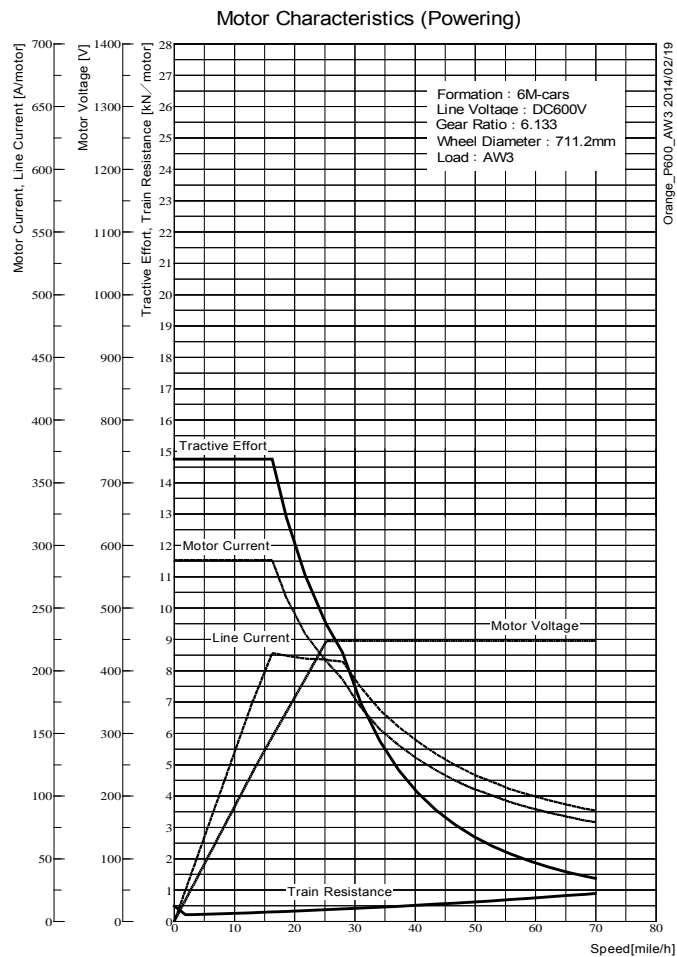


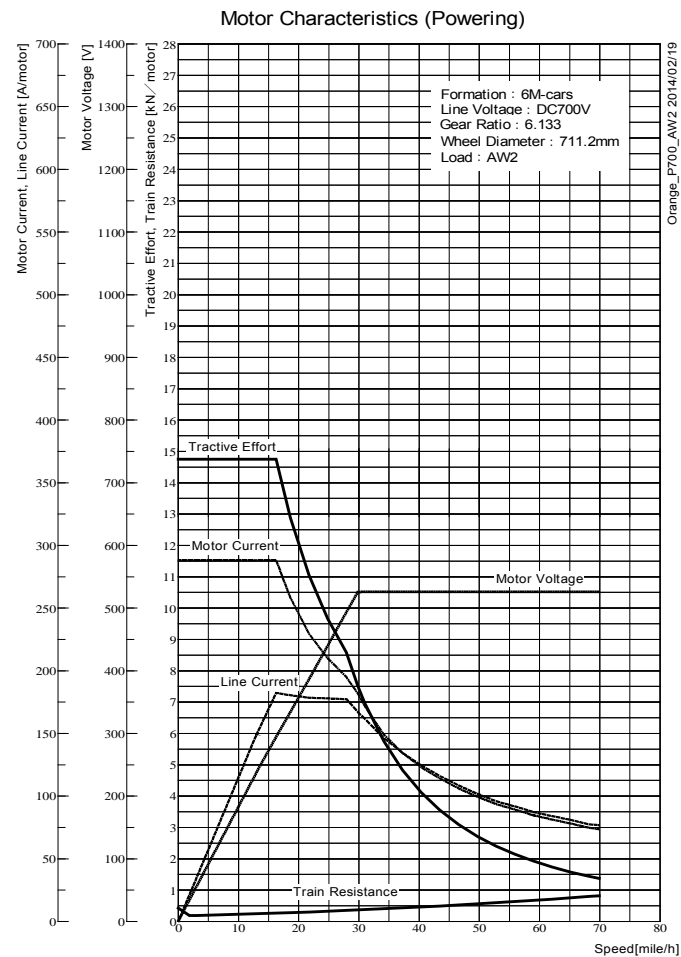
FIGURE I.1G-33
Motor Characteristics at Powering (600 VDC, AW2)



**FIGURE I.1G-34
Motor Characteristics at Powering (600 VDC, AW3)**



**FIGURE I.1G-35
Motor Characteristics at Powering (700 VDC, AW2)**



Braking

CSR Sifang JV has utilized the following motoring characteristics at braking in the determination of vehicle performance, including:

- Wheel Diameter – 28 inches
- Gear Ratio – 6.133
- Deceleration – 3.00 mphps
- Car formation – 3 married pairs (6 cars)
- Loading at AW0, AW2, and AW3

The following Figures define the braking characteristics at various loading and voltage levels, including:

- FIGURE I.1G-36: 'Motor Characteristics at Braking (600 VDC, AW2)'
- FIGURE I.1G-37: 'Motor Characteristics at Braking (600 VDC, AW3)'
- FIGURE I.1G-38: 'Motor Characteristics at Braking (660 VDC, AW2)'
- FIGURE I.1G-39: 'Motor Characteristics at Braking (660 VDC, AW3)'
- FIGURE I.1G-40: 'Motor Characteristics at Braking (700 VDC, AW2)'
- FIGURE I.1G-41: 'Motor Characteristics at Braking (700 VDC, AW3)'

The deceleration rate at 600 VDC to 700 VDC and AW3 maintains 3.0 mphps from 0 to 42 mph in accordance with the MBTA technical specification by means of dynamic brake only. For train speeds above 42 mph, a blending of both the friction and dynamic brakes maintain the required deceleration rate. At very low velocities, the friction brake only is required. Adhesion level was adjusted to become approximately 14%.

FIGURE I.1G-36
Motor Characteristics at Braking (600 VDC, AW2)

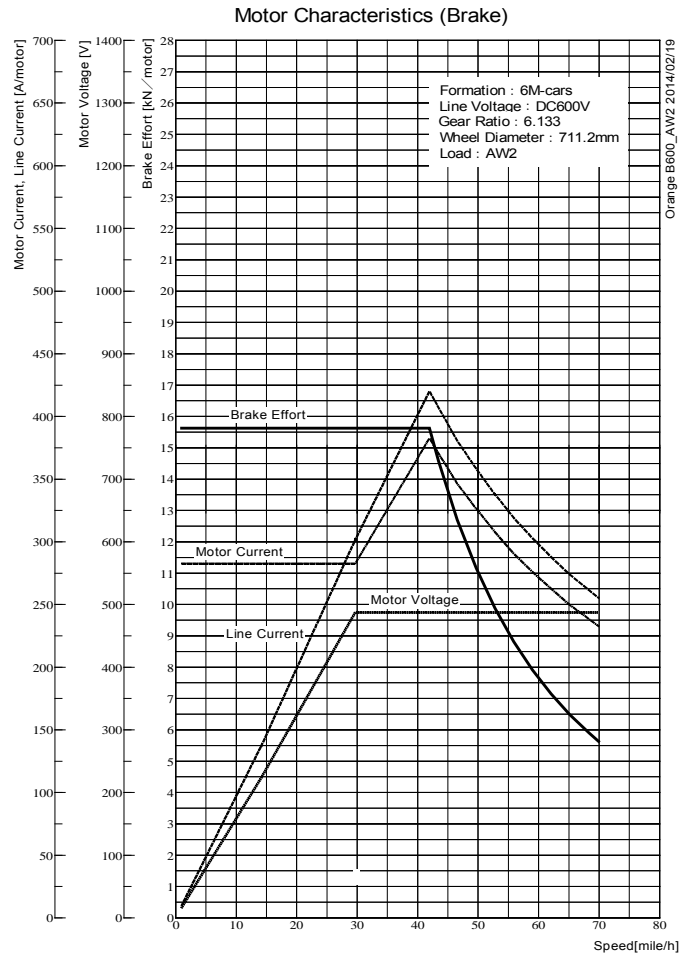


FIGURE I.1G-37
Motor Characteristics at Braking (600 VDC, AW3)

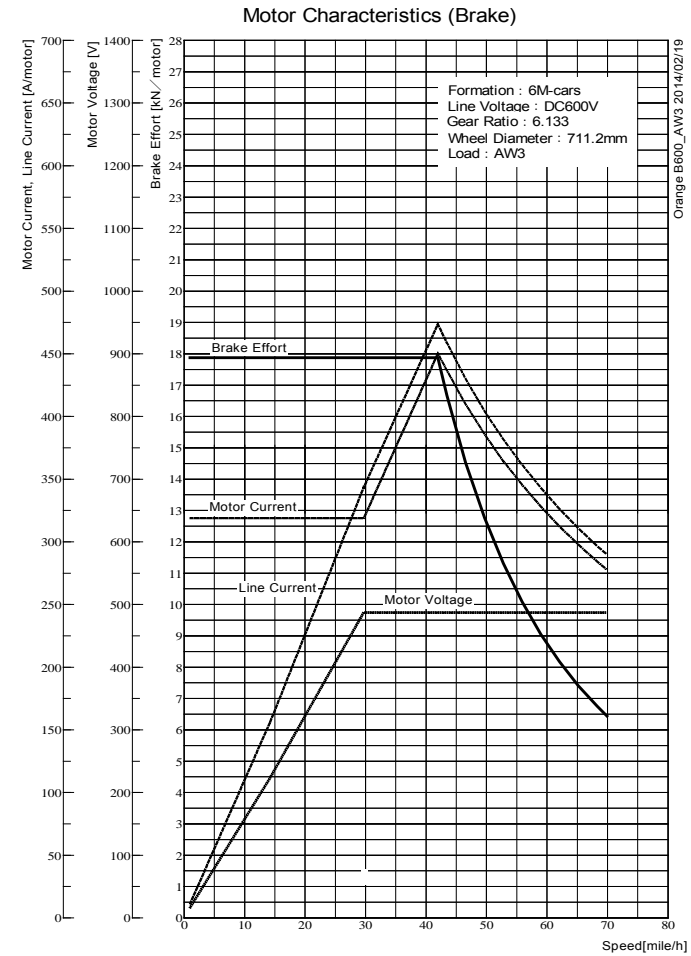


FIGURE I.1G-38
Motor Characteristics at Braking (660 VDC, AW2)

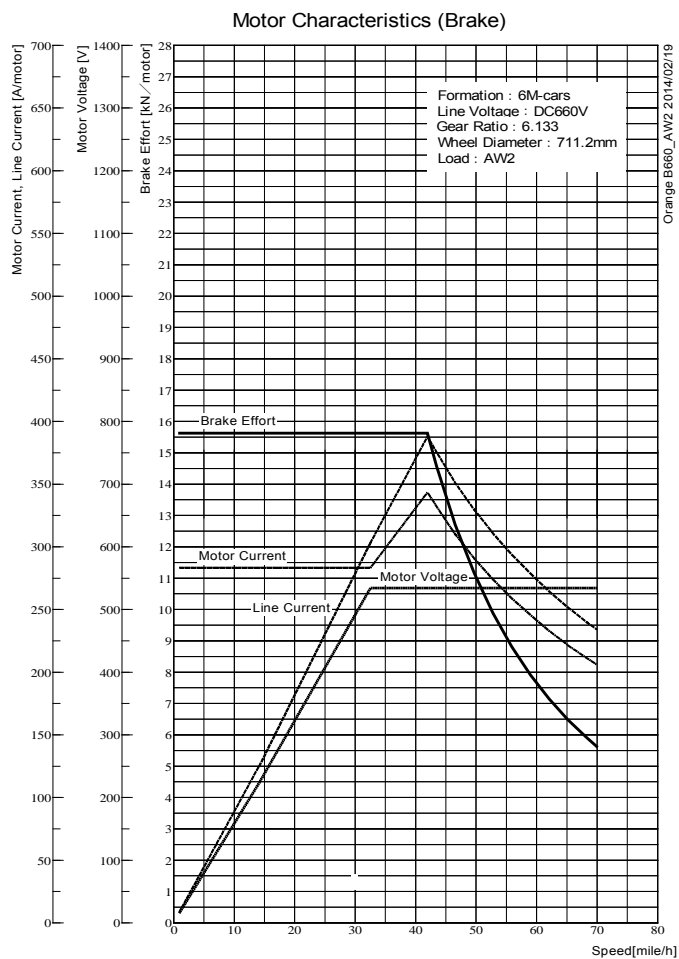


FIGURE I.1G-39
Motor Characteristics at Braking (660 VDC, AW3)

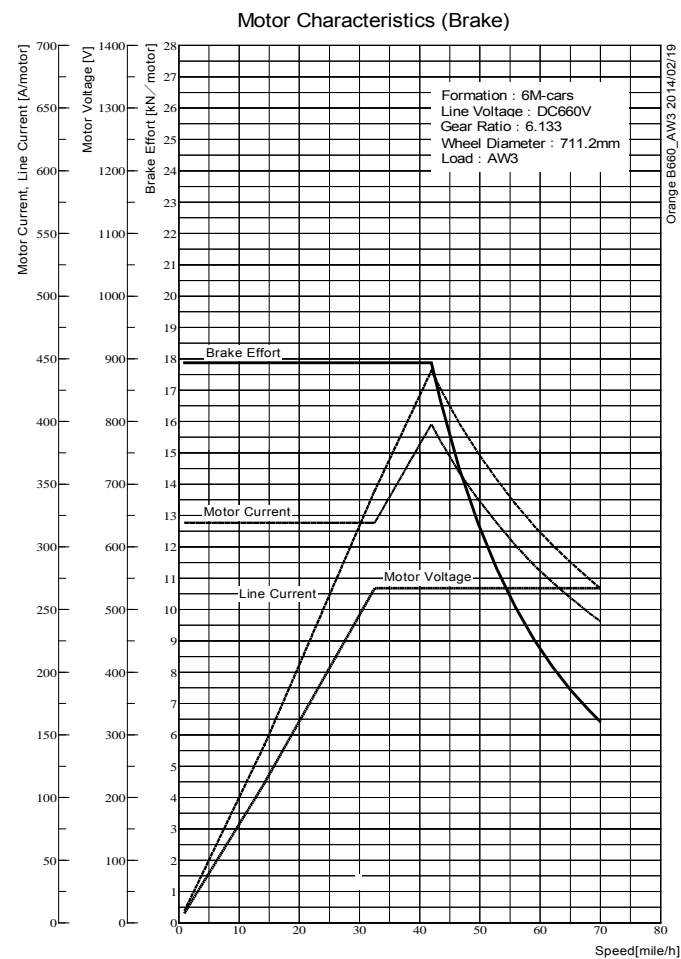


FIGURE I.1G-40
Motor Characteristics at Braking (700 VDC, AW2)

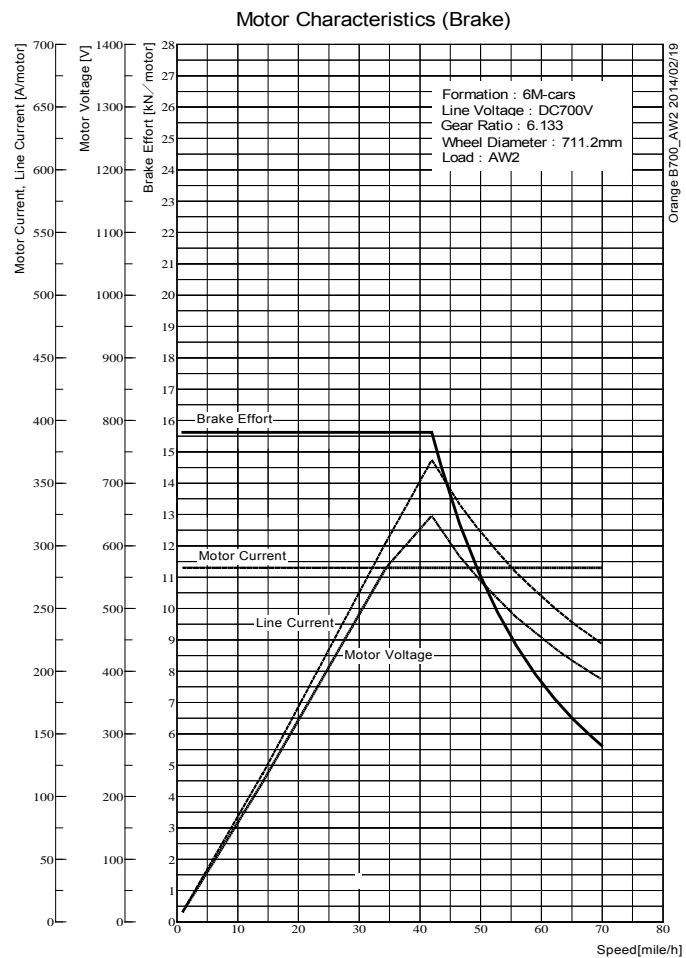
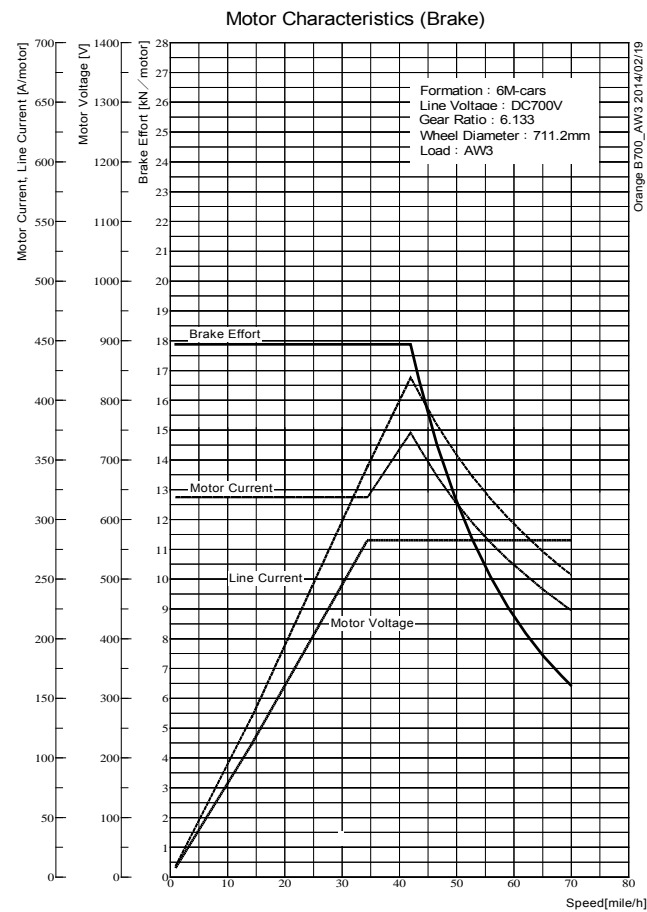


FIGURE I.1G-41
Motor Characteristics at Braking (700 VDC, AW3)



Duty Cycle Rating

CSR Sifang JV has utilized the following duty cycle ratings and assumptions, including:

- Line Voltage: Powering 530 VDC/Braking 660 VDC
Powering 600 VDC/Braking 700 VDC
- Car Formation – 3 married pairs (6 cars)
- Train Load – AW3
- Wheel Diameter – 28 inches
- Acceleration – maximum service rate
- Deceleration – maximum service rate
- Dwell Time – 30 seconds at each stop and 3 minutes at each end
- Operating Section – Red Line round trip

Simulation Results (Normal Conditions)

CSR Sifang JV is pleased to provide the following running simulation results under normal conditions summarized within the following Figures:

- FIGURE I.1G- 42: 'Running Simulation Results for Powering @ 530 VDC and braking at 660 VDC (FOREST HILLS – OAK GROVE)'
- FIGURE I.1G- 43: 'Running Simulation Results for Powering @ 530 VDC and braking at 660 VDC (OAK GROVE – FOREST HILLS)'
- FIGURE I.1G- 44: 'Running Simulation Results for Powering @ 600 VDC and braking at 700 VDC (FOREST HILLS – OAK GROVE)'
- FIGURE I.1G- 45: 'Running Simulation Results for Powering @ 600 VDC and braking at 700 VDC (OAK GROVE – FOREST HILLS)'

FIGURE I.1G- 42
Running Simulation Results for Powering @ 530 VDC and braking at 660 VDC (FOREST HILLS – OAK GROVE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
01:Forest Hills	0.69	76.9	0	206.3	185.2	1.129	-0.705	0.425
02:Green Street	0.51	63.7	30	193.0	154.6	0.701	-0.395	0.307
03:Stow y Brook	0.52	65.1	30	195.5	157.5	0.744	-0.417	0.327
04:Jackson Squire	0.55	67.2	30	191.4	153.8	0.684	-0.446	0.238
05:Roxbury Crossing	0.52	64.8	30	196.4	161.6	0.718	-0.472	0.247
06:Ruggles	0.41	54.6	30	211.4	169.7	0.717	-0.411	0.305
07:Massachusetts Avenue	0.69	115.7	30	148.8	115.1	0.700	-0.396	0.305
08:Back Bay	0.55	108.2	30	155.1	104.1	0.485	-0.427	0.058
09:N.E Medical Center	0.30	56.7	30	189.1	136.7	0.583	-0.193	0.390
10:China Tow n	0.27	50.5	30	184.9	125.8	0.452	-0.149	0.303
11:Dow ntow n Crossing	0.22	42.2	30	200.7	122.6	0.251	-0.274	-0.023
12:State Street	0.24	46.9	30	200.0	140.0	0.494	-0.190	0.303
13:Haymarket	0.25	47.5	30	191.1	117.7	0.288	-0.248	0.040
14:North Station	0.81	93.5	30	186.8	168.3	1.386	-0.545	0.841
15:Commonw ity College	0.83	85.1	30	214.6	201.8	1.588	-0.881	0.708
16:Sullivan Square	1.18	107.8	30	194.4	184.1	1.779	-0.907	0.872
17:Wellington	1.77	148.0	30	171.2	165.8	2.266	-0.908	1.358
18:Malden Center	0.78	81.4	30	213.2	197.1	1.562	-0.753	0.809
19:Oak Grove	0	0	180	0	0	0	0	0
Total	17.83	1375.8	690	188.8	158.1	16.529	-8.715	7.814

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

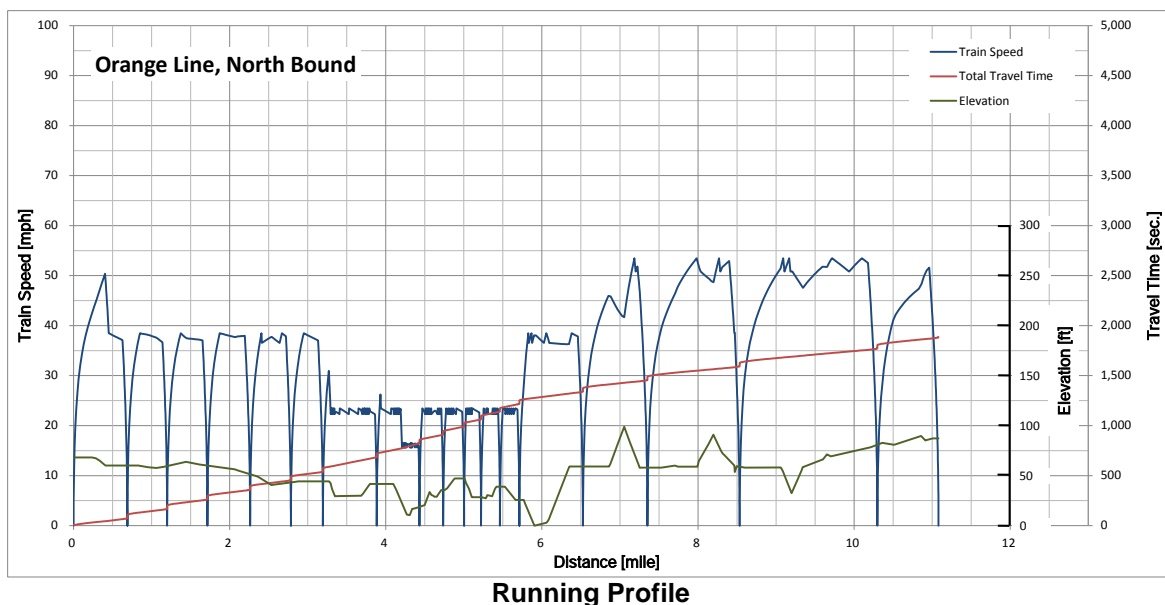


FIGURE I.1G- 43
Running Simulation Results for Powering @ 530 VDC and braking at 660 VDC (OAK GROVE – FOREST HILLS)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
19:Oak Grove	0.78	79.4	0	213.2	195.1	1.286	-0.833	0.452
18:Malden Center	1.77	183.4	30	129.6	115.3	1.070	-0.623	0.447
17:Wellington	1.18	110.0	30	188.2	176.6	1.614	-0.826	0.788
16:Sullivan Square	0.83	96.0	30	190.5	173.8	1.242	-0.723	0.519
15:Conoway College	0.81	93.6	30	193.3	175.6	1.023	-0.861	0.162
14:North Station	0.25	47.5	30	192.3	132.6	0.474	-0.151	0.323
13:Haymarket	0.24	46.7	30	196.7	125.4	0.329	-0.255	0.074
12:State Street	0.22	42.1	30	199.7	140.8	0.499	-0.113	0.386
11:Downtown Crossing	0.27	50.4	30	183.0	112.1	0.288	-0.229	0.059
10:Chinatown	0.30	56.4	30	188.6	123.2	0.359	-0.316	0.043
09:NE Medical Center	0.55	94.5	30	153.9	118.6	0.729	-0.212	0.517
08:Back Bay	0.69	98.8	30	167.6	136.4	0.886	-0.480	0.406
07:Massachusetts Avenue	0.41	54.5	30	211.5	169.6	0.705	-0.420	0.285
06:Ruggles	0.52	64.5	30	198.0	164.5	0.855	-0.416	0.439
05:Roxbury Crossing	0.55	67.9	30	193.4	158.5	0.834	-0.406	0.428
04:Jackson Squire	0.52	65.2	30	194.9	156.5	0.733	-0.418	0.315
03:Stoway Brook	0.51	63.6	30	197.1	160.8	0.758	-0.427	0.331
02:Green Street	0.69	78.1	30	205.8	185.6	1.235	-0.662	0.573
01:Forest Hills	0	0	180	0	0	0	0	0
Total	17.83	1392.8	690	184.3	153.2	14.918	-8.371	6.547

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

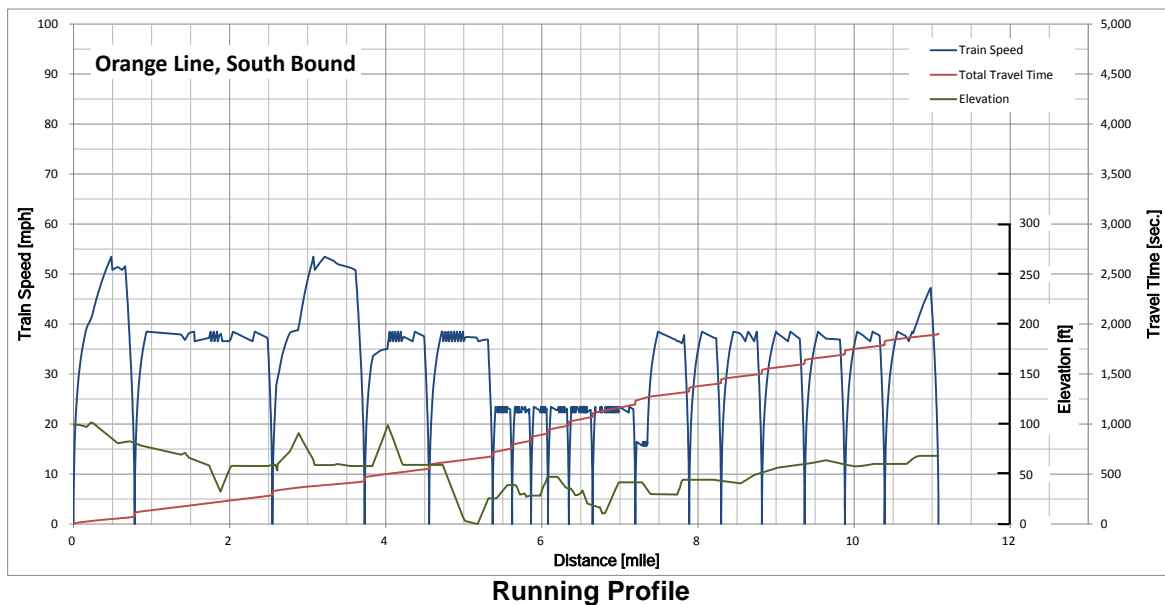


FIGURE I.1G- 44
Running Simulation Results for Powering @ 600 VDC and braking at 700 VDC (FOREST HILLS – OAK GROVE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
01:Forest Hills	0.69	76.9	0	200.3	168.9	0.993	-0.667	0.326
02:Green Street	0.51	63.7	30	190.2	139.6	0.617	-0.372	0.244
03:Stow y Brook	0.52	65.1	30	192.5	142.2	0.654	-0.394	0.261
04:Jackson Squire	0.55	67.2	30	188.6	139.4	0.602	-0.421	0.180
05:Roxbury Crossing	0.52	64.8	30	193.0	146.6	0.632	-0.445	0.186
06:Ruggles	0.41	54.6	30	208.2	153.3	0.630	-0.388	0.242
07:Massachusetts Avenue	0.69	115.7	30	148.0	103.6	0.616	-0.373	0.242
08:Back Bay	0.55	108.2	30	154.9	94.1	0.426	-0.403	0.023
09:N.E Medical Center	0.30	56.7	30	188.8	121.7	0.512	-0.182	0.330
10:China Tow n	0.27	50.5	30	184.8	111.8	0.397	-0.141	0.256
11:Dow ntow n Crossing	0.22	42.2	30	200.5	111.3	0.221	-0.259	-0.038
12:State Street	0.24	46.9	30	199.6	124.7	0.435	-0.177	0.257
13:Haymarket	0.25	47.5	30	191.0	106.3	0.253	-0.234	0.019
14:North Station	0.81	93.5	30	181.2	151.6	1.218	-0.515	0.703
15:Commonw ity College	0.83	85.1	30	206.7	183.9	1.397	-0.834	0.562
16:Sullivan Square	1.18	107.8	30	186.9	167.8	1.565	-0.860	0.705
17:Wellington	1.77	148.0	30	164.0	150.5	1.993	-0.860	1.133
18:Malden Center	0.78	81.4	30	206.0	179.1	1.374	-0.713	0.660
19:Oak Grove	0	0	180	0	0	0	0	0
Total	17.83	1375.8	690	184.9	143.2	14.532	-8.239	6.293

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

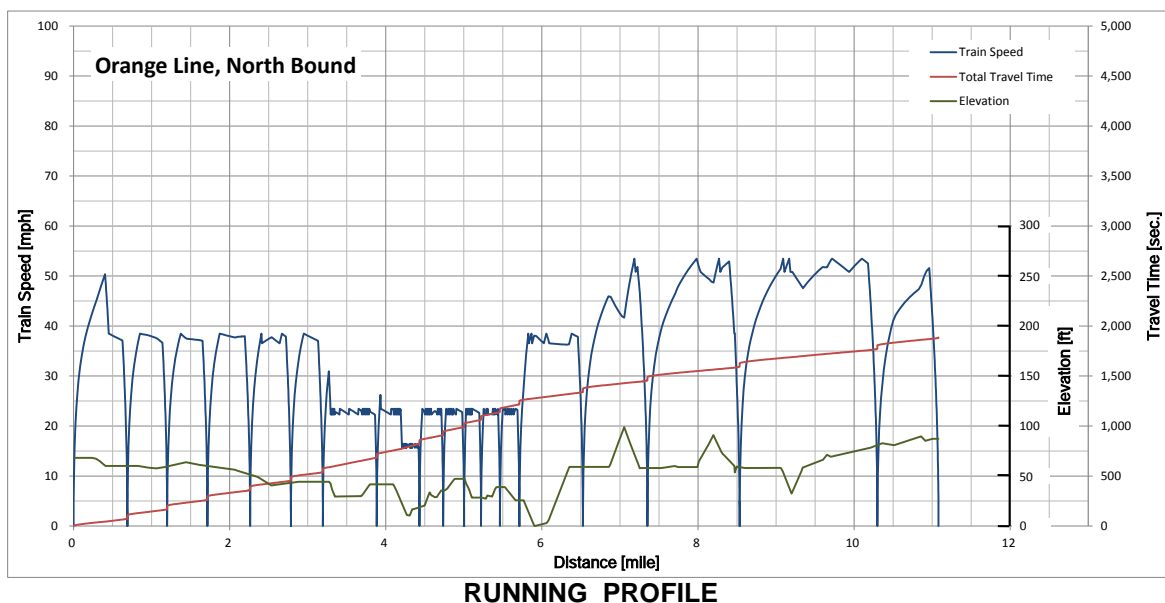
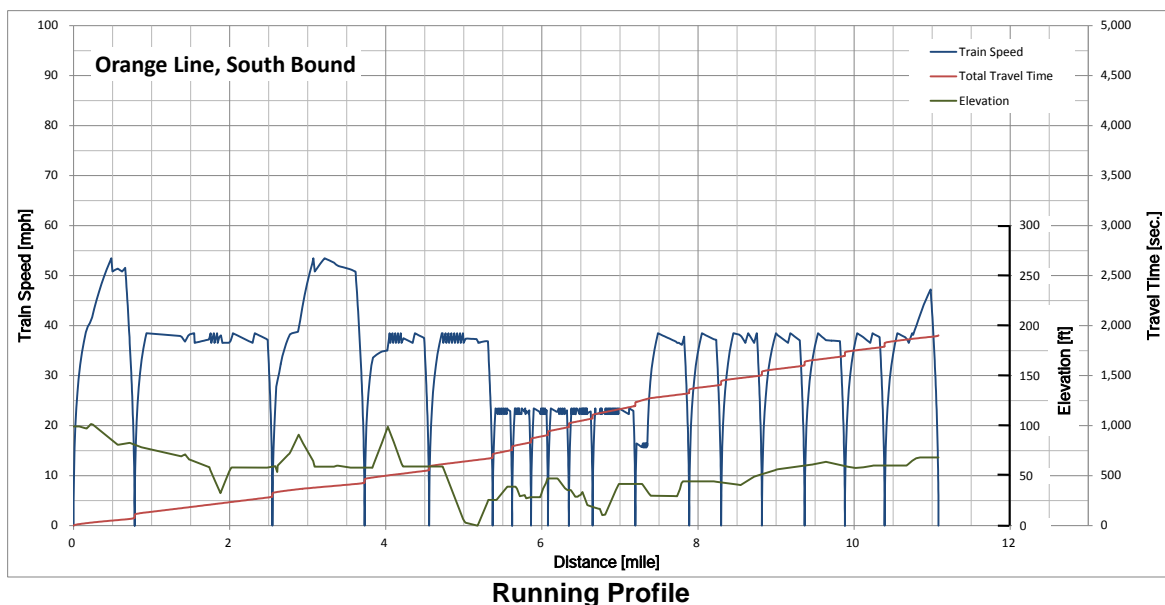


FIGURE I.1G- 45
Running Simulation Results for Powering @ 600 VDC and braking at 700 VDC (OAK GROVE – FOREST HILLS)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
19:Oak Grove	0.78	79.4	0	206.3	178.2	1.130	-0.789	0.341
18:Malden Center	1.77	183.4	30	126.1	104.6	0.940	-0.589	0.351
17:Wellington	1.18	110.0	30	181.3	160.6	1.419	-0.783	0.637
16:Sullivan Square	0.83	96.0	30	184.7	157.8	1.092	-0.684	0.408
15:Conoway College	0.81	93.6	30	187.7	160.7	0.900	-0.815	0.085
14:North Station	0.25	47.5	30	192.1	117.8	0.416	-0.143	0.273
13:Haymarket	0.24	46.7	30	196.6	113.1	0.289	-0.241	0.048
12:State Street	0.22	42.1	30	199.5	124.8	0.438	-0.107	0.332
11:Downtown Crossing	0.27	50.4	30	182.9	101.1	0.253	-0.216	0.036
10:Chinatown	0.30	56.4	30	188.5	111.4	0.315	-0.299	0.017
09:NE Medical Center	0.55	94.5	30	153.6	105.4	0.640	-0.200	0.440
08:Back Bay	0.69	98.8	30	164.4	123.2	0.779	-0.453	0.326
07:Massachusetts Avenue	0.41	54.5	30	208.4	153.4	0.620	-0.396	0.223
06:Ruggles	0.52	64.5	30	194.3	148.3	0.752	-0.392	0.359
05:Roxbury Crossing	0.55	67.9	30	190.0	142.8	0.733	-0.383	0.350
04:Jackson Square	0.52	65.2	30	192.0	141.4	0.644	-0.394	0.250
03:Stoway Brook	0.51	63.6	30	193.8	145.3	0.666	-0.403	0.263
02:Green Street	0.69	78.1	30	199.7	168.6	1.086	-0.627	0.459
01:Forest Hills	0	0	180	0	0	0	0	0
Total	17.83	1392.8	690	180.7	138.7	13.113	-7.914	5.199

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.



Travel Time and Average Speed (Normal Conditions)

CSR Sifang JV has calculated travel time and average speed under normal conditions as a result of the aforementioned simulation. TABLE I.1G-11: 'Travel Times and Average Speeds in Each Direction' documents these results.

**TABLE I.1G-11
Travel Times and Average Speeds in Each Direction**

Direction	Travel Time	Average Speed
	[second]	[mph]
Forest Hills → Oak Grove (North Bound) (Not include the dwell time at each station.)	1376	29.0
Forest Hills → Oak Grove (North Bound) (Include the dwell time at each station.)	2066	19.3
Oak Grove → Forest Hills (South Bound) (Not include the dwell time at each station.)	1393	28.6
Oak Grove → Forest Hills (South Bound) (Include the dwell time at each station.)	2083	19.1

Rated Motor Current and Motor Capacity (Normal Conditions)

CSR Sifang JV has calculated rated motor current and motor capacity under normal conditions as a result of the aforementioned simulation. Calculation conditions include a motor voltage of 440 VDC, a power factor of 0.785, and an efficiency of 0.930. Values cited below include dwell time considerations at each station. The motor capacity at the duty cycle rating is 90 KW. TABLE I.1G-12: 'Rated Motor Current and Motor Capacity' documents these results.

**TABLE I.1G-12
Rated Motor Current and Motor Capacity**

Direction	Rated Motor Current	Motor Capacity (Continuance)
	[Arms]	[kW]
Orange Line round trip	154.1	85.7

Equipment Thermal Capacities (Normal Conditions)

CSR Sifang JV has calculated equipment thermal capacities under normal conditions as a result of the aforementioned simulation. Calculation conditions consider an ambient temperature of 49 degrees C. Operationally, round trips are considered continuous at normal duty cycle for each route. TABLE I.1G-13: 'Maximum Temperature of Equipment' documents these results.

**TABLE I.1G-13
Maximum Temperature of Equipment**

Equipment	Specified limit	Estimated temperature
Traction Motor winding	220°C	192.6°C
IGBT junction in Inverter	150°C	102.0°C
IGBT junction in Brake Chopper	150°C	122.4°C

Simulation Results (Abnormal Conditions)

CSR Sifang JV is pleased to provide the following running simulation results under abnormal conditions. Assumptions utilized in this simulation include:

- Line Voltage: Powering 530 VDC/Braking 660 VDC
 Powering 600 VDC/Braking 700 VDC
- Car Formation – 3 married pairs (6 cars)

- Train Load – AW3
- Wheel Diameter – 28 inches
- 16% propulsion system cut out
- Operating Section – Red Line round trip

Results are summarized within the following Figures:

- FIGURE I.1G- 46: 'Running Simulation Results (Abnormal) for Powering @ 530 VDC and braking at 660 VDC (FOREST HILLS – OAK GROVE)'
- FIGURE I.1G- 47: 'Running Simulation Results (Abnormal) for Powering @ 530 VDC and braking at 660 VDC (OAK GROVE – FOREST HILLS)'
- FIGURE I.1G- 48: 'Running Simulation Results (Abnormal) for Powering @ 600 VDC and braking at 700 VDC (FOREST HILLS – OAK GROVE)'
- FIGURE I.1G- 49: 'Running Simulation Results (Abnormal) for Powering @ 600 VDC and braking at 700 VDC (OAK GROVE – FOREST HILLS)'

FIGURE I.1G- 46
Running Simulation Results (Abnormal) for Powering @ 530 VDC and braking at 660 VDC
(FOREST HILLS – OAK GROVE)'

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
01:Forest Hills	0.69	79.8	0	207.6	184.7	1.246	-0.658	0.587
02:Green Street	0.51	65.5	30	200.2	161.8	0.838	-0.397	0.442
03:Stow y Brook	0.52	66.8	30	204.6	167.2	0.911	-0.425	0.486
04:Jackson Squire	0.55	69.0	30	198.2	160.6	0.817	-0.449	0.368
05:Roxbury Crossing	0.52	66.5	30	202.2	166.9	0.845	-0.467	0.378
06:Ruggles	0.41	56.5	30	219.4	178.2	0.865	-0.418	0.447
07:Massachusetts Avenue	0.69	116.8	30	154.1	119.3	0.805	-0.378	0.427
08:Back Bay	0.55	109.4	30	159.8	106.8	0.553	-0.412	0.141
09:N.E Medical Center	0.30	57.7	30	198.6	145.7	0.695	-0.190	0.505
10:China Tow n	0.27	51.6	30	195.5	136.0	0.553	-0.154	0.398
11:Dow ntown Crossing	0.22	43.1	30	200.3	118.7	0.256	-0.254	0.002
12:State Street	0.24	47.7	30	204.5	142.9	0.552	-0.171	0.381
13:Haymarket	0.25	48.5	30	202.0	128.4	0.369	-0.267	0.102
14:North Station	0.81	96.1	30	195.0	177.5	1.660	-0.546	1.114
15:Commonw ity College	0.83	89.3	30	216.5	203.0	1.790	-0.840	0.950
16:Sullivan Square	1.18	112.3	30	197.9	187.5	2.055	-0.880	1.175
17:Wellington	1.77	151.6	30	172.8	166.4	2.504	-0.825	1.678
18:Malden Center	0.78	85.7	30	214.2	196.7	1.738	-0.697	1.041
19:Oak Grove	0	0	180	0	0	0	0	0
Total	17.83	1413.9	690	194.0	162.6	19.050	-8.429	10.621

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

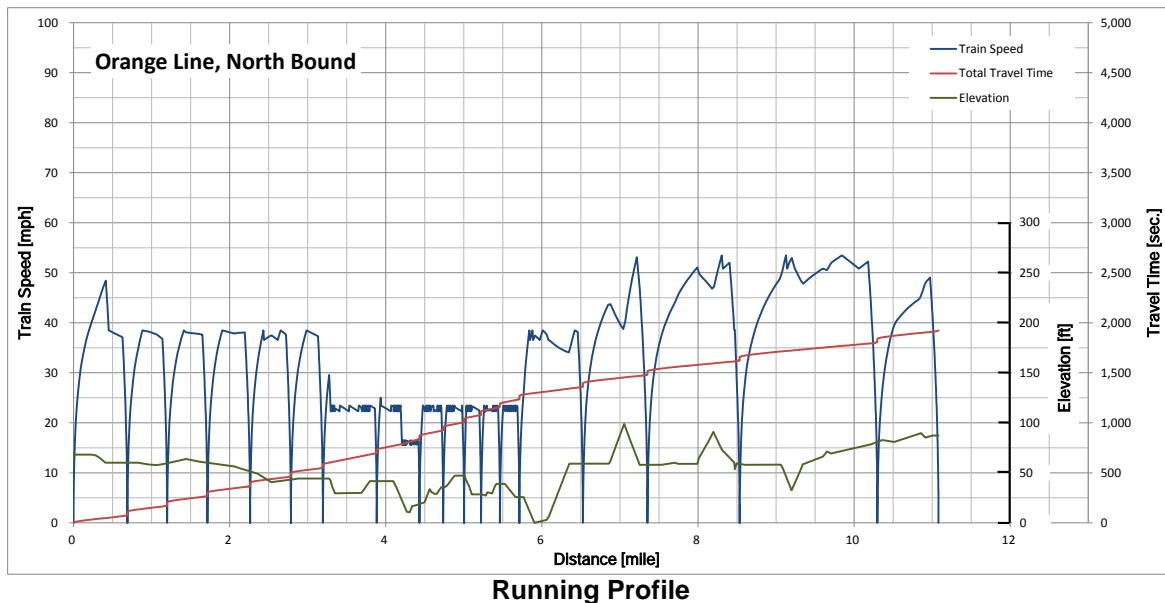


FIGURE I.1G- 47
Running Simulation Results (Abnormal) for Powering @ 530 VDC and braking at 660 VDC (OAK GROVE – FOREST HILLS)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
19:Oak Grove	0.78	82.3	0	219.6	201.9	1.554	-0.844	0.710
18:Malden Center	1.77	185.4	30	135.3	121.3	1.286	-0.627	0.659
17:Wellington	1.18	113.6	30	191.1	178.7	1.797	-0.782	1.015
16:Sullivan Square	0.83	99.1	30	195.4	178.6	1.438	-0.693	0.745
15:Conoway College	0.81	96.0	30	197.1	178.4	1.174	-0.837	0.337
14:North Station	0.25	48.6	30	202.3	142.0	0.567	-0.156	0.411
13:Haymarket	0.24	47.7	30	200.8	127.3	0.370	-0.244	0.125
12:State Street	0.22	43.1	30	209.9	150.3	0.592	-0.113	0.480
11:Downtown Crossing	0.27	51.4	30	190.0	117.4	0.339	-0.233	0.106
10:China Town	0.30	57.2	30	191.3	123.5	0.391	-0.298	0.094
09:NE Medical Center	0.55	95.4	30	162.2	127.1	0.870	-0.212	0.658
08:Back Bay	0.69	100.3	30	173.8	141.8	1.036	-0.466	0.570
07:Massachusetts Avenue	0.41	56.3	30	219.2	177.7	0.849	-0.425	0.424
06:Ruggles	0.52	66.6	30	202.6	168.0	0.971	-0.402	0.569
05:Roxbury Crossing	0.55	70.0	30	203.0	169.1	1.022	-0.422	0.600
04:Jackson Squire	0.52	66.9	30	203.9	166.3	0.894	-0.430	0.464
03:Stow y Brook	0.51	65.4	30	204.6	168.7	0.912	-0.431	0.481
02:Green Street	0.69	80.4	30	210.0	188.8	1.415	-0.631	0.783
01:Forest Hills	0	0	180	0	0	0	0	0
Total	17.83	1425.5	690	190.5	159.0	17.479	-8.246	9.232

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

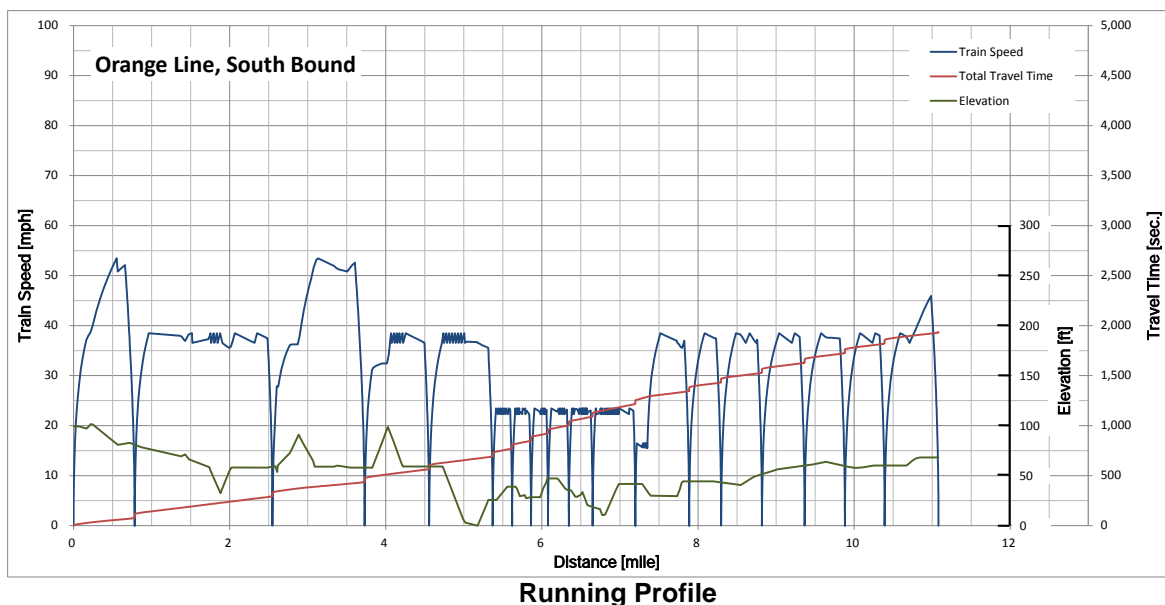


FIGURE I.1G- 48
Running Simulation Results (Abnormal) for Powering @ 600 VDC and braking at 700 VDC
(FOREST HILLS – OAK GROVE)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
01:Forest Hills	0.69	79.8	0	201.9	167.8	1.095	-0.623	0.472
02:Green Street	0.51	65.5	30	197.1	145.7	0.737	-0.374	0.362
03:Stow y Brook	0.52	66.8	30	201.2	150.5	0.801	-0.401	0.400
04:Jackson Squire	0.55	69.0	30	195.0	145.1	0.718	-0.424	0.294
05:Roxbury Crossing	0.52	66.5	30	198.6	150.9	0.743	-0.441	0.302
06:Ruggles	0.41	56.5	30	215.9	160.5	0.760	-0.395	0.366
07:Massachusetts Avenue	0.69	116.8	30	153.4	106.9	0.707	-0.357	0.351
08:Back Bay	0.55	109.4	30	159.7	96.2	0.485	-0.389	0.096
09:N.E Medical Center	0.30	57.7	30	198.1	129.1	0.607	-0.179	0.428
10:China Tow n	0.27	51.6	30	195.3	120.7	0.485	-0.146	0.339
11:Dow ntown Crossing	0.22	43.1	30	200.2	107.5	0.224	-0.240	-0.015
12:State Street	0.24	47.7	30	204.2	127.1	0.484	-0.162	0.323
13:Haymarket	0.25	48.5	30	201.9	115.7	0.324	-0.252	0.071
14:North Station	0.81	96.1	30	188.8	159.4	1.459	-0.516	0.943
15:Commonw ity College	0.83	89.3	30	208.6	184.3	1.574	-0.796	0.778
16:Sullivan Square	1.18	112.3	30	190.3	170.2	1.807	-0.834	0.973
17:Wellington	1.77	151.6	30	165.6	150.5	2.202	-0.782	1.420
18:Malden Center	0.78	85.7	30	207.2	178.0	1.528	-0.660	0.868
19:Oak Grove	0	0	180	0	0	0	0	0
Total	17.83	1413.8	690	190.0	146.7	16.742	-7.970	8.772

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.

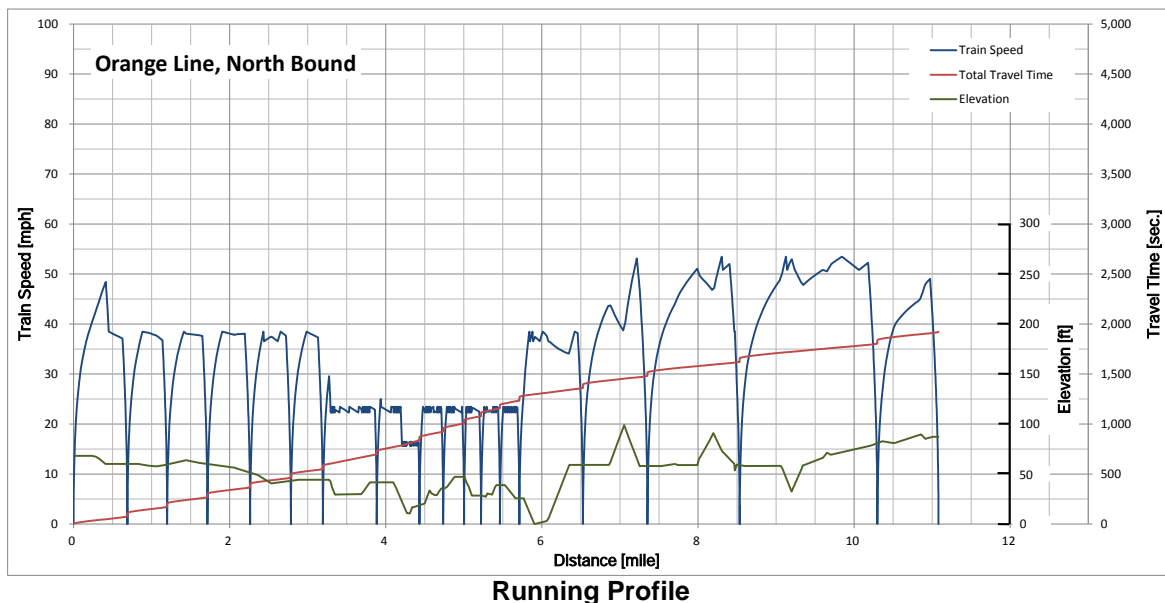
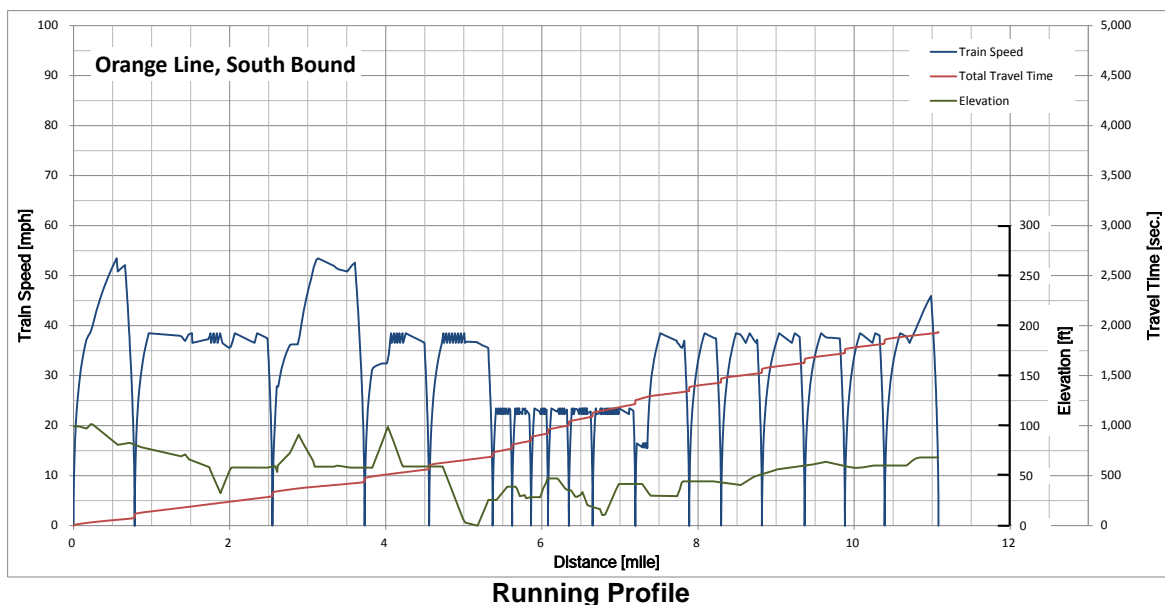


FIGURE I.1G- 49
Running Simulation Results (Abnormal) for Powering @ 600 VDC and braking at 700 VDC (OAK GROVE – FOREST HILLS)

Station	Distance (mile)	Travel Time (sec)	Dwell Time (sec)	RMS Current		Power Consumption		
				Motor (A / motor)	Line (A / motor)	Powering (kWh/motor)	Regenerating (kWh/motor)	Total Power Consumption (kWh/motor)
19:Oak Grove	0.78	82.3	0	212.4	183.9	1.367	-0.799	0.567
18:Malden Center	1.77	185.4	30	131.5	109.8	1.130	-0.592	0.538
17:Wellington	1.18	113.6	30	184.2	161.9	1.581	-0.741	0.840
16:Sullivan Square	0.83	99.1	30	189.5	161.6	1.265	-0.655	0.610
15:Conoway College	0.81	96.0	30	191.5	162.7	1.032	-0.792	0.240
14:North Station	0.25	48.6	30	202.0	126.1	0.498	-0.147	0.351
13:Haymarket	0.24	47.7	30	200.7	114.5	0.324	-0.231	0.094
12:State Street	0.22	43.1	30	209.7	133.1	0.521	-0.107	0.414
11:Downtown Crossing	0.27	51.4	30	190.0	105.6	0.298	-0.220	0.078
10:Chinatown	0.30	57.3	30	190.9	111.2	0.343	-0.280	0.063
09:NE Medical Center	0.55	95.4	30	161.9	112.8	0.764	-0.201	0.563
08:Back Bay	0.69	100.3	30	170.4	127.5	0.911	-0.440	0.470
07:Massachusetts Avenue	0.41	56.3	30	215.7	160.2	0.746	-0.401	0.345
06:Ruggles	0.52	66.6	30	198.8	151.0	0.854	-0.379	0.474
05:Roxbury Crossing	0.55	70.0	30	199.2	152.0	0.899	-0.398	0.500
04:Jackson Square	0.52	66.9	30	200.5	149.9	0.786	-0.406	0.380
03:Stoway Brook	0.51	65.4	30	200.9	152.1	0.802	-0.407	0.395
02:Green Street	0.69	80.4	30	203.8	170.9	1.244	-0.597	0.646
01:Forest Hills	0	0	180	0	0	0	0	0
Total	17.83	1425.6	690	186.7	143.5	15.365	-7.795	7.570

Note: Regarding RMS Current and Power Consumption, the values in the total column do not include the dwell time at each station.



Travel Time and Average Speed (Abnormal Conditions)

CSR Sifang JV has calculated travel time and average speed under abnormal conditions as a result of the aforementioned simulation. TABLE I.1G-14: 'Travel Times and Average Speeds (Abnormal Conditions) in Each Direction' documents these results.

**TABLE I.1G-14
Travel Times and Average Speeds (Abnormal Conditions) in Each Direction**

Direction	Travel Time	Average Speed
	[second]	[mph]
Forest Hills → Oak Grove (North Bound) (Not include the dwell time at each station.)	1414	28.2
Forest Hills → Oak Grove (North Bound) (Include the dwell time at each station.)	2104	19.0
Oak Grove → Forest Hills (South Bound) (Not include the dwell time at each station.)	1426	28.0
Oak Grove → Forest Hills (South Bound) (Include the dwell time at each station.)	2116	18.8

Rated Motor Current and Motor Capacity (Abnormal Conditions)

CSR Sifang JV has calculated rated motor current and motor capacity under abnormal conditions as a result of the aforementioned simulation. Calculation conditions include a motor voltage of 440 VDC, a power factor of 0.785, and an efficiency of 0.930. Values cited below include dwell time considerations at each station. The motor capacity at the duty cycle rating is 90 KW. TABLE I.1G-15: 'Rated Motor Current and Motor Capacity (Abnormal Conditions)' documents these results.

**TABLE I.1G-15
Rated Motor Current and Motor Capacity (Abnormal Conditions)**

Condition	Direction	Rated Motor Current	Motor Capacity (Continuance)
		[Arms]	[kW]
Abnormal operation	Orange Line round trip	159.1	88.5

Equipment Thermal Capacities (Abnormal Conditions)

CSR Sifang JV has calculated equipment thermal capacities under abnormal conditions as a result of the aforementioned simulation. Calculation conditions consider an ambient temperature of 49 degrees C. Operationally, round trips are considered continuous at a 16% cut out in duty cycle for each route. TABLE I.1G-16: 'Maximum Temperature of Equipment (Abnormal Conditions)' documents these results.

**TABLE I.1G-16
Maximum Temperature of Equipment (Abnormal Conditions)**

Equipment	Specified limit	Estimated temperature
Traction Motor winding	220°C	201.5°C
IGBT junction in Inverter	150°C	106.4°C
IGBT junction in Brake Chopper	150°C	121.0°C

Towing Operations

CSR Sifang JV has calculated towing condition impacts at the maximum gradient with good results. The assumptions used for calculation include:

- Train configuration: 1 normal condition vehicle (AW3) + 1 dead vehicle (AW3)
1 normal condition vehicle (AW0) + 1 dead vehicle (AW0)
- Maximum vertical grade: 4% (Red Line)
- Train resistance at starting: 39.2 N/ton

- Uphill acceleration: 0.19 mphps

TABLE I.1G-17: 'Towing Operation Performance' documents these results.

**TABLE I.1G-17
Towing Operation Performance**

	Load	Acceleration [mphps]	Result
Orange Line 5.6 %	AW0	0.22	Enable
	AW3	0.19	Enable

Regenerative Rate Operations

CSR Sifang JV has calculated regenerative rate impacts with good results. The assumptions used for calculation include:

- Line voltage: Braking at 660 VDC
- Car formation: 3 married pairs (6 cars)
- Train load: AW3
- Wheel diameter: 28 inches
- Operation section: Straight, level tangent and dry track

TABLE I.1G-18: 'Regenerative Rate Performance' documents these results.

**TABLE I.1G-18
Regenerative Rate Performance**

Speed	Regenerative rate required	Regenerative rate at simulation	Result
42→5 mph (67.6→8 km/h)	Above 72 %	88 %	Pass
50→5 mph (80.5→8 km/h)	Above 65 %	83 %	Pass

I.1H. VEHICLE DESIGN APPROACH

CSR Sifang JV understands fully the importance of integrating subsystem and component standardization and commonality between Red and Orange Line to the greatest extent possible. The benefits of this approach include reduced maintenance burden for the MBTA and lower associated costs.

CSR Sifang JV has extensive experience with successfully integrating product modularity strategies. Modular design of products forms a design method which takes a simplified final assembly detail as the primary goal while realizing production flexibility. Flexible production has the further benefit of allowing the same worker to randomly assemble various similar products using the same process. CSR Sifang JV has repeatedly and extensively proven this approach at our assembly facility in Qingdao (China).

The key to commonality in the modular design involves reasonable disassembly of the final product. The assembly/disassembly method is typically in accordance with the functional or structural features of the components and the parts having similar function or structure being grouped within a common module. The assembly/disassembly principle is therefore to realize complete function and relative independence of module disassembly. The internal features of a module can be relatively aggregated while external interfaces of the module are as simple as possible. For the case of invoked changes within a module, the external features may remain unchanged thereby rendering the assembly method unchanged.

CSR Sifang JV has conducted a preliminary design analysis screening of various components having potential commonality between the proposed Orange and Red Line cars. CSR Sifang JV is pleased to report the potential for significant subsystem and component commonality between the Red and Orange line cars. The following carbody subsystems and components can be shared:

- Coupler buffer system
- Coupler mounting seat
- Coupler and Draft beam
- Coupler tappit valves and electrical pins
- Bolster
- Buffer beam
- Cross beam
- Corrugated floor
- Corrugated roof plate
- Anti-creeper
- Anti-collision pillar
- Corner post
- Air conditioning platform structure

For interior equipment subsystems and components can be shared:

- Seats in passenger area
- Seat inserts
- Handrail
- Air diffuser
- Lighting fixtures
- Windshield
- Floor heater grid
- Seats
- Interior graphics and markers
- Driver's seat
- Emergency ladder
- Fire extinguisher
- Floor covering
- Heat insulation materials
- Shroud lock
- Other

For exterior equipment subsystems and components can be shared:

- Doors
- Windows

For air conditioning equipment subsystems and components can be shared:

- Heat, ventilation, and air conditioning unit
- Side wall heater

For braking equipment subsystems and components can be shared:

- BCU (with minor software differences)
- Tread braking unit
- Tread braking unit (with parking)
- Brake shoes
- Snow brake
- Speed sensors
- Anti-Slide control valve
- Parking braking unit
- Main air reservoir
- Auxiliary reservoir
- Air compressor
- Duplex pressure gauge
- Pneumatic horn system
- Air filter
- Check valve
- Differential pressure valve
- Pressure test points
- Two-way check valve
- Emergency valve
- Single channel limit valve
- Parking brake reservoir
- Load weigh valve
- Various pneumatic cutout cocks
- Various hose assemblies
- Emergency braking button
- Passenger emergency stop devices
- Automatic stopping devices
- Stainless steel pipe and pipe joints
- Pipe clip

For electrical equipment subsystems and components can be shared:

- Electrical traction and braking system (minor software differences)
- Auxiliary power supply system (minor software differences)
- Train communication and information system (minor software differences)
- Monitoring system (minor software differences)

- Lighting system (minor software differences)
- Signal system (minor software differences)
- Train network control system
- Driver control screen
- Operating button
- Switch
- Indicator
- Touch screen
- Display unit
- Cable
- Electrical connector(s)
- Wire conductors
- Wire clips
- Pipe clips
- Other

For truck equipment subsystems and components, CSR Sifang JV envisions the entire bogie frame can be utilized for both types of vehicles including the truck frame, bolsters, journal boxes, levelling valves, bearings, wheelsets, snow plow, antenna bracket, flange lubrication, and other.

I.1I. EMC

CSR Sifang JV is well experienced with determining and mitigating adverse EMC impacts. The rolling stock will be designed, manufactured and tested so that train borne equipment will not:

- Interfere with other onboard systems;
- Interfere with equipment on other rolling stock that meet the same standards for EMC;
- Interfere with wayside equipment meeting the same standards for EMC;
- Interfere with cardiac pacemakers and implantable defibrillators;
- Subject train crew or passengers to excessive levels of electric or magnetic fields.

In addition, the train borne equipment will not interfere with goods and appliances that meet the same standards for EMC which could be carried by passengers or used in premises in close vicinity with the rail network. National Health and Medical Research Council Guidelines on limits of exposure to 50/60Hz electric and magnetic field (1989) Radiation Health Series No. 30 and for magnetic resonance diagnostic facilities (1991) Radiation Health Series No. 34 will apply.

EMC DESIGN PRINCIPLES

Good EMC design schemes to resolve the Electro Magnetic Interference (EMI) issue is to look at key approaches that form EMI including the EMI source, coupling approach or propagating channel and equipment sensitivity. TABLE I.1I-1: 'EMC Design Methods and Technology' defines the three basic methods of EMI including:

**TABLE I.1I-1
EMC Design Methods and Technology**

Basic Method	Design Technology
Eliminate the EMI source or reduce its ability to generate the EMI externally	Grounding technology, filtration technology, shielding technology, EMC quality management (type selection)
Install protective measures to reduce the EMI coupling factor, and reduce the possibility of propagation	Rational layout of equipment, rational type selection, layout and isolation technology of cable
Increase the immunity of sensitive equipment	Grounding technology, filtration technology, shielding technology, EMC quality management (type selection)

The critical elements that CSR Sifang JV considers in their EMC designs include: layout of vehicle equipment; EMC classification of equipment; industry requirement of equipment spacing; classification of

cables; layout of cables; types of cables; selection of cable connectors; protective/shielding of grounding cables; vehicle grounding; and functional grounding.

DESIGN OF EMC SHIELDING

Electric Field Shielding is required to solve the electric field interference (EFI). Design parameters include:

- A satisfactory shielding plate material is copper and aluminum alloy
- A fully enclosed metal geometric box provides the optimal protection
- The material of the shielding plate must match the conductor.

Magnetic Field Shielding is required for the following components: traction inverter, static inverter, traction motor and motor cables. Ferro-magnetic materials with high permeability and low magnetic resistance are utilized as the shielding material. Electromagnetic Field Shielding is used to contain the interference generated by the coupling of the electromagnetic field when the interference source is far away from the sensitive devices.

OTHER APPLIED SHIELDING TECHNOLOGIES

FILTERING is the most direct and effective method to contain conducted interference. It also plays an excellent role in restraining the radiated interference as it restrains the leakage of the interference source. The design of the input and output terminal for the traction converter and the auxiliary converter of vehicles uses filtering technology, for example, ferrite bead, filtering capacitance or other EMC interference restraining device, to restrain the radiated emission and conducting interference emission of the inverter to the external environment.

DESIGN OF CABLE TROUGH AND CONDUIT using aluminum alloy sheet can provide excellent shielding to reduce the crosstalk among different cables.

EQUIPMENT ENCLOSURE APERTURES are used to provide electromagnetic shielding. Openings such as access doors, covers and vents are potentially a source of leaks for electromagnetic radiation. EMC gaskets will be used that will provide dust and moisture ingress protection. In addition, it provides continuity and EMC integrity of the enclosure shielding when the covers or doors are closed.

REQUIREMENT FOR GROUNDING AND LAPPING INSTALLATION is necessary to prevent electrochemical properties of different metal materials at the lapping joint surface, to prevent metal exposure to salt spray, fuel and chemical agent that generate the galvanic effect, which may corrode the metal surface. All grounding connection points for earthing, shielding and bonding will remain unplated or unpainted to provide the best possible contact and shielding performance.

EMC DESIGN AND MANAGEMENT

The electrical, electronic system and the electrical/electronic equipment purchased by CSR Sifang JV require the supplier to provide related document of EMC Management Plan, Measure of EMC Design and an EMC Test Plan for this system and equipment. The subsystem and other electrical system suppliers will submit an EN50121-3-1 compliant test plan and provide the EMC interface requirements at the design stage of vehicles. TABLE I.11-2: 'EMC Mechanism List of Subsystems or Electrical Equipment' describes emission restraint mechanisms applied to various subsystems and electrical equipment.

**TABLE I.11-2
EMC Mechanism List of Subsystems or Electrical Equipment**

Name of Subsystem or Electrical Equipment	Emission Restrained Mechanism	Interference Immunity Improved Mechanism
External Vehicle Temperature Collection System		Shielding Cable, Grounding, Filtering and Rational Wiring
Smoke and Fire Alarm System		Shielding, Grounding, Filtering and Rational Wiring
Audio and Video System		Shielding, Grounding, Filtering, Isolation and Rational Wiring
High Voltage Equipment Box	Grounding, Shielding, Filtering and Rational Wiring	
Traction Motor	Grounding and Rational Wiring	
Wireless Data Transmission Device		Grounding and Rational Wiring
Traction and Brake Data Recorder		Grounding, Rational Wiring and Shielding
Speed Sensor		Grounding, Rational Wiring and Shielding
Vehicle Side Destination Display		Grounding, Rational Wiring, Shielding and Filtering
Auxiliary Power Supply Converter	Grounding, Rational Wiring, Shielding, Filtering and Isolation	
Passenger Information Display		Grounding, Rational Wiring, Shielding and Filtering
Vehicle Information Control System		Grounding, Rational Wiring, Shielding, Filtering and Isolation
Traction Converter	Grounding, Rational Wiring, Shielding and Filtering	

EMC HAZARD ANALYSIS

The proposed electrical and electronic equipment system can be classified in accordance with interference sources and the affected areas according to the design requirement of the EMI/EMC. TABLE I.11-3: 'Interference Source Classification' describes various interference source classifications.

**TABLE I.11-3
EMC Design Methods and Technology**

Equipment Type ID	Characteristics	Key Systems or Equipment
Z-HD	Serious interference	The traction converter, high speed circuit breaker and filter reactor of the traction system and the auxiliary inverter of the auxiliary power supply system
Z-D	Major interference	Motor, high voltage disconnecting switch, and air conditioning system
Z-N	Neutral	Air compressor
Z-S	Major sensitive	TMS, train door controller, air conditioning controller, CCTV system, PIDS system and smoke and fire alarm
Z-HS	Serious sensitive	Signal antenna of the signal system, various sensors, vehicle-mounted wireless communication system

The types of interference hazard of the EMC for the proposed vehicles are composed of three grades per the EN50121-1 standard. For Grade A, the equipment will operate continuously according to the expected requirement during and after the test. The performance of equipment is not degraded or function loss is not allowed to be less than corresponding performance grade specified by manufacturers. For Grade B, the equipment can operate continuously according to the expected requirement only after the test. Performance degrading is allowed during the test. However, it is not allowed to change the actual operating state or the storage data. For Grade C, equipment is allowed to lose the function temporarily only when the function of equipment may be restored automatically or by operating the controller.

The hazard analysis of potential interference between CSR Sifang JV vehicles and MBTA infrastructure includes:

- Hazards of EMC power supply system on peripheral electronic equipment
- The high voltage feeder line of the traction electric network and substation for the rail system may be high frequency or low frequency noise source

- The power supply is the high voltage AC power supply, and its high radiation field strength interferes with peripheral electronic equipment. This further includes the hazard of EMC traction system on peripheral electronic equipment
- The radiation source of the power system for vehicles mainly from radiated field strength interference generated during the operation of the traction converter and traction motor.

RISK ANALYSIS

The traction converter takes the controllable semiconductor devices, such as the IGBT. For the “ON-OFF” operation of these elements, the large current rate of change will generate magnetic field noise. The energy generated by the traction converter system may be radiated directly by the device on the vehicle or indirectly by the power supply circuit. The energy of the harmonic wave and surge wave generated by the traction converter is high and must be prevented. Otherwise, it may interfere with the on-board communication and the control signal.

To reduce the effect of the EMI on the signal generator, the following measures will be considered:

- The equipment box will be designed with a conductive metal crate to shield the emission of the electromagnetic field to the external environment.
- Circuits will be simplified to reduce their elements.
- Reducing the line length which generates the EMI as much as possible.
- The input and output ports of the power supply will integrate a ferrite bead and filter capacitor to realize filtration and reduce the conducted emission of the power line.

EMC radiation of the complete vehicle will meet the requirement of EN50121-3-1. To mitigate potential risk associated with various subsystems, CSR Sifang JV will institute the following reduction schemes:

The traction motor at the bottom of the vehicle may generate various harmonic currents during the operation and the frequency range of the formed electromagnetic field is usually 0-100MHz. The external low frequency alternating magnetic field emission of the 3-phase AC power cable from the traction converter to the traction motor may interfere with the normal operation of various low frequency signal antennas for the signal system.

The auxiliary converter power for vehicle is high; therefore, it will be considered a noise source. It's input and output port of the power supply, the voltage conducting noise emission may exceed the emission limit value of EN50121-3-2 EMC standard.

The platform information system notification will be displayed by ceiling mounted screens and the equipped Dynamic Route Map Displays (DRMD) will be connected by screened coaxial cable. The proposed vehicles will not interfere with the passenger information system under the condition that it meets the limit value of the radiation emission for the complete vehicle.

The train door controller will integrate microcomputer and PLC controller respectively. The noise frequency bandwidth (Hz-kHz, up to MHz) generated by the traction converter and auxiliary converter of vehicle as the interference source is considered lower than the operating frequency bandwidth (MHz-GHz) of the microcomputer and the PLC controller, whose difference is more than 30dB.

The AC power cord of the air conditioning system will not be laid with the power cord of the signal system, communication cable and sensor cable. These cables are subject to interference from the AC power cords of the air conditioning system.

The network control and brake system are critical systems whose control and communication cable will be subject to interference from other sources. They will be protected by the shielding layer of the communication cable.

COMPATIBILITY OF VEHICLE MOUNTED SIGNAL SYSTEM

The compatibility of the line for the traveling signal system in the rail transit system is an essential requirement of the line. The signal system will be composed of the sensor for the signal collection, the channel for the signal transmission and various control units for the signal processing. It will be necessary to set standard technical indexes of EMC for all vehicle-mounted signal equipment according to the requirement of EN50121-3-2. The signal will be transmitted by wireless network. The EMC of the vehicle system will be designed according to the EN50121 standard; the equipment of the terrestrial signal system will be designed and manufactured by complying with the requirement of EN50121-4.

INTERFERENCE ANALYSIS OF COMMUNICATION SYSTEM

The critical links for the communication EMC of the system include:

- The control center to vehicle communication
- The signal transmission between the vehicle and the track system
- In-vehicle voice broadcasting.

The system A and B are of the wireless communication and the system C will be wired communication. The operating frequency of the system A and B is high, while the operating frequency of the system C is low. It will be possible that the system B will interfere with the system A. It is therefore necessary for various equipment to set the transmission frequency onto different frequency bands as much as possible. Through integration, filtration, grounding and shielding, CSR Sifang JV can reduce the radiation at the transmitting terminal to achieve the operating objective of EMC.

EFFECTS OF SIGNAL FAILURE

The interference of the external signal will affect the safety and cause the termination of the normal operation of the following sub systems: traction motor, brake system, vehicle signal system, lighting, air conditioning train door control, passenger information alarm.

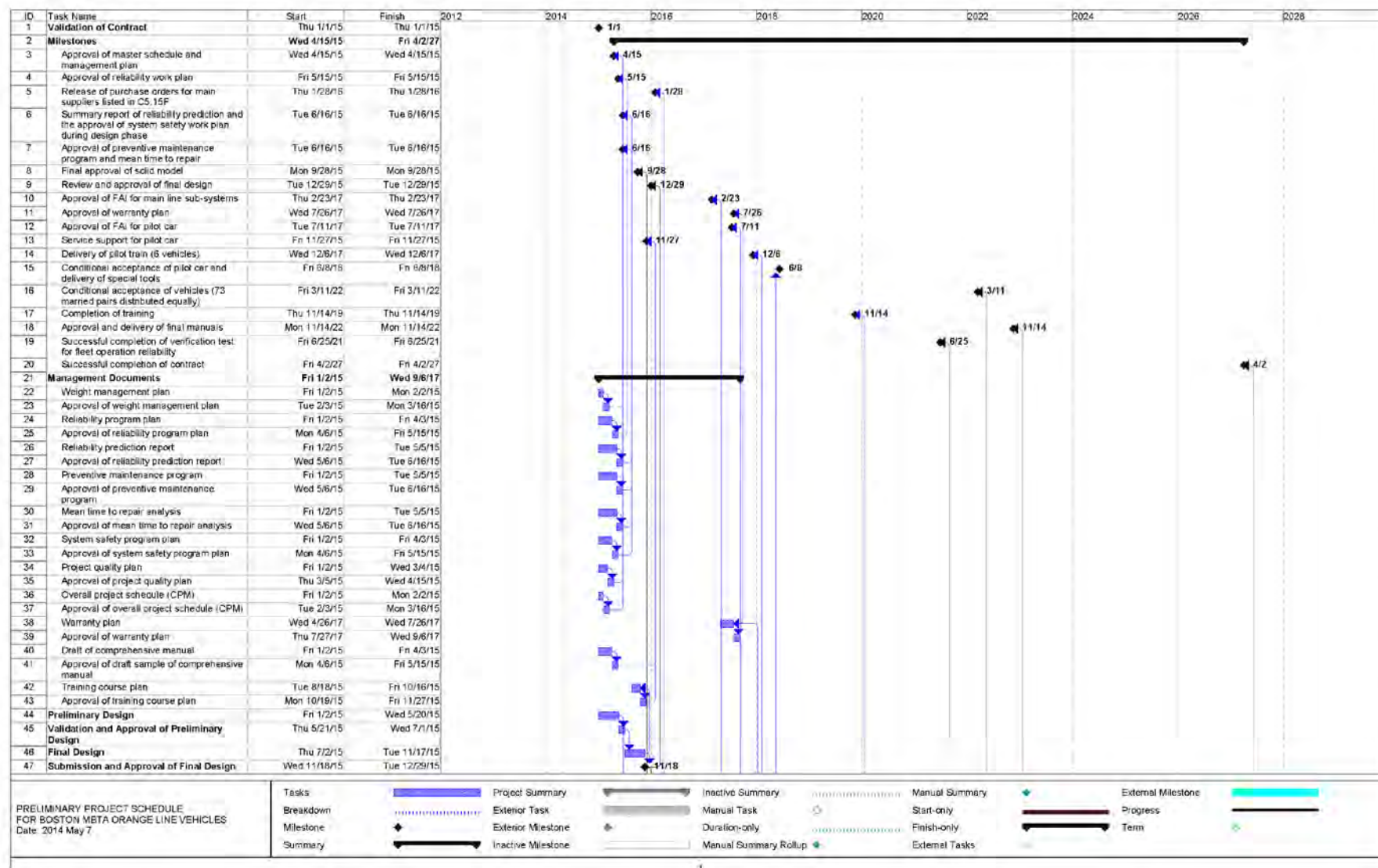
INDEPENDENCE OF SUBSYSTEM/EQUIPMENT/PART. The electrical equipment of the complete vehicle will be independent in terms of function.

IDENTIFICATION AND REPORTING OF SINGLE FAILURE. It may display communication failure in the display screen of the monitoring system TMS. Once received the failure will be identified, recorded and reported immediately.

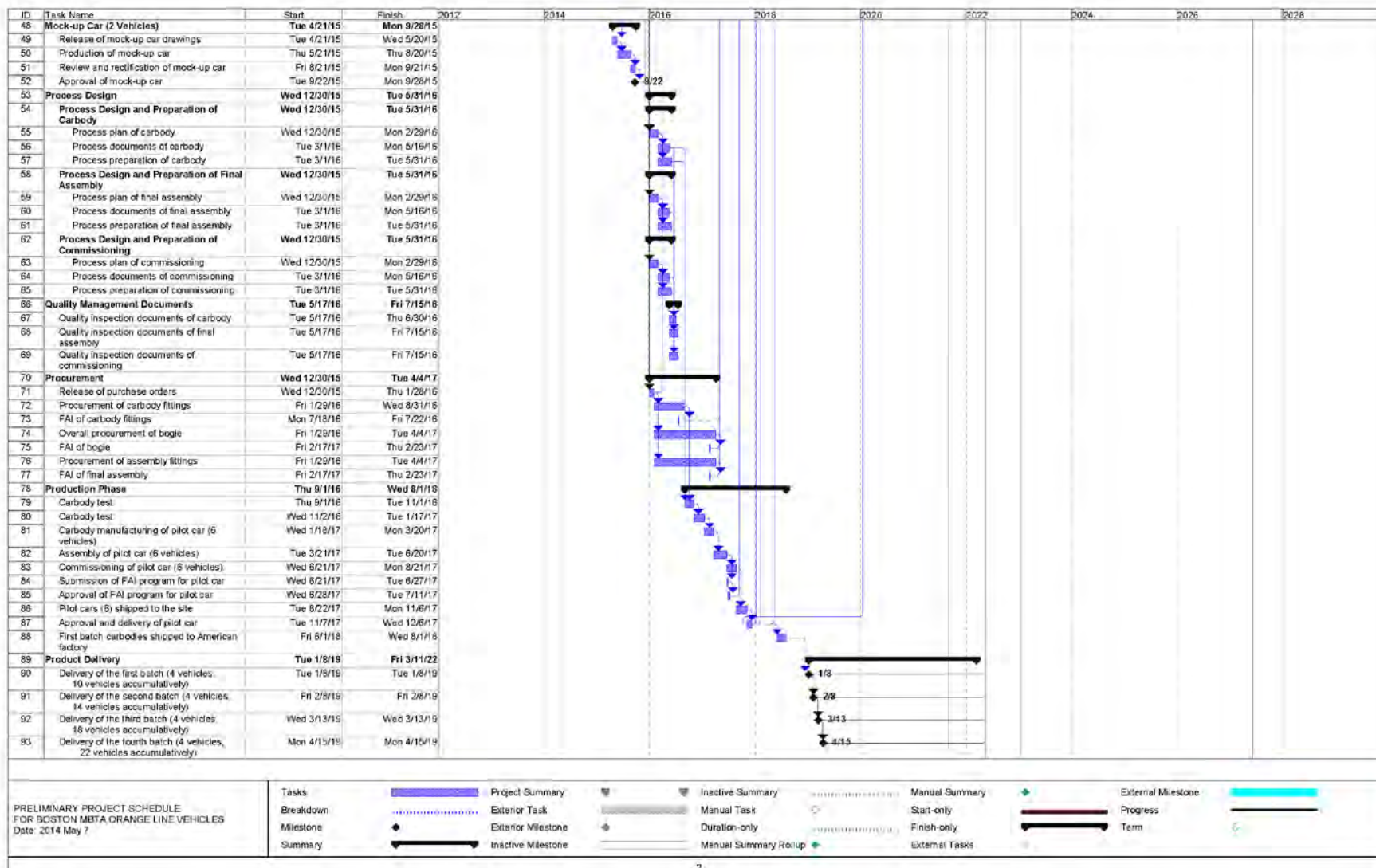
I.1J. PROPOSED SCHEDULE

Figure I.1J-1, Preliminary Project Schedule Orange Line and Figure I.1J-2, Preliminary Project Schedule Red Line indicate the proposed start and completion dates for these projects.

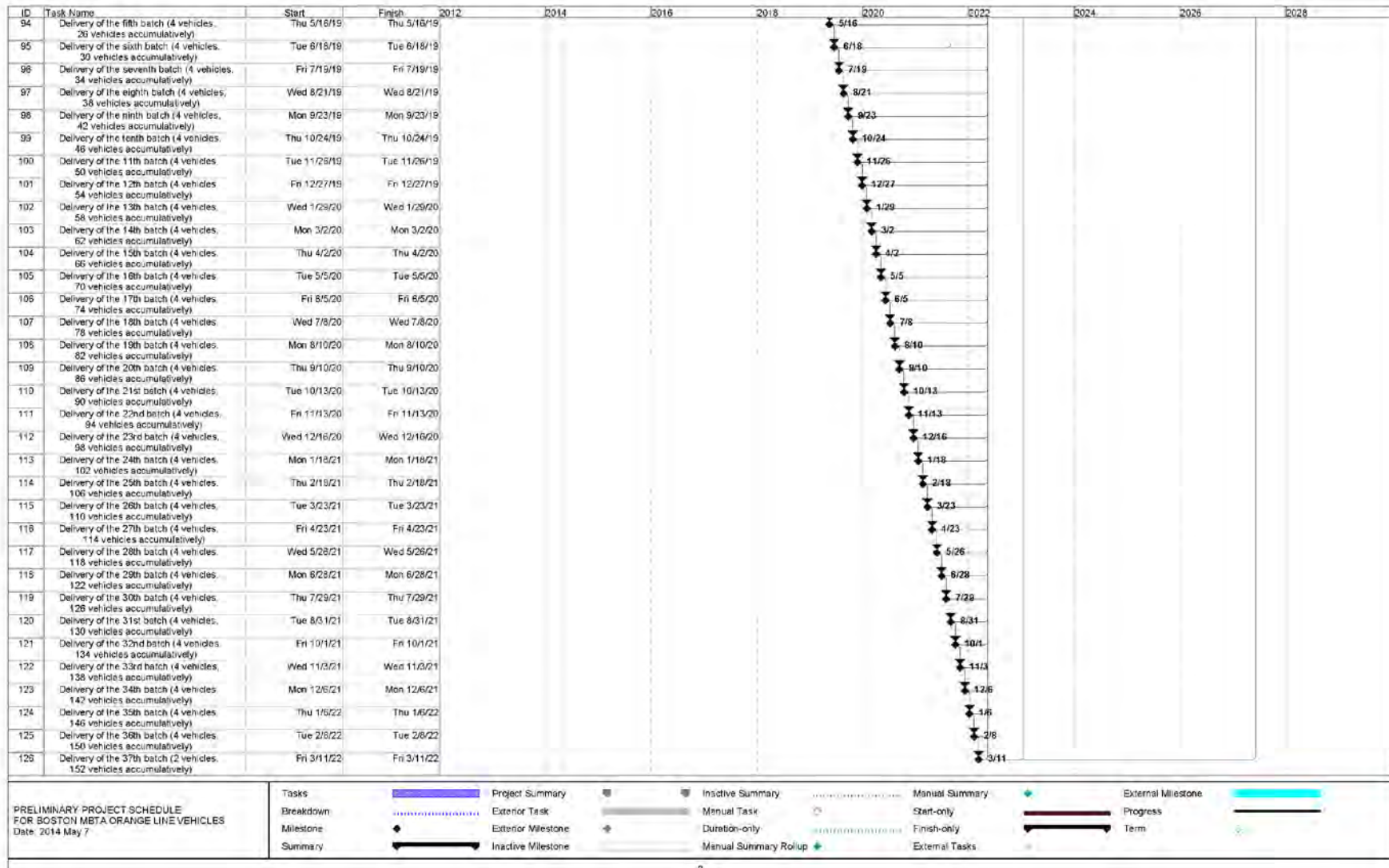
FIGURE I.1J-1
Preliminary Project Schedule Orange Line



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

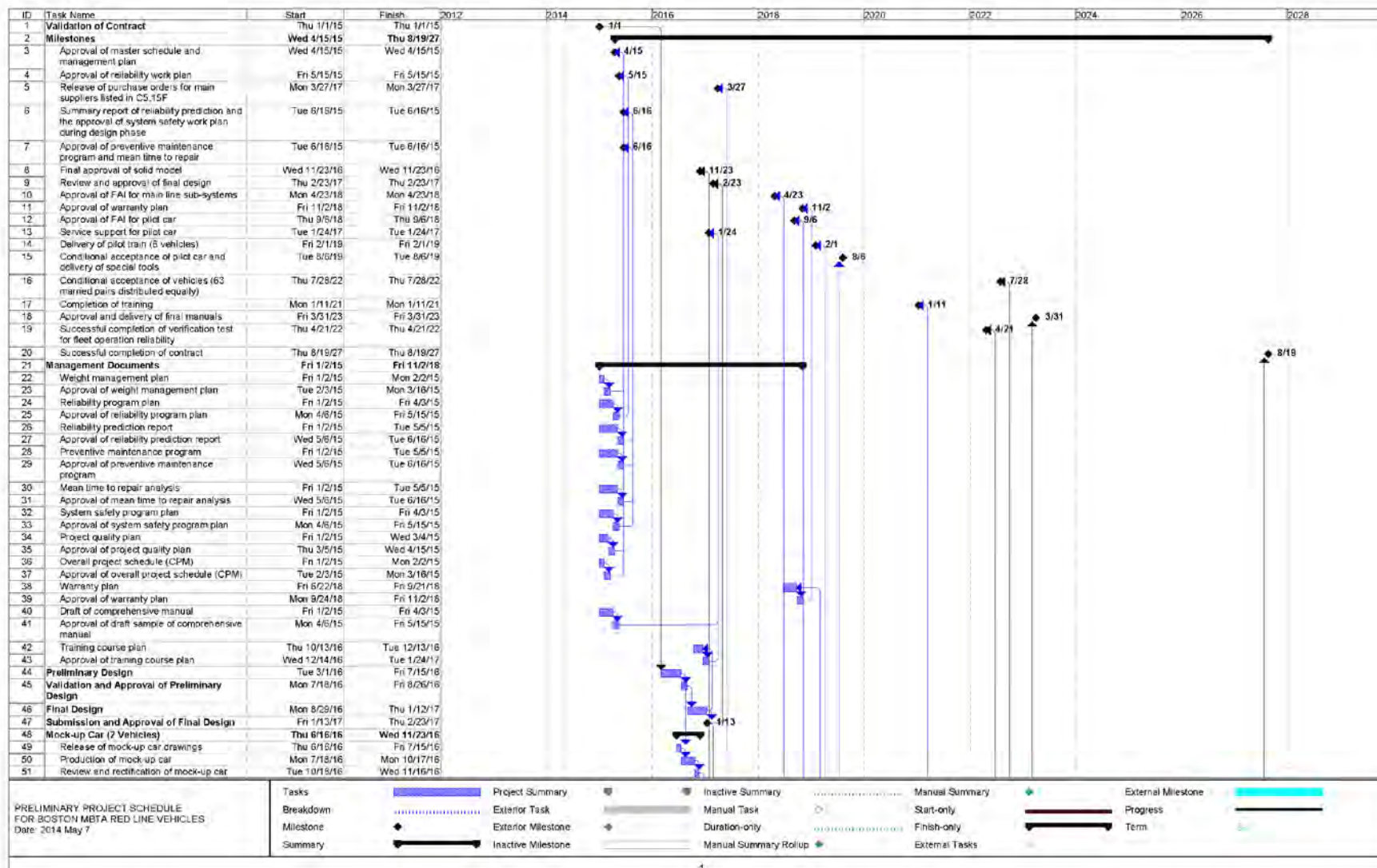
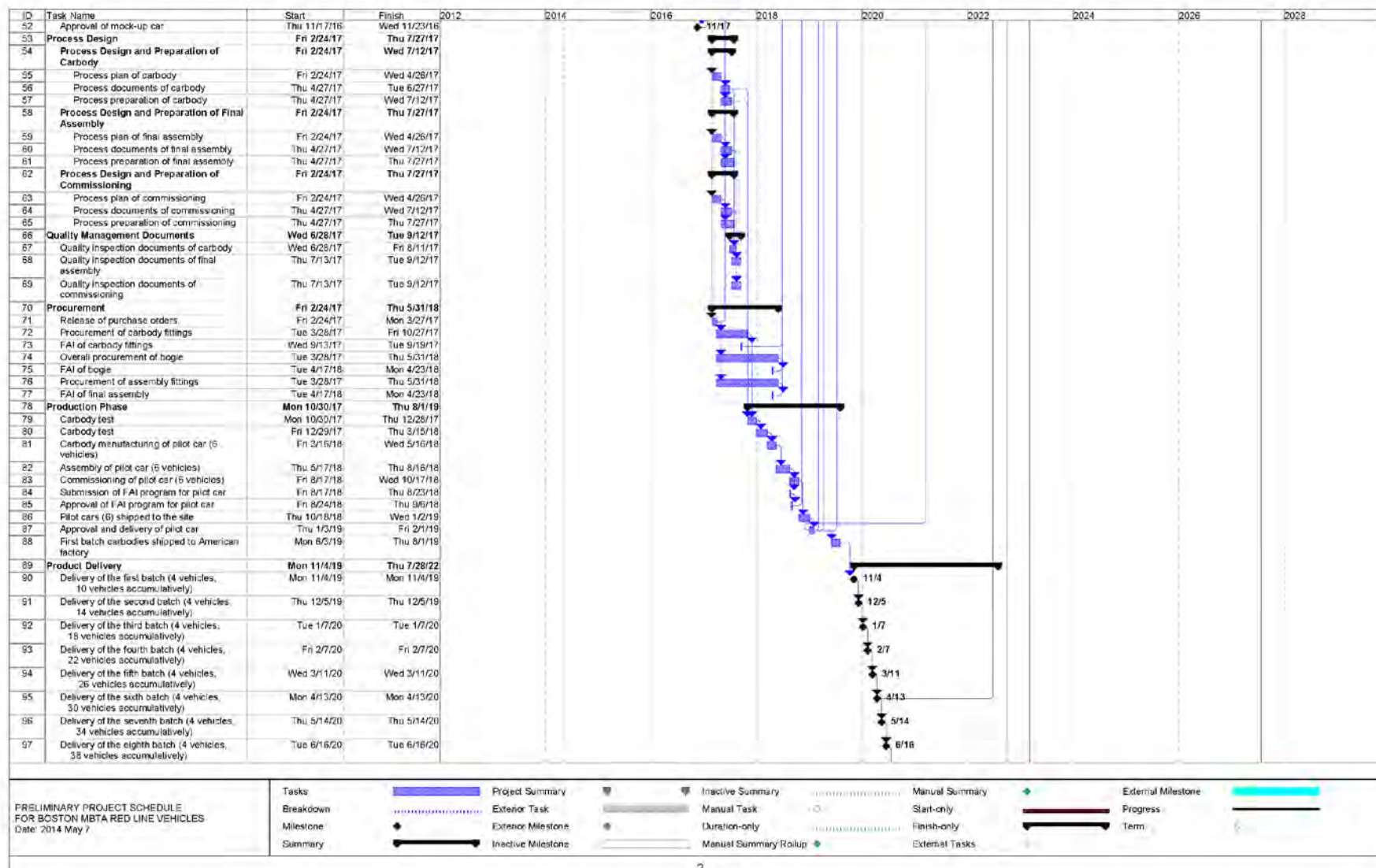
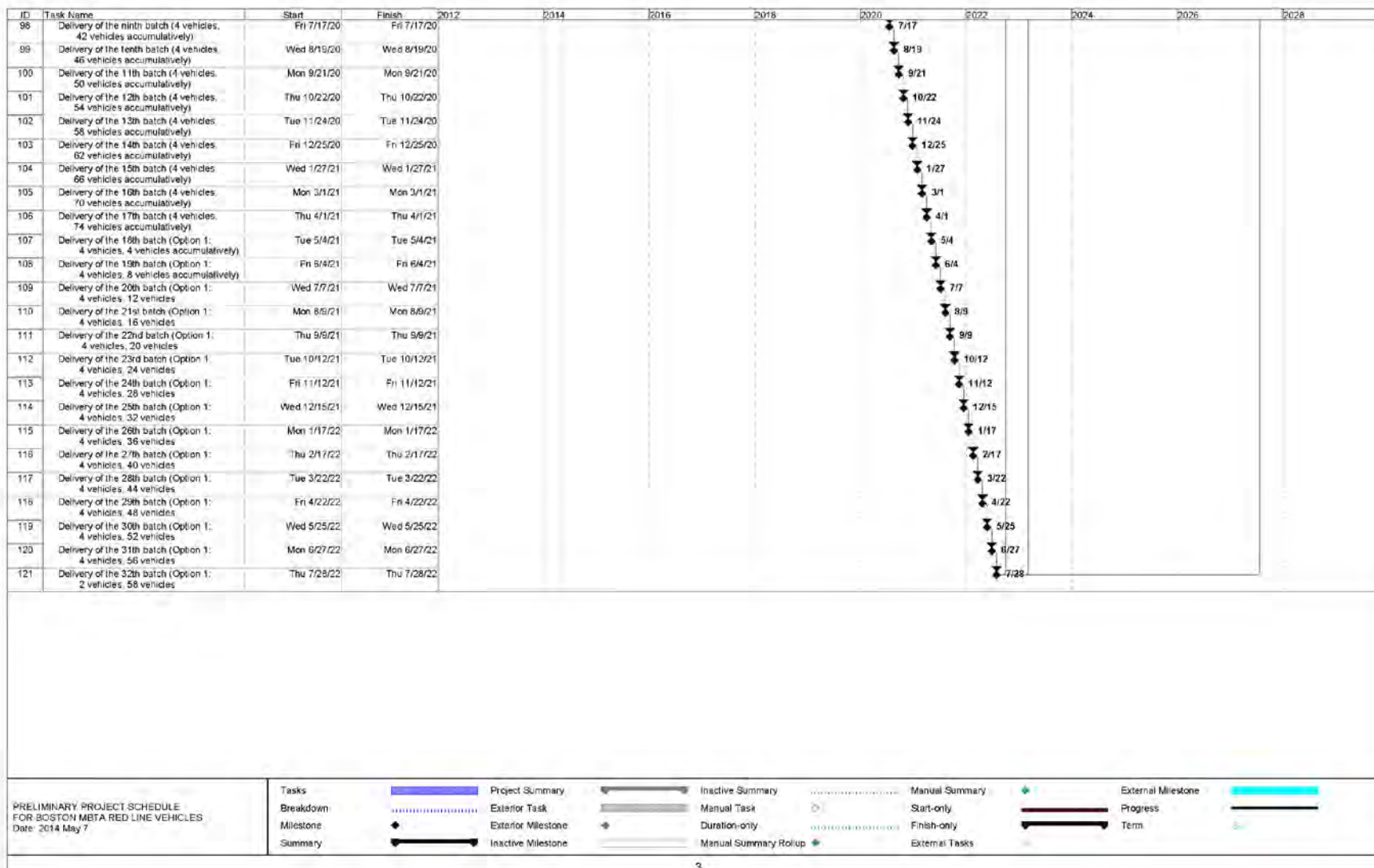


FIGURE I.1J-2
Preliminary Project Schedule Red Line



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement



I.1K. DESIGN REVIEW PROCESS

CSR Sifang JV the design review process to be critical to the overall success of this MBTA program. For clarity, CSR Sifang JV has divided the following process description into major sections which, together, form an effective and proven strategy for implementing the design review process.

INTERNAL REVIEW

CSR Sifang JV routinely manages the design and development process through establishing a product design control system. This system highlights the necessity of reviewing design input, output, and associated modifications and divides the process into three phases – the Plan Design, the Technical Design, and the Construction Design. Appropriate methods are also adopted within discrete design phases to augment and/or complete the review on design output required to ensure that this output can fully satisfy the requirements of the design input.

During the Plan Design Phase, the inputs related to product requirements are defined while considering the requirements of RAMS and LCC input. The design suitability is reviewed for adequacy against Q/SFG 03-12 'Product Design Review Management Regulations'. Design results are further verified in accordance with Q/SFG 03-13 'Product Design Verification Control Procedures'. Several subject matter specialists and departments may review the results including process, production, quality management and finance. Relevant records are documented within Design Review Reports, Design Review Record Lists, and other.

The Technical Design Phase focuses on refinement and improvement of the compiled contents of the Plan Design. The design for primary components and systems are further defined therefore creating a foundation for later Construction Design activities. Verification and comparison activities are again performed against Q/SFG 03-13 'Product Design Verification Control Procedures'. The conformance of the Design Plan is further verified via computer simulation or testing to ensure that the design output can satisfy the design inputs. Relevant records are documented within Test Reports, Simulation and Calculation Reports, Design Review Reports, Design Review Record Lists, Drawings, and other.

The Construction Design Phase provides further refinement and improvement of the output of technical design. Construction drawings and technical documents of all parts are typically completed during this phase. Similar verification and documentation protocol applies relative to the Plan and Technical Design Phases. Upon the trial production of the first article unit, CSR Sifang JV verifies the use functions of the product in accordance to Q/SFG 03-14 'Product Design Confirmation Control Procedure' to validate and provide evidence that the product performs as designed.

DESIGN MEETING AND DESIGN REVIEW

CSR Sifang JV will divide the design function associated with the MBTA vehicles into three phases as described above (Plan Design, Technical Design, and Construction Design). At the beginning of each design phase, CSR Sifang JV will submit to the MBTA a Design Plan outlining critical issues which must be addressed between CSR Sifang JV and MBTA. The resolution of these will form the foundation for a resolved Design Plan utilized for subsequent development action. The basis for the Design Meeting and Design Review will include:

- The MBTA/CSR Sifang JV procurement contract and corresponding specification
- The technical clarification and modification plan as endorsed by both parties
- Review comments documented during Design Review activities
- Work contact list(s), meeting minutes, and related memoranda.

CSR Sifang JV estimates that the first Design Meeting will focus on the vehicle initial design and last approximately 3 weeks. Meeting subjects may include general train composition drawings, general

equipment arrangement of equipment, vehicle interior style, interface issues, major system discussion, other. CSR Sifang JV will provide a detailed meeting agenda in advance at least 2 weeks prior to the mutually scheduled activity.

The second Design Meeting will be held near the beginning of the Technical Design and last approximately 2 weeks. Meeting subjects may include MBTA comments on the CSR Sifang JV Technical Plan, a review of the interface plan between the vehicle and traction systems, clarification of interface plans, and other subjects.

A third Design Meeting will further refine topics and evaluate subjects in greater detail (including primary subsystems such as the bogie, air supply equipment, lighting, and other). Subsuppliers may also be asked to participate directly. MBTA will be asked for written concurrence with resolved outcomes. Similarly, a further Design Meeting will focus not only on technical issues but schedule and logistical issues such as testing, commissioning and acceptance procedures for the vehicles. CSR Sifang JV will provide all follow-up documentation concerning Design Meeting activities.

DESIGN REVIEW FOR SUBCONTRACTORS

Prior to each design communication function and activity (as described above) between CSR Sifang JV and MBTA, related technical principals of each subsystem should validate the Design Plan together with relevant subcontractors to ensure that materials proposed and provided fully meet the MBTA requirements.

I.1L. SYSTEM INTEGRATION

CSR Sifang JV considers the scope of system integration functions and activities to be critical relative to the overall success of rail vehicle development. System integration forms the foundation of vehicle design, manufacturing and testing which is the basis for ensuring that all systems and equipment can be integrated together. In addition, system integration activities must consider the internal and external interface relationships between vehicle and signaling, power supply, monitoring, communication, and other critical subsystems.

PROVEN CSR SIFANG JV SYSTEM INTEGRATION CONTROL STRATEGIES

As CSR Sifang JV has successfully applied on other similar projects, the following system integration strategies will be implemented for this MBTA project including:

- Create/establish a dedicated system integration plan and define the range of interfaces and functional documents
- Select similar proven solutions from already existing rail vehicles
- Create/establish interface control standards
- Formulate a dedicated system integration project group (task force)
- Determine interface inspection procedures and verification methods
- Establish a dedicated interface decision making system
- Verify and test components and assemblies in the car prototype
- Test evaluation of subsystems
- Test evaluation of cars and trains

SEAMLESS SYSTEM INTEGRATION

The CSR Sifang JV Project Manager is ultimately responsible for creating specific project wide system integration functions including with associated work tasks being applied by the System Integration Project Engineer. Other key CSR Sifang JV project staff involved with administering the system integration function includes the proposed Chief Designer, System Engineers, and key staff affiliated with major subcontractors.

System integration professionals will be responsible for reviewing the drawing and design data of relevant critical interfaces. System Engineers will join other key system integration professionals during the design review process and focus on optimizing and enhancing the system integration rational process. The System Integrator will act as an arbitrator/facilitator for the various aspects of the car design and be fully experienced in the various disciplines required for effective car design.

System integration professionals will utilize the following proven and functional management tools to guarantee that the intended application of specification requirements are achieved, including:

- Clear work breakdown structure
- Project criteria matrix
- Interface control procedures
- Configuration control procedures
- Documentation flow instructions and program
- Internet-based communication and project control.

During the project design phase, system integration professionals will review interface drawings and technical documents, prepare and modify interface control documents/drawings, and participate in design review meetings with subcontractors and System Engineer. During subsequent first article inspection activities, CSR Sifang JV system integration professionals will support the verification and validation of interfaces in various subsystems. This further includes their participation during testing and inspection of mechanical, electrical, and pneumatic interfaces. CSR Sifang JV regards the first article inspection function as the first verification activity for confirming interface acceptability.

The proven CSR Sifang JV system integration procedure further focuses on the commissioning tests associated with the proposed vehicle. The initial test vehicle will provide actual interface layout which will validate that interface standards and issues. The results of these initial tests will form the foundation of the final system integration plan.

The mission of system integration continues through acceptance inspection and test/reliability demonstration periods. Under static and dynamic modes, system integration activities confirm satisfactory vehicle performance. Specific items will be verified concurrently such as clearance between MBTA infrastructure and various interfaces between the railway and communication subsystem (among others).

To reinforce the effectiveness of the system integration process, CSR Sifang JV system integration professionals will determine the interface relationships between various subsystems early in the project. These, in turn, will be specified and controlled according to their corresponding relationship between themselves and other key subsystems. TABLE I.1L-1: 'Subsystem Interface System Integration Matrix' describes various known relationships from prior CSR Sifang JV project.

For each interface, system integration standardization methods are applied by defining the interface standard and preparing the interface control drawings or documents. Detailed interface information typically includes (but is not limited to):

- Equipment input/output requirements/tolerances
- Equipment power supply/consumption requirements
- Equipment pneumatic power supply/consumption requirements
- Protection of equipment power supply circuit
- Limitations of equipment installation
- Limitations of equipment location and operation
- Limitations of equipment EMI/EMC
- Isolation/shielding requirements related to equipment wiring
- Equipment impact and vibration limits as well as vibration damping requirements

- Equipment operation intervals
- Generation of equipment operation noise
- Requirements of equipment diagnostic interfaces
- Compatibility with existing equipment and infrastructures
- Software requirements
- Limitations of system failure mode(s)
- System bypass/cut-off requirements
- Other

TABLE I.1L.-1
Subsystem Interface System Integration Matrix

	Air braking/pneumatic	Cab	Carbody	Communication	Coupler/Buffer	Diagnostics	Door Control	Door	Event Recorder	HVAC	Power Distribution System	Interior	Lighting	LVP System	Traction System	PTC	Bogie	Trackside Equipment	Command Center	Maintenance Shop	Station	Railway
Air braking/Pneumatic																						
Cab																						
Carbody																						
Communication																						
Coupler/Buffer																						
Diagnostics																						
Door Control																						
Door																						
Event Recorder																						
HVAC																						
Power Distribution System																						
Interior																						
Lighting																						
LVP System																						
Traction System																						
PTC																						
Bogie																						
Trackside Equipment																						
Command Center																						
Maintenance Shop																						
Station																						
Railway																						
EMI/EMC Management																						
FMECA																						
Weight Management																						
Publication and Training																						

I.1M. CONCEPTUAL DESIGNS

Please refer to the Appendix of this proposal section for conceptual design information.

I.1N. MOBILIZATION PLAN AND APPROACH FOR CONDUCTING DYNAMIC VEHICLE-LEVEL QUALIFICATION TESTING

The overall philosophy of CSR Sifang JV towards test mobilization is the early and ongoing involvement of the project team in the design, development, and testing of the cars. This will lead to a smooth transition from all specified phases of the project. CSR Sifang JV will dedicate all appropriate and adequate resources to this project, which will be mobilized rapidly in a manner that will ensure the effective and timely completion of all required dynamic vehicle-level qualification testing to the full satisfaction of the MBTA.

GENERAL

The following test sequences will be performed on MBTA's premises. It is the objective of the test program to perform a significant part of the tests on external sites or at our facilities to minimize test duration on the MBTA property and to reduce interference with regular system operation.

QUALIFICATION TESTING FOR PILOT CARS

After delivery of the cars to MBTA's site, CSR Sifang JV will perform the Dynamic Vehicle Qualification Tests before permitting the cars to proceed into Acceptance Tests. Dynamic Qualification Tests will be conducted during revenue service off-periods (with the exception of the shake down tests, which must be performed during revenue service).

Proposed testing will follow the sequence outlined in TABLE I.1N-1: "Test Sequence" below:

**TABLE I.1N-1
Test Sequence**

Sequence	Test	Sequence	Test
1	Noise and Vibration	7	Miscellaneous
2	Drift	8	Signal System
3	Propulsion and Braking Performance	9	Operation
4	Friction Brake Performance	10	Air Conditioning
5	Ride Quality	11	Heating
6	Electrical Interference		

All dynamic tests at MBTA premises (except for shakedown tests and other main line tests) should be performed on straight and level track. Simulated passenger load (such as cast iron blocks) for the loads up to AW3 will be made available. For slip and spin protection tests, a special setup necessary to spray a prepared water/soap solution onto the rails may be provided. Third rail power supply with sufficient power must be made available by the MBTA for all dynamic tests. For examination purposes and setup of test equipment, access to a pit-equipped track should be made available by the MBTA. For tests conducted on MBTA property, MBTA train operators will be required during dynamic testing operations. For loading/unloading of simulated passenger loads, temporary assistance of MBTA staff will be necessary.

TEST EQUIPMENT AND TOOLS

All regular test equipment and tools will be furnished by CSR Sifang JV. For tests conducted at the MBTA, CSR Sifang JV would like to kindly request that the MBTA make available all wayside equipment manufacturer's special equipment.

Procedures for Test Results Requiring Corrective Action

CSR Sifang JV internal procedures ensure that all changes resulting from the pre-delivery tests and qualification tests will be conducted prior to delivery of the pilot cars. All necessary changes will be implemented directly during car design activities.

DESIGN REVIEWS

Throughout the design review process, responsible test experts are responsible to feedback test results from any component or car test(s), which may have either a direct or indirect impact on design. CSR Sifang JV believes it is critically important for test engineers to have the opportunity to influence the design process and share their experience during the early project development stage(s). This minimizes the likelihood for repeated errors or omissions.

TEST RESULT REPORTS

Test engineers may again influence the design process through creating test result reports. Each test result is thoroughly documented in test result sheets. The test result sheets do not only include the results of the tests, they also include conclusions of these results. Test reports are then distributed internally within the project organization and the resulting knowledge shared and made available for use in other concurrent CSR Sifang JV projects.

I.10. RELIABILITY

CSR Sifang JV is well experienced providing exceptional reliability vehicles and systems. All reliability targets established by the MBTA will either be met or exceeded by the proposed CSR Sifang JV vehicle systems.

During the design phase of the project, reliability targets will be allocated for relevant subsystems. Reliability performance will be predicted utilizing methods such as a reliability block diagram and fault tree analysis. Associated equipment failures will be considered and integrated within the analysis in terms of their potential impact.

Utilizing the reliability analysis, CSR Sifang JV will estimate the projected reliability performance of the overall system, determine the potential weaknesses and identify the subsystem having the greatest improvement potential. Should any latent defects be identified, corrective measures will be analyzed and implemented. An analysis report will be created by CSR Sifang JV during the design stage to document how the system configuration can meet the requirements of overall reliability and communicate the results of the reliability performance prediction. The report will be updated during the construction phase.

CSR Sifang JV will utilize appropriate design standards to assess human factors which may influence system safety and efficient system operation. Specific human factors may be analyzed to ensure that the man-machine interface design of major systems reduces potential adverse influence based on human factors. In general, considered failure modes which may adversely impact safety will be documented within the hazard log. Fault information from similar installations and equipment may be utilized to augment analysis activities.

The analytical method applied will be based on failure mode, effect, and criticality analysis (FMEA) and other suitable reliability analysis methods. Initially, the FMEA will identify potential problems and then analyzes to resolve possible effects and severity. Related systems and subsystems will be integrated into the FMEA to the greatest extent possible. The effects of low level equipment relative to the entire operating system will be discerned in a top-down manner (including software and human factor failure modes). The effects of various assembly failure modes may migrate to other associated systems. The impact of any redundant equipment features will be considered. This iterative process will continue until

the overall impact on system functionality can be determined. Human factors elements will further be considered.

Other relevant analysis methods such as the utilization of reliability block diagrams and fault tree analysis will be utilized for the assessment of specific failure modes. During the testing and initial operating phases of the project, CSR Sifang JV will test and evaluate relevant equipment and components to ensure that reliability targets established as part of the design process can be realistically achieved.

To support validation of the reliability analysis prior to vehicle acceptance, identified equipment will be tested utilizing simulated operating conditions. During test activities, vehicles will be operated for 40 hours of simulated actual service without system failures. Major subsystems will be individually evaluated during testing including, for example, window wipers, door operations, and other. Any failures will be fully investigated and documented. Test details and results will be provided within the reliability report.

FAILURE REPORTING AND CORRECTIVE ACTION SYSTEM

CSR Sifang JV will create FRACAS system software in accordance with actual conditions. Subsystem suppliers will further be required to participate in the FRACAS system. A provided RAM Demonstration Plan will contain operational details associated with any failure reporting and corrective action analysis. The FRACAS system will utilize RELEX software. CSR Sifang JV encourages further dialogue with the MBTA to actually participate in the FRACAS program including the failure report and rehabilitation programs themselves. Further, agreement will be sought between CSR Sifang JV and the MBTA in terms of specific data to be collected relative to preventative and corrective maintenance requirements.

SUBSYSTEM SUPPLIER RAMS ACTIVITIES AND MANAGEMENT

Subsystem supplier RAMS activities will be administered, managed and conducted utilizing proven methods, including:

- RAMS requirements for specific subsystem will be defined by CSR Sifang JV
- RAMS experts will guide and support the work of the subsystem supplier as necessary
- RAMS of the subsystem suppliers will be combined together to achieve complete RAMS requirements
- Subsupplier RAMS documents will be frequently reviewed to validate achievement of RAMS requirements
- Regular meetings will be conducted between CSR Sifang JV and subsystem suppliers.

TAB I.1 Attachments

TAB I.1 ATTACHMENTS – CONCEPTUAL DESIGN DRAWINGS

Please refer to Part B, Volume 2 of this proposal for Conceptual Design Drawings.

TAB I.2

TAB I.2 MANUFACTURING PLAN

I.2A. TOTAL PLAN BY PRIME, CAPACITY AND LOCATIONS

WORK BY PRIME CONTRACTOR

CSR Sifang JV team member CSR Qingdao Sifang Co. Ltd (hereinafter referred to as CSR Sifang) is China's largest industrial base for manufacturing rail transportation equipment and trains. It occupies 14.4 million sq.ft. (1.34 million sq.m.) of well-equipped manufacturing space. Currently, it has the capacity to produce 1,000 metro type cars annually. In the last 10 years it has been producing world class quality metro vehicles for China and Export markets.

CSR Sifang JV will act as the prime contractor on this project. CSR Sifang JV team (including all suppliers) will perform all project activities necessary for the delivery of cars in complete compliance with all contract requirements, including:

- Project management
- Risk Management
- System integration
- Design and engineering of carbody, propulsion, auxiliary power supply and other electrical subsystems
- Interior and exterior design of the cars
- Purchasing/contracting the coordination of qualification testing of equipment and services within CSR Sifang JV scope of supply
- Manufacture and testing of carbody shell, traction propulsion system (including traction inverter, traction motor and gears, and controls), control equipment, and auxiliary inverter
- Supervision of final assembly
- Assembled Vehicle Testing (including dynamic testing and commissioning)
- Documentation and training activities and the management thereof
- Warranty assistance and field support.

The CSR Sifang JV Project Group Executive for this project will have the full responsibility to act on behalf of CSR Sifang JV on overall project matters and will direct, coordinate, and control the project team throughout the duration of the project. The Program Manager will be the primary contact point with the MBTA for this project and will directly report to the Project Group Executive. The Program Manager will be headquartered at the Boston Project Office with full complement of support staff. Further support staff for this project will also be located at CSR Sifang (Qingdao, China) and at the final assembly facility in Massachusetts.

CSR Sifang JV will design the cars and integrate all systems for this project. CSR Sifang JV will maintain the highest level of quality control and assurance for all systems throughout the design, build and testing of the MBTA Red and Orange Line cars.

CSR Sifang JV will have the overall design responsibility and coordinate the ultimate approval and acceptance by MBTA. The overall design functions of CSR Sifang JV Team (including suppliers) include:

- Basic design for the complete vehicles
- Systems integration (including mechanical and electrical subsystems)
- All design aspects of the car body and its arrangement
- Subsystem specifications (mechanical and electrical)
- Detailed engineering of the following subsystems:
 - Propulsion
 - APS/LVPS
 - Trucks
 - Door systems
 - Couplers and draw gear
 - Train Monitoring System (TMS)
 - Automatic Train Protection / Automatic Speed Regulation (ATP/ASR)
 - Vehicle Monitoring System (VMS)
 - Communication systems
 - Automatic Vehicle Identification (AVI)/Passenger Emergency Intercom (PEI)
 - Brake systems.
- All associated matters concerned with quality assurance and design management
- Underfloor layout engineering
- Installation engineering (electrical and mechanical).

MANUFACTURING LOCATIONS

CSR Sifang JV will manufacture major carbody components, perform carbody assembly, inspection, conduct testing and measuring, and apply interior and exterior surface treatments to the stainless steel carbodies proposed for this project. The vehicle final assembly work will be carried out by CSR Sifang JV in the final assembly metro car plant located in Massachusetts. This location will meet the definition of final assembly and the general requirements as defined in Section C7.18 of the MBTA RFP CAP27-10 package. This plant will also meet or exceed the domestic USA content requirement as defined in this section.

CSR Sifang JV will conduct various manufacturing activities from its manufacturing plants in the following locations:

- Qingdao China (carbody)

- Massachusetts, USA (final assembly activities for production (non-pilot) vehicles, as listed on Section C7.18)

The manufacture and assembly of carbody shells (hereafter referred to as 'carbody') will be conducted at CSR Sifang' Qingdao Manufacturing Plant.

The integration of the propulsion system into the vehicle will be performed at the CSR Sifang JV Massachusetts Final Assembly Plant in the USA. The pilot set of propulsion equipment (inverters, motors, and controls) will be tested on a dynamometer capable and programmed to simulate all the MBTA service demand conditions. The TMS system will also be tested in the same configuration as used in the cars.

System integration and the definition of system requirements will be performed at the CSR Sifang' engineering offices in Qingdao, China. Basic layout of major electrical components and the definition of their requirements will also be performed at the same location. The production (non-pilot) integration of electric control equipment will be conducted primarily at the CSR Sifang JV's final assembly plant in Massachusetts.

The CSR Sifang Qingdao, China manufacturing plant already possesses an adequate workforce and technological capability to conduct all specified car production activities. The final assembly plant in Massachusetts will be constructed and staffed to the qualified manpower levels to meet or exceed the project schedule requirements and quality standards.

MANUFACTURING CAPACITY

CSR Sifang Qingdao, China manufacturing plant has allocated capacity to produce one vehicle per day (batch process). Should the project require an accelerated schedule the plant has the capacity to meet the increased volume.

Initial project planning of the final assembly plant capacity in Massachusetts is projected to be one vehicle every two days. As this is in the design stage capacity could be increased should the need arise prior to NTP.

CARBODY MANUFACTURING WORK AT CSR SIFANG QINGDAO PLANT

All major carbody design and manufacturing work will be performed in-house at its CSR Sifang Qingdao Manufacturing Plant. The manufacture of the stainless steel carbodies by CSR Sifang will comprise the following processes:

- Manufacturing of the major carbody components such as the underframe, sidewalls, endwalls, and the roof
- Assembly of the carbody shell, inspection and quality check of the carbody shell
- Finishing, sealing, and prime coating of the inside of the carbody
- Surface treatment of the exterior carbody surface
- Install FRP cab for the lead end of car.

For the manufacture of major carbody components and the assembly of the carbody for this project, CSR Sifang Qingdao Plant has allocated 30 welding fixtures or stands. The cycle for the single car batch welding is 26 working days and the cycle for pilot production is 45 days. For this capacity 168 manufacturing personnel will be required which will be composed of: 74 assemblers/journeymen, 74 certified welders, and 20 ironworkers for cutting, punching and forming.

Typical Carbody Process flow

Main welding process methods used for the stainless steel carbody of the metro car include arc resistance welding, manual and automatic resistance spot welding, resistance seam welding, stud welding, etc.

The underframe, side wall, roof, end wall and cab of the carbody are separately welded into large sub-assemblies from components, which will be assembled together into the final carbody by welding.

Pre-assembly of the underframe edge beam (side sill) with the connecting steel is completed with the spot welding machine and the side sill pre-assembly tools. Welding is performed using the spot welding machine and MIG welding machine with the underframe in the inverted assembly position. After the underframe is assembled and welded, it shall be rolled over using the underframe overturning device. Complete inspection of all critical full penetration welds shall be performed using liquid penetrant inspection (LPI) for critical welds on the underside and the topside of the stainless steel underframe.

Series spot welding and laser welding are applied in welding side walls, which will use an profile conforming plane welding mode to ensure the flatness and the profile of the outer surface of side walls. When performing series spot welding, a layer of copper plate with high conductivity, acting as the auxiliary electrode, is positioned in the fixture platform to reduce effects of spot welding shunt on the quality of the welding spots. Laser welding is used in the majority of the skin welding assembly of the sidewall units. The sidewall welding consists of two steps: first, the welding between beam and side skin assembly with the longitudinal beams and then the welding between columns and the sidewall assembly is performed. Before taking each step, the assembly relationship shall be checked thoroughly to ensure high quality of welding.

Curved roof beam and longitudinal connection frames are pre-assembled in a perimeter roof beam pre-assembly tool. Roof panels are seam welded by an automatic seam welder that prevents marks or indents to the exposed surface. Roof structure assembly is completed for the roof using precise assembly tools. Spot welding work is performed using an automatic welding machine and an automatic spot welding machine. Other arc welding not accessible to the automatic machines, is completed using MIG welding. Upon completion of assembly and welding of the roof, it shall be rolled over using the roof overturning tools. Additional parts shall be welded on the roof, that are inside the car, and shall be weld sealed and completed prior to a local water test, that shall be performed.

The assembly of exterior end sub assembly consists of frame assembly welding, which is positioned in the fixtures and carries out the sheet and framing spot welding. Frame assembly welding is completed by utilizing end wall frame fixtures and welding tools, which are then positioned by clamping, to fix into the sub assembly which is then welded. This completes the end sub assembly welding.

The cab is designed as an independent modular unit, which following carshell integration, as noted below, is installed and connected to the under-frame, side walls and roofing using a bolted structure that ensures water-tightness during the on-site installation.

When performing general assembly of the carbody, the underframe is first lowered onto the underframe supporting tooling with the camber and vertical deflections preset.. Then after inspection checks of the camber profile, the side wall is lowered into position. To protect the exterior skin of the side wall, the side wall is the first to be lifted into position in the integration fixture. The trailing end or cab end are then lowered into position, and finally the roof structure is positioned.. After the entire carshell structure is adjusted and checked as positioned and complete, the integration welding shall be performed. The automatic spot welder is used to weld the joint between the outer surface of the side wall and the side sill beam of the underframe. For the side wall and the roof structure, spot welding is performed by the automatic spot welder and for other welding work, the required MIG or TIG arc welding shall be performed.

I.2B. USA FINAL ASSEMBLY ORGANIZATION AND LOCATION

The final assembly operations processes and measures will be accomplished in a new facility located in the State of Massachusetts (USA). It will be under the management and supervision of the CSR Sifang Final Assembly Site Manager. The minimum operations to be performed in this facility are:

- Installation and interconnection of propulsion control, propulsion cooling, brake system, battery system, power distribution panels, low voltage power distribution panels, interior framework, HVAC, cab and signaling controls, communication equipment, passenger information equipment, auxiliary motors, truck installation of wheel sets, truck suspensions, pneumatic system pipework, control panels, compressor and reservoirs and auxiliary control and contactor enclosures.
- Inspection and verification of all CSR installation and interconnection work completed in the assembly site location; inspection and verification of the subcontractors work; incoming inspections of all materials from suppliers.
- In-plant static testing of the equipped products to verify all functions including the finished vehicle and married pairs.
- Other manufacturing processes, inspections, other testing, and operations as approved by MBTA.

The proposed factory will include the following facilities: general assembly workshop, materials, single car test workshop, commissioning workshop, single and married pair static test area, and other service areas for repairs and supplier work. The initial production capacity is designed to produce 1 car every two days. The facility shall be designed to have workshop bays and assembly areas having 30 ft. (9 meter) clear height fully equipped with cranes, compressed air, water, and various electrical power levels. The plant will be heated using indirect forced air over natural gas. The capability to implement plant expansion for increased vehicle production capacity shall be included in the plan.

ASSEMBLY PROCEDURES

Carbodies delivered to the CSR Sifang JV Final Assembly Plant in Massachusetts will be moved by truck with a crane and stored protected in a secure outside area. Movement of the carbody from the outside area to the assembly area will be accomplished through the use of a rubber-tired transport dollies. These dollies will be replaced by jack stands inside the facility, for a fixed position, then other moving stands or steel-wheeled dummy trucks, will be used, as appropriate for underframe equipment station installation processes. Dummy trucks or moveable stands, will be used to transport carbody within the assembly area. The production trucks will be fitted at the end of the production line, and will be used in instead of dummy trucks when transferring the carbody to the static testing/final assembly location. A rail equipped transfer table connects the assembly area to the static testing, exterior finishing, snag clearing areas.

CONTROLS

Production Control at the CSR Sifang JV Massachusetts plant will consist of the following activities:

- Preparing and updating production schedules
- Materiel control, marshalling and stocking the work stations and off line shops
- Monitoring work progress through the documented & tracked car travelers
- Tracking and reconciling production man-hours
- Producing processing sheets and updates to work instructions

- Materiel shortage and expediting
- Work flow balancing at station positions, revising work methods to improve quality and efficiency
- Production configuration control.

For production control, CSR Sifang JV will use software packages to control the aforementioned activities. Floor documents will be customized for the specific project. Car travelers will track tasks through individual workstations before and during inspection, quality assurance and testing. Production configuration control resulting from engineering changes is accomplished through the thorough and strict adherence to documentation control. The component upgrade or replacement and updating of engineering processes and all resulting production process changes are also ensured through this thorough and strict documentation control.

MATERIAL AND SERVICES CONTROL PROGRAM

The operational success of the project is critically dependent upon ensuring that all project materials are delivered to the CSR Sifang JV Massachusetts facility at the right time. Material control and expediting shall provide this function.

Under the supervision of CSR Sifang JV and the Final Assembly Site Manager, material control activities begin at contracting stage, and followed by regular progress reporting, and the inspection and receipt of material from vendors. Material received will be verified for both type and quantity and inspected by CSR Sifang JV Massachusetts incoming Quality Assurance Organization. If the material is to specification and /or drawing and deemed acceptable, the material will be logged, staged and subsequently made available for production. This material is accounted for, logged into the Enterprise Resource Planning (ERP) system and placed in storage at the designated locations. Inventory levels and material schedules are monitored and exception reports generated far enough in advance so as to ensure timely delivery of materials or expediting the delivery of the materiel. A proven and fully integrated ERP software system is always utilized to perform this function.

A Material Review Board (MRB) will review all materials, stored (in a separate and secured designated area) and tag all non-conforming material. The MRB will meet on a regular basis, so as to discuss and disposition materiel, in the quarantined area. The MRB also has the responsibility to document, resolve, apply a disposition and account for all discrepant materials. The MRB will be comprised of Engineering, Quality Assurance, CSR Massachusetts Final Assembly Site Manager, and Material Control representatives.

FINAL ASSEMBLY ORGANIZATION

CSR Sifang JV Massachusetts' Final Assembly Site Manager will control the final assembly of cars. The MBTA Project Manager of CSR Sifang JV will work closely with CSR Sifang JV's Final Assembly Site Manager to ensure that all final assembly work is performed properly, efficiently, and at the highest possible level of quality. CSR Sifang JV Massachusetts Final Assembly Site Manager will ensure that the workforce is organized, trained, and maintained in order to meet the production schedules. The Final Assembly Site Manager will also ensure that all finished products meet or exceed the quality standards of CSR Sifang JV, and the MBTA.

At the final assembly location, CSR Sifang JV will establish specific groups responsible for the preparation of the following:

- Production Layout, line stations, car movements, and manpower loading
- Schedules

- Procedures
- Quality control
- Material control
- Detailed Workflow Plans and Procedures
- Material Process flow
- Testing and snag clearing.

The general process flow of Final Assembly plant in Massachusetts will include:

Carbody Transportation and Unloading → Assembly → Carbody/Truck Mounting → QA Inspection → Water Testing → Weighing → Gauge Testing → Static Testing → Commissioning → Deliver to Customer

The cycle time of the US final assembly process is estimated to be 39 days for each car. The detailed production assembly line activities shall include:

HVAC and Air Duct Installation → Onboard Finishing and Wiring → Passenger Door Installations → Middle Section Ceiling Panel Installation → Side Wall Panels Installation → Cab and Hostelling Panel Installations → End Ceiling Sections Installation → Corner Ceiling Panels Installation → Seat Installation → Stanchion and Handrail Installation → Wiring point to point ring out → Mega testing → High Pot testing → Vehicle QA Inspection

Production configuration control resulting from engineering changes will be introduced and strictly controlled through documentation control coordination with production and test functions. The replacement and updating of engineering and subsequent production process changes, including their resulting effects, will be accomplished through this function. Field service changes will also be strictly controlled following line production activities and processing. Production, testing and Documentation control will ensure these activities are timely and properly accomplished and tested.

SCHEDULES

Critical path activities will be highlighted and used to create visibility of major project activities that illustrates progress of the intermediate milestones and final deadlines. The master schedule plan for the project will be created and updated by CSR Sifang JV for project activities. This overall master schedule will be formed from the detailed activity scheduling of the program.

Upon receipt of the Notice-to-Proceed, CSR Sifang JV will create a detailed Critical Path Method (CPM) schedule. The CPM schedule will include the flow time and man-power loading of all areas of the design, procurement, tooling, manufacturing, assembly, inspection and testing for the entire project. The CPM schedule will also define the key milestones and timelines required by the MBTA in order to comply with the projected completion dates and schedules. CSR Sifang JV and its suppliers will proceed with the required planning, conceptual assembly drawings, detail drawings, approved assembly drawings, and procurement of and/or design of unique tooling necessary to produce the systems and associated hardware.

Design reviews will be held at key phases of the design to evaluate adherence to specification requirements, operational performance, production, methods of fabrication, and schedule. A final design review will be conducted. The official release of all drawings to production for the final manufacture of equipment will begin immediately following the successful completion of the final design review and

approval of the design by the MBTA. These activities are critical to the production and timely delivery schedule of the vehicles.

I.2C. WORK PERFORMED BY PRIME CONTRACTOR AND LOCATIONS

Work performed by Prime Contractor (CSR Sifang JV) is as follow:

- Project management
- Risk Management
- System integration
- Purchasing/contracting the coordination of qualification testing of equipment and services within CSR Sifang JV scope of supply
- Manufacture and testing of carbody shell
- Supervision of final assembly
- Assembled Vehicle Testing (including dynamic testing and commissioning)
- Documentation and training activities and the management thereof
- Warranty assistance and field support
- Basic design for the complete vehicles
- Design, engineer and manufacture of carbodies
- Subsystem specifications
- All associated matters concerned with quality assurance and production management.

CSR Sifang JV will manufacture major carbody components, perform carbody assembly, inspection, conduct testing and measuring, and apply interior and exterior surface treatments to the stainless steel carbodies proposed for this project. The vehicle final assembly work will be carried out by the CSR Sifang JV in the final assembly metro car plant located in Massachusetts. This location will meet the definition of final assembly and the general requirements as defined in Section C7.18 of the MBTA RFP CAP27-10 package. This plant will also meet or exceed the domestic USA content requirement as defined in this section.

CSR Sifang JV will conduct various manufacturing activities from its manufacturing plants in the following locations:

- Qingdao China (carbody, pilot vehicle assembly, testing, commissioning)
- Massachusetts, USA (final assembly activities for production (non-pilot) vehicles, as listed on Section C7.18).

The manufacture and assembly of carbody will be conducted at CSR Sifang' Qingdao Manufacturing Plant.

The integration of the propulsion system into the vehicle will be performed at CSR Sifang JVs' Massachusetts Final Assembly Plant in the USA. The pilot set of propulsion equipment (inverters, motors,

and controls) will be tested on a dynamometer capable and programmed to simulate all the MBTA service demand conditions. The TMS system will also be tested in the same configuration as used in the cars.

System integration and the definition of system requirements will be performed at the CSR Sifang' engineering offices in Qingdao, China. Basic layout of major electrical components and the definition of their requirements will also be performed at the same location. The production (non-pilot) integration of electric control equipment will be conducted primarily at the CSR Sifang JV's final assembly plant in Massachusetts.

The CSR Sifang Qingdao, China manufacturing plant already possesses an adequate workforce and technological capability to conduct all specified car production activities. The final assembly plant in Massachusetts will be constructed and staffed to the qualified manpower levels to meet or exceed the project schedule requirements and quality standards.

I.2D. PLAN FOR CSR FINAL ASSEMBLY

CONTRACTOR

Final assembly contractor will be a new facility wholly owned, managed and run by CSR Sifang JV to be located in the state of Massachusetts, USA.

PRODUCTION IMPLEMENTATION PROCESS

Upon carbody shipment from China and receipt at CSR Sifang JV Massachusetts, installation of interior and exterior frames and brackets to accepted equipment, interior walls, conduits and pipes will be carried out followed by the installation of interior and exterior equipment. Wiring Continuity, Mega and Hi-Pot tests followed by pressurization tests comes next. Exterior closeout equipment and components are subsequently installed to allow the environmental and heat and air-conditioning testing. This is followed by completion of the interior finishing and by single car tests, including the water test, gauge clearance check and weighing tests. Completed car testing include static and trainline testing. After factory acceptance, shipment readiness, protective packaging and shipping to customer site for commissioning preparation, dynamic testing, and final burn-in testing & commissioning. Following this, the vehicles will be readied for service and handed over to the Authority following their final acceptance.

PRODUCTION ORGANIZATION PROCESS

CSR employs a "Just-in-Time Pull Type" philosophy of production (see sample flow diagram next page) will be used as a means of tracking manufacturing resources, processes and logistics from start to finish. This type of system is driven by pre-planned production activities and targets. The production phase is determined by "its previous process pulling into the next process" and "interaction between previous and the succeeding processes" is closely linked. The rate of production is highly influenced by; process split, materials splits and scheduled time, logistics, and required quantity setting. These planned production targets will dictate production speed, just-in-time material logistics and the extent of automation in the production processes.

FIGURE I.2D-1: "Production 'Just-in-Time Pull-Type System'" graphically illustrates this organization process type.

ASSEMBLY QUALITY MANAGEMENT

Duties of the assembly QA is to:

- Organize process training in advance to familiarize the constructors with installation processes and quality milestones.
- During the construction of each process, technical department and quality control department will be organized to perform process evaluation, so problems can be found and corrected in a timely manner.
- Perform final inspection during delivery of initial and subsequent complete trains to find issues and correct these problems on the existing and in-production vehicles.
- Test the vehicles together with the client after static; dynamic and commissioning testing, agree solutions and accept the Authorities decision and make rectifications timely.
- Organize daily quality processes; organize inspection to maintain quality and production process continuity.

MATERIALS MANAGEMENT

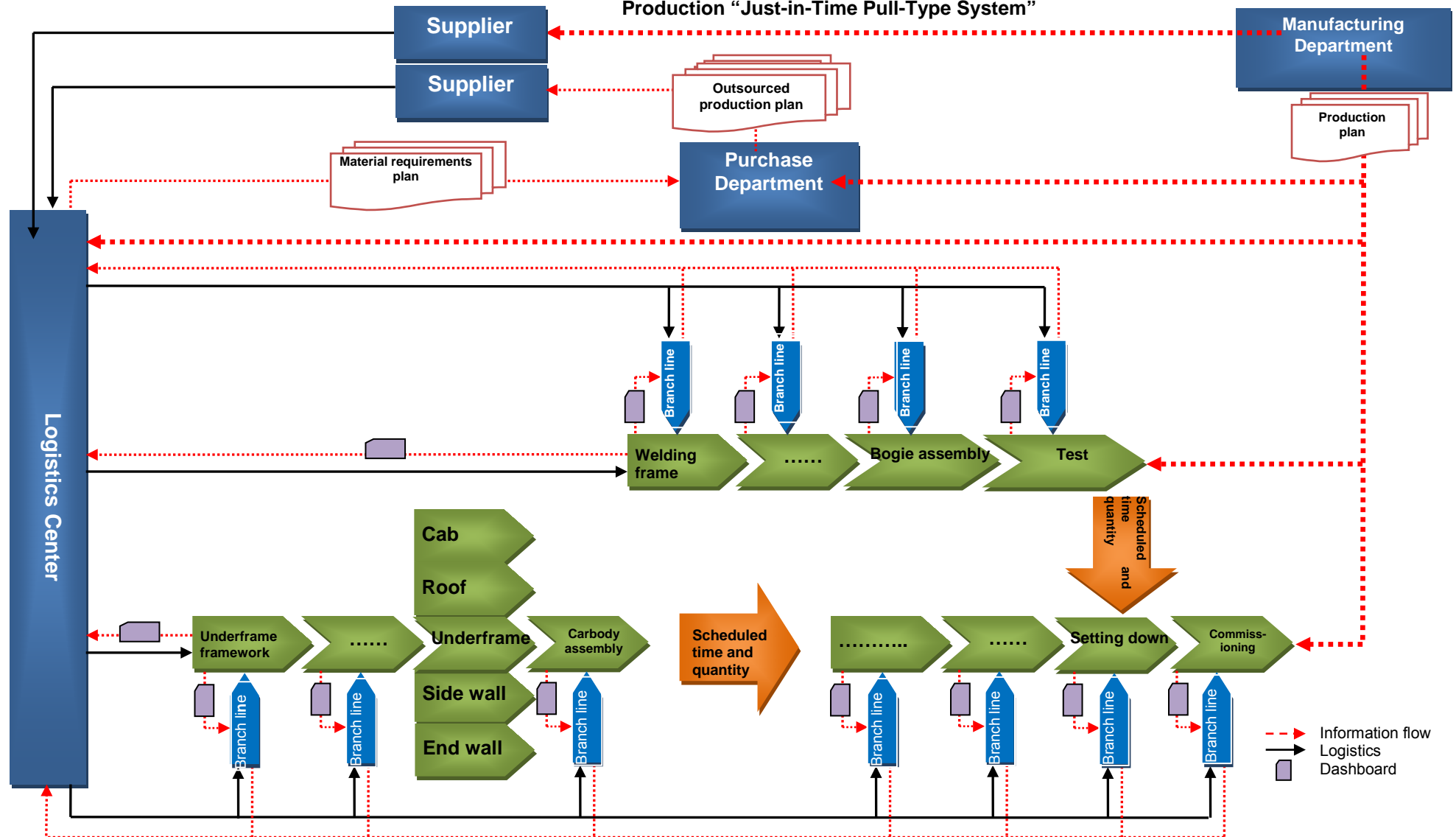
All materials shall submit to the receiving inspection in the stores/warehouse before being put into inventory in the warehouse according to the material code. The warehouse activities shall in-phase with production; ensure the planned quantity of materials will be inspected and available for production. All materials to be put into storage are housed and marshaled and distributed according to the three-day plan or notice and the quantity of materials to be put into storage is according to the production material plan. Quantity of the raw materials and adjusted materials are recorded and modified by the production process personnel according to actual usage. Insufficient and redundant materials warnings are provided to the production and program staff regularly during the implementation of the project. Redundant materials statistics is performed during and at the end of the project and action taken to treat these materials and processes so revised methods are used in accordance with the specified requirements and relevant regulations.

RETROFIT WORK

If reconstruction is required during the operation of vehicles and MBTA's facility and/or equipment are not available for the retrofit activities, CSR Massachusetts will implement the retrofit on site providing their own equipment and manpower to complete the job. This work will not interfere with the daily normal operation of vehicles.

FIGURE I.2D.-1

Production “Just-in-Time Pull-Type System”



I.2E. NEW FACILITY: CAPACITY, PROCESS AND EQUIPMENT

FINAL ASSEMBLY

A new Final Assembly plant with a capacity capable of delivering 96-100 cars annually, located in Massachusetts, is proposed by CSR Sifang JV. This facility will be designed, owned and operated by the proposer to meet the requirements under MBTA RFP CAP27-10 section C7.18 and the delivery schedule of commissioned cars.

CAPACITY, PROCESSES, EQUIPMENT, AND SCHEDULES

The new factory in the USA includes minor damage repair shop, general assembly workshop, materials preassembly workshop, single car test workshop, commissioning workshop, dynamic test commissioning track, etc. The factory will be sized and arranged to perform vehicle assembly, single car static test, high voltage testing, coupled static and commissioning on a 2 day vehicle production cycle until completion of the project.

**TABLE I.2E-1
List of Processes, Capacities and Facilities**

No.	Name of workshop	Approx. Area SQ. FT (m²)	Remarks
1	Administration Area	10,700 (1000)	Conditioned space
2	Pre-assembly area: truck; pneumatics & small parts; wiring & harness	21,500 (2000)	Pre-assembly zone 3 sections: trucks/bogies; pneumatics & small parts; electronics
3	General assembly workshop on cars	54,800 (5100)	11 stands, 2 cranes, 2 omni bearing trolleys
4	Commissioning workshop	20,500 (1900)	Pits
5	Car test workshop	19,400 (1800)	Rails indoors
6	Logistics	10,700 (1000)	Caged enclosure, logistics warehouse
7	Water test, rework, static test	5,400 (500)	Spray booths water, floor drain & pumps
8	Transverser and other material handling /Pkg	19,400 (1800)	Reinforced floor for transverser
TOTAL MANUFACTURING UNDER ROOF		162,400 (15100)	

Note: The clear height for all workshops is 9m (30+ ft.), and all supporting utilities will be provided as necessary to all workstations.

**TABLE I.2E-2
Miscellaneous Process Equipment for Final Assembly Plant**

No.	Equipment name	Quantity (set)	Manufacturer
1	Window installation equipment	4	TBD
2	Single girder overhead traveling crane	2	TBD
3	Traverser	1	TBD
4	Track mobile car	1	TBD
5	Assembly high stands	18	TBD
6	Dummy trucks	30	TBD
7	Self-driven electric lifting platform	4	TBD
8	Scissor lifts for undercar equipment	4	TBD
9	Forklift	2	TBD
10	Forklift	1	TBD
11	Car unloading stand	1	TBD
12	Lifting device for complete train	1	TBD
13	Lifting device for air conditioner	1	TBD

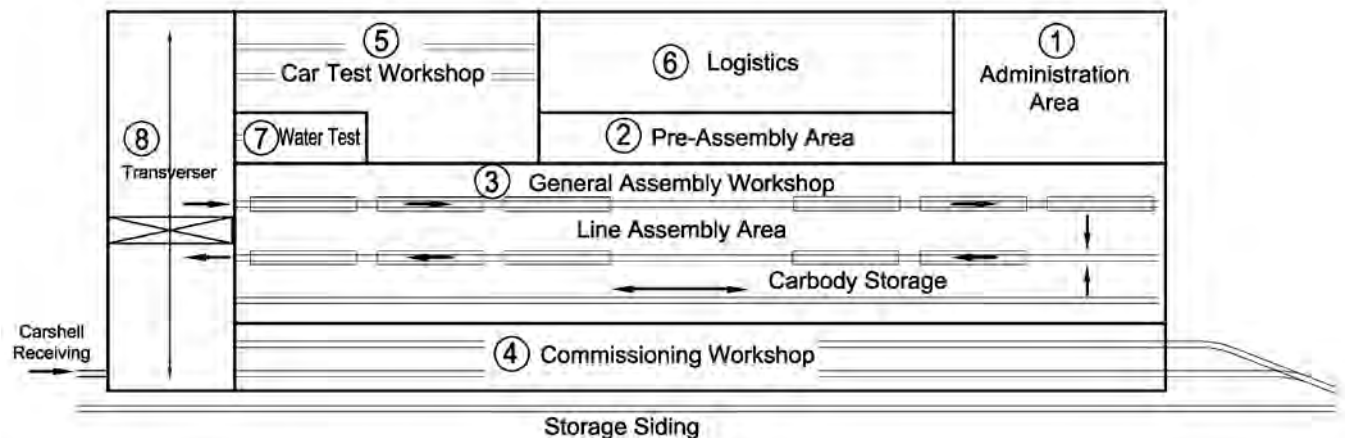
No.	Equipment name	Quantity (set)	Manufacturer
14	Mechanical device for installation of the windshield glass into front windows	1	TBD
15	Door mechanism lifting stand	1	TBD
16	Frame air duct lifting table	1	TBD
17	Frame air duct rotating table	1	TBD
18	Accessory storage and transportation tools	1	TBD
19	Preassembly tools, fixtures & platforms	1	TBD
20	Pneumatic Pressure Air tightness test bench	1	TBD
21	Pneumatic test tools	1	TBD
22	Pressure maintaining cart	2	TBD
23	Pneumatic tools	1	TBD
24	Torque & Tightening tools	As Req'd	TBD
25	Tools carter/boxes	20	TBD
26	Transport cart	11	TBD

RECRUITING US PERSONNEL EFFORTS

CSR intends to ensure overall compliance with the MBTA's policy of hiring and training of skilled labor in the greater Massachusetts Bay Area. The CSR strategy to identify and contact qualified skilled trade personnel for their employment in the US Final Assembly plant includes the following actions:

1. Contacting and confirming certification of all the job placement organizations, along with possible schools in the greater Boston Metro Area sending them a a list of positions and corresponding work description including the number of job openings that would be needed to staff the US assembly plant. Using Reference:
https://www.mbta.com/business_center/bidding_solicitations/materials_management/invitation_for_bids/Default.asp
2. Accessing the Supplier Diversity Office (SDO) website and downloading the pertinent companies and agencies that can assist in recruiting the best possible candidates.
<https://www.somwba.state.ma.us/BusinessDirectory/BusinessDirectory.aspx>
3. Identifying if any recruiting firms from the December 3, 2013 MBTA New Orange Red Line Vehicle Procurement Pre-Proposal Meeting sign-in sheets.
4. Contacting the SDO office to discuss other resources available through that office and to talk with the SDO representative overseeing this RFP.
5. Contacting the SDO office for a list of firms that have successfully performed for the MBTA or its primes in the past.
6. Searching the directories and contacting firms providing personnel services in the manufacture of rail vehicles.
7. Placing openings in the "*Boston Globe*" inviting job seekers to participate. The "*Globe*" is the largest general circulation newspaper in Massachusetts
8. Placing a notice in the Springfield "*Republican*" for the various job openings needed. The "*Republican*" is a large newspaper in western Massachusetts

9. Placing want ads on the MBE Magazine website (mbemag.com) seeking workers for the disadvantage socio- economic regions of Massachusetts to apply. "Minority Business Entrepreneur" (MBE) magazine is the largest national MBE-focused magazine in the USA.
10. Placing a notice in Passenger Transport (the APTA magazine) inviting unemployed skill trades to apply. "Passenger Transport" magazine is the APTA bi-weekly and the public transportation industry's leading publication

FIGURE I.2E-1
FINAL ASSEMBLY PLANT LAYOUT


I.2F. STAFFING: FINAL ASSEMBLY CSR MASSACHUSETTS

CSR Sifang JV expects to create numerous jobs and career opportunities throughout the execution of this project. Specifically, CSR Sifang JV estimates a total of 70 direct labor positions will be created. TABLE I.2F-1: "US Final Assembly: Work Duration and Staffing" summarizes the total number and type of positions that will be created by the creation of CSR Sifang JV's Final Assembly Plant in Massachusetts.

TABLE I.2F-1
US Final Assembly: Work Duration and Direct Labor Staffing

TASK NUMBER	WORK DESCRIPTION	DURATION hours per 40 hr-wk	PERSONNEL COUNT + TYPE		NOTES
			ELECTRICIAN	JOURNEYMAN	COMMENTS
0	Cab console and power distribution cabinet pre-assembly	8	3		
	Interior component pre-assembly	16		3	
1.	Installation of air conditioning, wiper and headlight	16	2	3	
2.	Wiring duct and wiring upon and under the car	16	(4)		Staff from Task 1
3.	Installation of middle ceiling panel, door mechanism, underneath equipment and braking equipment	16		4	
4.	Installation of end panel and	16	1	2	

	equipment cabinet				
5.	Installation of wall panel, end ceiling, side door of the cab, air supply and air return	16		4	
6.	Wall panel under the window	8		(2)	Staff from Task 5
7.	Installation of door pillar, door handle and electrical equipment	16	2	2	
8.	Side-roof panel, interior electric equipment, electrical heat installation	16	1	2	
9.	Seat frame, door panel installation and interior equipment wiring	16	4	2	
10.	Partition door, rear end door, underframe wire crimping	16	2	2	
11.	Side-roof adjustment, equipment wiring	16	(4)	2	Electricians from Task 9
12.	Lamp, seat and handrail installation	16	2	2	
13.	Passenger area equipment, wiring above underframe	16	(3)	1	Electricians from Task 9
14.	Handrail, pillar, interior wiring	16	(2)	2	Electricians from Task 9
15.	End finishing, interior wiring	16	(2)	2	Electricians from Task 9
16.	Line continuity test	8	3		
17.	Insulation and voltage withstand test	8	(3)		Electricians from Task 16
18.	Falling carbody on bogie	4		(8)	Staff from Task 19
19.	Weighing, gauge, rain leakage	2 for each		4	
20.	Marshalling	8	(2)	2	Electricians from Task 21
21.	Inspection and measurement before electrical energized	8	4	4	
22.	Battery operation, wiper and air horn test	8			
23.	High voltage power supply, air compressor and pipeline pressure maintaining test	8			
24.	Auxiliary system, anti-sliding and parking brake test	8			
25.	Door test, air conditioning test, BC pressure measuring	8			
26.	Test of vehicle monitoring system	8			
27.	Starting, snow resistant brake, brake failure loop test	8			
28.	Car delivery	16	2	2	
29.	Dynamic commissioning	8	(2)	(2)	Electricians, fitters from Task 21
30.	Water test of whole train	8		2	
31.	Test at customer's site	24	3		
			26	44	Total: 70 persons

NOTE: (#) personnel not specifically assigned to this task item on a continuing basis.

I.2G. REFERENCE WORK DONE WITH STAINLESS STEEL CARS FOR OTHER METROS

Table I.2G-1: “List of Previous CSR Sifang Stainless Steel Carbody Customers” provides a reference list of CSR Sifang’s manufacturing experience in supplying world class metro stainless steel carbodies similar in scope and magnitude to this project. CSR Sifang JV has selected only highly accomplished and proven system integration suppliers, professionals, and subcontractors who will meet or exceed all specified MBTA goals for the project.

TABLE I.2G-1
List of Previous CSR Sifang Stainless Steel Carbody Customers

METRO CUSTOMERS	QTY of CARS	CONTRACT DATES	CARBODY MANUFACTURER
Beijing Subway Operation Co., Ltd (Beijing Metro Line 1)	120	05/25/2006-06/2008	CSR Sifang
Beijing MTR Corporation (Beijing Metro Line 4)	240	05/26/2006-09/2009	CSR Sifang
Chengdu Metro Co., Ltd (Chengdu Metro Line 1)	102	10/12/2007-05/2010	CSR Sifang
Shenyang Metro Co., Ltd (Shenyang Metro Line 2)	120	02/29/2008-07/2011	CSR Sifang
Tianjin Metro Group Co., Ltd (Tianjin Metro Line 3)	162	09/01/2008-10/2011	CSR Sifang
Beijing Rail Transit Construction & Management Co., Ltd (Beijing Metro Line 8)	198	07/29/2009-10/2012	CSR Sifang
Beijing Rail Transit Construction & Management Co., Ltd (Beijing Metro Daxing Line)	198	07/29/2009-12/2010	CSR Sifang
Beijing Rail Transit Construction & Management Co., Ltd (Beijing Metro Changping Line)	162	12/29/2009-12/2010	CSR Sifang
Chengdu Metro Co., Ltd (Chengdu Metro Line 2)	138	03/23/2010-05/2012	CSR Sifang
Chengdu Metro Co., Ltd (Chengdu Metro Line 2)	114	01/28/2011-12/2013	CSR Sifang
Beijing Subway Operation Co., Ltd (Beijing Metro Line 1)	114	04/27/2011-02/2012	CSR Sifang
Beijing Rail Transit Construction & Management Co., Ltd (Beijing Metro Line 14)	150	03/23/2012-2014	CSR Sifang
Beijing MTR Corporation (Beijing Metro Line 4)	78	09/24/2012-11/2013	CSR Sifang
Beijing Rail Transit Construction & Management Co., Ltd (Beijing Metro Line 8)	36	11/21/2012-08/2013	CSR Sifang

Shenyang Metro Co., Ltd (Shenyang-Tieling Intercity Railway Project)	66	09/27/2013-2014	CSR Sifang
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STATEMENT OF MANUFACTURING RESOURCES AVAILABLE FOR MBTA PROJECT

Based on current backlog and future work forecasting, CSR Sifang JV will have the capacity, personnel and all necessary resources to satisfy and deliver on time all of the vehicles and supporting scope items for this project.

I.2H. PROPOSED SUPPLIERS OF MAJOR SUB-SYSTEMS

TABLE I.2H-1: 'Potential Supplier Scope, Location, Capacity, and Experience' contains information regarding the scope, manufacturing locations, capacity, and experience of the candidate suppliers CSR Sifang JV has identified in planning for this project.

TABLE I.2H-1
Potential Supplier Scope, Location, Capacity, and Experience

Name	Major Subsystem(s)	Supplier Proposed Equipment	Supplier Manufacturing Location	Total Supplier Mfg Capacity	Supplier Capacity for this Project?	North American Mfg Experience (include qty)
ABB	Propulsion, VMS	Orgalime S2000 with ABB Amendment, for a total quantity of 113 Propulsion & VMS Systems per married pair.	Phoenix, Arizona	100 sets/year	Yes	<ul style="list-style-type: none"> • 53 BORDLINE@CC400 Propulsion Systems for MTA Maryland LRV (2013) • 2 BORDLINE@CC400 Propulsion Systems DART Dallas Streetcar (2013) • 72 BORDLINE@CC400 Propulsion Systems Newark LRV (2012) • 12 BORDLINE@CC400 Propulsion Systems SDOT Seattle LRV (2012) • 24 BORDLINE@CC750 Propulsion Systems DCTA Denton DMU (2009) • 13 BORDLINE@CC750 Propulsion Systems Capital Metro DMU (2005)
Toyo Denki	Propulsion, Auxiliary Power, VMS, LVPS, Network Equipment	Propulsion Inverter, Knife Switch Box, HSCB, API & LVPS, VMS & Digital Network Traction Motor Gear Unit Brake Resistor HSCB	<ol style="list-style-type: none"> 1. Toyo Denki USA, Inc. 2507 Lovi Rd. Freedom, PA 15042 2. Swiger Coil Systems, 4677 Manufacturing Rd. Cleveland, OH 44135 3. ZF Industries, Inc. 1261 Palmour Drive SW, Gaineville, GA 30501 4. Microelettrica Scientifica, 4 Middlebury Blvd, Unit 12, Randolph, NJ 07869 5. 3-8 Fukuura, Kanazawa-Ku, 	Factory Size: 36,258 square feet 8 propulsion inverters (4 trains) will be assembled per month;	Approx. 40% of the capacity will be allocated to the MBTA program.	<ul style="list-style-type: none"> • Propulsion systems for DART LRV Project - 20 Car sets (2004) • Propulsion systems for DART SLRV Project - 48 Car sets (2004)

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

Name	Major Subsystem(s)	Supplier Proposed Equipment	Supplier Manufacturing Location	Total Supplier Mfg Capacity	Supplier Capacity for this Project?	North American Mfg Experience (include qty)																																																																																				
			Yokohama, Japan																																																																																							
Bradken	Trucks and Major Truck Components	Bradken Truck Frames & Bolster Assemblies	Truck castings: 400 South 4th Street, Atchison, Kansas. Final machining, paint, and truck assembly: 3811 South 48th Terrace, St. Joseph, Missouri.	Declined to state	Yes	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 292 trucks for California and Miami are in service were manufactured by Bradken.																																																																																				
Columbus Steel (formerly Buckeye Steel)	Trucks and Major Truck Components	226 carsets of complete trucks consisting of: 2 truck frame castings, 2 truck bolsters, assembly labor, and 2 kits of ancillary components	2211 Parsons Avenue Columbus, OH 43207	Declined to state	Yes	<table><tr><th colspan="2">Transit Authority</th><th>Car Type</th><th>Year</th></tr><tr><td>Denver</td><td>Eagle</td><td></td><td>2013</td></tr><tr><td>Amtrak</td><td>Viewliner LDSL</td><td></td><td>2012</td></tr><tr><td>SEPTA</td><td>Silverliner V</td><td></td><td>2010</td></tr><tr><td>Alaska Rail</td><td>Bi-Level</td><td></td><td>2008</td></tr><tr><td>NJDOT</td><td>Comet V</td><td></td><td>2005</td></tr><tr><td>Amtrak</td><td>Surfliner</td><td></td><td>2000</td></tr><tr><td>CALTRANS</td><td>JPB</td><td></td><td>1999</td></tr><tr><td>NJDOT</td><td>Comet IV</td><td></td><td>1998</td></tr><tr><td>NJDOT</td><td>Comet III</td><td></td><td>1996</td></tr><tr><td>CALTRANS</td><td>California</td><td></td><td>1995</td></tr><tr><td>MNCR</td><td>Single Level</td><td></td><td>1995</td></tr><tr><td>Amtrak</td><td>Viewliner</td><td></td><td>1994</td></tr><tr><td>MNCR</td><td>M6</td><td></td><td>1993</td></tr><tr><td>Amtrak</td><td>Superliner II</td><td></td><td>1992</td></tr><tr><td>MBTA</td><td>#3 Red Line</td><td></td><td>1992</td></tr><tr><td>Amtrak</td><td>1500 Series MHC</td><td></td><td>1990</td></tr><tr><td>Amtrak</td><td>Horizon</td><td></td><td>1989</td></tr><tr><td>NYCT</td><td>R-62A</td><td></td><td>1984</td></tr><tr><td>CALTRANS</td><td>Bi-Level</td><td></td><td>1984</td></tr><tr><td>LIRR</td><td>Single Level</td><td></td><td>1983</td></tr></table>	Transit Authority		Car Type	Year	Denver	Eagle		2013	Amtrak	Viewliner LDSL		2012	SEPTA	Silverliner V		2010	Alaska Rail	Bi-Level		2008	NJDOT	Comet V		2005	Amtrak	Surfliner		2000	CALTRANS	JPB		1999	NJDOT	Comet IV		1998	NJDOT	Comet III		1996	CALTRANS	California		1995	MNCR	Single Level		1995	Amtrak	Viewliner		1994	MNCR	M6		1993	Amtrak	Superliner II		1992	MBTA	#3 Red Line		1992	Amtrak	1500 Series MHC		1990	Amtrak	Horizon		1989	NYCT	R-62A		1984	CALTRANS	Bi-Level		1984	LIRR	Single Level		1983
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Transitair	Trucks and Major Truck Components, HVAC,	Truck Assembly, HVAC	One William K. Jackson Lane Hornell, New York 14843	Two fully equipped locations in Hornell, New York (180,000 sqft primary, 50,000 sqft reserve) Hornell facility at approx. 30%	Yes, up to 70% of total facility capacity is available for this project.	<table><tr><th colspan="2">Truck Supply History</th></tr><tr><td colspan="2">• METRA: 102 Push-Pull Trucks (2013-present)</td></tr><tr><td colspan="2">• CAF, USA: 260 Amtrak Trucks (2012-present)</td></tr><tr><td colspan="2">• SEPTA M4: 470 Trucks (2012-present)</td></tr><tr><td colspan="2">• METRA: 240 Push-Pull Trucks (2009-present)</td></tr><tr><td colspan="2">• MBTA: 100 Truck Frame Repair (2009-present)</td></tr><tr><td colspan="2">• NYCT: 312 Truck Frame Repair (2008-present)</td></tr><tr><td colspan="2">• MTA Baltimore: 204 Trucks (2009-2013)</td></tr><tr><td colspan="2">• MARTA CQ310: 208 Trucks (2003-2008)</td></tr><tr><td colspan="2">• WMATA 2K/3K: 744 Trucks (2002-2008)</td></tr><tr><td colspan="2">• GCRTA: 68 Trucks (2006-2008)</td></tr><tr><td colspan="2">• VRE: 20 Trucks (2002-2003)</td></tr><tr><td colspan="2">• NJT Comet V: 530 Trucks (2001-2004)</td></tr><tr><td colspan="2">• CTA: 1,194 Trucks (1999-2004)</td></tr><tr><th colspan="2">New HVAC Supply History</th></tr></table>	Truck Supply History		• METRA: 102 Push-Pull Trucks (2013-present)		• CAF, USA: 260 Amtrak Trucks (2012-present)		• SEPTA M4: 470 Trucks (2012-present)		• METRA: 240 Push-Pull Trucks (2009-present)		• MBTA: 100 Truck Frame Repair (2009-present)		• NYCT: 312 Truck Frame Repair (2008-present)		• MTA Baltimore: 204 Trucks (2009-2013)		• MARTA CQ310: 208 Trucks (2003-2008)		• WMATA 2K/3K: 744 Trucks (2002-2008)		• GCRTA: 68 Trucks (2006-2008)		• VRE: 20 Trucks (2002-2003)		• NJT Comet V: 530 Trucks (2001-2004)		• CTA: 1,194 Trucks (1999-2004)		New HVAC Supply History																																																							
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Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

Name	Major Subsystem(s)	Supplier Proposed Equipment	Supplier Manufacturing Location	Total Supplier Mfg Capacity	Supplier Capacity for this Project?	North American Mfg Experience (include qty)
						<ul style="list-style-type: none"> • VRE 2009 Unitized Bi-Level Commuter • NICTD 2008 Unitized Bi-Level Commuter • MBTA 2008 Unitized Heavy Rail • VRE 2008 Unitized Bi-Level Commuter • METRA 2006 Unitized Bi-Level Commuter • VRE 2006 Unitized Bi-Level Commuter
Faiveley	Auxiliary Power, Low Voltage DC Power. HVAC, Doors, Air Brake Equipment and Controls	Auxiliary Power, Low Voltage DC Power. HVAC, Doors, Air Brake Equipment and Controls	Faiveley Transport North America GREENVILLE, SC	<ul style="list-style-type: none"> • 405,000 sq.ft of climate controlled space on 33 acres. • 17 acres of additional land for growth • On-site R&D facility 	Yes	<p><u>APS Reference List</u></p> <ul style="list-style-type: none"> • CTA USA, 271 Metro Main converters, 2014 • CALTRANS, 130 intercity reversible inverters, 2013 • NYCTA, 6 Metro Brake compressors, 2013 • METRA, 163 Main converters, 2011 • AMTRAK, 10 Battery Chargers, 2005 • Sacramento RT, 36 Main converters, 2004 • Phoenix, 51 LRV Main converters, 2004 • Dallas city, 20 LRV Battery Chargers, 2004 • Dallas city, 20 LRV Main converters, 2004 • METRA, 28 Main converters, 2003 • METRA, 108 Battery Chargers/ LVPS, 2001 • NJT, 270 Battery Chargers, 2000 <p><u>HVAC Reference List</u></p> <ul style="list-style-type: none"> • Atlanta Airport APM, 2001 • Sound Transit (Seattle) Option, 8 units, 2008 • Sound Transit (Seattle) 31 Cars, 2008 • Valley Metro Rail (Phoenix) 36 cars, 2008 • Valley Metro Rail (Phoenix) 36 cars, 2008 • NJT Comet V - 265 cars, 2004 • Metro North/Conn Dot, 18 units, 1990 • Metro North/Conn Dot, 10 units, 2002 • San Francisco Airport APM, 64 units, 2002 • Houston APM, 20 units, 2002 • Denver APM, 10 units, 2001 • Las Vegas Airport APM, 4 units, 2000 • Dallas Airport APM, 128 units, 2003 • Denver Airport APM - 4 cars, 2007 • Pittsburgh APM, 2 units, 1999 • Atlanta Airport APM, 39 units, 2000 • San Francisco Airport APM, 39 units, 2000 • Miami DPM APM, 29 units, 2000 • Las Vegas Airport, 32 units, 2008 • Tampa Airport APM, 8 units, 2008

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

Name	Major Subsystem(s)	Supplier Proposed Equipment	Supplier Manufacturing Location	Total Supplier Mfg Capacity	Supplier Capacity for this Project?	North American Mfg Experience (include qty)
						<ul style="list-style-type: none"> • Sound Transit (Seattle) 31 cars, 2008 • Valley Metro Rail (Phoenix), 28 units, 2008 • Miami APM, 59 units, 2008 • GTW New Jersey, 40 units, 2002 • Talgo US Oregon/ Wisconsin, 60 units, 2011 <u>Door Reference List</u> <ul style="list-style-type: none"> • WASHINGTON S 5000, 2304 POCKET SLIDING, 2000 • SEPTA COMMUTER CARS, 2688 POCKET SLIDING, 2000 • NJT COMET 5, 817 POCKET SLIDING, 2002 • NJT COMET 5, 460 POCKET SLIDING, 2002 • INNOVIA (DALLAS), 200 OUTSIDE SLIDING, 2003 • NJT BI-LEVEL - End side, 370 POCKET SLIDING, 2005 • NJT BI-LEVEL - Quarter point, 415 POCKET SLIDING, 2005 • LOS ANGELES LRV, 400 POCKET SLIDING, 2005 • NABCO MIAMI, 110 POCKET SLIDING, 2005 • NJT BI-LEVEL - Option 1 -End side, 485 POCKET SLIDING, 2007 • NJT BI-LEVEL - Option 1 - Quarter point, 543 POCKET SLIDING, 2007 • SILVERLINER V 720, POCKET SLIDING, 2008 • NJT BI-LEVEL - Option 2 -End side, 166 POCKET SLIDING, 2008 • NJT BI-LEVEL - Option 2 - Quarter point, 185 POCKET SLIDING, 2008
Transtechnik	Auxiliary Power, Low Voltage DC Power	Auxiliary Power, Low Voltage DC Power	Transtechnik Corp. USA . Ball Ground GA 30107 . USA	Currently the estimated workforce is utilized at approximately 40% of capacity. We have the capabilities of adding an additional shift should a specific project require the extra attention.	Yes	Transtechnik has delivered more than 20,000 static power converters for more than 360 projects in more than 80 cities around the globe
Sutrak	HVAC	ACE238RR (2014 Model)	SUTRAK USA 6897 E. 49th Avenue Commerce City CO 80022	Declined to state	Yes	More than 30,000 U.S. manufactured systems in deployment
Westcode Inc	HVAC	HVAC	Westcode Incorporated Goshen Corporate Park	Declined to state	Yes	<ul style="list-style-type: none"> • Denver RTD, Roof Top, In Production • Smart/Metrolinx, Roof Top, In Production

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

Name	Major Subsystem(s)	Supplier Proposed Equipment	Supplier Manufacturing Location	Total Supplier Mfg Capacity	Supplier Capacity for this Project?	North American Mfg Experience (include qty)
			1372 Enterprise Drive West Chester, PA 19380			<ul style="list-style-type: none"> • PATCO, Split System, In Production • Metrolinx, Packaged, In Production • Septa, Roof Mounting, 2011 • Metro North Railroad (M8), Roof Top Mounting, 2011 • Niagara Frontier Transit Authority, Split System, In Production • METRA, Under Roof Mounting, 2013 • Amtrak, Locomotive, 2007/2013 • PATH, Split System, 2010 • Amtrak (Viewliner), Under Car, 2008 • Amtrak (Superliner II), In-Car Mounting, 2007 • Amtrak (Superliner I & II), In-Car Mounting, 2010 • New Jersey Transit (NJT), Split System, 2006 • METRA, Under Roof Mounting, 2006 • New York City Transit (R160), Roof Mounting, 2009 • New York City Transit (R142s), Roof Mounting, 2004 • Metro North Railroad (M2), Split System, 2009 • SEPTA, Split System, 2003 • New York City Transit (R143), Roof Mounting, 2003 • New York City Transit (R142a), Roof Mounting, 2002 • Tren-Urbano, Roof Mounting, 2000 • BART, Under Car, 1999 • TTC, Split System, 1995
Dellner	Couplers, Draft Gear	Automatic Couplers	DELLNER INC 8334-H Arrowridge Blvd Charlotte NC 282 73	Declined to state	Yes	<ul style="list-style-type: none"> • Boston Red Line, 168 Couplers • Boston Green, 100 Couplers • Washington 5K, 6k, and 7k, 388 Couplers • Boston Blue Line, 100 Couplers • San Diego VII & VIII, 142 Couplers
Wabtec Passenger Transit	Couplers, Draft Gear, Air Brake Equipment and Controls	Couplers, Draft Gear, Air Brake Equipment and Controls	130 Ridgeview Center Drive, Duncan, South Carolina, 29334	60 car sets per month/per shift for all equipment	Yes 40 to 50% of total capacity	<u>Air Brake System and Controls</u> *Over 5100 Carsets <u>Coupler System</u> *Over 5100 Carsets <u>Current Collector</u> *Over 4400 Carsets
UTC RAS	Wheel Sets	Wheel Sets	UTCRA, Inc. 501 Highland Avenue Morton, PA 19070	3,000 wheelsets per month. Operating at 22% capacity	Yes Up to 88% capacity	<ul style="list-style-type: none"> • SCRRRA New Car Build, 644 Wheel Assemblies, 2013 • SEPTA New Car Build, 500 Wheel Assemblies, 2013 • Denver RTD New Car Build, 200 Wheel Assemblies, 2015 • MBTA New Car Build, 300 Wheel Assemblies, 2014 • MBTA Commuter Rail Running Repair, 624 Wheel Assemblies annually, present • Amtrak Locomotive, 292 Wheel assemblies, 2014

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

Name	Major Subsystem(s)	Supplier Proposed Equipment	Supplier Manufacturing Location	Total Supplier Mfg Capacity	Supplier Capacity for this Project?	North American Mfg Experience (include qty)
						<ul style="list-style-type: none"> • Amtrak Viewliner, 520 Wheel Assemblies, 2015 • MARTA Running Repair, 960 Wheel Assemblies Overhaul, 2013 • Caltrans Overhaul, 64 Wheel Assemblies, 2014 • PATCO Gear Unit Overhaul, 208, Gear Unit Overhaul and Parts annually, present • WMATA Brake Discs / Wheels, 4,520 Discs, 2015 • SCRRA Running Repair, 2,000 Wheel Assemblies, 2013-2017
Knorr Brake Company	Air Brake Equipment and Controls	Air Brake Equipment and Controls	Knorr Brake Company, LLC 1 Arthur Peck Drive Westminster, Maryland 21157	Declined to state	Yes	<ul style="list-style-type: none"> • WMATA 5000, 110 Friction Brake Systems, Metro Pneumatic • Toronto Rocket, 234 Friction Brake Systems, Metro Pneumatic • WMATA 6000, 62 Friction Brake Systems, Metro Pneumatic • WMATA 7000, 364 Friction Brake Systems, Metro Pneumatic
Ansaldo	Cab Signal Equipment	ATP/ASR (MicroCab)	ASTS USA Manufacturing & Service Center, Batesburg, SC	180,000 sq. ft. plant	The plant has ample production and staffing capacity to manufacture the proposed MicroCab ATP/ASR equipment, even with current and anticipated contracts in progress.	<p>Over the past 15 years, ASTS USA has furnished carborne control systems for 21 different North American and international customers, including continuous cab systems for these U.S. heavy-rail commuter lines and passenger railroads:</p> <ul style="list-style-type: none"> • LIRR (Diesel locomotives, Bi-Level Coaches, M-1, M-3, M-7 cars) • NJT (ALP-46, Comet V, PL42AC, Multi-Level cars) • Amtrak (Acela High Speed Trains) <p>Total sets delivered for the above projects is 1150. Currently ASTS USA is developing heavy-rail continuous cab signal systems for WMATA's 7000 series cars as well as Montreal's MR-73 and MPM-10 vehicles. Total sets under development for these projects is 384, with options for several hundred more sets.</p>
GE Transportation Systems	Cab Signal Equipment	ATP/ASR Subsystem	Grain Valley, MO and Warrensburg, MO	Grain Valley, MO Mfg: 58,682 sqft Warrensburg, MO Mfg: 3 blds: 40,000 sq. ft, 61,082 sq. ft, and 41,600 sq. ft	Yes	<ul style="list-style-type: none"> • ATP, UTA Weber County / Commuter Rail, Qty: 22, 2007 • ATP, Portland Tri-Met / Commuter Rail, Qty: 40, 2007 • ATP, New Jersey Transit-Hudson Bergen / LRT, Qty: 42, 2002 • ATP, New Jersey Transit-Newark City, Qty: 24, 2001 • ATP, SEPTA / Commuter Rail, Qty: 220, 1990 • ATP/ASR, Baltimore MTA, Qty: 53, 2002 • ATP, LA Gold Metro Line / LRT, Qty: 30, 2001 • ATP, RTD Denver TREX, Qty: 150, 2012

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

Name	Major Subsystem(s)	Supplier Proposed Equipment	Supplier Manufacturing Location	Total Supplier Mfg Capacity	Supplier Capacity for this Project?	North American Mfg Experience (include qty)
						<ul style="list-style-type: none"> • ATP, DART / LRT, Qty: 163, 2008 • CBTC, FMG, Qty: 100, 2013 • CBTC, Caltrain, Qty: 38, In Progress
Ultimate Transport	Door Systems, Seats	Sliding Pocket Doors Systems	30914 San Antonio St, Hayward, CA 94544	50 door sets per month	Yes	<ul style="list-style-type: none"> • Queensland Rail, Australia 8 doors/car • Perth SMU, Australia • V'locity Bombardier, Australia
Vapor Stone	Door Systems	Door Systems	Plattsburgh, New York	Declined to state	Yes	<ul style="list-style-type: none"> • NYCT R142, 1030 cars @ 12 doors/car, 2003 • NYCT R142A / R142S, 600 cars @ 12 doors/car, 2005 • NYCT R143, 212 cars @ 16 doors/car, 2003 • LIRR M-7, 906 cars @ 4 doors/car, 2007 • NYCT R160, 1002 cars @ 16 doors/car, 2010 • PATH, 350 cars @ 12 doors/car, 2013
Freedman	Seats	Passenger Seats	Chicago, IL	Declined to state	Freedman Seating will deliver seats as needed per the production schedule.	<ul style="list-style-type: none"> • Amsterdam, The Netherlands, 4,984 Metro Seats • Bucarest, Romania, 3,552 Metro Seats • Lima, Peru, 2,128 Metro Seats • Panama, Panama, 1,292 Metro Seats • Mexico City, Mexico, 10,200 Metro Seats • Istanbul, Turkey, 6,030 Metro Seats • Caracas, Venezuela, 15,264 Metro Seats • Argel, Romania, 2,940 Metro Seats • Mallorca, Spain, 450 Metro Seats • Santo Domingo, Spain, 2,176 Metro Seats • Madrid, Spain, 18,308 Metro Seats • Barcelona, Spain, 6,272 Metro Seats • Rome, Italy, 10,152 Metro Seats
Kustom Seating	Seats	Passenger Seats	3000 Madison Street Bellwood, Illinois 60104-2219:	KSU and its collective resources owns and operates over 220,000 sq. ft. of manufacturing space and employs over 200 people.	Yes	Kustom Seating Unlimited, Inc. (KSU) has served transportation authorities and Original Equipment Manufacturers (OEMS) for over 20 years. Our experience, proven performance, and continuous growth have allowed us to seat every major U.S. transportation authority.
USSC	Seats	Operator Seats (Model 9008) and Footrests (Model 9700)	Exton, PA	USSC has more than adequate capacity to produce the goods required to support this project. Operations are currently running at 44% capacity	56% capacity available	The Operator seat proposed for use in the Red and Orange line cars is our Model 9008. This is the same model seat provided to Rotem for use in MBTA's Bi-Level commuter cars. Several other end users include Wabtec and Motive Power.
RL Controls	Vehicle Monitoring System,	Vehicle Monitoring System,	10V Gill St, Woburn, MA 01801	VMS, Network Communications: 20 systems/month	Yes	<ul style="list-style-type: none"> • NJT, New Jersey, cab signals, AVL/APC • MTA Maryland, Comm Equipment, ETN, APC & CDRs

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

Name	Major Subsystem(s)	Supplier Proposed Equipment	Supplier Manufacturing Location	Total Supplier Mfg Capacity	Supplier Capacity for this Project?	North American Mfg Experience (include qty)
	Network Equipment and Integrator, Communications Equipment	Network Equipment and Integrator, Communications Equipment		ETN, Network Equipment, ICE: 4 systems/mo.		<ul style="list-style-type: none"> • Amtrak Chicago, NOMAD Wi-Fi Soln, RLC, • MBTA, radio, AVL/APC, EDACS comm Eqp • MTA Baltimore, AVL/APC/CCTV • ACS Stamford CT, AVL/APC, info signs • RIPTA Rhode Island, AVL/TPS/CCTV
Woojin	Vehicle Monitoring System, Communications Equipment	Vehicle Monitoring System, Communications Equipment	5108 Asusa Canyon Rd., Irwindale, CA 91706	14 Car Sets per Month in 8,000 ft ² facility	Yes	Southeastern Pennsylvania Transportation Authority Silverliner V EMU Commuter Rail Fleet Procurement, 2011
Luminator	Lighting	Lighting	Luminator, 900 Klein Road Plano, Texas, 75074	Currently at 22% from a Plant Total sqft of 103,000	Yes, up to 88% is available for MBTA backlog	<ul style="list-style-type: none"> • WMATA 700 Hvy Rail, 528 cars LED lighting • CTA 5000 Hveay Rail, 714 cars LED lighting • NYCT 300 cars, 300 Flourescent
Trans-Lite	Lighting	Interior, Exterior, Emergency Lights	120 Wampus Lane – Milford, CT 06460	Declined to state	Yes	

I.2I. CONVEYANCE PLAN: QINGDAO TO FINAL ASSEMBLY MASSACHUSETTS TO MBTA

Final assembled vehicles will be transported to MBTA site via land transport and then be re-connected as a married pair for customer acceptance. Metro carbodies manufactured in China, will be shipped from Qingdao Port to the Port of Boston by sea and be delivered to the final assembly plant in Massachusetts via land transportation. Proper protection measures will be taken during the transportation to avoid handling and transit damage.

TRANSPORTATION ROUTES AND MODES***China and Ocean transportation***

Upon completion, the carbodies will be transported from Sifang factory to Qingdao Port by land transport and unloaded by crane at the unloading dock of Qingdao port. They will be loaded and secured in an ocean transport vessel. Ocean transportation time to the USA is estimated to be 35 days.

US Route

Upon arrival to the USA east coast port, the carbodies will be unloaded and secured on a pallet truck (lowboy) for land transport to the final assembly plant in Massachusetts. The transportation company will investigate the road routes to understand and consider the potential obstacles like bridges and turning radii, roadway widths, and DOT regulatory considerations (permits, escort requirements, etc., as applicable) needed to accommodate the transport size and weight of the vehicle transporters. Upon arrival at the final assembly plant, the carbodies will be unloaded and hoisted by crane at the unloading dock of the facility.

MBTA Delivery Site

The completed final assembled metro cars will be packed and secured using a crane at the final assembly plant to a custom pallet truck for new vehicle delivery to MBTA site via land transport. It will be unloaded by crane. The delivered vehicles will be unpacked and prepared on the MBTA site to be ready for final tests and customer acceptance procedures.

CUSTOM PALLET-TRUCK AND LIFTING DEVICES

Custom pallet trucks will be used for land transport of carbodies and completed metro cars. Four sets of customized lifting tools for land transportation and two sets for marine use will be manufactured for loading and unloading carbody and vehicles at various shipping points: CSR Sifang factory, final assembly factory in Massachusetts and MBTA.

PACKAGING AND HANDLING PROTECTION

Custom fabricated wooden cushion blocks will be used inside the pallet truck for cushioning protection. Numerous lever blocks will be used for securing carbodies to the pallet truck. Exterior equipment, line ports, vents, interior floor, seats, handrails and other parts will be film protected. Completed vehicles will be protected with a coverall transportation cover.

TEMPORARY STORAGE

Vehicles and equipment will be subject to temporary storage inspection procedures that ensure:

- The vehicle be cleaned of dirt, debris, wire and filing clippings and dust, shall be removed and then the car vacuumed before storage.
- All doors will be locked, including exterior and interior access doors.

- All valves will be shut off.
- All equipment holes and pipework open ends shall be stopped up with protective film and/or plugs to prevent dust and debris intrusion.
- The entire vehicle shall be protected with a suitable weatherized cover.

During temporary storage prior to shipping, the vehicle shall be stored in a dry and well-ventilated area. All exposed Truck and carbody fasteners shall be coated with anti-corrosion oil/grease prior to ocean transportation.

I.2J. MASSACHUSETTS OFFICE STAFFING

CSR Sifang JV will establish a local Engineering and Business Office within 60 days after the NTP to last for the duration of the contract. The initial organization will be staffed as follows:

- Program Manager
- Lead Electrical Engineer
- Lead Mechanical Engineer
- Engineering Manager
- System Integration Manager
- Assembly Plant Manager
- Warranty/Reliability Engineer
- Supply Chain Manager
- Production Manager
- Testing and Commissioning
- Miscellaneous staff, such as, accountant, buyers and others to fulfill required tasks and activities at the facility.

The local office staff will supply to the Authority, clear and timely communications of all activities related to production, engineering, inspections, design reviews, project progress and project management. The local organization will have the decision- making authority to expedite problem resolution, engineering changes, and sub-contractor interaction. Sufficient staffing levels and equipment will be provided to enable designs presentation, conduct reviews, meetings, and assist in administration and technical matters.

Office space for the subcontractor's representative(s) will be available throughout the duration of the project. CSR Sifang JV will station all appropriate individuals required to perform the specified work. This office will be equipped with all necessary office supplies and equipment to perform the specified project activities (e.g. telephones, standard office desks with swivel chairs, CAD stations, copier machines, facsimile machines, meeting room with an overhead projector for conducting design reviews, etc.).

CSR Sifang JV will provide for the MBTA's representative office space, equipped with normal office equipment and furniture, for their use during inspections, reviews and project meetings. Telephone, fax, and e-mail connections will be supplied.

INFORMATION TRANSFER

With its experience and technological tools at hand, CSR Sifang JV is totally confident that it can fully support a timely exchange of information for review and approval purposes on a daily basis. CSR Sifang JV's ability to exchange and access information quickly is a prerequisite to the coordinated and efficient handling of projects in a multi-national, multi-partner business environment. CSR Sifang JV for this project will regularly transmit (electronically) drawings and data as part of its day to day business activities.

Various network systems and communications solutions will be utilized to interchange data between the different electronic systems within CSR Sifang JV. CSR Sifang JV will utilize a full range of file types and production software, CAD packages, as well as various word processing and database programs.

CSR Sifang JV's local area office in Massachusetts will be fully-equipped with a PC-based Local Area Network (LAN) to facilitate efficient teamwork among all staff members. The local office will use standard remote e-mail connections to all major partners in the local CSR Sifang JV Massachusetts area office as part of the overall system configuration for this project. High speed broadband connection will be utilized to provide electronic data transmission among all members of the CSR Sifang JV project team.

Procedures

Due to the complex nature of this project, CSR Sifang JV proposes to use simple but secure procedures for the review and approval process with the MBTA. Electronic transmission of documents to individuals or groups for review and approval will be conducted using fast and efficient e-mail procedures. Any documents not available in electronic format will be transmitted by mail or courier.

Keeping track of sent and received mail is an internal feature of standard e-mail packages. Additionally, CSR Sifang JV will create a numbering/filing system for drawings and related documents submitted for review to the MBTA.

CSR Sifang JV will comply with the MBTA's approval processes. As per the current planning activities of the project team, most drawings will be capable of electronic transfer. There are different options to handle the approval formalities (signatures and other), which CSR Sifang JV will discuss and mutually agreed with the MBTA.

TAB I.3 PAST PERFORMANCE**I.3A. RELIABILITY DATA OF PAST CONTRACTS SIMILAR TO THIS PROJECT****PROJECT RELIABILITY MATRIX**

CSR Sifang JV has listed reliability information for all CSR Sifang heavy rail transit car contracts, of similar size, scope, and operating environment for the past ten (10) years in the following two matrices:

- **TABLE I.3A-1: "CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix".**
- **TABLE I.3A-2: "CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix".**

Please note that the two matrices listed above list the same projects in corresponding order.

LETTERS OF CONCURRENCE

Letters of concurrence/certificate acceptance for the projects listed in the matrices as referenced above can be found attached to this Section.

I.3B. MAJOR SUBCONTRACTOR RELIABILITY DATA OF PAST SIMILAR CONTRACTS

Table I.3B-1: "Major Subcontractor Reliability History Data Matrix" shows a sample of candidate subcontractors' reliability information from projects similar to this project including heavy rail transit car contracts, of similar size, scope, and operating environment for the past ten (10) years. Additional reliability information for other candidate suppliers will be made available upon request.

I.3C. PROJECT INFORMATION FOR ALL PASSENGER RAILCAR CONTRACTS**PROJECT RELIABILITY MATRIX**

CSR Sifang JV has listed project information for all passenger rail car contracts issued to CSR Sifang for the past (10) years. This information is contained within the following TABLE I.3C-1: "CSR Sifang All Passenger Rail Projects – Project Information Matrix".



TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status																												
<div>1.</div> <div>Beijing Metro Line 4 Electric Vehicle Project</div> <div>Contact: Beijing MTR Corporation</div> <div>Address: Metro Line 4 Depot, Jiayuan Road, Fengtai District, Beijing</div> <div>Name: Guan Zhipeng</div> <div>Title: Lead Buyer</div> <div>Tel: 010-88641363</div> <div>Email: caigou@mtr.bj.cn</div> <div>Scope: Entire vehicle with stainless steel carbody, 240 cars</div> <div>Vehicle type: New design</div> <div>CSR Design Responsibility: General Design of vehicle, Carbody, Bogie</div>	<div>Vehicle model: Type B1</div> <div>Carbody: Stainless steel</div> <div>Length of composition: 117.88m</div> <div>Composition: 6-car / train</div> <div>+Tc1-M1-M3-T3-M2+Tc2+</div> <div>Seating capacity: AW2: 1468 persons / train</div> <div>AW3: 1880 persons / train</div> <div>Operation speed: 80km/h</div> <div>Grid voltage: DC750V</div> <div>Current collection method: Third rail upper current collection</div> <div>Carbody length: 19380mm (head car), 19000 (intermediate car)</div> <div>Vehicle height: 3800mm</div> <div>Height of saloon floor: 1100mm</div> <div>Distance between two bogies: 12600mm</div> <div>Bogie wheelbase: 2200mm</div> <div>Coupler height: 660mm</div> <div>Diameter of wheel: 840mm</div> <div>Distance between backs of wheelset: 1353mm</div> <div>Additional Features:</div> <div><ul style="list-style-type: none">Advanced vehicle stylingFully automated (ATO), and driverless system.The vehicle meets the BS6853 fireproof standard.Capable of full battery operation, including traction.APS assisted by brake regen mode.</div>	<table><tr><th>Parts</th><th>Supplier</th></tr><tr><td>Carbody</td><td>CSR Sifang</td></tr><tr><td>Bogie</td><td>CSR Sifang</td></tr><tr><td>Air conditioning system</td><td>Guangzhou Zhongche Railway Vehicles Equipment Joint-Stock Co., Ltd</td></tr><tr><td>Saloon door</td><td>Nanjing Kangni New Technology of Mechantronic Co., Ltd</td></tr><tr><td>PIDS system</td><td>Tianjin Beihai Communication Technology Co., Ltd</td></tr><tr><td>Gangway</td><td>Changzhou Hubner KTK Traffic Equipment Co., Ltd.</td></tr><tr><td>Coupler buffer device</td><td>Voith Turbo Power Transmission (Shanghai) Co., Ltd.</td></tr><tr><td>Current collector</td><td>Agent products of Beijing Jiteng Technology Co., Ltd. are from Germany STEMMANN</td></tr><tr><td>Traction, auxiliary and monitor system</td><td>CPC/BT</td></tr><tr><td>Braking system</td><td>Knorr</td></tr><tr><td>Radio system</td><td>Shanghai Xingantong Communication Equipment Co., Ltd.</td></tr><tr><td>CCTV system</td><td>Beijing Dongfangyonglong Technology Development Co., Ltd. (Guangzhou Global Link Communications Inc.)</td></tr><tr><td>Signaling system</td><td>Alcatel</td></tr></table>	Parts	Supplier	Carbody	CSR Sifang	Bogie	CSR Sifang	Air conditioning system	Guangzhou Zhongche Railway Vehicles Equipment Joint-Stock Co., Ltd	Saloon door	Nanjing Kangni New Technology of Mechantronic Co., Ltd	PIDS system	Tianjin Beihai Communication Technology Co., Ltd	Gangway	Changzhou Hubner KTK Traffic Equipment Co., Ltd.	Coupler buffer device	Voith Turbo Power Transmission (Shanghai) Co., Ltd.	Current collector	Agent products of Beijing Jiteng Technology Co., Ltd. are from Germany STEMMANN	Traction, auxiliary and monitor system	CPC/BT	Braking system	Knorr	Radio system	Shanghai Xingantong Communication Equipment Co., Ltd.	CCTV system	Beijing Dongfangyonglong Technology Development Co., Ltd. (Guangzhou Global Link Communications Inc.)	Signaling system	Alcatel	<div>Length of Contract: 2005-2009.9</div> <div>Notice to Proceed: 2006.5.26</div> <div>Date of Closeout: 2009.09</div> <div>Project Status: Completed on time</div>
Parts	Supplier																														
Carbody	CSR Sifang																														
Bogie	CSR Sifang																														
Air conditioning system	Guangzhou Zhongche Railway Vehicles Equipment Joint-Stock Co., Ltd																														
Saloon door	Nanjing Kangni New Technology of Mechantronic Co., Ltd																														
PIDS system	Tianjin Beihai Communication Technology Co., Ltd																														
Gangway	Changzhou Hubner KTK Traffic Equipment Co., Ltd.																														
Coupler buffer device	Voith Turbo Power Transmission (Shanghai) Co., Ltd.																														
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Traction, auxiliary and monitor system	CPC/BT																														
Braking system	Knorr																														
Radio system	Shanghai Xingantong Communication Equipment Co., Ltd.																														
CCTV system	Beijing Dongfangyonglong Technology Development Co., Ltd. (Guangzhou Global Link Communications Inc.)																														
Signaling system	Alcatel																														
<div>2.</div> <div>Chengdu Metro Line 1 First-stage Project</div> <div>Metro Vehicle</div>	<div>Vehicle model: Type B2</div> <div>Carbody: Stainless steel</div> <div>Length of composition: 118.2m</div> <div>Composition: 6-car / train</div>	<table><tr><th>Parts</th><th>Supplier</th></tr><tr><td>Carbody</td><td>CSR Sifang</td></tr><tr><td>Bogie</td><td>CSR Sifang</td></tr><tr><td>Air conditioning</td><td>New United Air-conditioning System</td></tr></table>	Parts	Supplier	Carbody	CSR Sifang	Bogie	CSR Sifang	Air conditioning	New United Air-conditioning System	<div>Length of Contract: 2009.05-2010.05</div>																				
Parts	Supplier																														
Carbody	CSR Sifang																														
Bogie	CSR Sifang																														
Air conditioning	New United Air-conditioning System																														

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

**TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix**

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status
Project Contact: Chengdu Metro Co., Ltd, No. 396, Middle Tianfu Avenue, Chengdu, Sichuan, 028-61639050 Name: Zhang Yang Title: Vice President Tel: 028-61638531 Email: 10193772@qq.com	+Tc—Mp—M1—M2—Mp—Tc+ AW2: 1468 persons / train AW3: 1880 persons / train Operation speed: 80km/h Grid voltage: DC1500V Current collection method: Pantograph catenary Carbody length: 19380 (head car), 19000 (intermediate car) Vehicle height: 3800mm Height of saloon floor: 1100mm Distance between two bogies: 12600mm Bogie wheelbase: 2200mm Coupler height: 660mm Diameter of wheel: 840mm Distance between backs of wheelset: 1353mm Additional Features: <ul style="list-style-type: none"> Stainless steel, light weight, unpainted carbody. Semi-automatic sealing couplers, both ends. Semi-permanent traction rods are used for intermediate cars. SDB-80 bolsterless bogies, with noise reduction dampers. Wet wheel rail lubrication system installed on front bogies of trailer car. Regenerative braking enabled. Capable of both automated and manual operation. 2 roof mounted 29kW HVAC units per car. 4 sets of electric sliding plug doors (one set enabled for manual operation) per side of train. 8 LCD video display units per car. LED electronic map above each pair of doors in car Video surveillance cameras installed in each car. Steel seats and stainless steel stanchions and hand grabs installed throughout. Electric heaters are installed under the seats. 	system Saloon door PIDS system (including CCTV) Gangway Coupler buffer device Pantograph Traction, auxiliary and monitor system Braking system Radio system Signaling system	Notice to Proceed: 2007.10.12 Date of Closeout: 2010.05 Project Status: Completed on time
3. Project of Shenyang Metro Line 2 First-stage	Vehicle model: Type B2 Carbody: Stainless steel Length of composition: 118m Composition: 6-car / train	Parts Carbody Bogie Air conditioning Supplier CSR Sifang CSR Sifang Longertek Group	Length of Contract: 2008.2—2011.12



TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status																																																
Project Vehicle Contact: Shenyang Metro Co., Ltd Address: NO 322 Qingnianda Street Heping District Name: Qu Xiangjun Title: President Tel: 024-22662266 Email: tsymetro@163.com	<table><tr><td>Seating capacity:</td><td>+Tc-Mp-M1-M2-Mp-Tc+</td></tr><tr><td>AW2: 1468 persons / train</td><td></td></tr><tr><td>AW3: 1820 persons / train</td><td></td></tr><tr><td>Operation speed:</td><td>80km/h</td></tr><tr><td>Grid voltage:</td><td>DC1500V</td></tr><tr><td>Current collection method:</td><td>Pantograph catenary</td></tr><tr><td>Carbody length:</td><td>19500mm (head car), 19000 (intermediate car)</td></tr><tr><td>Vehicle height:</td><td>3800mm</td></tr><tr><td>Height of saloon floor:</td><td>1100mm</td></tr><tr><td>Distance between two bogies:</td><td>12600mm</td></tr><tr><td>Bogie wheelbase:</td><td>2200mm</td></tr><tr><td>Coupler height:</td><td>660mm</td></tr><tr><td>Diameter of wheel:</td><td>840mm</td></tr><tr><td>Distance between backs of wheelset:</td><td>1353mm</td></tr></table> <p>Additional Features:</p> <ul style="list-style-type: none">Stainless steel, light weight, unpainted carbody.Semi-automatic sealing couplers, both ends with automatic centering function.SDB-80 bolsterless bogies.Wet wheel rail lubrication system installed on front bogies of trailer car.Roof mounted HVAC units feature advanced variable frequency flow design.4 sets of double-leaf electric inner sliding per side of train (one set enabled for manual operation) are microprocessor controlled and feature failure recording and self diagnosis.Interior PIS include LCD video displays, LED electronic maps, and video surveillance cameras installed in each car.Fiber reinforced plastic seats.Electric heaters are installed under the seats.Heated stainless steel seats and stainless steel stanchions and hand grabs installed throughout.Fireproof standard DIN5510 compliant.Fluorescent lighting.	Seating capacity:	+Tc-Mp-M1-M2-Mp-Tc+	AW2: 1468 persons / train		AW3: 1820 persons / train		Operation speed:	80km/h	Grid voltage:	DC1500V	Current collection method:	Pantograph catenary	Carbody length:	19500mm (head car), 19000 (intermediate car)	Vehicle height:	3800mm	Height of saloon floor:	1100mm	Distance between two bogies:	12600mm	Bogie wheelbase:	2200mm	Coupler height:	660mm	Diameter of wheel:	840mm	Distance between backs of wheelset:	1353mm	<table><tr><td>system</td><td></td></tr><tr><td>Saloon door</td><td>Beijing Bode Communication Equipment Co., Ltd</td></tr><tr><td>PIDS system (including CCTV)</td><td>Beijing Waycom Technology Development Co., Ltd</td></tr><tr><td>Gangway</td><td>Qingdao Ultimate</td></tr><tr><td>Coupler buffer device</td><td>Qingdao Sifang Rolling Stock Research Institute Co., Ltd.</td></tr><tr><td>Pantograph</td><td>Shanghai Sky & Sea Pantograph Manufacturing Ltd.</td></tr><tr><td>Traction, auxiliary and monitor system</td><td>CSR Times Electric Company Limited</td></tr><tr><td>Braking system</td><td>Locomotive and Car Research Institute, China Academy of Railway Sciences</td></tr><tr><td>Radio system</td><td>Beijing Waycom</td></tr><tr><td>Signaling system</td><td>Insigma</td></tr></table>	system		Saloon door	Beijing Bode Communication Equipment Co., Ltd	PIDS system (including CCTV)	Beijing Waycom Technology Development Co., Ltd	Gangway	Qingdao Ultimate	Coupler buffer device	Qingdao Sifang Rolling Stock Research Institute Co., Ltd.	Pantograph	Shanghai Sky & Sea Pantograph Manufacturing Ltd.	Traction, auxiliary and monitor system	CSR Times Electric Company Limited	Braking system	Locomotive and Car Research Institute, China Academy of Railway Sciences	Radio system	Beijing Waycom	Signaling system	Insigma	Notice to Proceed: 2008.2.29 Date of Closeout: 2011.07 Project Status: Completed ahead of schedule
Seating capacity:	+Tc-Mp-M1-M2-Mp-Tc+																																																		
AW2: 1468 persons / train																																																			
AW3: 1820 persons / train																																																			
Operation speed:	80km/h																																																		
Grid voltage:	DC1500V																																																		
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Saloon door	Beijing Bode Communication Equipment Co., Ltd																																																		
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Coupler buffer device	Qingdao Sifang Rolling Stock Research Institute Co., Ltd.																																																		
Pantograph	Shanghai Sky & Sea Pantograph Manufacturing Ltd.																																																		
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Braking system	Locomotive and Car Research Institute, China Academy of Railway Sciences																																																		
Radio system	Beijing Waycom																																																		
Signaling system	Insigma																																																		
4. Tianjin Metro Line 3 Electric	<table><tr><td>Vehicle model:</td><td>Type B1</td></tr><tr><td>Carbody:</td><td>Stainless steel</td></tr></table>	Vehicle model:	Type B1	Carbody:	Stainless steel	<table><tr><td>Parts</td><td>Supplier</td></tr><tr><td>Carbody</td><td>CSR Sifang</td></tr></table>	Parts	Supplier	Carbody	CSR Sifang	Length of Contract: 2008.9-																																								
Vehicle model:	Type B1																																																		
Carbody:	Stainless steel																																																		
Parts	Supplier																																																		
Carbody	CSR Sifang																																																		

TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status	
Passenger Vehicle Project Contact: Tianjin Metro Group Co.,Ltd Address: NO. 19 Hankouxi Street Heping District Tianjin Name: Wang Huifu Title: Director of vehicle center Tel: 13920122021 Email: wanghuifu2006@126.com	Length of composition: 118m Composition: 6-car / train +Tc-M+M-T+M-Tc+ Seating capacity: AW2: 1440 persons / train AW3: 1832 persons / train Operation speed: 80km/h Grid voltage: DC750V Current collection method: Third rail lower current collection Carbody length: 19380mm (head car), 19000mm (intermediate car) Vehicle height: 3800mm Height of saloon floor: 1100mm Distance between two bogies: 12600mm Bogie wheelbase: 2200mm Coupler height: 660mm Diameter of wheel: 840mm Distance between backs of wheelset: 1353mm	Bogie Air conditioning system Saloon door PIDS system (including CCTV) Gangway Coupler buffer device Current collector Traction, auxiliary and monitor system Braking system Radio system Signaling system	2011.11 Notice to Proceed: 2008.9.1 Date of Closeout: 2011.10 Project Status: Completed ahead of schedule	
	Additional Features: <ul style="list-style-type: none">Stainless steel, light weight, painted carbody.SDB-80 bolsterless bogies with noise reduction dampers.Dry wheel rail lubrication system installed on several bogies.Third rail DC750V current collection.VVVF controlled propulsion and braking system.Capable of both automated and manual operation.2 static inverters (SIV, 185kVA ea) and one Alkaline Cd-Ni battery pack (160Ah) per train.Roof mounted 29kW HVAC units.4 sets of electric sliding plug doors (one set enabled for manual operation) per side of train.PIS systems include LCD video display units and LED electronic maps.	CSR Sifang Zhejiang Liebherr Zhongche Transportation Systems Co., Ltd. Nanjing Kangni New Technology of Mechantronic Co., Ltd Tianjin Beihai Communication Technology Co., Ltd Changchun Golden Bean Passenger Train Stainless-steel Products Co., Ltd Qingdao Sifang Rolling Stock Research Institute Co., Ltd. Asian Tongdai (Qingdao) Railway Equipments Co.,Ltd (agent products of Beijing Jiteng Technology Co., Ltd. are from Germany Stemmann) Itami Production Agency of Mitsubishi Electric Corporation Knorr Tianjin Beihai Communication Technology Co., Ltd BT		
	Scope: Entire vehicle with stainless steel carbody, 162 cars			
	Vehicle type: New design			
	CSR Design Responsibility: General Design of vehicle, Carbody, Bogie			
	5. Beijing Metro Line 8 Second-stage Project Contact: Beijing Rail	Vehicle model: Type B1 Carbody: Stainless steel Length of composition: 118.26m Composition: 6-car / train +Tc-M-T-M-M-Tc+ Seating capacity: AW2: 1468 persons / train	Parts Carbody Bogie Air conditioning system Saloon door Supplier CSR Sifang CSR Sifang Shijiazhuang King Transportation Equipment Co., Ltd. Beijing Bode Communication	Length of Contract: 2011.4 Notice to Proceed: 2009.7.29



TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status																		
Transit Construction and Management Co., Ltd Address: NO.2 Baiwanzhuang Street Xicheng District Beijing Name: Li Dongmei Title: Project Manager Tel: 010-88376765 Email: gdltpz2012@126.com Scope: Entire vehicle with stainless steel carbody, 198 cars Vehicle type: New design CSR Design Responsibility: General Design of vehicle, Carbody, Bogie	AW3: 1880 persons / train Operation speed: 80km/h Grid voltage: DC750V Current collection method: Third rail upper current collection Carbody length: 19500mm (head car), 19000 (intermediate car) Vehicle height: 3800mm Height of saloon floor: 1100mm Distance between bogies: two Bogie wheelbase: 2200mm Coupler height: 660mm Diameter of wheel: 840mm Distance between backs of wheelset: 1353mm Additional Features: <ul style="list-style-type: none">Vehicle design features special consideration toward ergonomics, modularity, standardization, safety, reliability, environmental impacts and simplicity.Sleek, modern vehicle styling throughout the vehicles, with emphasis on interior passenger comfort, accessibility, and maintenance/operation friendly.Lightweight, energy efficient steel carbody.Cost effective modular design allows for greater interchangeability and maintainability while minimizing costs.Fire standard DIN 5510 compliant;Windows capable of manual operation provides additional passenger comfort during power outages.Full modern compliment of security and safety devices and systems installed throughout (surveillance cameras, fire alarms, fire extinguishers, emergency lighting, etc)Capable of both automated and manual operation (ATP, ATO)	<table><tr><td>PIDS system (including CCTV)</td><td>Equipment Co., Ltd</td></tr><tr><td>Gangway</td><td>Beijing Waycom Technology Development Co., Ltd</td></tr><tr><td>Coupler buffer device</td><td>Qingdao Ultimate</td></tr><tr><td>Current collector</td><td>Qingdao Sifang Rolling Stock Research Institute Co., Ltd.</td></tr><tr><td>Traction, auxiliary and monitor system</td><td>KTK Group (FERRAZ) and Hunan Zhonglong</td></tr><tr><td>Braking system</td><td>Itami Production Agency of Mitsubishi Electric Corporation</td></tr><tr><td>Radio system</td><td>Nabtesco Railroad Product Company (Beijing)</td></tr><tr><td>Signaling system</td><td>Research Institute 54 of China Technology Group Corporation</td></tr><tr><td></td><td>Siemens</td></tr></table>	PIDS system (including CCTV)	Equipment Co., Ltd	Gangway	Beijing Waycom Technology Development Co., Ltd	Coupler buffer device	Qingdao Ultimate	Current collector	Qingdao Sifang Rolling Stock Research Institute Co., Ltd.	Traction, auxiliary and monitor system	KTK Group (FERRAZ) and Hunan Zhonglong	Braking system	Itami Production Agency of Mitsubishi Electric Corporation	Radio system	Nabtesco Railroad Product Company (Beijing)	Signaling system	Research Institute 54 of China Technology Group Corporation		Siemens	Date of Closeout: 2012.10 Project Status: Completed on time
	PIDS system (including CCTV)	Equipment Co., Ltd																			
	Gangway	Beijing Waycom Technology Development Co., Ltd																			
	Coupler buffer device	Qingdao Ultimate																			
	Current collector	Qingdao Sifang Rolling Stock Research Institute Co., Ltd.																			
	Traction, auxiliary and monitor system	KTK Group (FERRAZ) and Hunan Zhonglong																			
	Braking system	Itami Production Agency of Mitsubishi Electric Corporation																			
	Radio system	Nabtesco Railroad Product Company (Beijing)																			
	Signaling system	Research Institute 54 of China Technology Group Corporation																			
		Siemens																			
6. Beijing Metro Daxing Line Project Contact: Beijing Rail Transit	<table><tr><td>Vehicle model: Carbody:</td><td>Type B1 Stainless steel</td></tr><tr><td>Length of composition:</td><td>117.88m</td></tr><tr><td>Composition:</td><td>6-car / train +Tc1-M1-M3-T3-M2-Tc2+</td></tr><tr><td>Seating capacity:</td><td>AW2: 1468 persons / train AW3: 1880 persons / train</td></tr></table>	Vehicle model: Carbody:	Type B1 Stainless steel	Length of composition:	117.88m	Composition:	6-car / train +Tc1-M1-M3-T3-M2-Tc2+	Seating capacity:	AW2: 1468 persons / train AW3: 1880 persons / train	<table><tr><td>Parts</td><td>Supplier</td></tr><tr><td>Carbody</td><td>CSR Sifang</td></tr><tr><td>Bogie</td><td>CSR Sifang</td></tr><tr><td>Air conditioning system</td><td>Guangzhou Zhongche Railway Vehicles Equipment Joint-Stock Co., Ltd</td></tr><tr><td>Saloon door</td><td>Nanjing Kangni New Technology of</td></tr></table>	Parts	Supplier	Carbody	CSR Sifang	Bogie	CSR Sifang	Air conditioning system	Guangzhou Zhongche Railway Vehicles Equipment Joint-Stock Co., Ltd	Saloon door	Nanjing Kangni New Technology of	Length of Contract: 2009.7-2010.12 Notice to Proceed: 2009.7.29
Vehicle model: Carbody:	Type B1 Stainless steel																				
Length of composition:	117.88m																				
Composition:	6-car / train +Tc1-M1-M3-T3-M2-Tc2+																				
Seating capacity:	AW2: 1468 persons / train AW3: 1880 persons / train																				
Parts	Supplier																				
Carbody	CSR Sifang																				
Bogie	CSR Sifang																				
Air conditioning system	Guangzhou Zhongche Railway Vehicles Equipment Joint-Stock Co., Ltd																				
Saloon door	Nanjing Kangni New Technology of																				

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status
<p>Construction and Management Co., Ltd</p> <p>Address: NO.2 Baiwanzhuang Street Xicheng District Beijing</p> <p>Name: Li Dongmei</p> <p>Title: Project Manager</p> <p>Tel: 010- 88376765</p> <p>Email: gdltzp2012@ 126.com</p> <p>Scope: Entire vehicle with stainless steel carbody, 198 cars</p> <p>Vehicle type: Existing design</p> <p>CSR Design Responsibility: General Design of vehicle, Carbody, Bogie</p>	<p>Operation speed: 80km/h</p> <p>Grid voltage: DC750V</p> <p>Current collection method: Third rail upper current collection</p> <p>Carbody length: 19380mm (head car), 19000mm (intermediate car)</p> <p>Vehicle height: 3800mm</p> <p>Height of saloon floor: 1100mm</p> <p>Distance between bogies: two</p> <p>Bogie wheelbase: 12600mm</p> <p>Coupler height: 2200mm</p> <p>Diameter of wheel: 660mm</p> <p>Distance between backs of wheelset: 840mm</p> <p>1353mm</p> <p>Additional Features:</p> <ul style="list-style-type: none"> All lights in the cab use reliable, energy efficient, environmentally friendly LED lighting. PIDS/CCTV system installed in each vehicle. Advanced, high performance CCTV system gives the vehicle operator comprehensive interior and exterior views, including boarding platforms. Advanced sliding exterior 'plug' doors provide airtight seals and superior reliability. Obstacle detection capability of the doors is 10mm. Advance uninterrupted power supply technology ensures continuous power to the APS in power outages. Vehicles are capable of full battery operation, including propulsion. 	<p>PIDS system</p> <p>Tianjin Beihai Communication Technology Co., Ltd</p> <p>Gangway</p> <p>Changzhou Hubner KTK Traffic Equipment Co., Ltd.</p> <p>Coupler buffer device</p> <p>Voith Turbo Power Transmission (Shanghai) Co., Ltd</p> <p>Current collector</p> <p>Agent products of Beijing Jiteng Technology Co., Ltd. are from Germany STEMMANN</p> <p>Traction, auxiliary and monitor system</p> <p>CPC/BT</p> <p>Braking system</p> <p>Knorr</p> <p>Radio system</p> <p>Shanghai Xingantong Communication Equipment Co., Ltd.</p> <p>CCTV system</p> <p>Beijing Dongfangyonglong Technology Development Co., Ltd. (Guangzhou Global Link Communications Inc.)</p> <p>Signaling system</p> <p>Alcatel</p>	<p>Date of Closeout: 2010.12</p> <p>Project Status: Completed On Time</p>
<p>Beijing Metro Changing Line Project</p> <p>Contact: Beijing Rail Transit Construction and Management</p>	<p>Vehicle model: Type B1</p> <p>Carbody: Stainless steel</p> <p>Length of composition: 118.26m</p> <p>Composition: 6-car / train +Tc-M-M-M-M-Tc+</p> <p>Seating capacity: AW2: 1460 persons / train AW3: 2070 persons / train</p> <p>Operation speed: 100km/h</p> <p>Grid voltage: DC750V</p>	<p>Parts</p> <p>Carbody</p> <p>Bogie</p> <p>Air conditioning system</p> <p>Saloon door</p> <p>PIDS system (including</p> <p>Supplier</p> <p>CSR Sifang</p> <p>CSR Sifang</p> <p>Guangzhou Zhongche Railway Vehicles Equipment Joint-Stock Co., Ltd.</p> <p>Beijing Bode Communication Equipment Co., Ltd</p> <p>Beijing Waycom Technology</p>	<p>Length of Contract: 2009.12- 2010.12</p> <p>Notice to Proceed: 2009.12.29</p> <p>Date of</p>



TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status
<p>Co., Ltd Address: NO.2 Baiwanzhuang Street Xicheng District Beijing Name: Li Dongmei Title: Project Manager Tel: 010- 88376765 Email: gdjlpz2012@ 126.com</p> <p>Scope: Entire vehicle with stainless steel carbody, 162 cars</p> <p>Vehicle type: New design</p> <p>CSR Design Responsibility: General Design of vehicle, Carbody, Bogie</p>	<p>Current collection method: Third rail upper current collection Carbody length: 19500mm (head car), 19000mm (intermediate car) Vehicle height: 3800mm Height of saloon floor: 1100mm Distance between two bogies: 12600mm Bogie wheelbase: 2300mm Coupler height: 660mm Diameter of wheel: 840mm Distance between backs of wheelset: 1353mm</p> <p>Additional Features:</p> <ul style="list-style-type: none"> Vehicle design features special consideration toward ergonomics, modularity, standardization, safety, reliability, environmental impacts and simplicity. Sleek, modern vehicle styling throughout the vehicles, with emphasis on interior passenger comfort, accessibility, and maintenance/operation friendly. Disk brakes are used to improve wheel performance and service life. Structural design optimizes overall weight while retaining high performance characteristic and increasing energy efficiency. TCN train control network conforms to IEC 61375. Automated train operation capable (ATO). 	<p>CCTV) Development Co., Ltd Gangway Golden Bean Coupler buffer device Qingdao Sifang Rolling Stock Research Institute Co., Ltd. Current collector KTK Group (FERRAZ) and Hunan Zhongtong Traction, auxiliary and monitor system Itami Production Agency of Mitsubishi Electric Corporation Braking system China Academy of Railway Sciences Radio system Research Institute 54 of China Technology Group Corporation Signaling system Beijing Traffic Control Technology Co., Ltd. Network monitoring Zhouzhou Times</p>	<p>Closeout: 2010.12</p> <p>Project Status: 15 trains have been completed at the first stage. Remaining 12 trains will be completed at the direction of the Client</p>
<p>Chengdu Metro Line 2 First-stage Project</p> <p>Contact: Chengdu Metro Co., Ltd. Address: No. 396, Middle Tianfu Avenue, Chengdu.</p>	<p>Vehicle model: Type B2 Carbody: Stainless steel Length of composition: 118m Composition: 6-car / train +Tc-Mp-M1 M2-Mp-Tc+ Seating capacity: AW2: 1468 persons / train AW3: 1820 persons / train Operation speed: 80km/h Grid voltage: DC1500V Current collection method: Pantograph catenary</p>	<p>Parts Supplier Carbody CSR Sifang Bogie CSR Sifang Air conditioning system Guangzhou Zhongche Railway Vehicles Equipment Joint-Stock Co., Ltd. Saloon door Nanjing Kangni New Technology of Mechantronics Co., Ltd PIDS system Beijing Waycom Technology Development Co., Ltd Gangway Qingdao Ultimate</p>	<p>Length of Contract: 2011.08-2012.05</p> <p>Notice to Proceed: 2010.3.23</p> <p>Date of Closeout: 2012.05</p>

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status																														
<p>Sichuan</p> <p>Name:Zhang Yang</p> <p>Title:Vice President</p> <p>Tel:028-61638531</p> <p>Email:10193772@qq.com</p> <p>Scope:</p> <p>Entire vehicle with stainless steel carbody, 138 cars</p> <p>Vehicle type:</p> <p>New design</p> <p>CSR Design Responsibility:</p> <p>General Design of vehicle, Carbody, Bogie</p>	<table><tr><td>Carbody length:</td><td>19555mm (head car), 19000 (intermediate car)</td></tr><tr><td>Vehicle height:</td><td>3800mm</td></tr><tr><td>Height of saloon floor:</td><td>1100mm</td></tr><tr><td>Distance between two bogies:</td><td>12600mm</td></tr><tr><td>Bogie wheelbase:</td><td>2200mm</td></tr><tr><td>Coupler height:</td><td>660mm</td></tr><tr><td>Diameter of wheel:</td><td>84 mm</td></tr><tr><td>Distance between backs of wheelset:</td><td>1353mm</td></tr></table> <p>Additional Features:</p> <ul style="list-style-type: none">Stainless steel, light weight, unpainted carbody.Semi-automatic sealing couplers, with automatic centering on both ends.Semi-permanent traction rods are used for intermediate cars.SDB-80 bolsterless bogies, with noise reduction dampers.Wet wheel rail lubrication system installed on front bogies of trailer car.VVVF controlled propulsion and braking system.Capable of both automated and manual operation.2 static inverters (SIV, 185kVA ea) and one Alkaline Cd-Ni battery pack (160Ah) per train.2 roof mounted 29kW HVAC units per car.4 sets of double-leaf electric inner sliding per side of train (one set enabled for manual operation) are microprocessor controlled and feature failure recording and self diagnosis.8 LCD video display units per car.LED electronic map above each pair of doors in carVideo surveillance cameras installed in each car.Steel seats and stainless steel stanchions and hand grabs installed throughout.Electric heaters are installed under the seats.	Carbody length:	19555mm (head car), 19000 (intermediate car)	Vehicle height:	3800mm	Height of saloon floor:	1100mm	Distance between two bogies:	12600mm	Bogie wheelbase:	2200mm	Coupler height:	660mm	Diameter of wheel:	84 mm	Distance between backs of wheelset:	1353mm	<table><tr><td>Coupler buffer device</td><td>Qingdao Sifang Rolling Stock Research Institute Co., Ltd.</td></tr><tr><td>Pantograph</td><td>Shanghai Sky & Sea Pantograph Manufacturing Ltd.</td></tr><tr><td>Traction, auxiliary and monitor system</td><td>TOYO ELECTRIC MFG. CO. LTD</td></tr><tr><td>Braking system</td><td>Locomotive and Car Research Institute, China Academy of Railway Sciences</td></tr><tr><td>Radio system</td><td></td></tr><tr><td>CCTV system</td><td>Beijing Waycom Technology Development Co., Ltd</td></tr><tr><td>Signaling system</td><td></td></tr></table>	Coupler buffer device	Qingdao Sifang Rolling Stock Research Institute Co., Ltd.	Pantograph	Shanghai Sky & Sea Pantograph Manufacturing Ltd.	Traction, auxiliary and monitor system	TOYO ELECTRIC MFG. CO. LTD	Braking system	Locomotive and Car Research Institute, China Academy of Railway Sciences	Radio system		CCTV system	Beijing Waycom Technology Development Co., Ltd	Signaling system		<p>Project Status:</p> <p>Completed on time</p>
	Carbody length:	19555mm (head car), 19000 (intermediate car)																															
	Vehicle height:	3800mm																															
	Height of saloon floor:	1100mm																															
	Distance between two bogies:	12600mm																															
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	Distance between backs of wheelset:	1353mm																															
	Coupler buffer device	Qingdao Sifang Rolling Stock Research Institute Co., Ltd.																															
Pantograph	Shanghai Sky & Sea Pantograph Manufacturing Ltd.																																
Traction, auxiliary and monitor system	TOYO ELECTRIC MFG. CO. LTD																																
Braking system	Locomotive and Car Research Institute, China Academy of Railway Sciences																																
Radio system																																	
CCTV system	Beijing Waycom Technology Development Co., Ltd																																
Signaling system																																	
9. Electric Passenger Vehicle Purchasing Project of Beijing Metro	<table><tr><td>Vehicle model:</td><td>Type A</td></tr><tr><td>Carbody:</td><td>Stainless steel</td></tr><tr><td>Length of composition:</td><td>118m</td></tr><tr><td>Composition:</td><td>6-car / train +Tc-Mp-M1 M2-Mp-Tc+</td></tr><tr><td>Seating capacity:</td><td>AW2: 1468 persons / train</td></tr></table>	Vehicle model:	Type A	Carbody:	Stainless steel	Length of composition:	118m	Composition:	6-car / train +Tc-Mp-M1 M2-Mp-Tc+	Seating capacity:	AW2: 1468 persons / train	<table><tr><td>Parts</td><td>Supplier</td></tr><tr><td>Carbody</td><td>CSR Sifang</td></tr><tr><td>Bogie</td><td>CSR Sifang</td></tr><tr><td>Air conditioning system</td><td>Shijiazhuang King</td></tr><tr><td>Saloon door</td><td>Beijing Bode Communication Equipment</td></tr></table>	Parts	Supplier	Carbody	CSR Sifang	Bogie	CSR Sifang	Air conditioning system	Shijiazhuang King	Saloon door	Beijing Bode Communication Equipment	<p>Length of Contract:</p> <p>March, 2012 to October, 2014</p>										
Vehicle model:	Type A																																
Carbody:	Stainless steel																																
Length of composition:	118m																																
Composition:	6-car / train +Tc-Mp-M1 M2-Mp-Tc+																																
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Parts	Supplier																																
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Bogie	CSR Sifang																																
Air conditioning system	Shijiazhuang King																																
Saloon door	Beijing Bode Communication Equipment																																



TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status																																										
Line 14 Contact: Beijing Rail Transit Construction and Management Co., Ltd Address: NO.2 Baiwanzhuang Street Xicheng District Beijing Name: Li Dongmei Title: Project Manager Tel: 010-88376765 Email: gdljzp2012@126.com Scope: Entire vehicle with stainless steel carbody, 150 cars Vehicle type: New design CSR Design Responsibility: General Design of vehicle, Carbody, Bogie	<table><tr><td>Operation speed:</td><td>AW3: 1820 persons / train</td></tr><tr><td>Grid voltage:</td><td>80km/h</td></tr><tr><td>Current collection method:</td><td>DC1500V</td></tr><tr><td>Carbody length:</td><td>Pantograph catenary</td></tr><tr><td>Vehicle height:</td><td>19555mm (head car), 19000 (intermediate car)</td></tr><tr><td>Height of saloon floor:</td><td>3800mm</td></tr><tr><td>Distance between two bogies:</td><td>1100mm</td></tr><tr><td>Bogie wheelbase:</td><td>12600mm</td></tr><tr><td>Coupler height:</td><td>2200mm</td></tr><tr><td>Diameter of wheel:</td><td>660mm</td></tr><tr><td>Distance between backs of wheelset:</td><td>84 mm</td></tr><tr><td></td><td>1353mm</td></tr></table> Additional Features: Type A metro vehicles of Beijing Metro Line 14 are the first Chinese metro vehicles to adopt a lightweight, coating-free stainless steel carbody, whose features are energy efficient, environmentally friendly and are sleek and modern looking. Vehicles feature advanced, proven, reliable manufacturing techniques. Vehicle impact resistance and carbody strength conform to the latest European technical standards.	Operation speed:	AW3: 1820 persons / train	Grid voltage:	80km/h	Current collection method:	DC1500V	Carbody length:	Pantograph catenary	Vehicle height:	19555mm (head car), 19000 (intermediate car)	Height of saloon floor:	3800mm	Distance between two bogies:	1100mm	Bogie wheelbase:	12600mm	Coupler height:	2200mm	Diameter of wheel:	660mm	Distance between backs of wheelset:	84 mm		1353mm	<table><tr><td>PIDS system</td><td>Co., Ltd.</td></tr><tr><td>Gangway</td><td>Beijing Waycom</td></tr><tr><td>Coupler buffer device</td><td>Jilin Jinyue Vehicles Equipment Co., Ltd.</td></tr><tr><td>Current collector</td><td>Qingdao Sifang Rolling Stock Research Institute Co., Ltd.</td></tr><tr><td>Traction, auxiliary and monitor system</td><td>Bombardier</td></tr><tr><td>Braking system</td><td>China Academy of Railway Sciences</td></tr><tr><td>Radio system</td><td>Beijing Waycom</td></tr><tr><td>CCTV system</td><td>Beijing Waycom</td></tr><tr><td>Signalling system</td><td>Beijing TCT</td></tr></table>	PIDS system	Co., Ltd.	Gangway	Beijing Waycom	Coupler buffer device	Jilin Jinyue Vehicles Equipment Co., Ltd.	Current collector	Qingdao Sifang Rolling Stock Research Institute Co., Ltd.	Traction, auxiliary and monitor system	Bombardier	Braking system	China Academy of Railway Sciences	Radio system	Beijing Waycom	CCTV system	Beijing Waycom	Signalling system	Beijing TCT	Notice to Proceed: 2012.3.23 Date of Closeout: 2014 Project Status: In progress
		Operation speed:	AW3: 1820 persons / train																																										
		Grid voltage:	80km/h																																										
		Current collection method:	DC1500V																																										
		Carbody length:	Pantograph catenary																																										
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Purchasing Project for Motor Vehicle for branch lines of Guangzhou	<table><tr><td>Vehicle model:</td><td>Type L</td></tr><tr><td>Carbody:</td><td>Aluminum alloy</td></tr><tr><td>Length of composition:</td><td>70.84m</td></tr><tr><td>Composition:</td><td>4-car / train</td></tr><tr><td></td><td>-A+B=B+A-</td></tr></table>	Vehicle model:	Type L	Carbody:	Aluminum alloy	Length of composition:	70.84m	Composition:	4-car / train		-A+B=B+A-	<table><tr><td>Parts</td><td>Supplier</td></tr><tr><td>Carbody</td><td>CSR Sifang</td></tr><tr><td>Bogie</td><td>CSR Sifang</td></tr><tr><td>Air conditioning system</td><td>Shijiazhuang King Transportation Equipment Co., Ltd.</td></tr></table>	Parts	Supplier	Carbody	CSR Sifang	Bogie	CSR Sifang	Air conditioning system	Shijiazhuang King Transportation Equipment Co., Ltd.	Length of Contract: Line 4: 2004.8-2008.7 Line 5:																								
		Vehicle model:	Type L																																										
		Carbody:	Aluminum alloy																																										
Length of composition:	70.84m																																												
Composition:	4-car / train																																												
	-A+B=B+A-																																												
Parts	Supplier																																												
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Bogie	CSR Sifang																																												
Air conditioning system	Shijiazhuang King Transportation Equipment Co., Ltd.																																												



TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status
<p>Metro Line 4 and Line 5</p> <p>Contact: Guangzhou Metro Corporation Address: NO. 8 Huadidadao Fangcun District Guangzhou Name: Xie Dongmei Title: Project Manager Tel: 020-83106368 Email: dipxzx@vip.163.com</p> <p>Scope: Entire vehicle with aluminum alloy carbody, 180 cars</p> <p>Vehicle type: New design</p> <p>CSR Design Responsibility: General Design of vehicle</p>	<p>Seating capacity: AW2: 918 persons / train AW3: 1318 persons / train</p> <p>Operation speed: 90km/h</p> <p>Grid voltage: DC1500V</p> <p>Current collection method: Third rail lower current collection / pantograph</p> <p>Carbody length: 17600mm (head car), 16840mm (intermediate car)</p> <p>Vehicle height: 3625mm</p> <p>Height of saloon floor: 930mm</p> <p>Distance between two bogies: 11140mm</p> <p>Bogie wheelbase: 2000mm</p> <p>Coupler height: 500mm</p> <p>Diameter of wheel: 730mm</p> <p>Distance between backs of wheelset: 1353mm</p> <p>Additional Features:</p> <ul style="list-style-type: none"> Aluminum alloy drum carbody; Linear motor traction; Minimum curve radius of 60m; Electric sliding plug door; Stainless steel seats; Dual end fully automatic couplers. 	<p>Saloon door</p> <p>PIDS system</p> <p>Gangway</p> <p>Coupler buffer device</p> <p>Current collector</p> <p>Traction, auxiliary and monitor system</p> <p>Braking system</p> <p>Radio system</p> <p>CCTV system</p> <p>Signaling system</p> <p>Nanjing Kangni New Technology of Mechantronic Co., Ltd</p> <p>Beijing Dongfangyonglong Technology Development Co., Ltd.</p> <p>Qingdao Ultimate</p> <p>Voith Turbo Power Transmission (Shanghai) Co., Ltd</p> <p>KTK Group (FERRAZ)</p> <p>Itami Production Agency of Mitsubishi Electric Corporation</p> <p>knorr</p> <p>Shanghai Xingantong Communication Equipment Co., Ltd.</p> <p>Guangzhou Global Link Communications Inc.</p> <p>Siemens</p>	<p>2004-8--8-2010.5</p> <p>Notice to Proceed: 2004.8.5</p> <p>Date of Closeout: Line 4: 2008.07 Line 5: 2010.5</p> <p>Project Status: Completed on time</p>
<p>11. Electric Passenger Vehicle Project of Beijing Metro Line 1 Blanking Engineering</p>	<p>Vehicle model: Type B1</p> <p>Carbody: Stainless steel</p> <p>Length of composition: 117.65m</p> <p>Composition: 6-car / train +Tc-M-T+M1-M-Tc+</p> <p>Seating capacity: AW2: 1428 persons / train AW3: 1820 persons / train</p>	<p>Parts</p> <p>Carbody</p> <p>Bogie</p> <p>Air conditioning system</p> <p>Saloon door</p> <p>Supplier</p> <p>CSR Sifang</p> <p>CSR Sifang</p> <p>New United Air-conditioning System (Jiangsu) Co., Ltd.</p> <p>Beijing Bode Communication Equipment Co., Ltd</p>	<p>Length of Contract: 2006.5-2008.6</p> <p>Notice to Proceed: 2006.5.25</p>



TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status
Contact: Beijing Subway Operation Co., Ltd Address: NO. 2 Xizhimenwai Street Xicheng District Beijing Name: Li Li Title: Project Manager Tel: 010-62293672 Email: lili2012@126.com	Operation speed: 80km/h Grid voltage: DC750V Current collection method: Third rail upper current collection Carbody length: 19000mm (appropriate length added to the head car) Vehicle height: 3510mm Height of saloon floor: 1050mm Distance between two bogies: 12600mm Bogie wheelbase: 2200mm Coupler height: 660mm Diameter of wheel: 840mm Distance between backs of wheelset: 1353mm	PIDS (including CCTV) Gangway Coupler buffer device Current collector Traction, auxiliary and monitor system Braking system Radio system Signaling system Parts	Date of Closeout: 2008.06 Project Status: Completed on time
Scope: Entire vehicle with stainless steel carbody, 120 cars Vehicle type: New design CSR Design Responsibility: General Design of vehicle	Additional Features: <ul style="list-style-type: none"> Carbody features advanced paint-free vehicle styling. Design approach prioritized light-weight structures. Rubber safety shield installed to prevent falling accidents between traincars. Anti-creeping function and regenerative braking. Bolsterless bogies Gap mitigation devices installed throughout. Fully automated (ATO), and driverless system. The vehicle meets the BS6853 fireproof standard. Capable of full battery operation, including traction. APS assisted by brake regen mode. 	Beijing Aotewei Technology Co., Ltd Qingdao Ultimate Voith Turbo Power (Shanghai) Co., Ltd. KTK Group (FERRAZ) TOYO ELECTRIC MFG. CO. LTD Nabtesco (Beijing) Research Institute 54 of China Technology Group Corporation Westinghouse Supplier	
12. Linear Motor Vehicle of Guangzhou Metro Line 6 Contact: Guangzhou Metro Corporation Address: NO. 8 Huadadao Fangcun District	Vehicle model: Type L Carbody: Aluminum alloy Length of composition: 71.64m Composition: 4-car / train -A+B+B+A- Seating capacity: AW2: 918 persons / train AW3: 1318 persons / train Operation speed: 90km/h Grid voltage: DC1500V Current collection method: Third rail lower current collection / pantograph Carbody length: A: 17600mm; B: 16840mm	Parts Carbody Bogie Air conditioning system Saloon door PIDS system Gangway Coupler buffer device Current collector	Length of Contract: 2010.4-2015.12 Notice to Proceed: 2010.4.26 Date of Closeout: 2015.12
		Supplier CSR Sifang CSR Sifang Guangzhou Zhongche Railway Vehicles Equipment Joint-Stock Co., Ltd. Kangni company Guangzhou Global Link Communications Inc. Qingdao Ultimate Voith Turbo KTK Group Co., Ltd. (FERRAZ)	

TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status																																																
Guangzhou Name: Xie Dongmei Title: Project Manager Tel: 020-83106368 Email: dtpxzx@vip.163.com	<table><tr><td>Vehicle height:</td><td>3650mm</td></tr><tr><td>Height of saloon floor:</td><td>930mm</td></tr><tr><td>Distance between bogies:</td><td>two 11140mm</td></tr><tr><td>Bogie wheelbase:</td><td>2200mm</td></tr><tr><td>Coupler height:</td><td>500mm</td></tr><tr><td>Diameter of wheel:</td><td>730mm</td></tr><tr><td>Distance between backs of wheelset:</td><td>1353mm</td></tr></table> <p>Additional Features:</p> <ul style="list-style-type: none">3 phase AC linear drive system with advanced VVVF inverter.Microprocessor based IGBT and diagnostic systems.45 minute emergency load battery life.Network control system features high-redundancy ladder network topological structure (train control, vehicle control and subsystem control levels). <p>Vehicle type: New design</p> <p>CSR Design Responsibility: General Design of vehicle</p>	Vehicle height:	3650mm	Height of saloon floor:	930mm	Distance between bogies:	two 11140mm	Bogie wheelbase:	2200mm	Coupler height:	500mm	Diameter of wheel:	730mm	Distance between backs of wheelset:	1353mm	<table><tr><td>Pantograph</td><td>Asian Tongdai (Qingdao) Railway Equipments Co., Ltd. (Stemmann)</td></tr><tr><td>Traction, auxiliary and monitor system</td><td>Mitsubishi Electric Corporation</td></tr><tr><td>Braking system</td><td>Knorr-Bremse</td></tr><tr><td>Radio system</td><td>Shanghai Railway Communication Co., Ltd.</td></tr><tr><td>CCTV system</td><td>Guangzhou Global Link Communications Inc.</td></tr></table>	Pantograph	Asian Tongdai (Qingdao) Railway Equipments Co., Ltd. (Stemmann)	Traction, auxiliary and monitor system	Mitsubishi Electric Corporation	Braking system	Knorr-Bremse	Radio system	Shanghai Railway Communication Co., Ltd.	CCTV system	Guangzhou Global Link Communications Inc.	<p>Project Status: In progress. 40 trains have been delivered by April 2013</p>																								
Vehicle height:	3650mm																																																		
Height of saloon floor:	930mm																																																		
Distance between bogies:	two 11140mm																																																		
Bogie wheelbase:	2200mm																																																		
Coupler height:	500mm																																																		
Diameter of wheel:	730mm																																																		
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Pantograph	Asian Tongdai (Qingdao) Railway Equipments Co., Ltd. (Stemmann)																																																		
Traction, auxiliary and monitor system	Mitsubishi Electric Corporation																																																		
Braking system	Knorr-Bremse																																																		
Radio system	Shanghai Railway Communication Co., Ltd.																																																		
CCTV system	Guangzhou Global Link Communications Inc.																																																		
13. Extension Project for Linear Motor Vehicle of Guangzhou Metro Line 5 Contact: Guangzhou Metro Corporation Address: NO.8 Huadadao Fangcun District Guangzhou Name: Xie Dongmei Title: Project	<table><tr><td>Vehicle model:</td><td>Type L</td></tr><tr><td>Carbody:</td><td>Aluminum alloy</td></tr><tr><td>Length of composition:</td><td>107.16m</td></tr><tr><td>Composition:</td><td>6-car / train</td></tr><tr><td>Seating capacity:</td><td>-A+B+B1+B2=B3+A- AW2: 1402 persons / train AW3: 2012 persons / train</td></tr><tr><td>Operation speed:</td><td>90km/h</td></tr><tr><td>Grid voltage:</td><td>DC1500V</td></tr><tr><td>Current collection method:</td><td>Third rail lower current collection / pantograph</td></tr><tr><td>Carbody length:</td><td>A: 17600mm; B: 16840mm</td></tr><tr><td>Vehicle height:</td><td>3625mm</td></tr><tr><td>Height of saloon floor:</td><td>930mm</td></tr><tr><td>Distance between bogies:</td><td>two 11140mm</td></tr><tr><td>Bogie wheelbase:</td><td>2000mm</td></tr></table>	Vehicle model:	Type L	Carbody:	Aluminum alloy	Length of composition:	107.16m	Composition:	6-car / train	Seating capacity:	-A+B+B1+B2=B3+A- AW2: 1402 persons / train AW3: 2012 persons / train	Operation speed:	90km/h	Grid voltage:	DC1500V	Current collection method:	Third rail lower current collection / pantograph	Carbody length:	A: 17600mm; B: 16840mm	Vehicle height:	3625mm	Height of saloon floor:	930mm	Distance between bogies:	two 11140mm	Bogie wheelbase:	2000mm	<table><tr><td>Parts</td><td>Supplier</td></tr><tr><td>Carbody</td><td>CSR Sifang</td></tr><tr><td>Bogie</td><td>CSR Sifang</td></tr><tr><td>Air conditioning system</td><td>Shijiazhuang King Transportation Equipment Co., Ltd.</td></tr><tr><td>Saloon door</td><td>Nanjing Kangni New Technology of Mechantronic Co., Ltd</td></tr><tr><td>PIDS system</td><td>Guangzhou Global Link Communications Inc.</td></tr><tr><td>Gangway</td><td>Qingdao Ultimate</td></tr><tr><td>Coupler buffer device</td><td>Qingdao Sifang Rolling Stock Research Institute Co., Ltd.</td></tr><tr><td>Current collector</td><td>KTK Group (FERRAZ)</td></tr><tr><td>Pantograph</td><td>Asian Tongdai (Qingdao) Railway Equipments Co., Ltd. (Stemmann)</td></tr><tr><td>Traction, auxiliary and monitor</td><td>Times Electric</td></tr></table>	Parts	Supplier	Carbody	CSR Sifang	Bogie	CSR Sifang	Air conditioning system	Shijiazhuang King Transportation Equipment Co., Ltd.	Saloon door	Nanjing Kangni New Technology of Mechantronic Co., Ltd	PIDS system	Guangzhou Global Link Communications Inc.	Gangway	Qingdao Ultimate	Coupler buffer device	Qingdao Sifang Rolling Stock Research Institute Co., Ltd.	Current collector	KTK Group (FERRAZ)	Pantograph	Asian Tongdai (Qingdao) Railway Equipments Co., Ltd. (Stemmann)	Traction, auxiliary and monitor	Times Electric	<p>Length of Contract: 2010.12-2012.10</p> <p>Notice to Proceed: 2010.12.28</p> <p>Date of Closeout: 2012.10</p> <p>Project Status: Completed on time</p>
Vehicle model:	Type L																																																		
Carbody:	Aluminum alloy																																																		
Length of composition:	107.16m																																																		
Composition:	6-car / train																																																		
Seating capacity:	-A+B+B1+B2=B3+A- AW2: 1402 persons / train AW3: 2012 persons / train																																																		
Operation speed:	90km/h																																																		
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Parts	Supplier																																																		
Carbody	CSR Sifang																																																		
Bogie	CSR Sifang																																																		
Air conditioning system	Shijiazhuang King Transportation Equipment Co., Ltd.																																																		
Saloon door	Nanjing Kangni New Technology of Mechantronic Co., Ltd																																																		
PIDS system	Guangzhou Global Link Communications Inc.																																																		
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Coupler buffer device	Qingdao Sifang Rolling Stock Research Institute Co., Ltd.																																																		
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Traction, auxiliary and monitor	Times Electric																																																		



TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle			Major Suppliers	Contract Schedule & Status
Manager Tel: 020-83106368 Email: dtpzxz@vip.163.com	Coupler height:	500mm		system	
	Diameter of wheel:	730mm		Braking system	China Academy of Railway Sciences
	Distance between backs of wheelset:	1353mm		Radio system	Shanghai Xingantong Communication Equipment Co., Ltd.
				CCTV system	Guangzhou Global Link Communications Inc.
Scope: Entire vehicle with aluminum alloy carbody, 192 cars	Additional Features: <ul style="list-style-type: none"> Design approach prioritized light-weight structures. Bolsterless, light weight bogie design refined through simulation analysis, testing, and verification. AC linear drive system with advanced VVVF inverter. Light weight APS system TCN IEC 61375 compliant DTECS network control system was independently developed. Carbody features advanced paint-free vehicle styling. 				
Vehicle type: New design					
CSR Design Responsibility: General Design of vehicle					
14. Metro Vehicle Purchasing Project of Chengdu Metro Line 2 Second-stage Project					
Contact: Chengdu Metro Co., Ltd, No. 396, Middle Tianfu Avenue, Chengdu, Sichuan, 028-61639050 Name: :Zhang Yang Title: Vice President Tel: 028-61638531 Email: 10193772	Vehicle model: Carbody: Length of composition: Composition: Seating capacity: Operation speed: Grid voltage: Current collection method: Carbody length: Vehicle height: Height of saloon floor: Distance between bogies: Bogie wheelbase: Coupler height: Diameter of wheel: Distance between backs of wheelset:	Type B2 Stainless steel 118m 6-car / train +Tc-Mp-M1-M2-Mp-Tc+ AW2: 1468 persons / train AW3: 1820 persons / train 80km/h DC1500V Pantograph catenary 19,555mm (head car), 19000mm (intermediate car) 3800mm 1100mm 12600mm 2200mm 660mm 840mm 1353mm	Parts Carbody Bogie Air conditioning system Saloon door PIDS system (including CCTV) Gangway Coupler buffer device Pantograph Traction, auxiliary and monitor system Braking system Radio system	Supplier CSR Sifang CSR Sifang New United Air-conditioning System (Jiangsu) Co., Ltd. Beijing Bode Communication Equipment Co., Ltd Beijing Waycom Technology Development Co., Ltd Qingdao Ultimate Voith Turbo Power Transmission (Shanghai) Co., Ltd. Zhuzhou Jiufang Electronic Equipment Co., Ltd Toyo Electric Mfg. Co. Ltd Nablesco Railroad Product Company (Beijing) Shanghai Xingantong Communication Equipment Co., Ltd.	Length of Contract: 2011.1-2013.12 Notice to Proceed: 2011.1.28 Date of Closeout: 2013.12 Project Status: Completed



TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers		Contract Schedule & Status
		Signaling system	Insignia	
<p>@qq.com</p> <p>Scope: Entire vehicle with stainless steel carbody, 114 cars</p> <p>Vehicle type: Existing design</p> <p>CSR Design Responsibility: General Design of vehicle</p>	<p>Additional Features:</p> <ul style="list-style-type: none"> Stainless steel, light weight, unpainted carbody. Semi-automatic sealing couplers, with automatic centering on both ends. Semi-permanent traction rods are used for intermediate cars. SDB-80 bolsterless bogies, with noise reduction dampers. Wet wheel rail lubrication system installed on front bogies of trailer car. VVVF controlled propulsion and braking system. Capable of both automated and manual operation. 2 static inverters (SIV, 185kVA ea) and one Alkaline Cd-Ni battery pack (160Ah) per train. 2 roof mounted 29kW HVAC units per car. 4 sets of double-leaf electric inner sliding per side of train (one set enabled for manual operation) are microprocessor controlled and feature failure recording and self diagnosis. 8 LCD video display units per car. LED electronic map above each pair of doors in car Video surveillance cameras installed in each car. Steel seats and stainless steel stanchions and hand grabs installed throughout. Electric heaters are installed under the seats. 		Insignia	
<p>15.</p> <p>Updated Electric Passenger Vehicle Purchasing Project of Beijing Metro Line 1</p> <p>Contact: Beijing Subway Operation Co., Ltd</p> <p>Address: NO.2 Xizhimenwai Street Xicheng District Beijing</p>	<p>Vehicle model: Carbody: Stainless steel Length of composition: 117.88m Composition: 6-car / train +Tc1-M1-M3-T3-M2+Tc2+ Seating capacity: AW2: 1468 persons / trainzaaza AW3: 1880 persons / train Operation speed: 80km/h Grid voltage: DC750V Current collection method: Third rail upper current collection Carbody length: 19380mm (head car), 19000 (intermediate car) Vehicle height: 3800mm Height of saloon floor: 1100mm Distance between two bogies: 12600mm</p>	<p>Parts</p> <p>Carbody</p> <p>Bogie</p> <p>Air conditioning system</p> <p>Saloon door</p> <p>PIDS system</p> <p>Gangway</p> <p>Coupler buffer device</p> <p>Current collector</p> <p>Traction, auxiliary</p>	<p>Supplier</p> <p>CSR Sifang</p> <p>CSR Sifang</p> <p>Guangzhou Zhongche Railway Vehicles Equipment Joint-Stock Co., Ltd</p> <p>Nanjing Kangni New Technology of Mechantronic Co., Ltd</p> <p>Tianjin Beihai Communication Technology Co., Ltd</p> <p>Changzhou Hubner KTK Traffic Equipment Co., Ltd.</p> <p>Voith Turbo Power Transmission (Shanghai) Co., Ltd.</p> <p>Agent products of Beijing Jiteng Technology Co., Ltd. are from Germany STEMMANN</p> <p>CPC/BT</p>	<p>Length of Contract: 2011.4-2012.2</p> <p>Notice to Proceed: 2011.4.27</p> <p>Date of Closeout: 2012.02</p> <p>Project Status: Completed on time</p>



TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status
Name: Li Li Title: Project Manager Tel: 010-62293672 Email: lili2012@126.com Scope: Entire vehicle with stainless steel carbody, 114 cars Vehicle type: Design optimization based on the original design CSR Design Responsibility: General Design of vehicle	Bogie wheelbase: 2200mm Coupler height: 660mm Diameter of wheel: 840mm Distance between backs of wheelset: 1353mm Additional Features: <ul style="list-style-type: none"> Advanced vehicle styling Fully automated (ATO), and driverless system. The vehicle meets the BS6853 fireproof standard. Capable of full battery operation, including traction. APS assisted by brake regen mode. 	and monitor system Braking system Radio system CCTV system Signaling system Knorr Shanghai Xingantong Communication Equipment Co., Ltd. Beijing Dongfangyonglong Technology Development Co., Ltd. (Guangzhou) Global Link Communications Inc.) Alcatel	
16. Purchasing Project of Qingdao Metro Vehicle First-stage Project Contact: Qingdao Metro Corporation NO.2 Xianggang Road Road Shinan District Qingdao Name: Wangli Title: Project Manager Tel: 0532-80797630 Email:	Vehicle model: Type B1 Carbody: Aluminum alloy Length of composition: 118m Composition: 6-car / train + Tc – M – M1 + M1 – M – Tc + Seating capacity: AW2: 1484 persons / train AW3: 1896 persons / train Operation speed: 80km/h Grid voltage: DC1500V Current collection method: Current collection by contacting with the lower part of the third rail Carbody length: 19500mm (head car), 19000 (intermediate car) Vehicle height: 3700mm Height of saloon floor: 1100mm Distance between two bogies: 12600mm	Parts Carbody Bogie Air conditioning system Saloon door PIDS system Gangway Coupler buffer device Current collector Traction, auxiliary and monitor system Braking system Radio system CCTV system Supplier CSR Sifang CSR Sifang Merak Jinxin Air Conditioning Systems (Wuxi) Co. Ltd. IFE-Victali Beijing Waycom Ultimate Qingdao Sifang Rolling Stock Research Institute Co., Ltd. Alstom Knorr Beijing Waycom Beijing Waycom	Length of Contract: 2011.12-2015.5 Notice to Proceed: 2011.12.9 Date of Closeout: 2015 (planned) Project Status: In progress



TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle		Major Suppliers		Contract Schedule & Status
qdmvysz@126.com Scope: Entire vehicle with aluminum alloy carbody, 144 cars Vehicle type: New design CSR Design Responsibility: General Design of vehicle	Bogie wheelbase: 2200mm Coupler height: 660mm Diameter of wheel: 840mm Distance between backs of wheelset: 1353mm Additional Features: <ul style="list-style-type: none">Design approach of the vehicles prioritized energy efficiency, environmentally friendliness, advanced proven technologies, and passenger comfort.Light weight aluminum alloy structure compliant with the most stringent design standards for smoke and fire protection, toxicity, and other safety standards.Cabin air filters and other design features maximize passenger comfort.Heated stainless steel seats installed throughout.Advanced passenger information systems (PIS) provide operator with the latest in PIS technology amenities		Signaling system	Siemens	

Extended Train Project of Beijing Metro Line 4 Contact: Beijing MTR Corporation Address: Metro Line 4 Depot, Jiayuan Road, Fengtai District, Beijing Name: Guan Zhipeng Title: Lead Buyer Tel: 010-88641363 Email: caigou@mtr.bj.cn Scope: Entire vehicle	17. Vehicle model: Type B1 Carbody: Stainless steel Length of composition: 117.88m Composition: 6-car / train +Tc1-M1-M3-T3-M2+Tc2+ Seating capacity: AW2: 1468 persons / train AW3: 1880 persons / train Operation speed: 80km/h Grid voltage: DC750V Current collection method: Third rail upper current collection Carbody length: 19380mm (head car), 19000 (intermediate car) Vehicle height: 3800mm Height of saloon floor: 1100mm Distance between two bogies: 12600mm Bogie wheelbase: 2200mm Coupler height: 660mm Diameter of wheel: 840mm Distance between backs of wheelset: 1353mm					Length of Contract: August 2012 to November 2013 Notice to Proceed: 2012.9.24 Date of Closeout: 2013.11 Project Status: Completed on time
		Parts	Supplier			
Carbody	CSR Sifang					
Bogie	CSR Sifang					
Air conditioning system	Guangzhou Zhongche Railway Vehicles Equipment Joint-Stock Co., Ltd					
Saloon door	Nanjing Kangni New Technology of Mechantronic Co., Ltd					
PIDS system	Tianjin Beihai Communication Technology Co., Ltd					
Gangway	Changzhou Hubner KTK Traffic Equipment Co., Ltd.					
Coupler buffer device	Voith Turbo Power Transmission (Shanghai) Co., Ltd.					
Current collector	Agent products of Beijing Jiteng Technology Co., Ltd. are from Germany STEMMANN					
Traction, auxiliary and monitor system	CPC/BT					
Braking system	Knorr					
Radio system	Shanghai Xingantong Communication Equipment Co., Ltd.					
CCTV system	Beijing Dongfangyinglong Technology					



TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status																																																										
<p>with stainless steel carbody, 78 cars</p> <p>Vehicle type: Design optimization based on the existing design</p> <p>CSR Design Responsibility: General Design of vehicle</p>	<p>Additional Features:</p> <ul style="list-style-type: none">Advanced vehicle stylingFully automated (ATO), and driverless system.The vehicle meets the BS6853 fireproof standard.Capable of full battery operation, including traction.APS assisted by brake regen mode.	<table><tr><td></td><td>Development Co., Ltd. (Guangzhou Global Link Communications Inc.)</td></tr><tr><td>Signaling system</td><td>Alcatel</td></tr></table>		Development Co., Ltd. (Guangzhou Global Link Communications Inc.)	Signaling system	Alcatel																																																							
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<p>18.</p> <p>Connecting Line Project between Beijing Metro</p> <p>Changping Line and Beijing Metro Line 8</p> <p>Contact: Beijing Rail Transit Construction and Management Co., Ltd</p> <p>Address: NO.2 Baiwanzhuang Street Xicheng District Beijing</p> <p>Name: Li Dongmei</p> <p>Title: Project Manager</p> <p>Tel: 010-88376765</p> <p>Email: gdjzpzp2012@126.com</p>	<table><tr><td>Vehicle model:</td><td>Type B1</td></tr><tr><td>Carbody:</td><td>Stainless steel</td></tr><tr><td>Length of composition:</td><td>118.26m</td></tr><tr><td>Composition:</td><td>6-car / train +Tc-M-T-M-M-Tc+</td></tr><tr><td>Seating capacity:</td><td>AW2: 1468 persons / train AW3: 1880 persons / train</td></tr><tr><td>Operation speed:</td><td>80km/h</td></tr><tr><td>Grid voltage:</td><td>DC750V</td></tr><tr><td>Current collection method:</td><td>Third rail upper current collection</td></tr><tr><td>Carbody length:</td><td>19500mm (head car), 19000 (intermediate car)</td></tr><tr><td>Vehicle height:</td><td>3800mm</td></tr><tr><td>Height of saloon floor:</td><td>1100mm</td></tr><tr><td>Distance between bogies:</td><td>two 12600mm</td></tr><tr><td>Bogie wheelbase:</td><td>2200mm</td></tr><tr><td>Coupler height:</td><td>660mm</td></tr><tr><td>Diameter of wheel:</td><td>840mm</td></tr><tr><td>Distance between backs of wheelset:</td><td>1353mm</td></tr></table> <p>Additional Features:</p> <ul style="list-style-type: none">Vehicle design features special consideration toward ergonomics, modularity, standardization, safety, reliability, environmental impacts and simplicity.	Vehicle model:	Type B1	Carbody:	Stainless steel	Length of composition:	118.26m	Composition:	6-car / train +Tc-M-T-M-M-Tc+	Seating capacity:	AW2: 1468 persons / train AW3: 1880 persons / train	Operation speed:	80km/h	Grid voltage:	DC750V	Current collection method:	Third rail upper current collection	Carbody length:	19500mm (head car), 19000 (intermediate car)	Vehicle height:	3800mm	Height of saloon floor:	1100mm	Distance between bogies:	two 12600mm	Bogie wheelbase:	2200mm	Coupler height:	660mm	Diameter of wheel:	840mm	Distance between backs of wheelset:	1353mm	<table><tr><td>Parts</td><td>Supplier</td></tr><tr><td>Carbody</td><td>CSR Sifang</td></tr><tr><td>Bogie</td><td>CSR Sifang</td></tr><tr><td>Air conditioning system</td><td>Shijiazhuang King Transportation Equipment Co., Ltd.</td></tr><tr><td>Saloon door</td><td>Beijing Bode Communication Equipment Co., Ltd</td></tr><tr><td>PIDS system (including CCTV)</td><td>Beijing Waycom Technology Development Co., Ltd</td></tr><tr><td>Gangway</td><td>Qingdao Ultimate</td></tr><tr><td>Coupler buffer device</td><td>Qingdao Sifang Rolling Stock Research Institute Co., Ltd.</td></tr><tr><td>Current collector</td><td>KTK Group (FERRAZ) and Hunan Zhongtong</td></tr><tr><td>Traction, auxiliary and monitor system</td><td>Itami Production Agency of Mitsubishi Electric Corporation</td></tr><tr><td>Braking system</td><td>Nabtesco Railroad Product Company (Beijing)</td></tr><tr><td>Radio system</td><td>Research Institute 54 of China Technology Group Corporation</td></tr><tr><td>Signaling system</td><td>Siemens</td></tr></table>	Parts	Supplier	Carbody	CSR Sifang	Bogie	CSR Sifang	Air conditioning system	Shijiazhuang King Transportation Equipment Co., Ltd.	Saloon door	Beijing Bode Communication Equipment Co., Ltd	PIDS system (including CCTV)	Beijing Waycom Technology Development Co., Ltd	Gangway	Qingdao Ultimate	Coupler buffer device	Qingdao Sifang Rolling Stock Research Institute Co., Ltd.	Current collector	KTK Group (FERRAZ) and Hunan Zhongtong	Traction, auxiliary and monitor system	Itami Production Agency of Mitsubishi Electric Corporation	Braking system	Nabtesco Railroad Product Company (Beijing)	Radio system	Research Institute 54 of China Technology Group Corporation	Signaling system	Siemens	<p>Length of Contract: 2012.11-2013.8</p> <p>Notice to Proceed: 2012.11.21</p> <p>Date of Closeout: 2013.08</p> <p>Project Status: Completed on time</p>
Vehicle model:	Type B1																																																												
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TABLE I.3A-1
CSR Sifang Similar Past Heavy Rail Projects – Project Information Matrix

Project Information	Description of Vehicle	Major Suppliers	Contract Schedule & Status
<p>Scope: Entire vehicle with stainless steel carbody, 36 cars</p> <p>Vehicle type: New design</p> <p>CSR Design Responsibility: General Design of vehicle</p>	<ul style="list-style-type: none">• Sleek, modern vehicle styling throughout the vehicles, with emphasis on interior passenger comfort, accessibility, and maintenance/operation friendly.• Lightweight, energy efficient steel carbody.• Cost effective modular design allows for greater interchangeability and maintainability while minimizing costs.• Fire standard DIN 5510 compliant;• Windows capable of manual operation provides additional passenger comfort during power outages.• Full modern compliment of security and safety devices and systems installed throughout (surveillance cameras, fire alarms, fire extinguishers, emergency lighting, etc)• Capable of both automated and manual operation (ATP, ATO)		



TABLE I.3A-2
CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results																		
1. Beijing Metro Line 4 Electric Vehicle Project	<p>Failure Definitions:</p> <p>(a) Operation outage: The train is unable to continue regular passenger service.</p> <ul style="list-style-type: none">- All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fire or emergency device fault, etc.- All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed, two or more gates per train are out of order, etc.- All faults that may reduce the comfort experience of passengers. For example, HVAC failure, etc.- Conditions where further operation may damage the train, and/or associated equipment, including wayside. For example, the braking system fails to be released. <p>(b) Train operation delay: Train is delayed for two or more minutes.</p> <p>(c) Original delay: Extended passenger travel time.</p> <p>(d) Departure failure: Train is unable to depart station on time.</p> <p>(e) MTBF: Mean time between failures, per train.</p> <p>(f) MDBF: Mean distance between failures, per train.</p> <p>System RAM Goals:</p> <table><tr><th>MTBF per Train</th><th>MTBF Goal</th><th>Unit</th></tr><tr><td>Original delay for 2 minutes or greater</td><td>3,221</td><td>Hours</td></tr><tr><td>Departure failure</td><td>11,583</td><td>Hours</td></tr></table> <table><tr><th>MDTF per Train</th><th>MTBF Goal</th><th>Unit</th></tr><tr><td>Original delay for 2 minutes or greater</td><td>112,735 (= 3,221 x 35)</td><td>km</td></tr><tr><td>Departure failure</td><td>405,405 (=11,583 x 35)</td><td>km</td></tr></table>	MTBF per Train	MTBF Goal	Unit	Original delay for 2 minutes or greater	3,221	Hours	Departure failure	11,583	Hours	MDTF per Train	MTBF Goal	Unit	Original delay for 2 minutes or greater	112,735 (= 3,221 x 35)	km	Departure failure	405,405 (=11,583 x 35)	km	<p>Reliability Data Collection Process:</p> <p>CSR Qingdao Sifang developed a system of fault reporting and correction approaches (FRACAS) which was used to collect fault information of Beijing Subway Line 4 and supplement the fault information of original defect records. By use of FRACAS, Beijing Subway Line 4 met the reporting requirements, made statistics, analyzed the fault data, and calculated the reliability index.</p> <p>Reliability Calculation Method:</p> <p>Basic RAM Calculation Method</p> <p>MTBF: If a fault requires operational or maintenance staff to provide special assistance (abnormal mode) or to maintain or recover the system/device operation, including all false alarms or indication errors resulting in travel delay, it shall be counted in the MTBF calculation. Incidents incurred by external factors such as external electricity outage, flood or staff's mistakes, shall not be taken into the calculation. The equation is as follows:</p> $MTBF = \frac{\text{The total service time of all trains}}{\text{The total number of faults}}$ <p>Raw Defect History Data Sample:</p> <p><i>During daily inspection in depot: there is a 15mm*5mm tear on the seat's surface at right side of M3 car door B3.</i></p>	<p>Actual Reliability at end of Warranty Period:</p> <p>After the expiration of the warranty period, the reliability index met the contract requirements. For the faults of original delay in 2 minutes or above, the reliability index exceeds 3,221 hours for MTBF per unit train; for the faults of departure failure, the index exceeds 11,583 hours for MTBF per unit train.</p> <p>Actual Reliability Currently Being Realized:</p> <p>Not available</p> <p>Met MBTA T2.03.03 Requirements?:</p> <p>YES</p>
MTBF per Train	MTBF Goal	Unit																			
Original delay for 2 minutes or greater	3,221	Hours																			
Departure failure	11,583	Hours																			
MDTF per Train	MTBF Goal	Unit																			
Original delay for 2 minutes or greater	112,735 (= 3,221 x 35)	km																			
Departure failure	405,405 (=11,583 x 35)	km																			
2. Chengdu Metro Line 1 First-stage Project Metro Vehicle Project	<p>Failure Definitions:</p> <p>(a) Operation outage: The train is unable to continue regular passenger service.</p> <ul style="list-style-type: none">- All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fire or emergency device fault, etc.- All faults under which the train cannot satisfy the minimum	<p>Reliability Data Collection Process:</p> <p>CSR Qingdao Sifang established a system of fault reporting and correction approaches (FRACAS) which is used to collect the fault information of Chengdu Metro Line 2 and supplement the fault information of original defect records. By use of FRACAS, Chengdu Metro Line 2 can meet the</p>	<p>Actual Reliability at end of Warranty Period:</p> <p>After the expiration of the warranty period, the reliability index meets the contract requirements. For the faults of original delay in 2 minutes or above, the reliability index</p>																		



TABLE I.3A-2
CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results									
	<p>headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed, two or more gates per train are out of order, etc.</p> <ul style="list-style-type: none">- All faults that may reduce the comfort experience of passengers. For example, HVAC failure, etc.- Conditions where further operation may damage the train, and/or associated equipment, including wayside. For example, the braking system fails to be released. <p>(b) Train operation delay: Train is delayed for two or more minutes.</p> <p>(c) Original delay: Extended passenger travel time.</p> <p>(d) Departure failure: Train is unable to depart station on time.</p> <p>(e) MTBF: Mean time between failures, per train.</p> <p>(f) MDBF: Mean distance between failures, per train.</p> <p>System RAM Goals:</p> <table><tr><th>MTBF per Train</th><th>MTBF Goal</th><th>Unit</th></tr><tr><td>Original delay for 2 minutes or greater</td><td>$\geq 3,085$</td><td>Hours</td></tr><tr><td>Departure failure</td><td>$\geq 10,987$</td><td>Hours</td></tr></table>	MTBF per Train	MTBF Goal	Unit	Original delay for 2 minutes or greater	$\geq 3,085$	Hours	Departure failure	$\geq 10,987$	Hours	<p>requirements to report, make statistics and analyze the fault data as well as to calculate the reliability index.</p> <p>Reliability Calculation Method:</p> <p>If any fault requires operational or maintenance staff to provide special assistance (abnormal mode) or it fails to maintain or recover the system/device operation, including all false alarms or indication errors resulting in travel delay, it shall be put into MTBF calculation. Incidents incurred by external factors such as external electricity outage, flood or staff's mistakes, shall not be taken into the calculation. The equation is as follows:</p> <p>MTBF =The total service time of all trains/ The total number of fault times</p> <p>Raw Defect History Data Sample:</p> <p>1. 2012/6/27, it was reported that the condenser fan No. 1 of air conditioning unit No. 2 in Train 101035 jammed when the fan blades were rotated manually, and it restored to normal condition after replacing the condenser fan motor</p> <p>2. 2012/7/19, Door No. 1 in Train 101092 closed slowly, the motor encoder failed, replace the encoder</p>	<p>exceeds 3,085 hours for MTBF per unit train; for the faults of departure failure, the index exceeds 10,987 hours for MTBF per unit train.</p> <p>Actual Reliability Currently Being Realized: MTBF=426 MTBFS=13647</p> <p>Met MBTA T2.03.03 Requirements?: YES</p>
MTBF per Train	MTBF Goal	Unit										
Original delay for 2 minutes or greater	$\geq 3,085$	Hours										
Departure failure	$\geq 10,987$	Hours										
3. Project of Shenyang Metro Line 2 First-stage Project Vehicle	<p>Categorization of operational malfunctions</p> <p>Operational service fault: Operational Service Fault refers to the fault under which the train fails to continue revenue operation or which the fault exerts material effects on the revenue operation, including:</p> <p>Rescue: when it is required for one train to drag the faulty train back to the depot.</p> <p>No signal: when it is required to evacuate passengers immediately and the empty train returns to the depot. As an alternative, the train first transports the passengers to the terminal station and returns to the depot.</p> <p>No delivery: as components does not work properly, the train cannot carry out on-line operation according to the running diagram arranged and another train is put into operation instead of the faulty one.</p> <p>Delay fault:</p> <p>Major delay: service delayed over 3min due to fault.</p>	<p>Reliability Data Collection Process:</p> <p>CSR Qingdao Sifang developed a system of fault reporting and correction approaches (FRACAS) which was used to collect fault information of Shenyang Metro Line 2 and supplement the fault information of original defect records. By use of FRACAS, Shenyang Metro Line 2 met the reporting requirements, made statistics, analyzed the fault data, and calculated the reliability index.</p> <p>Reliability Calculation Method:</p> <p>The train reliability shall be calculated annually by the following equation:</p> <p>MTBF per train = (annual distance/travel speed)/ the number of annual faults</p>	<p>Actual Reliability at end of Warranty Period:</p> <p>The reliability index met the contract requirements at the end of the warranty period. MTBF per unit train exceeded 6,000h. MTBF delay faults per unit train exceeded 3,000h. MTBF contingent inspection faults per train exceeded 150h.</p> <p>Actual Reliability Currently Being Realized: MTBF=2240</p> <p>Met MBTA T2.03.03 Requirements?:</p>									



TABLE I.3A-2
CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results									
	<p>Delay: service delayed under 3min due to some fault.</p> <p>Troubleshooting: Fault from contingent inspections: any fault discovered by the driver during operation or the maintenance staff during inspection.</p> <p>Requirements of Operational Reliability</p> <p>Service fault: MTBF per unit train of 6,000h; Delay fault: MTBF per unit train of 3,000h; Fault from contingent inspections: MTBF per train of 150h.</p>	<p>MDBF exceeds 100,000km (the inspection is kicked off on the 366th day after acceptance)</p> <p>Raw Defect History Data Sample: 1. 2013/7/27, on July 27, 2013 (16:05), when the train (Fleet 15) got to the Quanyun Road Station, the electronic maps of the whole train were inactive, and the LCD on the train showed no picture. When the train got to the destination, it was taken out of the service.</p>	YES									
4. Tianjin Metro Line 3 Electric Passenger Vehicle Project	<p>Failure Definitions:</p> <p>(a) Operation outage: The train is unable to continue regular passenger service.</p> <ul style="list-style-type: none">- All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fire or emergency device fault, etc.- All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed, two or more gates per train are out of order, etc.- All faults that may reduce the comfort experience of passengers. For example, HVAC failure, etc.- Conditions where further operation may damage the train, and/or associated equipment, including wayside. For example, the braking system fails to be released. <p>(b) Train operation delay: Train is delayed for two or more minutes.</p> <p>(c) Original delay: Extended passenger travel time.</p> <p>(d) Departure failure: Train is unable to depart station on time.</p> <p>(e) MTBF: Mean time between failures, per train.</p> <p>RAM Goals:</p> <table><tr><th>MTBF per Train</th><th>MTBF Goal</th><th>Unit</th></tr><tr><td>Original delay for 2 minutes or greater</td><td>3,218</td><td>Hours</td></tr><tr><td>Departure failure</td><td>11,615</td><td>Hours</td></tr></table> <p>Contract requirement: MDBF shall exceed 100,000km within the first 366 days of operation after final acceptance.</p>	MTBF per Train	MTBF Goal	Unit	Original delay for 2 minutes or greater	3,218	Hours	Departure failure	11,615	Hours	<p>Reliability Data Collection Process: CSR Qingdao Sifang developed a system of fault reporting and correction approaches (FRACAS) which was used to collect fault information of Metro Line 3 and supplement the fault information of original defect records. By use of FRACAS, Tianjin Metro Line 3 met the reporting requirements, made statistics, analyzed the fault data, and calculated the reliability index.</p> <p>Reliability Calculation Method: The train reliability shall be calculated annually by the following equation: MTBF per train = (annual distance/travel speed)/ the number of annual faults</p> <p>Raw Defect History Data Sample: 1. 2012/8/4, no image displayed in the camera at End A of Train 3256. Replace the camera at End A of Train 3256. The train was put back in service. 2. 2012/8/5, abnormal noises generated during door opening/closing process of Door No. 6 and 8 for Train 3035. Replace the screw rod for Door No. 6 and 8 of Train 3035. Train was put back in service. 3. 2012/8/9, electronic map at door area was inactive for Door No. 4 of Train 3215. Replace the electronic map at door area for Door No. 4 of Train 3215. Train was put back in service.</p>	<p>Actual Reliability at end of Warranty Period: The reliability index met the contract requirements at the conclusion of the warranty period. Departure Failure MTBF exceeded 11,615 hours per unit train. Original Delay MBTF of 2 minutes or greater exceeded 3,218 hours per unit train.</p> <p>Actual Reliability Currently Being Realized: MTBF=609 MTBFS=24344</p> <p>Met MBTA T2.03.03 Requirements?: YES</p>
MTBF per Train	MTBF Goal	Unit										
Original delay for 2 minutes or greater	3,218	Hours										
Departure failure	11,615	Hours										



TABLE I.3A-2
CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results
5. Beijing Metro Line 8 Second-stage Project	<p>Categorization of operational malfunctions</p> <p>Operational service fault: Operational Service Fault refers to the fault under which the train fails to continue revenue operation or which the fault exerts material effects on the revenue operation, including:</p> <p>Rescue: when it is required for one train to drag the faulty train back to the depot.</p> <p>No signal: when it is required to evacuate passengers immediately and the empty train returns to the depot. As an alternative, the train first transports the passengers to the terminal station and returns to the depot.</p> <p>No delivery: as components does not work properly, the train cannot carry out on-line operation according to the running diagram arranged and another train is put into operation instead of the faulty one.</p> <p>Delay fault:</p> <p>Major delay: service delayed over 3min due to fault.</p> <p>Delay: service delayed under 3min due to some fault.</p> <p>Troubleshooting:</p> <p>Fault from contingent inspections: any fault discovered by the driver during operation or the maintenance staff during inspection.</p> <p>Requirements of Operational Reliability</p> <p>Service fault: MTBF per unit train of 6,000h;</p> <p>Delay fault: MTBF per unit train of 30,000h;</p> <p>Fault from contingent inspections: MTBF per train of 150h.</p> <p>Contract requirement: MDBF shall exceed 100,000km within the first 366 days of operation after final acceptance.</p>	<p>Reliability Data Collection Process:</p> <p>CSR Qingdao Sifang developed a system of fault reporting and correction approaches (FRACAS) which was used to collect fault information of Beijing Metro Line 8 and supplement the fault information of original defect records. By use of FRACAS, Beijing Metro Line 8 met the reporting requirements, made statistics, analyzed the fault data, and calculated the reliability index.</p> <p>Reliability Calculation Method:</p> <p>The train reliability shall be calculated annually by the following equation:</p> <p>MTBF per train = (annual distance/travel speed)/ the number of annual faults</p> <p>Raw Defect History Data Sample:</p> <p>Not available</p>	<p>Actual Reliability at end of Warranty Period:</p> <p>The reliability index met the contract requirements at the end of the warranty period. MTBF per unit train exceeded 6,000h. MTBF delay faults per unit train exceeded 3,000h. MTBF contingent inspection faults per train exceeded 150h.</p> <p>Actual Reliability Currently Being Realized:</p> <p>MTBF=1175</p> <p>Met MBTA T2.03.03 Requirements?:</p> <p>YES</p>
6. Beijing Metro Daxing Line Project	<p>Failure Definitions:</p> <p>(a) Operation outage: The train is unable to continue regular passenger service.</p> <ul style="list-style-type: none"> - All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fire or emergency device fault, etc. - All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the 	<p>Reliability Data Collection Process:</p> <p>CSR Qingdao Sifang developed a system of fault reporting and correction approaches (FRACAS) which was used to collect fault information of Beijing Metro Daxing Line and supplement the fault information of original defect records. By use of FRACAS, Beijing Metro Daxing Line met the reporting requirements, made statistics, analyzed</p>	<p>Actual Reliability at end of Warranty Period:</p> <p>After the expiration of the warranty period, the reliability index met the contract requirements. For the faults of original delay in 2 minutes or above, the reliability index exceeds 3,221 hours for MTBF per</p>



TABLE I.3A-2
CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results																		
	<p>fault of traction system, the train cannot travel at the preset speed, two or more gates per train are out of order, etc.</p> <ul style="list-style-type: none">- All faults that may reduce the comfort experience of passengers. For example, HVAC failure, etc.- Conditions where further operation may damage the train, and/or associated equipment, including wayside. For example, the braking system fails to be released. <p>(b) Train operation delay: Train is delayed for two or more minutes.</p> <p>(c) Original delay: Extended passenger travel time.</p> <p>(d) Departure failure: Train is unable to depart station on time.</p> <p>(e) MTBF: Mean time between failures, per train.</p> <p>(f) MDBF: Mean distance between failures, per train.</p> <p>System RAM Goals:</p> <table><tr><th>MTBF per Train</th><th>MTBF Goal</th><th>Unit</th></tr><tr><td>Original delay for 2 minutes or greater</td><td>3,221</td><td>Hours</td></tr><tr><td>Departure failure</td><td>11,583</td><td>Hours</td></tr></table> <table><tr><th>MDTF per Train</th><th>MTBF Goal</th><th>Unit</th></tr><tr><td>Original delay for 2 minutes or greater</td><td>112,735 (= 3,221 x 35)</td><td>km</td></tr><tr><td>Departure failure</td><td>405,405 (=11,583 x 35)</td><td>km</td></tr></table>	MTBF per Train	MTBF Goal	Unit	Original delay for 2 minutes or greater	3,221	Hours	Departure failure	11,583	Hours	MDTF per Train	MTBF Goal	Unit	Original delay for 2 minutes or greater	112,735 (= 3,221 x 35)	km	Departure failure	405,405 (=11,583 x 35)	km	<p>the fault data, and calculated the reliability index.</p> <p>Reliability Calculation Method: Basic RAM Calculation Method</p> <p>MTBF: If a fault requires operational or maintenance staff to provide special assistance (abnormal mode) or to maintain or recover the system/device operation, including all false alarms or indication errors resulting in travel delay, it shall be counted in the MTBF calculation. Incidents incurred by external factors such as external electricity outage, flood or staff's mistakes, shall not be taken into the calculation. The equation is as follows:</p> $MTBF = \frac{\text{The total service time of all trains}}{\text{The total number of faults}}$ <p>Raw Defect History Data Sample: 1. 2011/1/11, it was found in the overhaul that the tightening retaining ring at the top of lifting and resetting device of current collector cracked and broke, and it was found that it was a common phenomenon in all the trains in this section after general survey. Replace all the retaining rings in Train 061-090, 093.</p>	<p>unit train; for the faults of departure failure, the index exceeds 11,583 hours for MTBF per unit train.</p> <p>Actual Reliability Currently Being Realized: MTBF=53685</p> <p>Met MBTA T2.03.03 Requirements?: YES</p>
MTBF per Train	MTBF Goal	Unit																			
Original delay for 2 minutes or greater	3,221	Hours																			
Departure failure	11,583	Hours																			
MDTF per Train	MTBF Goal	Unit																			
Original delay for 2 minutes or greater	112,735 (= 3,221 x 35)	km																			
Departure failure	405,405 (=11,583 x 35)	km																			
7. Beijing Metro Changing Line Project	<p>Failure Definitions:</p> <p>(a) Operation outage: The train is unable to continue regular passenger service.</p> <ul style="list-style-type: none">- All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fire or emergency device fault, etc.- All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed, two or more gates per train are out of order, etc.- All faults that may reduce the comfort experience of passengers. For example, HVAC failure, etc.- Conditions where further operation may damage the train, and/or associated equipment, including wayside. For example, the braking system fails to be released. <p>(b) Train operation delay: Train is delayed for two or more minutes.</p>	<p>Reliability Data Collection Process: CSR Qingdao Sifang developed a system of fault reporting and correction approaches (FRACAS) which was used to collect fault information of Beijing Metro Changing Line and supplement the fault information of original defect records. By use of FRACAS, Beijing Metro Changing Line met the reporting requirements, made statistics, analyzed the fault data, and calculated the reliability index.</p> <p>Reliability Calculation Method: Basic RAM Calculation Method</p> <p>MTBF: If a fault requires operational or maintenance staff to provide special assistance (abnormal mode) or to maintain or recover the system/device operation, including all false alarms or indication</p>	<p>Actual Reliability at end of Warranty Period: After the expiration of the warranty period, the reliability index met the contract requirements. For the faults of original delay in 2 minutes or above, the reliability index exceeds 3,215 hours for MTBF per unit train; for the faults of departure failure, the index exceeds 11,290 hours for MTBF per unit train.</p> <p>Actual Reliability Currently Being Realized: MTBF=602 MTBFS=82490</p>																		

TABLE I.3A-2

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results																	
	<p>(c) Original delay: Extended passenger travel time.</p> <p>(d) Departure failure: Train is unable to depart station on time.</p> <p>(e) MTBF: Mean time between failures, per train.</p> <p>(f) MDBF: Mean distance between failures, per train.</p> <p>System RAM Goals:</p> <table><tr><th>MTBF per Train</th><th>MTBF Goal</th><th>Unit</th></tr><tr><td>Original delay for 2 minutes or greater</td><td>3,221</td><td>Hours</td></tr><tr><td>Departure failure</td><td>11,583</td><td>Hours</td></tr></table> <p>MDTF per Train</p> <table><tr><th>MTBF Goal</th><th>Unit</th></tr><tr><td>Original delay for 2 minutes or greater</td><td>112,735 (= 3,221 x 35)</td><td>km</td></tr><tr><td>Departure failure</td><td>405,405 (=11,583 x 35)</td><td>km</td></tr></table>	MTBF per Train	MTBF Goal	Unit	Original delay for 2 minutes or greater	3,221	Hours	Departure failure	11,583	Hours	MTBF Goal	Unit	Original delay for 2 minutes or greater	112,735 (= 3,221 x 35)	km	Departure failure	405,405 (=11,583 x 35)	km	<p>errors resulting in travel delay, it shall be counted in the MTBF calculation. Incidents incurred by external factors such as external electricity outage, flood or staff's mistakes, shall not be taken into the calculation. The equation is as follows:</p> <p>MTBF = $\frac{\text{The total service time of all trains}}{\text{The total number of faults}}$</p> <p>Raw Defect History Data Sample:</p> <p>1. 2012/7/19, the monitor display (HMI) for Train CP013 indicated a red failure in Door B14 for Car No. 1. It was caused by door opening/closing indicator (HL1) failure for Door B14 of Car No. 1, replace door opening/closing indicator (HL1) for Door B14 of Car No. 1.</p> <p>2. 2013/7/1, the driver reported that the air conditioners in Car No. 1, 2, 3 of Train CP015 had abnormal noises, it was found that slight buzzing sound existed when the air conditioners were operating in the whole train. Replace 20 ventilators in the whole train</p>	<p>Met MBTA T2.03.03 Requirements?: YES</p>
MTBF per Train	MTBF Goal	Unit																		
Original delay for 2 minutes or greater	3,221	Hours																		
Departure failure	11,583	Hours																		
MTBF Goal	Unit																			
Original delay for 2 minutes or greater	112,735 (= 3,221 x 35)	km																		
Departure failure	405,405 (=11,583 x 35)	km																		
8. Chengdu Metro Line 2 First-stage Project	<p>Failure Definitions:</p> <p>(a) Operation outage: The train is unable to continue regular passenger service.</p> <ul style="list-style-type: none">- All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fire or emergency device fault, etc.- All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed, two or more gates per train are out of order, etc.- All faults that may reduce the comfort experience of passengers. For example, HVAC failure, etc.- Conditions where further operation may damage the train, and/or associated equipment, including wayside. For example, the braking system fails to be released. <p>(b) Train operation delay: Train is delayed for two or more minutes.</p> <p>(c) Original delay: Extended passenger travel time.</p> <p>(d) Departure failure: Train is unable to depart station on time.</p> <p>(e) MTBF: Mean time between failures, per train.</p> <p>(f) MDBF: Mean distance between failures, per train.</p> <p>System RAM Goals:</p>	<p>Reliability Data Collection Process:</p> <p>CSR Qingdao Sifang established a system of fault reporting and correction approaches (FRACAS) which is used to collect the fault information of Chengdu Metro Line 2 and supplement the fault information of original defect records. By use of FRACAS, Chengdu Metro Line 2 can meet the requirements to report, make statistics and analyze the fault data as well as to calculate the reliability index.</p> <p>Reliability Calculation Method:</p> <p>If any fault requires operational or maintenance staff to provide special assistance (abnormal mode) or it fails to maintain or recover the system/device operation, including all false alarms or indication errors resulting in travel delay, it shall be put into MTBF calculation. Incidents incurred by external factors such as external electricity outage, flood or staff's mistakes, shall not be taken into the calculation. The equation is as follows:</p>	<p>Actual Reliability at end of Warranty Period:</p> <p>After the expiration of the warranty period, the reliability index meets the contract requirements. For the faults of original delay in 2 minutes or above, the reliability index exceeds 3,215 hours for MTBF per unit train; for the faults of departure failure, the index exceeds 11,290 hours for MTBF per unit train.</p> <p>Actual Reliability Currently Being Realized: Realized: MTBF=602 MTBFS=82490</p> <p>Met MBTA T2.03.03 Requirements?: YES</p>																	



TABLE I.3A-2
CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix

Project	Contractual Reliability Requirements			Reliability Processes	Reliability Results									
9. Electric Passenger Vehicle Purchasing Project of Beijing Metro Line 14	<table border="1"><thead><tr><th>MTBF per Train</th><th>MTBF Goal</th><th>Unit</th></tr></thead><tbody><tr><td>Original delay for 2 minutes or greater</td><td>≥3,215</td><td>Hours</td></tr><tr><td>Departure failure</td><td>≥11,290</td><td>Hours</td></tr></tbody></table>			MTBF per Train	MTBF Goal	Unit	Original delay for 2 minutes or greater	≥3,215	Hours	Departure failure	≥11,290	Hours	<p>MTBF =The total service time of all trains/ The total number of fault times</p> <p>Raw Defect History Data Sample:</p> <p>1. 2012/5/31, the isolation indicator for Door No. 4 of Train 102045 was not lit. The indicator was burned out, replaced it</p> <p>2. 2012/6/18, no sound existed when the media played in saloon of Train 102035. The voice controlling and processing module for Car No. 5 failed, replaced it</p>	<p>Actual Reliability at end of Warranty Period:</p> <p>The reliability index met the contract requirements at the end of the warranty period. MTBF per unit train exceeded 6,000h. MTBF delay faults per unit train exceeded 3,000h. MTBF contingent inspection faults per train exceeded 150h.</p> <p>Actual Reliability Currently Being Realized:</p> <p>MTBF=1175</p> <p>Met MBTA T2.03.03 Requirements?:</p> <p>YES</p>
	MTBF per Train	MTBF Goal	Unit											
Original delay for 2 minutes or greater	≥3,215	Hours												
Departure failure	≥11,290	Hours												
10. Purchasing	<p>Categorization of operational malfunctions</p> <p>Operational service fault: Operational Service Fault refers to the fault under which the train fails to continue revenue operation or which the fault exerts material effects on the revenue operation, including:</p> <p>Rescue: when it is required for one train to drag the faulty train back to the depot.</p> <p>No signal: when it is required to evacuate passengers immediately and the empty train returns to the depot. As an alternative, the train first transports the passengers to the terminal station and returns to the depot.</p> <p>No delivery: as components does not work properly, the train cannot carry out on-line operation according to the running diagram arranged and another train is put into operation instead of the faulty one.</p> <p>Delay fault:</p> <p>Major delay: service delayed over 3min due to fault.</p> <p>Delay: service delayed under 3min due to some fault.</p> <p>Troubleshooting:</p> <p>Fault from contingent inspections: any fault discovered by the driver during operation or the maintenance staff during inspection.</p> <p>Requirements of Operational Reliability</p> <p>Service fault: MTBF per unit train of 6,000h;</p> <p>Delay fault: MTBF per unit train of 3,000h;</p> <p>Fault from contingent inspections: MTBF per train of 150h.</p>			<p>Reliability Data Collection Process:</p> <p>CSR Qingdao Sifang developed a system of fault reporting and correction approaches (FRACAS) which was used to collect fault information of Beijing Metro Line 14 and supplement the fault information of original defect records. By use of FRACAS, Beijing Metro Line 14 met the reporting requirements, made statistics, analyzed the fault data, and calculated the reliability index.</p> <p>Reliability Calculation Method:</p> <p>The train reliability shall be calculated annually by the following equation:</p> <p>MTBF per train = (annual distance/travel speed)/ the number of annual faults</p> <p>Raw Defect History Data Sample:</p> <p>1. 2013/5/2, the amplitude flow fan No. 6 in 243 TC1 cars didn't work. The amplitude flow fan failed</p> <p>2. 2013/5/4, one light tube for cab lighting in TC1 car was not lit. The light tube was damaged.</p>	<p>Actual Reliability at end of Warranty Period:</p> <p>CSR Qingdao Sifang established a failure report and</p>									

TABLE 1.3A-2
CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results
Project for Motor Vehicle for branch lines of Guangzhou Metro Line 4 and Line 5	<p>Failure: defined as a fault that causes the train to be delayed for less than 3 minutes and commercial operation is not affected.</p> <p>Service Fault: defined as a state where the train cannot continue operation, resulting in delays of the train, the train cannot be put into commercial operation, the train requires rescue (towed back to depot), train delay is greater than 3 minutes, or fault requires passengers to be evacuated.</p> <p>Requirements of Operational Reliability MTBF (Mean Time Between Failure) shall be no less than 300 hours. MTBFS (Mean Time Between Failures) shall be more than 3,500 hours.</p>	<p>correction actions system (FRACAS) to collect the failure information of this project, and supplement the failure information of the original defect history of the existing project. Through the FRACAS, the requirements for reporting, statistics, analysis and calculation of reliability indexes of failure data of Motor Vehicle of Guangzhou Metro Line 4 and 5 was realized.</p> <p>Reliability Calculation Method: The train reliability was be calculated by the following equation: $MTBF = T1/N1$, where: T1 is the sum of train operation time; N1 is the total number of failures during T1. $MTBFS = T2/N2$, where: T2 is the sum of train operation time on line; N2 is the total number of failures during T2.</p> <p>Raw Defect History Data Sample: 1. <i>The head light on the right side of 04A023 was out.</i></p>	<p>When the warranty period came to an end, the reliability index complied with the contract requirements, and the reliability index during service fault ensured that the mean time between failures of each unit was more than 3500 hours; for the basic reliability index, the mean time between failure of each train was more than 300 hours.</p> <p>Actual Reliability Currently Being Realized: Line 4: Not Available Line 5: MBTF=308 MTBFS=57945</p> <p>Met MBTA T2.03.03 Requirements?: YES</p>
11. Electric Passenger Vehicle Project of Beijing Metro Line 1 Blanking Engineering	<p>Categorization of operational malfunctions Operational service fault: Operational Service Fault refers to the fault under which the train fails to continue revenue operation or which the fault exerts material effects on the revenue operation, including: Rescue: when it is required for one train to drag the faulty train back to the depot. No signal: when it is required to evacuate passengers immediately and the empty train returns to the depot. As an alternative, the train first transports the passengers to the terminal station and returns to the depot. No delivery: as components does not work properly, the train cannot carry out on-line operation according to the running diagram arranged and another train is put into operation instead of the faulty one. Delay fault: service delayed greater than or equal to 1 min due to some fault. Troubleshooting: Fault from contingent inspections: any fault discovered by the driver during operation or the maintenance staff during inspection.</p>	<p>Reliability Data Collection Process: CSR Qingdao Sifang established a failure report and correction actions system (FRACAS) to collect failure information of Electric Passenger Vehicle Project of Beijing Line 1 Blanking Engineering, and supplement the failure information of the original defect history of the existing project. Through the FRACAS, the requirements for reporting, statistics, analysis and calculation of reliability indexes of failure data of Electric Passenger Vehicle Project of Beijing Line 1 Blanking Engineering was realized.</p> <p>Reliability Calculation Method: MTBF per train=(annual kilometrage/travel speed)/the number of annual fault times</p> <p>Raw Defect History Data Sample: 1. <i>On November 6th, 2007, during the application of G401 sample car of Beijing Metro Line 1, the whole train's fire alarming devices alarmed.</i></p>	<p>Actual Reliability at end of Warranty Period: The reliability index met the contract requirements upon the expiration of the warranty period and for the reliability index of service faults, MTBF per unit train exceeded 12,000h; for that of delay faults, MTBF per unit train exceeded 2,000h; for that of faults from contingent inspections, MTBF per train exceeded 200h.</p> <p>Actual Reliability Currently Being Realized: Not available.</p> <p>Met MBTA T2.03.03 Requirements?: YES</p>



TABLE I.3A-2
CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results
12. Linear Motor Vehicle of Guangzhou Metro Line 6	<p>Requirements of Operational Reliability</p> <p>Operational Service fault: MTBF per unit train of 12,000h; Delay fault: MTBF per unit train of 2,000h; Fault from contingent inspections: MTBF per train of 200h.</p> <p>Categorization of operational malfunctions Reliability: Reliability refers to the capability of one unit to realize all required functions within a given operation period and under given conditions. System Reliability: The system reliable definition is defined as mean time between failures (MTBF) and is mainly applied for basic reliability. Operation Reliability: The operation reliability is defined as the mean time between failures (MTBFS), and is mainly applied for task reliability. Failure: failure refers to that a certain function cannot be realized so that the vehicle stops abnormally/part of functions loss causes the vehicle unable to operate normally and the elements are replaced or repaired due to failure. Service fault: means that a particular function can not be achieved, resulting in the delays of the train, or the train even can not be put into or continue to maintain commercial operation. Service fault includes: Rescue, i.e. the failed train shall be towed back to the depot by another train. Passengers clearing: passengers shall be evacuated, and the train shall return to the depot in empty. Delays: the stopping time of the train running on trial line is more than 3 minutes caused by the failures and this will have an impact on the commercial operation. Mean Time Between Failures (MTBF): the average continuous time between two adjacent failures of the operation train or functional units. Mean Time Between Failures (MTBFS): the average service time of two service faults of all operation trains. Mean Time Between Failures (MTBFS): shall be 300 hours; Mean Time Between Failures (MTBFS): shall be more than 4,000 hours.</p>	<p>2. On November 7th, 2007, during the application of G432 sample car of Beijing Metro Line 1, the car net voltages of G4321 and G4326 were 100V more than net voltage.</p> <p>Reliability Data Collection Process: CSR Qingdao Sifang established a failure report and correction actions system (FRACAS) to collect the failure information of Motor Vehicle of Guangzhou Metro Line 6, and supplement the failure information of the original defect history of the existing project. Through the FRACAS, the requirements for reporting, statistics, analysis and calculation reliability indexes of failure data of Motor Vehicle of Guangzhou Metro Line 6 is being realized.</p> <p>Reliability Calculation Method: The train reliability shall be calculated by the following equation: The following formula is used for train reliability calculation: $MTBF = T1/N1$, where T1 is the total running hours of the train N1 is the total number of failures in T1 The following formula is used for train reliability calculation: $MTBFS = T2/N2$, where T2 is the total hours running on the line N2 is the total number of service faults in T2</p> <p>Raw Defect History Data Sample: 1. 2013/1/4, in the type test 001002, it was found that the air conditioning ventilation grid between the end wall at the Position 2 and the electrical cabinet of the saloon vibrated and sounded in the train operation; after the general inspection, it was found that all ventilation grids at the these positions of the Line 6 showed signs of loose; when one pushed the grid upward with hand, there would be the moving clearance of 6-8mm with grid failing to contact the installation beam.</p> <p>Reliability Data Collection Process: CSR Qingdao Sifang established a failure report and correction actions system (FRACAS) to collect the</p>	<p>Actual Reliability at end of Warranty Period: When the warranty period comes to an end, the reliability index is expected to comply with the contract requirements, and the reliability index during service fault shall ensure that the mean time between failures of each unit shall be more than 4,000 hours; for the basic reliability index, the mean time between failures of each train shall be more than 300 hours.</p> <p>Actual Reliability Currently Being Realized: MTBF=313 MTBFS= No delay failure to date.</p> <p>Met MBTA T2.03.03 Requirements?: YES</p>
13. Extension Project for	<p>Categorization of operational malfunctions Failure: failure refers to that a certain function cannot be realized so that the vehicle stops abnormally/part of functions loss causes</p>		<p>Actual Reliability at end of Warranty Period: When the warranty period came to</p>

TABLE I.3A-2
CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results
Linear Motor Vehicle of Guangzhou Metro Line 5	<p>the vehicle unable to operate normally and the elements are replaced or repaired due to failure.</p> <p>Service fault: means that a particular function cannot be achieved, resulting in the delays of the train, or the train even cannot be put into or continue to maintain commercial operation. Service fault includes:</p> <p>Rescue, i.e. the failed train shall be towed back to the depot by another train.</p> <p>Passengers clearing: passengers shall be evacuated, and the train shall return to the depot in empty.</p> <p>Delays: the stopping time of the train running on trial line is more than 3 minutes caused by the failures and this will have an impact on the commercial operation.</p> <p>Mean Time Between Failures (MTBF): the average continuous time between two adjacent failures of the operation train or functional units.</p> <p>Mean Time Between Failures (MTBFS): the average service time of two service faults of all operation trains.</p> <p>Requirements of operational reliability</p> <p>Mean Time Between Failures (MTBFS): shall be 300 hours;</p> <p>Mean Time Between Failures (MTBFS): shall be more than 4,000 hours.</p>	<p>failure information of this project, and supplement the failure information of the original defect history of the existing project. Through the FRACAS, the requirements for reporting, statistics, analysis and calculation of reliability indexes of failure data of Extension Project for Linear Motor Vehicle of Guangzhou Line 5 were realized.</p> <p>Reliability Calculation Method:</p> <p>The train reliability shall be calculated by the following equation:</p> <p>$MTBF = T1/N1$, where:</p> <p>T1 is the sum of train operation time; N1 is the total number of failures during T1.</p> <p>$MTBFS = T2/N2$, where:</p> <p>T2 is the sum of train operation time on line; N2 is the total number of failures during T2.</p> <p>Raw Defect History Data Sample:</p> <p>1. 2012/1/8, on November 8, 2012, it was found in the annual inspection of the car 063064 (purchased in addition) that the brake of the No. 1 door of the car 05A063 went wrong, leading to the incapability of normal closure of the door.</p>	<p>an end, the reliability index complied with the contract requirements, and the reliability index during service fault ensured that the mean time between failures of each unit was more than 4,000 hours; for the basic reliability index, the mean time between failure of each train was more than 300 hours.</p> <p>Actual Reliability Currently Being Realized:</p> <p>MTBF=341</p> <p>MTBFS= No delay failure to date.</p> <p>Met MBTA T2.03.03 Requirements?:</p> <p>YES</p>
14. Metro Vehicle Purchasing Project of Chengdu Metro Line 2 Second-stage Project	<p>Failure Definitions:</p> <p>(a) Operation outage: The train is unable to continue regular passenger service.</p> <ul style="list-style-type: none"> - All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fire or emergency device fault, etc. - All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed, two or more gates per train are out of order, etc. - All faults that may reduce the comfort experience of passengers. For example, HVAC failure, etc. - Conditions where further operation may damage the train, and/or associated equipment, including wayside. For example, the braking system fails to be released. <p>(b) Train operation delay: Train is delayed for two or more minutes.</p> <p>(c) Original delay: Extended passenger travel time.</p> <p>(d) Departure failure: Train is unable to depart station on time.</p>	<p>Reliability Data Collection Process:</p> <p>CSR Qingdao Sifang established a failure report and correction actions system (FRACAS) to collect Chengdu Metro Line 2 Phase II failure information, and supplement the failure information of the original defect history of the existing project. Through the failure report and correction actions system (FRACAS), the requirements for reporting, statistics, analysis and calculation reliability indexes of failure data of Chengdu Metro Line 2 Phase II were realized.</p> <p>Reliability Calculation Method:</p> <p>If any fault requires operational or maintenance staff to provide special assistance (abnormal mode) or it fails to maintain or recover the system/device operation, including all false alarms or indication errors resulting in travel delay, it shall be put into MTBF calculation. Incidents incurred by external</p>	<p>Actual Reliability at end of Warranty Period:</p> <p>When the warranty period came to an end, the reliability index complied with the contract requirements, and the reliability index of operation service faults ensured that the mean time between failures of each unit was more than 12,000 hours; for the reliability index of delay failure, the mean time between failure of each train was more than 2,000 hours; the reliability index of odd repair and train inspection ensured that the mean time between failures of each train was more than 200 hours.</p>



TABLE I.3A-2
CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results									
	<p>(e) MTBF: Mean time between failures, per train.</p> <p>(f) MDBF: Mean distance between failures, per train.</p> <p>System RAM Goals:</p> <table><tr><th>MTBF per Train</th><th>MTBF Goal</th><th>Unit</th></tr><tr><td>Original delay for 2 minutes or greater</td><td>≥3,215</td><td>Hours</td></tr><tr><td>Departure failure</td><td>≥11,290</td><td>Hours</td></tr></table>	MTBF per Train	MTBF Goal	Unit	Original delay for 2 minutes or greater	≥3,215	Hours	Departure failure	≥11,290	Hours	<p>factors such as external electricity outage, flood or staff's mistakes, shall not be taken into the calculation. The equation is as follows:</p> <p>MTBF =The total service time of all trains/ The total number of fault times</p> <p>Raw Defect History Data Sample:</p> <p>1. 2013/8/26, DCP touching function failed at TC2 end during biweekly maintenance for Train 10230. The DCP of driver control unit failed, but restored to normal condition after replacement</p> <p>2. 2013/7/28, the saloon broadcasting could not report the station when it was controlled by Train 102306. It was found that the driver control unit in Car No. 6 failed, and it restored to normal condition after replacing the driver control unit</p>	<p>Actual Reliability Currently Being Realized: MTBF=602 MTBFS=82490</p> <p>Met MBTA T2.03.03 Requirements?: YES</p>
MTBF per Train	MTBF Goal	Unit										
Original delay for 2 minutes or greater	≥3,215	Hours										
Departure failure	≥11,290	Hours										
15. Updated Electric Passenger Vehicle Purchasing Project of Beijing Metro Line 1	<p>Categorization of operational malfunctions</p> <p>Operational service fault: Operational Service Fault refers to the fault under which the train fails to continue revenue operation or which the fault exerts material effects on the revenue operation, including:</p> <p>Rescue: When it is required for one train to drag the faulty train back to the depot.</p> <p>No signal: When it is required to evacuate passengers immediately and the empty train returns to the depot. As an alternative, the train first transports the passengers to the terminal station and returns to the depot.</p> <p>No delivery: As components fail, the train cannot carry out on-line operation according to the running diagram arranged and another train is put into operation instead of the faulty one.</p> <p>Delay fault: service delayed greater than or equal to 1 min due to some fault.</p> <p>Troubleshooting: Fault from contingent inspections: any fault discovered by the driver during operation or the maintenance staff during inspection.</p> <p>Requirements of Operational Reliability</p> <p>Operational Service fault: MTBF per unit train of 12,000h; Delay fault: MTBF per unit train of 2,000h; Fault from contingent inspections: MTBF per train of 200h.</p>	<p>Reliability Data Collection Process:</p> <p>CSR Qingdao Sifang established a failure report and correction actions system (FRACAS) to collect the failure information of Electric Passenger Vehicle Project of Beijing Line 1 Renewal, and supplement the failure information of the original defect history of the existing project. Through the FRACAS, the requirements for reporting, statistics, analysis and calculation of reliability indexes of failure data of Electric Passenger Vehicle Project of Beijing Line 1 Renewal were realized.</p> <p>Reliability Calculation Method:</p> <p>MTBF per train=(annual kilometrage/travel speed)/the number of annual fault times</p> <p>Raw Defect History Data Sample:</p> <p>1. 2012/3/16, No display on the CCTV monitor screen in cab of Train G4656. The monitor screen failed, replace the display screen.</p> <p>2. 2012/3/19, air leakage in duplex pressure gauge in Train G4684. The duplex pressure gauge was not tightly sealed, and the replaced pressure gauge was in normal condition.</p> <p>3. 2012/3/21, fluorine leakage in high pressure pipe of air conditioner compressor in cab of Train G4671. The high pressure pipe joint for compressor was</p>	<p>Actual Reliability at end of Warranty Period: The reliability index met the contract requirements upon the expiration of the warranty period and for the reliability index of service faults, MTBF per unit train exceeded 12,000h; for that of delay faults, MTBF per unit train exceeded 2,000h; for that of faults from contingent inspections, MTBF per train exceeded 200h.</p> <p>Actual Reliability Currently Being Realized: MBTF=755 MBTFS=No delay failure to date.</p> <p>Met MBTA T2.03.03 Requirements?: YES</p>									



TABLE I.3A-2
CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results																	
16. Purchasing Project of Qingdao Metro Vehicle First-stage Project	Failure Classifications <table><tr><th>Terms</th><th>Description</th></tr><tr><td>Original delay</td><td>Retention time for the train involved in the incident.</td></tr><tr><td>Inability to continue services</td><td><p>The train in operation is unable to continue services because of faults. The train faults leading to inability for future service include but not limited to:</p><ul style="list-style-type: none">All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fuming or emergency device fault etc.;All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed and two or more gates per train are out of order.;All faults may reducing the comfort experience of passengers, for example, all air conditioning systems go wrong on the same train, the air conditioning system makes noise etc.;If the train continues service, it may damage the train or lead to the faults of other railway appliances, for example, the braking system fails to be released.</td></tr><tr><td>Departure failure</td><td>The train cannot depart the station according to the schedule due to faults.</td></tr></table> Requirements of operational reliability <table><tr><th>Description</th><th>MTBF per train</th><th>Unit</th></tr><tr><td>Original delay for 2 minutes or above</td><td>≥3,215</td><td>Hours</td></tr><tr><td>Departure failure</td><td>≥11,290</td><td>Hours</td></tr></table>	Terms	Description	Original delay	Retention time for the train involved in the incident.	Inability to continue services	<p>The train in operation is unable to continue services because of faults. The train faults leading to inability for future service include but not limited to:</p> <ul style="list-style-type: none">All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fuming or emergency device fault etc.;All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed and two or more gates per train are out of order.;All faults may reducing the comfort experience of passengers, for example, all air conditioning systems go wrong on the same train, the air conditioning system makes noise etc.;If the train continues service, it may damage the train or lead to the faults of other railway appliances, for example, the braking system fails to be released.	Departure failure	The train cannot depart the station according to the schedule due to faults.	Description	MTBF per train	Unit	Original delay for 2 minutes or above	≥3,215	Hours	Departure failure	≥11,290	Hours	<p>Reliability Data Collection Process:</p> <p>CSR Qingdao Sifang established a failure report and correction actions system (FRACAS) to collect the failure information of Purchasing Project of Qingdao Metro Vehicle First-stage Project, and supplement the failure information of the original defect history of the existing project. Through the FRACAS, the requirements for reporting, statistics, analysis and calculation of reliability indexes of failure data of Purchasing Project of Qingdao Metro Vehicle First-stage Project will be realized.</p> <p>Reliability Calculation Method:</p> <p>For the train reliability, the calculation method is as follows:</p> <p>MTBF=The total service time of all trains/The total number of fault times</p> <p>Raw Defect History Data Sample:</p> <p>Not available</p>	<p>Actual Reliability at end of Warranty Period:</p> <p>When the warranty period comes to an end, the reliability index will comply with the contract requirements and the reliability index shall ensure that the mean time between failures of each unit shall be more than 11,290 hours; for the basic reliability index of initial delay fault of 2 minutes or above, the mean time between failure of each train shall be more than 3,215 hours.</p> <p>Actual Reliability Currently Being Realized:</p> <p>Prototype to be delivered. Not applicable.</p> <p>Met MBTA T2.03.03 Requirements?:</p> <p>Prototype to be delivered. To be determined. Expected to meet requirements.</p>
	Terms	Description																		
	Original delay	Retention time for the train involved in the incident.																		
Inability to continue services	<p>The train in operation is unable to continue services because of faults. The train faults leading to inability for future service include but not limited to:</p> <ul style="list-style-type: none">All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fuming or emergency device fault etc.;All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed and two or more gates per train are out of order.;All faults may reducing the comfort experience of passengers, for example, all air conditioning systems go wrong on the same train, the air conditioning system makes noise etc.;If the train continues service, it may damage the train or lead to the faults of other railway appliances, for example, the braking system fails to be released.																			
Departure failure	The train cannot depart the station according to the schedule due to faults.																			
Description	MTBF per train	Unit																		
Original delay for 2 minutes or above	≥3,215	Hours																		
Departure failure	≥11,290	Hours																		
17. Extended Train Project of Beijing Metro Line 4	<p>Failure Definitions:</p> <p>(a) Operation outage: The train is unable to continue regular passenger service.</p> <ul style="list-style-type: none">All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fire or emergency device fault, etc.All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed, two or more gates per train are out of order, etc.	<p>Reliability Data Collection Process:</p> <p>CSR Qingdao Sifang developed a system of fault reporting and correction approaches (FRACAS) which was used to collect fault information of Beijing Subway Line 4 and supplement the fault information of original defect records. By use of FRACAS, Beijing Subway Line 4 met the reporting requirements, made statistics, analyzed the fault data, and calculated the reliability index.</p>	<p>Actual Reliability at end of Warranty Period:</p> <p>After the expiration of the warranty period, the reliability index met the contract requirements. For the faults of original delay in 2 minutes or above, the reliability index exceeds 3,221 hours for MTBF per unit train; for the faults of departure failure, the index exceeds 11,583</p>																	



TABLE I.3A-2
CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results																		
	<p>- All faults that may reduce the comfort experience of passengers. For example, HVAC failure, etc.</p> <p>- Conditions where further operation may damage the train, and/or associated equipment, including wayside. For example, the braking system fails to be released.</p> <p>(b) Train operation delay: Train is delayed for two or more minutes.</p> <p>(c) Original delay: Extended passenger travel time.</p> <p>(d) Departure failure: Train is unable to depart station on time.</p> <p>(e) MTBF: Mean time between failures, per train.</p> <p>(f) MTBF: Mean distance between failures, per train.</p> <p>System RAM Goals:</p> <table border="1"> <thead> <tr> <th>MTBF per Train</th><th>MTBF Goal</th><th>Unit</th></tr> </thead> <tbody> <tr> <td>Original delay for 2 minutes or greater</td><td>3,221</td><td>Hours</td></tr> <tr> <td>Departure failure</td><td>11,583</td><td>Hours</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th>MDTF per Train</th><th>MTBF Goal</th><th>Unit</th></tr> </thead> <tbody> <tr> <td>Original delay for 2 minutes or greater</td><td>112,735 (= 3,221 x 35)</td><td>km</td></tr> <tr> <td>Departure failure</td><td>405,405 (=11,583 x 35)</td><td>km</td></tr> </tbody> </table>	MTBF per Train	MTBF Goal	Unit	Original delay for 2 minutes or greater	3,221	Hours	Departure failure	11,583	Hours	MDTF per Train	MTBF Goal	Unit	Original delay for 2 minutes or greater	112,735 (= 3,221 x 35)	km	Departure failure	405,405 (=11,583 x 35)	km	<p>Reliability Calculation Method: Basic RAM Calculation Method</p> <p>MTBF: If a fault requires operational or maintenance staff to provide special assistance (abnormal mode) or to maintain or recover the system/device operation, including all false alarms or indication errors resulting in travel delay, it shall be counted in the MTBF calculation. Incidents incurred by external factors such as external electricity outage, flood or staff's mistakes, shall not be taken into the calculation. The equation is as follows:</p> $MTBF = \frac{\text{The total service time of all trains}}{\text{The total number of faults}}$ <p>Raw Defect History Data Sample: Not available</p>	<p>hours for MTBF per unit train.</p> <p>Actual Reliability Currently Being Realized: Not Available</p> <p>Met MBTA T2.03.03 Requirements?: YES</p>
MTBF per Train	MTBF Goal	Unit																			
Original delay for 2 minutes or greater	3,221	Hours																			
Departure failure	11,583	Hours																			
MDTF per Train	MTBF Goal	Unit																			
Original delay for 2 minutes or greater	112,735 (= 3,221 x 35)	km																			
Departure failure	405,405 (=11,583 x 35)	km																			
18. Connecting Line Project between Beijing Metro Changping Line and Beijing Metro Line 8	<p>Categorization of operational malfunctions</p> <p>Operational service fault: Operational Service Fault refers to the fault under which the train fails to continue revenue operation or which the fault exerts material effects on the revenue operation, including:</p> <p>Rescue: when it is required for one train to drag the faulty train back to the depot.</p> <p>No signal: when it is required to evacuate passengers immediately and the empty train returns to the depot. As an alternative, the train first transports the passengers to the terminal station and returns to the depot.</p> <p>No delivery: as components does not work properly, the train cannot carry out on-line operation according to the running diagram arranged and another train is put into operation instead of the faulty one.</p> <p>Delay fault: Major delay: service delayed over 3min due to fault. Delay: service delayed under 3min due to some fault.</p>	<p>Reliability Data Collection Process: CSR Qingdao Sifang developed a system of fault reporting and correction approaches (FRACAS) which was used to collect fault information of Connecting Line Project between Beijing Metro Changping Line and Beijing Metro Line 8 and supplement the fault information of original defect records. By use of FRACAS, Connecting Line Project between Beijing Metro Changping Line and Beijing Metro Line 8 met the reporting requirements, made statistics, analyzed the fault data, and calculated the reliability index.</p> <p>Reliability Calculation Method: The train reliability shall be calculated annually by the following equation:</p> $MTBF \text{ per train} = (\text{annual distance/travel speed}) / \text{the}$	<p>Actual Reliability at end of Warranty Period: The reliability index met the contract requirements at the end of the warranty period. MTBF per unit train exceeded 6,000h. MTBF delay faults per unit train exceeded 3,000h. MTBF contingent inspection faults per train exceeded 150h.</p> <p>Actual Reliability Currently Being Realized: MTBF=1175 MTBFS=40959</p> <p>Met MBTA T2.03.03 Requirements?:</p>																		



TABLE I.3A-2
CSR Sifang Similar Past Heavy Rail Projects – Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results
	<p>Troubleshooting: Fault from contingent inspections: any fault discovered by the driver during operation or the maintenance staff during inspection.</p> <p>Requirements of Operational Reliability</p> <p>Service fault: MTBF per unit train of 6,000h; Delay fault: MTBF per unit train of 3,000h; Fault from contingent inspections: MTBF per train of 150h.</p>	<p>number of annual faults MDBF exceeds 100,000km (the inspection is kicked off on the 366th day after acceptance).</p> <p>Raw Defect History Data Sample:</p> <p>1. 2014/2/2, during inspection of 08036 car, Door 2 opening speed was found to be slow in No. 1 position of 6# Car. The door controller was under malfunction condition, but restored to normal condition after replacement.</p> <p>2. 2014/3/17, during inspection of 08035 car, cab intercom of 6# Car was voiceless. The driver control unit was under malfunction condition, but restored to normal condition after replacement.</p> <p>3. 2014/4/17, during inspection of 08036 car, closing action of the left door in 6# Car was in bad condition. Cab door's backstop was broken, but restored to normal condition after replacement.</p>	YES



TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results												
Major Subsystem: LED Lighting Vendor Name: Luminator Project Title: WMATA 7000 (Washington) PRIME: Kawasaki Carlos Denasi 914-376-4700	Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train. System RAM Goals: <table><tr><td>MTBF per Train</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean distance between failure</td><td>400,000</td><td>miles</td></tr></table> <table><tr><td>MTBD per Train</td><td>MTBD Goal</td><td>Unit</td></tr><tr><td>mean distance between delay</td><td>4,000,000</td><td>miles</td></tr></table>	MTBF per Train	MTBF Goal	Unit	mean distance between failure	400,000	miles	MTBD per Train	MTBD Goal	Unit	mean distance between delay	4,000,000	miles	Reliability Data Collection Process: LUMINATOR performed prediction Reliability Calculation Method: Basic RAM Calculation Method MTBF (in hours): 6.256269E+04 MDBF (in miles): =(MTBF x avg 15 mps) 9.384404E+ 05 Raw Defect History Data Sample: None provided	Actual Reliability at end of Warranty Period: Not at end of warranty yet. Actual Reliability Currently Being Realized: No letter from Carbuilder Met MBTA T2.03.03 Requirements: YES
MTBF per Train	MTBF Goal	Unit													
mean distance between failure	400,000	miles													
MTBD per Train	MTBD Goal	Unit													
mean distance between delay	4,000,000	miles													
Major Subsystem: LED Lighting Vendor Name: Luminator Project Title: Houston Metro PRIME: CAF Lisa Brady 607-737-3011	Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train. System RAM Goals: <table><tr><td>MTBCF per Train</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean distance between component failure</td><td>350,000</td><td>miles</td></tr></table> <table><tr><td>MTBD per Train</td><td>MTBD Goal</td><td>Unit</td></tr><tr><td>mean distance between train delay</td><td>1,000,000</td><td>miles</td></tr></table>	MTBCF per Train	MTBF Goal	Unit	mean distance between component failure	350,000	miles	MTBD per Train	MTBD Goal	Unit	mean distance between train delay	1,000,000	miles	Reliability Data Collection Process: LUMINATOR performed prediction Reliability Calculation Method: Basic RAM Calculation Method MTBF (in hours): 8.644619E+04 MDBCF (in miles): =(MTBF x avg 25 mph) 2.161155EE+06 Raw Defect History Data Sample: None provided	Actual Reliability at end of Warranty Period: Not at end of warranty yet. Actual Reliability Currently Being Realized: No letter from Carbuilder Met MBTA T2.03.03 Requirements: YES
MTBCF per Train	MTBF Goal	Unit													
mean distance between component failure	350,000	miles													
MTBD per Train	MTBD Goal	Unit													
mean distance between train delay	1,000,000	miles													
Major Subsystem: Fluorescent Lighting Vendor Name: Luminator Project Title: 812 Hiawata LRV (Minneapolis)	Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train. System RAM Goals: <table><tr><td>MTBCF per Train</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean distance between component failure</td><td>350,000</td><td>miles</td></tr></table> <table><tr><td>MTBD per Train</td><td>MTBD Goal</td><td>Unit</td></tr><tr><td></td><td></td><td></td></tr></table>	MTBCF per Train	MTBF Goal	Unit	mean distance between component failure	350,000	miles	MTBD per Train	MTBD Goal	Unit				Reliability Data Collection Process: LUMINATOR performed prediction Reliability Calculation Method: Basic RAM Calculation Method MDBCF (in miles): 730,000 Raw Defect History Data Sample: None provided	Actual Reliability at end of Warranty Period: Carbuilder will have to provide actual data Actual Reliability Currently Being Realized: Carbuilder has not provided any data from car Met MBTA T2.03.03 Requirements:
MTBCF per Train	MTBF Goal	Unit													
mean distance between component failure	350,000	miles													
MTBD per Train	MTBD Goal	Unit													



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements			Reliability Processes	Reliability Results																	
PRIME: Bombardier Karine Sirolis 450-441-2020	mean distance between train delay	3,000,000	miles		YES																	
Major Subsystem: Fluorescent Lighting Vendor Name: Luminator Project Title: NYCT PRIME: Kawasaki Y. Araki 914-376-4700	Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train. System RAM Goals: <table><tr><td>MDBSCF per Train</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean distance between component failure</td><td>500,000</td><td>miles</td></tr></table>	MDBSCF per Train	MTBF Goal	Unit	mean distance between component failure	500,000	miles		Reliability Data Collection Process: LUMINATOR performed prediction Reliability Calculation Method: Basic RAM Calculation Method MDBSCF (in miles): 6,098,196 as of 4/2011 Raw Defect History Data Sample: None provided	Actual Reliability at end of Warranty Period: Provided by Alstom. Actual Reliability Currently Being Realized: Letter Met MBTA T2.03.03 Requirements: YES												
MDBSCF per Train	MTBF Goal	Unit																				
mean distance between component failure	500,000	miles																				
Major Subsystem: Pocket Door Systems Vendor Name: Wabtec Vapor Stone Project Title: MNR M-8 (Metro North NY) Amir Rahimi 212-499-4408 PRIME: Kawasaki Carlos Denasi 914-376-4700	Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train. c) Annual failure rate+ chargeable relevant failure x product of avg. cars and LLRU d) MDBCF ratio of total operating distance accumulated by total population of cars/ the total no. chargeable relevant failures for the population of cars within the sytem @ a specified period of time. System RAM Goals: <table><tr><td>MDBCF per Train</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean distance between component failure</td><td>140,000</td><td>miles</td></tr><tr><td>MDBSF per Train</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean distance between system failure</td><td>2,000,000</td><td>miles</td></tr><tr><td>MDBF per Train</td><td>MDBD Goal</td><td>Unit</td></tr><tr><td>mean distance between failure</td><td>4,000,000</td><td>miles</td></tr></table>	MDBCF per Train	MTBF Goal	Unit	mean distance between component failure	140,000	miles	MDBSF per Train	MTBF Goal	Unit	mean distance between system failure	2,000,000	miles	MDBF per Train	MDBD Goal	Unit	mean distance between failure	4,000,000	miles		Reliability Data Collection Process: Vapor receives data from field service, vapor material return process directly from MNR Receives relevant failures data from carbuilder and entered into RAMS data base. Reliability Calculation Method: FRACAS and basic RAM Calculation Method Raw Defect History Data Sample: None provided	Actual Reliability at end of Warranty Period: Not at end of warranty yet. Actual Reliability Currently Being Realized: as of 11/2013 MDBCF: 158,640 miles MDBSF: 2,419,267 miles MDBF: 9,677,067 miles 6 months Met MBTA T2.03.03 Requirements: YES
MDBCF per Train	MTBF Goal	Unit																				
mean distance between component failure	140,000	miles																				
MDBSF per Train	MTBF Goal	Unit																				
mean distance between system failure	2,000,000	miles																				
MDBF per Train	MDBD Goal	Unit																				
mean distance between failure	4,000,000	miles																				
Major Subsystem: Pocket Door Systems	Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train. c) Annual failure rate+ chargeable relevant failure x product of avg. cars and LLRU		Reliability Data Collection Process: Vapor receives data from field service, vapor material return process directly from MNR Receives relevant failures data from carbuilder and entered into RAMS data base.	Actual Reliability at end of Warranty Period: At end of warranty Actual Reliability Currently Being																		



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results																		
Vendor Name: Wabtec Vapor Stone Project Title: LIRR M-7 (NY) John Gariti 718-558-4877 PRIME: Bombardier	<p>d) MDBCF ratio of total operating distance accumulated by total population of cars/ the total no. chargeable relevant failures for the population of cars within the sytem @ a specified period of time.</p> <p>System RAM Goals:</p> <table><tr><td>MDBCF per Train</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean distance between component failure</td><td>140,000</td><td>miles</td></tr></table> <table><tr><td>MDBSF per Train</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean distance between system failure</td><td>2,000,000</td><td>miles</td></tr></table> <table><tr><td>MDBF per Train</td><td>MDBD Goal</td><td>Unit</td></tr><tr><td>mean distance between failure</td><td>4,000,000</td><td>miles</td></tr></table>	MDBCF per Train	MTBF Goal	Unit	mean distance between component failure	140,000	miles	MDBSF per Train	MTBF Goal	Unit	mean distance between system failure	2,000,000	miles	MDBF per Train	MDBD Goal	Unit	mean distance between failure	4,000,000	miles	<p>Reliability Calculation Method: FRACAS and basic RAM Calculation Method</p> <p>Raw Defect History Data Sample: None provided</p>	<p>Realized: as of 11/2013 MDBCF: 180,400 miles MDBSF: not provided MDBF: not provided</p> <p>Met MBTA T2.03.03 Requirements: YES</p>
MDBCF per Train	MTBF Goal	Unit																			
mean distance between component failure	140,000	miles																			
MDBSF per Train	MTBF Goal	Unit																			
mean distance between system failure	2,000,000	miles																			
MDBF per Train	MDBD Goal	Unit																			
mean distance between failure	4,000,000	miles																			
Major Subsystem: Pocket Door Systems Vendor Name: Wabtec Vapor Stone Project Title: NYCT R-142 (NY) Bruce Alexander 718-694-4485 PRIME: Bombardier	<p>Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train. c) Annual failure rate+ chargeable relevant failure x product of avg. cars and LLRU d) MDBCF ratio of total operating distance accumulated by total population of cars/ the total no. chargeable relevant failures for the population of cars within the sytem @ a specified period of time.</p> <p>System RAM Goals:</p> <table><tr><td>MDBCF per Train</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean distance between component failure</td><td>60,000</td><td>miles</td></tr></table> <table><tr><td>MDBF per Train</td><td>MDBD Goal</td><td>Unit</td></tr><tr><td>mean distance between failure</td><td>320,000</td><td>miles</td></tr></table>	MDBCF per Train	MTBF Goal	Unit	mean distance between component failure	60,000	miles	MDBF per Train	MDBD Goal	Unit	mean distance between failure	320,000	miles	<p>Reliability Data Collection Process: Vapor receives data from field service, vapor material return process directly from MNR Receives relevant failures data from carbuilder and entered into RAMS data base.</p> <p>Reliability Calculation Method: FRACAS and basic RAM Calculation Method</p> <p>Raw Defect History Data Sample: None provided</p>	<p>Actual Reliability at end of Warranty Period: At end of warranty</p> <p>Actual Reliability Currently Being Realized: as of 11/2013 MDBF: 2,500,000 miles MDBSF: not provided MDBF: not provided</p> <p>Met MBTA T2.03.03 Requirements: YES</p>						
MDBCF per Train	MTBF Goal	Unit																			
mean distance between component failure	60,000	miles																			
MDBF per Train	MDBD Goal	Unit																			
mean distance between failure	320,000	miles																			
Major Subsystem: Pocket Door Systems Vendor Name: Wabtec Vapor Stone Project Title:	<p>Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train. c) Annual failure rate+ chargeable relevant failure x product of avg. cars and LLRU d) MDBCF ratio of total operating distance accumulated by total population of cars/ the total no. chargeable relevant failures for the population of cars within the sytem @ a specified period of time.</p> <p>System RAM Goals:</p>	<p>Reliability Data Collection Process: Vapor receives data from field service, vapor material return process directly from MNR Receives relevant failures data from carbuilder and entered into RAMS data base.</p> <p>Reliability Calculation Method: FRACAS and basic RAM Calculation Method</p>	<p>Actual Reliability at end of Warranty Period: Not at end of warranty yet.</p> <p>Actual Reliability Currently Being Realized: as of 11/2013 MDBSCF: 131,163 miles 1 yr.</p>																		



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements			Reliability Processes		Reliability Results
	MDBSCF per Train mean distance between system component failure	MTBF Goal	Unit	Raw Defect History Data Sample:		
PATH (NY) Mark Barberash 973-350-2854 PRIME: Kawasaki Carlos Denasi 914-376-4700		60,000	miles	None provided		Met MBTA T2.03.03 Requirements: YES
Major Subsystem: CAB Signal Equipment Vendor Name: Ansaldo STS Eric Shook 1000 Technology Dr Pittsburgh, PA 15219 412-688-2400 Project Title: Montreal MPM PRIME: Dessau EtienneMalouin 514-281-5020	Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train. System RAM Goals: MDBF per Train mean distance between failure MTBF per Train mean time between failure	MTBF Goal 4,570,360 MTBF Goal 22,952	km miles	Reliability Data Collection Process: FRCAP Reliability Calculation Method: MIL-217 Raw Defect History Data Sample: None provided	Actual Reliability at end of Warranty Period: Provided by Dessau Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES	
Major Subsystem: CAB Signal Equipment Vendor Name: Ansaldo STS Eric Shook 1000 Technology Dr Pittsburgh, PA 15219 412-688-2400 Project Title: WMATA PRIME: WMATA David Kubicek	Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train. System RAM Goals: MDBF per Train mean distance between failure MTBF per Train mean time between failure	MTBF Goal 344,272 MTBF Goal 22,952	miles miles	Reliability Data Collection Process: FRCAP Reliability Calculation Method: MIL-217 Raw Defect History Data Sample: None provided	Actual Reliability at end of Warranty Period: Provided by Dessau Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES	



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results												
202-962-2585															
Major Subsystem: CAB Signal Equipment Vendor Name: Ansaldo STS Eric Shook 1000 Technology Dr Pittsburgh, PA 15219 412-688-2400 Project Title: STM- Montreal PRIME: Dessau EtienneMalouin 514-281-5020	Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train. System RAM Goals: <table><tr><td>MTBF per Train</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean distance between failure</td><td>3,586,550</td><td>km</td></tr></table> <table><tr><td>MTBF per Train</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean time between failure</td><td>12,456</td><td>km</td></tr></table>	MTBF per Train	MTBF Goal	Unit	mean distance between failure	3,586,550	km	MTBF per Train	MTBF Goal	Unit	mean time between failure	12,456	km	Reliability Data Collection Process: FRCAP Reliability Calculation Method: MIL-217 Raw Defect History Data Sample: None provided	Actual Reliability at end of Warranty Period: Provided by Dessau Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES
MTBF per Train	MTBF Goal	Unit													
mean distance between failure	3,586,550	km													
MTBF per Train	MTBF Goal	Unit													
mean time between failure	12,456	km													
Major Subsystem: Wheel assemblies Vendor Name: UTC-RAS Frank Orsone 501 Highland Morton, Pennsylvania 610-328-1100 Project Title: Denver RTD New Car PRIME: Hyundai Rotem Andy Hyer 215-952-3637	Failure Definitions: (a) Operation outage: The train is unable to continue regular passenger service. - All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fire or emergency device fault, etc. - All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed, two or more gates per train are out of order, etc. - All faults that may reduce the comfort experience of passengers. For example, HVAC failure, etc. - Conditions where further operation may damage the train, and/or associated equipment, including wayside. For example, the braking system fails to be released. (b) Train operation delay: Train is delayed for two or more minutes. (c) Original delay: Extended passenger travel time. (d) Departure failure: Train is unable to depart station on time. (e) MTBF: Mean time between failures, per train. (f) MDBF: Mean distance between failures, per train. System RAM Goals:	Reliability Data Collection Process: FRACAS Reliability Calculation Method: Basic RAM Calculation Method MTBF: If a fault requires operational or maintenance staff to provide special assistance (abnormal mode) or to maintain or recover the system/device operation, including all false alarms or indication errors resulting in travel delay, it shall be counted in the MTBF calculation. Incidents incurred by external factors such as external electricity outage, flood or staff's mistakes, shall not be taken into the calculation. The equation is as follows: $MTBF = \frac{\text{The total service time of all trains}}{\text{The total number of faults}}$ Raw Defect History Data Sample: Not submitted	Actual Reliability at end of Warranty Period: Not provided by car builder. Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES												



TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements			Reliability Processes	Reliability Results
Major Subsystem: Wheel assemblies Vendor Name: UTC-RAS Frank Ursone 501 Highland Morton, Pennsylvania 610-328-1100 Project Title: MBTA new car PRIME: Hyundai Rotem Andy Hyer 215-952-3637	MTBF per Train	MTBF Goal	Unit	Reliability Data Collection Process: FRACAS Reliability Calculation Method: Basic RAM Calculation Method MTBF: $\text{MTBF} = \frac{\text{The total service time of all trains}}{\text{The total number of faults}}$ Raw Defect History Data Sample: Not submitted Actual Reliability at end of Warranty Period: Not provided by car builder. Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES	Actual Reliability at end of Warranty Period: Not provided by car builder. Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES
	Departure failure	12,000	Hours		
	MDTF per Train	MTBF Goal	Unit		
	Departure failure	500,000	km		
	Failure Definitions: (a) Departure failure: Train is unable to depart station on time. (b) MTBF: Mean time between failures, per train. (c) MDBF: Mean distance between failures, per train. System RAM Goals:				
	MTBF per Train	MTBF Goal	Unit		
	Departure failure	11,583	Hours		
	MDTF per Train	MTBF Goal	Unit		
	Departure failure	405,405 (=11,583 x 35)	km		
Major Subsystem: Wheel assemblies Vendor Name: UTC-RAS Frank Ursone 501 Highland Morton, Pennsylvania 610-328-1100 Project Title: Amtrak Locomotive PRIME:	Failure Definitions: (a) Departure failure: Train is unable to depart station on time. (b) MTBF: Mean time between failures, per train. (c) MDBF: Mean distance between failures, per train. System RAM Goals:			Reliability Data Collection Process: FRACAS Reliability Calculation Method: Basic RAM Calculation Method MTBF: $\text{MTBF} = \frac{\text{The total service time of all trains}}{\text{The total number of faults}}$ Raw Defect History Data Sample: Not submitted	Actual Reliability at end of Warranty Period: Not provided by car builder. Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES
	MTBF per Train	MTBF Goal	Unit		
	Departure failure	20,000	Hours		
	MDTF per Train	MTBF Goal	Unit		
	Departure failure	2,000,000	km		



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results						
Siemens Steve Rocha 916-525-2887									
Major Subsystem: HVAC	Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train.	Reliability Data Collection Process: FRACAS	Actual Reliability at end of Warranty Period: Not at end of warranty yet.						
Vendor Name: Faiveley 50 Beechtree Blvd., Greenville, SC 29605 Herve Savary 864-423-6348	System RAM Goals: <table><tr><td>MDBCF per Train mean distance between component failure</td><td>MTBF Goal 100,000 (161,000)</td><td>Unit miles (km)</td></tr><tr><td>MTTR per Train mean time to repair</td><td>MDBD Goal 1.5</td><td>Unit m-hr</td></tr></table>	MDBCF per Train mean distance between component failure	MTBF Goal 100,000 (161,000)	Unit miles (km)	MTTR per Train mean time to repair	MDBD Goal 1.5	Unit m-hr	Reliability Calculation Method: Basic RAM Calculation Method MTTR (in hours): 1.5 man-hr mean time to repair MDBF (in miles): 100,000 Raw Defect History Data Sample: None provided	Actual Reliability Currently Being Realized: No letter from Carbuilder Met MBTA T2.03.03 Requirements: YES
MDBCF per Train mean distance between component failure	MTBF Goal 100,000 (161,000)	Unit miles (km)							
MTTR per Train mean time to repair	MDBD Goal 1.5	Unit m-hr							
Project Title: NJ Transit PRIME: Alstom									
Major Subsystem: HVAC	Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train.	Reliability Data Collection Process: FRACAS	Actual Reliability at end of Warranty Period: Not at end of warranty yet.						
Vendor Name: Faiveley 50 Beechtree Blvd., Greenville, SC 29605 Herve Savary 864-423-6348	System RAM Goals: <table><tr><td>MDBCF per Train mean distance between component failure</td><td>MTBF Goal 100,000 (161,000)</td><td>Unit miles (km)</td></tr><tr><td>MTTR per Train mean time to repair</td><td>MDBD Goal 1.5</td><td>Unit m-hr</td></tr></table>	MDBCF per Train mean distance between component failure	MTBF Goal 100,000 (161,000)	Unit miles (km)	MTTR per Train mean time to repair	MDBD Goal 1.5	Unit m-hr	Reliability Calculation Method: Basic RAM Calculation Method MTTR (in hours): 1.5 man-hr mean time to repair MDBF (in miles): 100,000 Raw Defect History Data Sample: None provided	Actual Reliability Currently Being Realized: No letter from Carbuilder Met MBTA T2.03.03 Requirements: YES
MDBCF per Train mean distance between component failure	MTBF Goal 100,000 (161,000)	Unit miles (km)							
MTTR per Train mean time to repair	MDBD Goal 1.5	Unit m-hr							
Project Title: New York MTA PRIME: Bombardier									
Major Subsystem: HVAC	Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train.	Reliability Data Collection Process: FRACAS	Actual Reliability at end of Warranty Period: Carbuilder will have to provide actual data						
Vendor Name:	System RAM Goals:	Reliability Calculation Method: Basic RAM Calculation Method							

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements			Reliability Processes		Reliability Results
	MDBCF per Train mean distance between component failure	MTBF Goal 100,000 (161,000)	Unit miles (km)	MTTR (in hours): 1.5 man-hr mean time to repair	MDBF (in miles): 100,000	
Project Title: Faiveley 50 Beechtree Blvd., Greenville, SC 29605 Herve Savary 864-423-6348 Project Title: Valley Metro Phoenix PRIME: Kinkisharyo	MTTR per Train mean time to repair	MDBD Goal 1.5	Unit m-hr	Raw Defect History Data Sample: None provided	Met MBTA T2.03.03 Requirements: YES	Actual Reliability Currently Being Realized: Carbuilder has not provided any data from car Met MBTA T2.03.03 Requirements: YES
Major Subsystem: Trucks/ Components Vendor Name: BRADKEN- Atchison Truck Dennis anderson@br adken.com 913-367-2121 12200 NW Ambassador, Kansas City, MO 64163 Project Title: SCRRRA Southern Calif. Metro since 1992 PRIME: Hyundai Rotem Andy Hyer 215-952-3637	Failure Definitions: (a) Operation outage: The train is unable to continue regular passenger service. - All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fire or emergency device fault, etc. - All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed, two or more gates per train are out of order, etc. - Conditions where further operation may damage the train, and/or associated equipment, including wayside. For example, the braking system fails to be released. (b) Train operation delay: Train is delayed for two or more minutes. (c) Original delay: Extended passenger travel time. (d) Departure failure: Train is unable to depart station on time. (e) MTBF: Mean time between failures, per train. (f) MDBF: Mean distance between failures, per train. System RAM Goals:			Reliability Data Collection Process: FPMH-failures per million hours FPMH-failures per million miles Reliability Calculation Method: Use 41mph to convert NPRD value from (FPMH) to FPMH FPMH=FPMH x41 MDBCF: PREDICTED 821,271 miles Raw Defect History Data Sample: FPMH=Predicted Failure 49.922 FPMH=Predicted Failure 1.217	Actual Reliability at end of Warranty Period: Not provided by car builder. Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES	Actual Reliability at end of Warranty Period: Not provided by car builder.
Major Subsystem: Trucks/ Components	Failure Definitions: (a) Departure failure: Train is unable to depart station on time. (b) MTBF: Mean time between failures, per train. (c) MDBF: Mean distance between failures, per train.			Reliability Data Collection Process: FPMH-failures per million hours FPMH-failures per million miles		Actual Reliability at end of Warranty Period: Not provided by car builder.



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results						
assemblies Vendor Name: BRADKEN- Atchison Truck Dennis Anderson danderson@br adken.com 913-367-2121 Project Title: GO transit TORONTO Metro since 1977 PRIME: Bombardier	System RAM Goals: <table><tr><td>MTBF per Train mean time between failures</td><td>MTBF Goal 200,000</td><td>Unit Hours</td></tr></table> <table><tr><td>MDBCF per Train Mean distance between component failure</td><td>MTBF Goal 750,000</td><td>Unit km</td></tr></table>	MTBF per Train mean time between failures	MTBF Goal 200,000	Unit Hours	MDBCF per Train Mean distance between component failure	MTBF Goal 750,000	Unit km	Reliability Calculation Method: Use 41mph to convert NPRD value from (FPMH) to FPMH FPMH=FPMH x41 MDBCF: PREDICTED 821,271 miles Raw Defect History Data Sample: FPMH=Predicted Failure 49,922 FPMH=Predicted Failure 1,217	Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES
MTBF per Train mean time between failures	MTBF Goal 200,000	Unit Hours							
MDBCF per Train Mean distance between component failure	MTBF Goal 750,000	Unit km							
Major Subsystem: Trucks/ Components assemblies Vendor Name: BRADKEN- Atchison Truck Dennis Anderson danderson@br adken.com 913-367-2121 Project Title: AMT Montreal Metro since 2005 PRIME: Bombardier	Failure Definitions: (a) Departure failure: Train is unable to depart station on time. (b) MTBF: Mean time between failures, per train. (c) MDBF: Mean distance between failures, per train. System RAM Goals: <table><tr><td>MTBF per Train mean time between failures</td><td>MTBF Goal 200,000</td><td>Unit Hours</td></tr></table> <table><tr><td>MDBCF per Train Mean distance between component failure</td><td>MTBF Goal 750,000</td><td>Unit km</td></tr></table>	MTBF per Train mean time between failures	MTBF Goal 200,000	Unit Hours	MDBCF per Train Mean distance between component failure	MTBF Goal 750,000	Unit km	Reliability Data Collection Process: FPMH-failures per million hours FPMH- failures per million miles Reliability Calculation Method: Use 41mph to convert NPRD value from (FPMH) to FPMH FPMH=FPMH x41 MDBCF: PREDICTED 821,271 miles Raw Defect History Data Sample: FPMH=Predicted Failure 49,922 FPMH=Predicted Failure 1,217	Actual Reliability at end of Warranty Period: Not provided by car builder. Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES
MTBF per Train mean time between failures	MTBF Goal 200,000	Unit Hours							
MDBCF per Train Mean distance between component failure	MTBF Goal 750,000	Unit km							
Major Subsystem: Propulsion System Vendor Name: ABB Michael	Failure Definitions: (a) Operation outage: The train is unable to continue regular passenger service. - All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fire or emergency device fault, etc. - All faults under which the train cannot satisfy the minimum	Reliability Data Collection Process: FPMH-failures per million hours FPMH- failures per million miles Reliability Calculation Method:	Actual Reliability at end of Warranty Period: Not provided by car builder. Actual Reliability Currently Being Realized: Not submitted						



TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results						
Habouri 514-209-2984 180 Brunswick Point-Claire, QC CANADA Project Title: Stuttgart LRV GERMANY PRIME: SSB-AG Stuttgarter Strassenbahnen Tom Moser +49 711 7885 2774	<p>headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed, two or more gates per train are out of order, etc.</p> <p>- Conditions where further operation may damage the train, and/or associated equipment, including wayside. For example, the braking system fails to be released.</p> <p>(b) Train operation delay: Train is delayed for two or more minutes.</p> <p>(c) Original delay: Extended passenger travel time.</p> <p>(d) Departure failure: Train is unable to depart station on time.</p> <p>(e) MTBF: Mean time between failures, per train.</p> <p>(f) MDBF: Mean distance between failures, per train.</p> <p>System RAM Goals:</p> <table><tr><td>MTBF per Train mean time between failures</td><td>MTBF Goal 200,000</td><td>Unit Hours</td></tr><tr><td>MDBCF per Train Mean distance between component failure</td><td>MTBF Goal 950,000</td><td>Unit km</td></tr></table>	MTBF per Train mean time between failures	MTBF Goal 200,000	Unit Hours	MDBCF per Train Mean distance between component failure	MTBF Goal 950,000	Unit km	<p>Use 41mph to convert NPRD value from (FPMH) to FPMH FPMH=FPMH x50</p> <p>MDBCF: PREDICTED 1,000,000 miles</p> <p>Raw Defect History Data Sample:</p> <p>FPMH=Predicted Failure 60 FPMH=Predicted Failure 1.2</p>	<p>Met MBTA T2.03.03 Requirements: YES</p>
MTBF per Train mean time between failures	MTBF Goal 200,000	Unit Hours							
MDBCF per Train Mean distance between component failure	MTBF Goal 950,000	Unit km							
Major Subsystem: Propulsion System Vendor Name: ABB Michael Habouri 514-209-2984 180 Brunswick Point-Claire, QC CANADA Project Title: Newark LRV NJ Airport PRIME: Bombardier Robert Bartkey 813-417-8673	<p>Failure Definitions: (a) Departure failure: Train is unable to depart station on time. (b) MTBF: Mean time between failures, per train. (c) MDBF: Mean distance between failures, per train.</p> <p>System RAM Goals:</p> <table><tr><td>MTBF per Train mean time between failures</td><td>MTBF Goal 200,000</td><td>Unit Hours</td></tr><tr><td>MDBCF per Train Mean distance between component failure</td><td>MTBF Goal 750,000</td><td>Unit km</td></tr></table>	MTBF per Train mean time between failures	MTBF Goal 200,000	Unit Hours	MDBCF per Train Mean distance between component failure	MTBF Goal 750,000	Unit km	<p>Reliability Data Collection Process:</p> <p>FPMH-failures per million hours FPMH- failures per million miles</p> <p>Reliability Calculation Method:</p> <p>Use 41mph to convert NPRD value from (FPMH) to FPMH FPMH=FPMH x25</p> <p>MDBCF: PREDICTED 750,000 miles</p> <p>Raw Defect History Data Sample:</p> <p>FPMH=Predicted Failure 32.5 FPMH=Predicted Failure 1.3</p>	<p>Actual Reliability at end of Warranty Period: Not provided by car builder.</p> <p>Actual Reliability Currently Being Realized: Not submitted</p> <p>Met MBTA T2.03.03 Requirements: YES</p>
MTBF per Train mean time between failures	MTBF Goal 200,000	Unit Hours							
MDBCF per Train Mean distance between component failure	MTBF Goal 750,000	Unit km							
Major Subsystem: Propulsion System	<p>Failure Definitions: (a) Departure failure: Train is unable to depart station on time. (b) MTBF: Mean time between failures, per train. (c) MDBF: Mean distance between failures, per train.</p>	<p>Reliability Data Collection Process:</p> <p>FPMH-failures per million hours FPMH- failures per million miles</p>	<p>Actual Reliability at end of Warranty Period: Not provided by car builder.</p>						



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results												
Vendor Name: ABB Michael Habouri 514-209-2984 180 Brunswick Point-Claire, QC CANADA Project Title: Sound Transit SDOT Seattle WA PRIME: SDOT, 802 e 25 th st, Tacoma, WA Robert Blackburn 206-370-5674	(d) Warranty 36 after delivery System RAM Goals: <table><tr><th>MTBF per Train</th><th>MTBF Goal</th><th>Unit</th></tr><tr><td>mean time between failures</td><td>400,000</td><td>Hours</td></tr></table> <table><tr><th>MDBCF per Train</th><th>MTBF Goal</th><th>Unit</th></tr><tr><td>Mean distance between component failure</td><td>950,000</td><td>km</td></tr></table>	MTBF per Train	MTBF Goal	Unit	mean time between failures	400,000	Hours	MDBCF per Train	MTBF Goal	Unit	Mean distance between component failure	950,000	km	Reliability Calculation Method: Use 41mph to convert NPRD value from (FPMH) to FPMH FPMH=FPMH x45 MDBCF: PREDICTED 950,000 miles Raw Defect History Data Sample: FPMH=Predicted Failure 50.4 FPMH=Predicted Failure 1.12	Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES
MTBF per Train	MTBF Goal	Unit													
mean time between failures	400,000	Hours													
MDBCF per Train	MTBF Goal	Unit													
Mean distance between component failure	950,000	km													
Major Subsystem: Air Brakes, Couplers, Collectors Vendor Name: WABTEC PT Cornelius Stevenson 412-825-1000 1001 Air Brake Wilmerding, PA 15148 Project Title: PATH PA-5 New Jersey/ New York D. Dreisback 973-350-2850 PRIME: Kawasaki Railcar since 2009	Failure Definitions: (a) Operation outage: The train is unable to continue regular passenger service. - All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fire or emergency device fault, etc. - All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed, two or more gates per train are out of order, etc. - Conditions where further operation may damage the train, and/or associated equipment, including wayside. For example, the braking system fails to be released. (b) Train operation delay: Train is delayed for two or more minutes. (c) Original delay: Extended passenger travel time. (d) Departure failure: Train is unable to depart station on time. (e) MTBF: Mean time between failures, per train. (f) MDBF: Mean distance between failures, per train. System RAM Goals: <table><tr><th>MDCBF per Train</th><th>MTBF Goal</th><th>Unit</th></tr><tr><td>mean distance between component</td><td>80,000</td><td>miles</td></tr></table>	MDCBF per Train	MTBF Goal	Unit	mean distance between component	80,000	miles	To date over 5100 carsets in Use PREDICTED BRAKE SYSTEM MDBF: 497,084 miles (A-CAR) MDBF: 2,692,515 miles (C-CAR) PREDICTED COUPLER SYSTEM MDBF: 1,727,116 miles (A-CAR) MDBF: 1,149,425 miles (C-CAR) PREDICTED COLLECTOR SYSTEM MDBSCF: 4,966,887 miles (A-CAR) MDBF: 2,852,120,279 miles (C-CAR)	Actual Reliability at end of Warranty Period: Not provided by car builder. Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES						
MDCBF per Train	MTBF Goal	Unit													
mean distance between component	80,000	miles													



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements			Reliability Processes	Reliability Results	
	failures					
	MDBF per Train		MTBF Goal			
	Mean distance between failure		60,000			
Major Subsystem: Air Brakes, Couplers, Collectors	Failure Definitions: (a) Departure failure: Train is unable to depart station on time. (b) MTBF: Mean time between failures, per train. (c) MDBF: Mean distance between failures, per train.				Actual Reliability at end of Warranty Period: Not provided by car builder. Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES	
Vendor Name: WABTEC PT Cornelius Stevenson 412-825-1000 1001 Air Brake Wilmerding, PA 15148	System RAM Goals:			To date over 5100 carsets in Use PREDICTED BRAKE SYSTEM MDBF: 94,925 miles PREDICTED COUPLER SYSTEM MDBF: Not provided by supplier PREDICTED COLLECTOR SYSTEM MDBF: 3,973,512 miles		
Project Title: MBTA#5 Blue Boston S. Atkins 617-293-4635 PRIME: Bombardier	MDCBF per Train	mean distance between component failures	MTBF Goal			
	MDBF per Train	Mean distance between t failure	MTBF Goal			
Major Subsystem: Air Brakes, Couplers, Collectors	Failure Definitions: (a) Departure failure: Train is unable to depart station on time. (b) MTBF: Mean time between failures, per train. (c) MDBF: Mean distance between failures, per train. (d) Warranty 36 after delivery				Actual Reliability at end of Warranty Period: Not provided by car builder. Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES	
Vendor Name: WABTEC PT Cornelius Stevenson 412-825-1000 1001 Air Brake Wilmerding, PA 15148	System RAM Goals:			To date over 5100 carsets in Use PREDICTED BRAKE SYSTEM MDBCF: 113,160 miles MDBF: 1,267,455 miles PREDICTED COUPLER SYSTEM MDBCF: 3,048,780 miles MDBF: 38,461,545 miles PREDICTED COLLECTOR SYSTEM MDBSCF: 4,966,980 miles MDBF: 1,315,789,108,681 miles		
Project Title: NYCT R142 NY to CT M Wetherall 718-694-4460 PRIME: Bombardier	MDBF per Train	mean distance between failures	MTBF Goal			
	MDBCF per Train	Mean distance between component failure	MTBF Goal			



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements				Reliability Processes	Reliability Results
since 1999	mean distance between failures		6,000,000	miles	To date over 5100 carsets in Use PREDICTED BRAKE SYSTEM MDBCF: 110,852 miles MDBF: 1,2607,504 miles PREDICTED COUPLER SYSTEM MDBCF: 3,048,780 miles MDBF: 38,461,545 miles PREDICTED COLLECTOR SYSTEM MDBSCF: 4,966,980 miles MDBF: 1,315,789, 108,681 miles	Actual Reliability at end of Warranty Period: Not provided by car builder. Actual Reliability Currently Being Realized: Not submitted Met MBTA T2.03.03 Requirements: YES
	MDBCF per Train		MTBF Goal	Unit		
	Mean distance between component failure		3,000,000	miles		
	Failure Definitions:					
	(a) Departure failure: Train is unable to depart station on time.					
	(b) MTBF: Mean time between failures, per train.					
	(c) MDBF: Mean distance between failures, per train.					
	(d) Warranty 36 after delivery					
	System RAM Goals:					
	BRAKES					
Major Subsystem: Air Brakes, Couplers, Collectors Vendor Name: WABTEC PT Cornelius Stevenson 412-825-1000 1001 Air Brake Wilmerding, PA 15148 Project Title: NYCT R160 M Wetherall 718-694-4460 PRIME: Alstom/ Kawasaki since 2003	MDBF per Train		MTBF Goal	Unit	PREDICTED COLLECTOR SYSTEM MDBSCF: 4,966,887 miles (A-CAR) MDBF: 2,852,120,279 miles (C-CAR)	Met MBTA T2.03.03 Requirements: YES
	mean distance between failures		1,000,000	miles		
	MDBCF per Train		MTBF Goal	Unit		
	Mean distance between component failure		60,000	miles		
	COUPLER					
	MDBF per Train		MTBF Goal	Unit		
	mean distance between failures		6,000,000	miles		
	MDBCF per Train		MTBF Goal	Unit		
	Mean distance between component failure		3,000,000	miles		
	COLLECTOR					
Major Subsystem: Propulsion Inverters; API; LVPS; VMS; Vendor Name: Toyo Denki US Ichiro Sueoka 724-709-4764 2507 Lovi Rd Freedom PA15042 Project Title: DART LRV Dallas Metro PRIME: Kinkisharyo since 2004	MDBF per Train		MTBF Goal	Unit	PREDICTED COLLECTOR SYSTEM MDBSCF: 4,966,887 miles (A-CAR) MDBF: 2,852,120,279 miles (C-CAR)	Met MBTA T2.03.03 Requirements: YES
	mean distance between failures		6,000,000	miles		
	MDBCF per Train		MTBF Goal	Unit		
	Mean distance between component failure		3,000,000	miles		
	Failure Definitions:					
	(a) Operation outage: The train is unable to continue regular passenger service.					
	- All faults endangering travel safety and/or normal operation, such as braking system, interlock/protection circuit, fire or emergency device fault, etc.					
	- All faults under which the train cannot satisfy the minimum headway time requirements, for example, because of the fault of traction system, the train cannot travel at the preset speed, two or more gates per train are out of order, etc.					
	- Conditions where further operation may damage the train, and/or associated equipment, including wayside. For example, the braking system fails to be released.					
	(b) Train operation delay: Train is delayed for two or more minutes.					



TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results																				
	<div>System RAM Goals:</div> <table><tr><td>MDCBF per Train</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean distance between component failures</td><td>80,000</td><td>miles</td></tr></table> <div>MDBF per Train</div> <table><tr><td>MTBF Goal</td><td>Unit</td></tr><tr><td>60,000</td><td>miles</td></tr></table> <div>Failure Definitions:</div> <div>(a) Departure failure: Train is unable to depart station on time. (b) MTBF: Mean time between failures, per train. (c) MDBF: Mean distance between failures, per train.</div> <div>System RAM Goals:</div> <table><tr><td>MDCBF per Train</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean distance between component failures</td><td>80,000</td><td>miles</td></tr></table> <div>MDBF per Train</div> <table><tr><td>MTBF Goal</td><td>Unit</td></tr><tr><td>60,000</td><td>miles</td></tr></table>	MDCBF per Train	MTBF Goal	Unit	mean distance between component failures	80,000	miles	MTBF Goal	Unit	60,000	miles	MDCBF per Train	MTBF Goal	Unit	mean distance between component failures	80,000	miles	MTBF Goal	Unit	60,000	miles	<div>To date over 5100 carsets in use.</div> <div>PREDICTED BRAKE SYSTEM</div> <div>MDBF: 94,925 miles</div> <div>PREDICTED COUPLER SYSTEM</div> <div>MDBF: Not provided by supplier</div> <div>PREDICTED COLLECTOR SYSTEM</div> <div>MDBF: 3,973,512 miles</div>	<div>Actual Reliability at end of Warranty Period:</div> <div>Not provided by car builder.</div> <div>Actual Reliability Currently Being Realized:</div> <div>Not submitted</div> <div>Met MBTA T2.03.03 Requirements:</div> <div>YES</div>
MDCBF per Train	MTBF Goal	Unit																					
mean distance between component failures	80,000	miles																					
MTBF Goal	Unit																						
60,000	miles																						
MDCBF per Train	MTBF Goal	Unit																					
mean distance between component failures	80,000	miles																					
MTBF Goal	Unit																						
60,000	miles																						
<div>Project</div> <div>Queensland Rail</div> <div>Major Subsystem:</div> <div>Passenger Sliding Plug Doors</div> <div>Vendor Name:</div> <div>Ultimate N.A. LLC</div> <div>30914 San Antonio St., Hayward, CA 94544</div> <div>Ed Feldman</div>	<div>TYPE 1 FAILURE:</div> <div>A service is terminated due to:</div> <div>(a) the development of an unsafe situation or injury occasioned to the Purchaser's staff or a member of the public; or</div> <div>(b) a train is unable to complete a journey under its own power; or</div> <div>(c) failure of a train to commence its scheduled service.</div> <div>TYPE 2 FAILURE:</div> <div>(a) a delay of the arrival of a train at a station for a period of greater than or equal to 15 minutes; or</div> <div>(b) the delay of the departure of a train at a station for a period of greater than or equal to 4 minutes; due to a fault that had to be rectified by on-board staff/train crew. For the avoidance of doubt, the potential delay is applicable regardless of whether or not the train driver is able to recover any lost time.</div> <div>TYPE 3 FAILURE:</div> <div>Any fault requiring maintenance that is not scheduled in the maintenance specifications and/or scope of works. This excludes items identified by TMS as requiring attention where the</div>	<div>Reliability Data Collection Process:</div> <div>Not Known - proprietary</div> <div>Reliability Calculation Method:</div> <div>Not Known - proprietary</div> <div>Raw Defect History Data Sample:</div> <div>Not Available</div>	<div>Actual Reliability at end of Warranty Period:</div> <div>Not Known</div> <div>Actual Reliability Currently Being Realized:</div> <div>No claims so exceeds the contract</div> <div>Met MBTA T2.03.03 Requirements:</div> <div>Exceeds the MBTA requirements by x 4.3</div>																				



TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results
<p>732-887-9715</p> <p>Project Title: IMU/SMU/High Speed Tilt Train</p> <p>Customer Contact David Alston I Mayne Service Integration Manager Downer Rail</p> <p>T 07 3216 1343 M 0418 283 655 F 07 3216 1613 53 Campbell Street., Bowen Hills QLD 4006</p>	<p>equipment has not actually failed. The mean distance between failures shall be as follows: Type 1 failures 3,000,000 km Type 2 failures 4,500,000 km Type 3 failures 550,000 km The following targets have to be met during stage 3 of the reliability period to achieve the reliability requirements of this clause:</p> <ul style="list-style-type: none"> • MDBF 1 value for 3 consecutive monthly calculations has to be > 250,000 km per calculation and any 4 monthly calculations during a six consecutive monthly period > 250,000km per calculation. • MDBF 2 value for 3 consecutive monthly calculations has to be > 62,500 km per calculation and any 4 monthly calculation during a six consecutive monthly period > 62,500 km per calculation. • MDBF 3 calculations for 3 consecutive monthly calculations has to be > 10,000 km per calculation and any 4 monthly calculation during a six consecutive monthly period > 10,000 km per calculation. <p>TYPE 1 FAILURE: Safety related failures comprising faults which under a reasonably foreseeable set of conditions could result in a notifiable Train accident</p> <p>TYPE 2 FAILURE: A substitution of a train, or a malfunction of equipment which requires the driver to leave the cab to restore the operation of equipment, or a reduction in performance resulting in a unrecoverable delay in the train service of four minutes or more.</p> <p>TYPE 3 FAILURE: A malfunction or reduction in performance of equipment which does not result in a delay of four (4) minutes or more.</p>		
<p>Project Perth SMU</p> <p>Major Subsystem: Passenger Sliding Plug Doors</p> <p>Vendor Name:</p>	<p>TYPE 1 FAILURE: A service is terminated due to: (a) the development of an unsafe situation or injury occasioned to the Purchaser's staff or a member of the public; or (b) a train is unable to complete a journey under its own power; or (c) failure of a train to commence its scheduled service.</p> <p>TYPE 2 FAILURE: (a) a delay of the arrival of a train at a station for a period of greater than or equal to 15 minutes; or (b) the delay of the departure of a train at a station for a period of greater than or equal to 4 minutes; due to a fault that had to be rectified by on-board staff/train crew. For the avoidance of doubt,</p>	<p>Reliability Data Collection Process: Not Known – proprietary, cars being maintained by third party Joint Venture</p> <p>Reliability Calculation Method: Not Known or disclosed</p> <p>Raw Defect History Data Sample:</p>	<p>Actual Reliability at end of Warranty Period: Not known</p> <p>Actual Reliability Currently Being Realized: Exceeds contract Met MBTA T2.03.03 Requirements:</p>



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results															
Ultimate N.A. LLC 30914 San Antonio St., Hayward, CA 94544 Ed Feldman 732-887-9715 Project Title: Perth Transit Authority SMU Customer Contact TBA	<p>the potential delay is applicable regardless of whether or not the train driver is able to recover any lost time.</p> <p>TYPE 3 FAILURE: Any fault requiring maintenance that is not scheduled in the maintenance specifications and/or scope of works. This excludes items identified by TMS as requiring attention where the equipment has not actually failed.</p> <p>The mean distance between failures shall be as follows: Type 1 failures 3,000,000 km Type 2 failures 4,500,000 km Type 3 failures 550,000 km</p>	Not Known	Exceeds MBTA x 4.3															
Project Bombardier V'locity Major Subsystem: Passenger Sliding Plug Doors Vendor Name: Ultimate N.A. LLC 30914 San Antonio St., Hayward, CA 94544 Ed Feldman 732-887-9715 Project Title: V'locity Customer Contact Colin Madigan National Quality Manager Bombardier Australia +61 3 9794	<p>Taking into account the Vlocity requirements and the data collected from the Reliability department on past experiences. The reliability requirements for external door system for the Vlocity project have been extracted from the Bombardier Transportation Vlocity reliability model.</p> <p>The applicable requirements are presented in the table below:</p> <table><tr><th></th><th>Nbr Items</th><th>Delay f item Value</th><th>Delay f UNIT</th><th>Delay f train [fail/E6 km]</th></tr><tr><td>Sub-System</td><td>QTY_TOTAL</td><td>FAILURE</td><td>FR_UNIT</td><td>FAILURE_</td></tr><tr><td>Door System</td><td>8</td><td>0.2</td><td>FPMKM</td><td>1.6</td></tr></table> <p>"Failure" is defined as: _ Any fault, attributed to the Contractor, which causes a delay in service in excess of 10 min. at a station stop within the timetable _ Any Safety Critical Defect, attributed to the Contractor, which reduces the state of the Railcar to an unsafe condition _ Any fault, attributed to the Contractor, which results in one (1) door being out of service</p>		Nbr Items	Delay f item Value	Delay f UNIT	Delay f train [fail/E6 km]	Sub-System	QTY_TOTAL	FAILURE	FR_UNIT	FAILURE_	Door System	8	0.2	FPMKM	1.6	<p>Reliability Data Collection Process: Bombardier Transportation Vlocity reliability model.</p> <p>Reliability Calculation Method: Field data</p> <p>Raw Defect History Data Sample: Not available</p>	<p>Actual Reliability at end of Warranty Period: Not available</p> <p>Actual Reliability Currently Being Realized: No failure claims in 12 years Met MBTA T2.03.03 Requirements: Exceeds MBTA x 1.5</p>
	Nbr Items	Delay f item Value	Delay f UNIT	Delay f train [fail/E6 km]														
Sub-System	QTY_TOTAL	FAILURE	FR_UNIT	FAILURE_														
Door System	8	0.2	FPMKM	1.6														



TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements	Reliability Processes	Reliability Results												
2111															
Major Subsystem: Communication s Equipment Vendor Name: RL Controls Lena Walsh. 781-732-3349 10V Gill St., Woburn, MA 01801 Project Title: MBTA Blue Line Metro (Boston) PRIME: Alstom	Failure Definitions: (a) Operation outage: A chargeable failure shall be defined as any equipment related occurrence considered by MBTATA's Railroad Division as 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 (or which is approved as being a consumable item but is not achieving its design service life) and which failure has not either been due to a failure occurrence in equipment of another subsystem, or due to failure of MBTA to perform the recommended preventive maintenance actions, vandalism or physical mistreatment at a human interface, operating or weather conditions of unusual aspect or severity beyond those noted in Section 1.18.4, or due to accident. The term "unusual aspect or severity" shall be understood to mean a condition that does not occur on the MBTA at less than 10 year intervals. The time, place or type of service operated by the car at the time of a failure shall not be of any consequence. (b) RDB: Reliability Block Diagrams (c) DVCS: Digital Vehicle Communication System. (d) Departure failure: Train is unable to depart station on time. (e) MTBF: Mean time between failures, per train. (f) LLRU: Lowest level replaceable unit. System RAM Goals: <table><tr><td>MTBCF</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean time between componeht failure</td><td>10,000</td><td>hrs</td></tr><tr><td>MDBCF per Train</td><td>MDBCF Goal</td><td>Unit</td></tr><tr><td>Mean distance between component failure</td><td>50,000</td><td>miles</td></tr></table>	MTBCF	MTBF Goal	Unit	mean time between componeht failure	10,000	hrs	MDBCF per Train	MDBCF Goal	Unit	Mean distance between component failure	50,000	miles	The stated reliability requirements shall be met by only those components necessary to produce normal car operation. Components whose sole function is an auxiliary one, such as data logging, fault annunciation, etc., shall not have their failures counted against the basic system performance. An average operating speed of 15 miles/hour may be used for design calculations. MIL-HDBK-217F Total FPMH: 6.06870 Total FPMH: 60.6868	Actual Reliability at end of Warranty Period: Actual Reliability Currently Being Realized: MDBCF: 164,780 miles MTBCF: 16,478 hours Met MBTA T2.03.03 Requirements: YES
MTBCF	MTBF Goal	Unit													
mean time between componeht failure	10,000	hrs													
MDBCF per Train	MDBCF Goal	Unit													
Mean distance between component failure	50,000	miles													
Major Subsystem: Communication s Equipment Vendor Name: RL Controls Lena Walsh. 781-732-3349 10V Gill St., Woburn, MA 01801 Project Title:	Failure Definitions: (a) Operation outage: A chargeable failure shall be defined as any equipment related occurrence considered by MBTATA's Railroad Division as rendering the car unfit for service. (b) RDB: Reliability Block Diagrams (c) DVCS: Digital Vehicle Communication System. (d) Departure failure: Train is unable to depart station on time. (e) MTBF: Mean time between failures, per train. (f) LLRU: Lowest level replaceable unit. System RAM Goals: <table><tr><td>MTBCF</td><td>MTBF Goal</td><td>Unit</td></tr><tr><td>mean time between component failure</td><td>10,000</td><td>hrs</td></tr></table>	MTBCF	MTBF Goal	Unit	mean time between component failure	10,000	hrs	The stated reliability requirements shall be met by only those components necessary to produce normal car operation. Components whose sole function is an auxiliary one, such as data logging, fault annunciation, etc., shall not have their failures counted against the basic system performance. An average operating speed of 15 miles/hour may be used for design calculations. MIL-HDBK-217F Total FPMH: 6.06870 Total FPMH: 60.6868	Actual Reliability at end of Warranty Period: Actual Reliability Currently Being Realized: MDBCF: 164,780 miles MTBCF: 16,478 hours Met MBTA T2.03.03 Requirements: YES						
MTBCF	MTBF Goal	Unit													
mean time between component failure	10,000	hrs													



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix

Project	Contractual Reliability Requirements			Reliability Processes	Reliability Results
	MDBCF per Train	MDBCF Goal	Unit		
MBTA (Boston) PRIME: Rotem Hyundai	Mean distance between component failure	50,000	miles		
Major Subsystem: Communication s Equipment Vendor Name: Woojin IS America Inc. 626-386-0101 5108 Azusa Canyon Rd. Irwindale, CA 91706 Joseph Kim Project Title: Silverliner V SEPTA Southeastern Pennsylvania Transportation Authority Charles Tuzzo 215-580-8624 PRIME: Rotem	Failure Definitions: (a) Operation outage: A chargeable failure shall be defined as any equipment related occurrence considered by SEPTA's Railroad Division as 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 (or which is approved as being a consumable item but is not achieving its design service life) and which failure has not either been due to a failure occurrence in equipment of another subsystem, or due to failure of SEPTA to perform the recommended preventive maintenance actions, vandalism or physical mistreatment at a human interface, operating or weather conditions of unusual aspect or severity beyond those noted in Section 1.18.4, or due to accident. The term "unusual aspect or severity" shall be understood to mean a condition that does not occur on the SEPTA Railroad Division at less than 10 year intervals. The time, place or type of service operated by the car at the time of a failure shall not be of any consequence. (b) Train operation delay: Train is delayed for two or more minutes. (c) Original delay: Extended passenger travel time. (d) Departure failure: Train is unable to depart station on time. (e) MTBF: Mean time between failures, per train. (f) MDBF: Mean distance between failures, per train.			<p>The stated reliability requirements shall be met by only those components necessary to produce normal car operation. Components whose sole function is an auxiliary one, such as data logging, fault annunciation, etc., shall not have their failures counted against the basic system performance. An average operating speed of 27.5 miles/hour may be used for design calculations.</p> <p>AVERAGE MILES PER CAR /YR: 40,000 MILES</p>	<p>Actual Reliability at end of Warranty Period: There are 120 Silverliner V cars in service today. The 1st one entered service in February 2011</p> <p>Actual Reliability Currently Being Realized: Cars 701 to 821 Average odometer reading 98381</p> <p>Met MBTA T2.03.03 Requirements: YES</p>
Major Subsystem: ATP/ASR Equipment Vendor Name: Siemens Industry Inc. IC MOL Doug Minto	Mean distance between failure	10,000	miles	<p>Reliability Data Collection Process: FRCAP</p> <p>Reliability Calculation Method: MIL-217</p>	<p>Actual Reliability at end of Warranty Period: Still in warranty</p> <p>Actual Reliability Currently Being Realized: Not submitted</p> <p>Met MBTA T2.03.03</p>



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

**TABLE I.3B-1
Major Subcontractor Reliability History Data Matrix**

Project	Contractual Reliability Requirements			Reliability Processes	Reliability Results
412-829-7511 664 Linden Avenue, East Pittsburgh, PA 15112-1204 Project Title: MBTA/Alstom PRIME: Alstom	failure			Raw Defect History Data Sample: None provided	Requirements: YES
	MTBF per Train mean time between failure	MTBF Goal	Unit		
Major Subsystem: ATP/ASR Equipment Vendor Name: Siemens Industry Inc. IC MOL Doug Minto 412-829-7511 664 Linden Avenue, East Pittsburgh, PA 15112-1204 Project Title: AMTRAK PRIME: Bombardier	Failure Definitions: a) MTBF: Mean time between failures, per train. b) MDBF: Mean distance between failures, per train. System RAM Goals:			Reliability Data Collection Process: FRCAP Reliability Calculation Method: MIL-217 Raw Defect History Data Sample: None provided	Actual Reliability at end of Warranty Period: 12 years in service Actual Reliability Currently Being Realized: Not provided Met MBTA T2.03.03 Requirements: YES
	MDBF per Train mean distance between failure	MTBF Goal	Unit km		
	MTBF per Train mean time between failure	MTBF Goal	Unit		



TABLE I.3C-1
CSR Sifang All Passenger Rail Projects – Project Information Matrix

Project Name	Client Information	Contract Scope	Contractual Delivery Schedule	Actual Delivery Schedule	Project Status	Reason for Delay & Penalties
METRO VEHICLE PROJECTS						
Beijing Metro Batong Line Rail Project	Beijing Jingtong Development Co., Ltd	Entire vehicle with carbon steel carbody, 96 cars	2003.2-2014.2	2003.2-2014.2	Completed	NO
Purchasing Project for Motor Vehicle for branch lines of Guangzhou Metro Line 4 and Line 5	Guangzhou Metro Corporation	Entire vehicle with aluminum alloy carbody, 180 cars	Line 4:2004.8-2008.7 Line 5:2004.8-2010.5	Line 4:2004.8-2008.7 Line 5:2004.8-2010.5	Completed	NO
Electric Passenger Vehicle Project of Beijing Metro Line 1 Blanking Engineering	Beijing Subway Operation Co., Ltd	Entire vehicle with stainless steel carbody, 120 cars	2006.5-2008.6	2006.5-2008.6	Completed	NO
Beijing Metro Line 4 Electric Vehicle Project	Beijing MTR Corporation Address: Metro Line 4 Depot, Jiayuan Road, Fengtai District, Beijing	Entire vehicle with stainless steel carbody, 240 cars	2005.9-2009.9	2005.9-2009.9	Completed	NO
Chengdu Metro Line 1 First-stage Project Metro Vehicle Project	Chengdu Metro Co., Ltd, No. 396, Middle Tianfu Avenue, Chengdu, Sichuan, 028-61639050	Entire vehicle with stainless steel carbody, 102 cars	2009.5-2010.5	2009.11-2010.5	Completed	NO
Extended Composition and Extension project of Beijing Metro Batong Line	Beijing Subway Operation Co., Ltd	Entire vehicle with carbon steel carbody, 84 cars	2008.7-2008.9	2008.7-2008.9	Completed	NO
Project of Shenyang Metro Line 2 First-stage Project Vehicle	Shenyang Metro Co., Ltd	Entire vehicle with stainless steel carbody, 120 cars	2008.2-2011.12	2008.2-2011.12	Completed	NO
Tianjin Metro Line 3 Electric Passenger Vehicle Project	Tianjin Metro Group Co., Ltd	Entire vehicle with stainless steel carbody, 162 cars	2008.9-2011.11	2008.9-2011.11	Completed	NO
Beijing Metro Line 8 Second-stage Project	Tianjin Metro Group Co., Ltd	Entire vehicle with stainless steel carbody, 162 cars	2008.9-2011.11	2008.9-2011.11	Completed	NO
Beijing Metro Daxing Line Project	Beijing Rail Transit Construction and Management Co., Ltd	Entire vehicle with stainless steel carbody, 198 cars	2009.7-2010.12	2009.7-2010.12	Completed	NO
Beijing Metro Changping Line Project	Beijing Rail Transit Construction and Management Co., Ltd	Entire vehicle with stainless steel carbody, 162 cars	2009.12-2010.12	2009.12-2010.12	15 trains have been completed. Awaiting NTP for remaining 12 vehicles.	NO
Chengdu Metro Line 2 First-stage	Chengdu Metro Co., Ltd, No.	Entire vehicle with stainless steel carbody, 162 cars	2011.08-2012.05	2011.08-	Completed	NO



TABLE I.3C-1
CSR Sifang All Passenger Rail Projects – Project Information Matrix

Project Name	Client Information	Contract Scope	Contractual Delivery Schedule	Actual Delivery Schedule	Project Status	Reason for Delay & Penalties
Project	396, Middle Tianfu Avenue, Chengdu, Sichuan, 028-61639050	steel carbody, 138 cars		2012.05		
Linear Motor Vehicle of Guangzhou Metro Line 6	Guangzhou Metro Corporation	Entire vehicle with aluminum alloy carbody, 204 cars	2010.4-2015.12	40 trains have been delivered by April 2013	In progress	NO
Extension Project for Linear Motor Vehicle of Guangzhou Metro Line 5	Guangzhou Metro Corporation	Entire vehicle with aluminum alloy carbody, 192 cars	2010.12-2012.10	2010.12-2012.10	Complete	NO
Metro Vehicle Purchasing Project of Chengdu Metro Line 2 Second-stage Project	Chengdu Metro Co., Ltd, No. 396, Middle Tianfu Avenue, Chengdu, Sichuan, 028-61639050	Entire vehicle with stainless steel carbody, 114 cars	2012.05-2012.11	2012.07-2013.12	Complete	NO
Updated Electric Passenger Vehicle Purchasing Project of Beijing Metro Line 1	Beijing Subway Operation Co., Ltd	Entire vehicle with stainless steel carbody, 114 cars	2011.4-2012.2	2011.4-2012.2	Complete	NO
Purchasing Project of Qingdao Metro Vehicle First-stage Project	Qingdao Metro Corporation	Entire vehicle with aluminum alloy carbody, 144 cars	2011.12-2015.5	In progress	In progress	NO
Electric Passenger Vehicle Purchasing Project of Beijing Metro Line 14	Beijing Rail Transit Construction and Management Co., Ltd	Entire vehicle with stainless steel carbody, 150 cars	2012.3-2014.10	In progress	Complete	NO
Extended Train Project of Beijing Metro Line 4	Beijing MTR Corporation	Address: Metro Line 4 Depot, Jiayuan Road, Fengtai District, Beijing	2005.9-2009.9	2005.9-2009.9	Complete	NO
Connecting Line Project between Beijing Metro Changping Line and Beijing Metro Line 8	Beijing Rail Transit Construction and Management Co., Ltd	Entire vehicle with stainless steel carbody, 36 cars	2012.11-2013.8	2012.11-2013.8	Complete	NO
Vehicles of Shenyang –Tieling Intercity Railway Project	Shenyang Metro Co., Ltd	Entire vehicle with stainless steel carbody, 66 cars	2013.9-2015.3	In progress	Complete	NO
Vehicles of Guangzhou-Foshan Section Second-stage Project of Pearl River Delta Intercity Rapid Mass Transit	Foshan Metro Development Co., Ltd.	Entire vehicle with aluminum alloy carbody, 24 cars	2013.12-2015.3	In progress	In progress	NO
Singapore C151A Metro Project	Singapore Land Transport Authority NO.1 HAMPSHIRE ROAD SINGAPORE 219428	Entire vehicle with aluminum alloy carbody, 132 cars	2011.1-2012.1	2011.1-2011.12	Complete	NO
Singapore C151A Extension Project	Singapore Land Transport Authority NO.1 HAMPSHIRE ROAD SINGAPORE 219428	Entire vehicle with aluminum alloy carbody, 78 cars	2013.10-2014.8	In progress	In progress	NO
Singapore C151B Project	Singapore Land Transport Authority NO.1 HAMPSHIRE ROAD SINGAPORE 219428	Entire vehicle with aluminum alloy carbody, 132 cars	2015.5-2016.4	In progress	In progress	NO



TABLE I.3C-1
CSR Sifang All Passenger Rail Projects – Project Information Matrix

Project Name	Client Information	Contract Scope	Contractual Delivery Schedule	Actual Delivery Schedule	Project Status	Reason for Delay & Penalties
Singapore C151B Extension Project	Singapore Land Transport Authority NO.1 HAMPSHIRE ROAD SINGAPORE 219428	Entire vehicle with aluminum alloy carbody, 18 cars	2016.5-2016.6	In progress	In progress	NO
Sarmiento Line Metro Project of Argentina	Argentina Ministry of the Interior and Transport 25 de Mayo 101 CABA Argentina, seoprivada@miniterir.gov.ar	Entire vehicle with carbon steel carbody, 225 cars	2014.4-2014.10	In progress	In progress	NO
Mitre Line Metro Project of Argentina	Argentina Ministry of the Interior and Transport 25 de Mayo 101 CABA Argentina, seoprivada@miniterir.gov.ar	Entire vehicle with carbon steel carbody, 180 cars	2014.4-2014.10	In progress	In progress	NO
Roca Railroad Line Metro Project of Argentina	Argentina Ministry of the Interior and Transport 25 de Mayo 101 CABA Argentina, seoprivada@miniterir.gov.ar	Entire vehicle with carbon steel carbody, 300 cars	2015.1-2015.7	In progress	In progress	NO
HIGH SPEED RAIL VEHICLE PROJECTS						
Domestic manufacturing and purchase contract for EMUs of 300km/h speed level	Wuhan Railway Bureau ADD: 399# Qingwang Road, Qingshan District, Wuhan NAME: Wan Cheng TITLE: official for EMU department TEL: 027-51122454 EMAIL: Whj-dck@163.com	480 vehicles	2007.12-2010.6	2007.12-2010.6	Complete	NO
Purchase contract for EMUs of 350 km/h speed level	Wuhan Railway Bureau	1920 vehicles	2010.7-2012.2	2010.7-2012.2	Complete	NO
Purchase contract of 200-250 km/h seating EMUs with 8-car composition	Wuhan Railway Bureau	240 vehicles	2010.10-2011.10	2010.10-2011.10	Complete	NO
Purchase contract for seating EMUs of 200-250 km/h speed level with 8-car composition	Wuhan Railway Bureau	80 vehicles	2011.3-2011.6	2011.3-2011.6	Complete	NO
Purchase contract of 250 km/h EMUs	Nanchang Railway Bureau ADD:7# Zhanqian Road, Nanchang, Jiangxi province NAME:Tang Shanglin TITLE:officialfor EMU	Nanchang: 272 vehicles Nanning: 144 vehicles	2013.10-2013.12	2013.10-2013.12	Complete	NO



**TABLE I.3C-1
CSR Sifang All Passenger Rail Projects – Project Information Matrix**

Project Name	Client Information	Contract Scope	Contractual Delivery Schedule	Actual Delivery Schedule	Project Status	Reason for Delay & Penalties
	department TEL:0791-87022924 EMAIL:tsi22924@sohu.com Nanning Railway Bureau ADD:30# Hengyang West Road, Nanning, Guangxi province NAME:Liang Guangquan TITLE:official for EMU department TEL:0771-2730250 EMAIL:Kavinlgq@163.com					
Purchase contract of 250 km/h EMUs	Shanghai Railway Bureau ADD:80# Tianmu East Road, Shanghai NAME:Yang Sihai TITLE:official for EMU department TEL:021-51221181 EMAIL:Yangsihai888@163.com	168 vehicles	2013.10-2013.12	2013.10-2013.12	Complete	NO
Purchase contract of 350 km/h EMUs	Wuhan Railway Bureau Wuhan Railway Bureau Shanghai Railway Bureau	Wuhan: 24 vehicles Shanghai: 16 vehicles	2013.10-2013.12	2013.10-2013.12	Complete	NO
Purchase contract of 250 km/h EMUs	Nanchang Railway Bureau	Nanchang: 112 vehicles	2013.10-2013.12	2013.10-2013.12	Complete	NO
Purchase contract of 350 km/h EMUs	Wuhan Railway Bureau Nanchang Railway Bureau Nanning Railway Bureau	Wuhan: 80 vehicles Nanchang: 240 vehicles Nanning: 104 vehicles	2013.12-2014.09	In process	In progress	NO
350 km/h EMU for XRL	MTR Co., Ltd (MTR) NAME:Zhuo Wenhui (MF Cheuk) TITLE:Project manager TEL:+852 22083312 EMAIL:mfccheuk@mtr.com.hk	72 vehicles	2014.2-2014.9	In process	In progress	NO

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

TAB I.3 ATTACHMENTS

1. Beijing Metro Line 4 Electric Vehicle Project

北京地铁八通线车辆验收单

车组编号	TQ423、TQ424	合同编号	JTHS2003-01
编组辆数	2列8辆	质量证明书	齐全
制造厂家	南车四方股份公司	车辆履历簿	齐全
运营里程	TQ423 20292	到京日期	TQ423、2005.10.14、 TQ424 2005.12.15
(公里)	TQ424 17500		
运营单位意见	<p>南方工业集团 424 已运行 2006 年 1 月 12 日 基本符合合同</p> <p>北京地铁运营有限公司 运营分公司 运营管理部 运营管理部 运营管理部</p> <p>日期: 06 年 6 月 12 日</p> <p>签字 (盖章): 李素志</p>		
设备部	<p>签字 (盖章): 李素志</p> <p>日期: 2006 年 6 月 12 日</p>		
合同部	<p>签字 (盖章): 刘立鸿</p> <p>日期: 06 年 6 月 12 日</p>		
领导审批	<p>签字 (盖章): 李素志</p> <p>日期: 06 年 6 月 12 日</p>		
交车方代表:	<p>日期: 2006 年 6 月 12 日</p>		
验收地点:	<p>土桥车辆段</p>		

Acceptance Certificate of Vehicle for Beijing Metro Batong Line

No. 7

EMU No.	TO423, TO424	Contract No.	JTHS2003-01
Number of cars for composition	2 trains, 8 cars	Quality Certificate	Complete
Manufacturer	CSR Sifang	History Book of Vehicles	Complete
Operation Mileage (kilometer)	TO423	Arrival date in Beijing	October 14, 2005 TO423, TO424 December 15, 2005
	TO424		
TO423 and 424 manufactured by CSR Sifang have operated for 2000 km and can basically conform to the technical requirements in the contract. Train Acceptance is agreed. Left issues can be found in the attachment and they should be solved within the specified timetable.			
Comments of operating unit			
Signature (seal): [signature] Date: June 12, 2006			
Equipment Department	<div>Beijing Subway Jinglong Development Co., Ltd [red] Equipment Department</div>		
Signature (seal): Li Chuncheng [signature] Date: June 12, 2006			
Contract Department	<div>Beijing Subway Jinglong Development Co., Ltd [red] Contract Department</div>		
Signature (seal): Liu Lihong [signature] Date: June 12, 2006			
Approval of leader	<div>Beijing Subway Jinglong Development Co., Ltd [red]</div>		
Signature (seal): Han Zhiwei [signature] Date: June 12, 2006			
Comments of Jinglong Company			
Signature (seal): Sun Dandong [signature] Date: June 12, 2006			
Delivery representative: Sun Dandong [signature] Date: June 12, 2006			
Acceptance location: Tuqiao Depot			

2. Chengdu Metro Line 1 First-stage Project Metro Vehicle Project

初步验收证书

合同号: ID0268-2007-083-GX034

1D0269-2007-084-GX035

初步验收日期: 2010 年 10 月 8 日

名称	预验收情况	批 注
地铁车辆及牵引制动系统	2010年6月20日所有车辆完成实体验收; 2010年9月22日所有车辆完成5000公里稳定运行。	

上述货物按合同专用条款 18.8 条款之规定, 卖方已按本合同要求提供全部货物及质量保证期之前的服务, 特此证明。

初步验收证书签字地点：成都

初步验收证书签字日期: 2010 年 10 月 8 日

买方代表(签字):

成都轨道交通有限公司(公章)

Preliminary Acceptance Certificate

Preliminary Acceptance Certificate

Contract No.:

ID0269-2007-084-GX035

ID0268-2007-083-GX034

Date: October 8, 2010

Name	Pre-acceptance condition	Remarks
Metro vehicle and traction and braking system	<p>Entity acceptance was completed for all trains on June 20, 2010;</p> <p>All trains had completed 5000 km stable operation by September 22, 2010.</p>	

As specified in Clause 18.8 of special terms and conditions, for the above goods, hereby certify that the Seller has provided all goods and service within the warranty period.

Signing place of Preliminary Acceptance	Signing date of Preliminary Acceptance
Certificate: Chengdu	Certificate: October 8, 2010

Representative of the Buyer: Yin Zhong

[signature]



Chengdu Metro Co., Ltd [seal]

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

3. Project of Shenyang Metro Line 2 First-stage Project Vehicle

SYDT/SBCX034-2

归档编号: DE10-3

设备预验收证书

项目名称: 沈阳地铁二号线一期工程 编号: CLYZ10-002

设备名称	地铁列车 (含牵引制动设备)	合同号	D2/ZB SB-2007-001 D2/ZB SB-2007-003
致: 南车青岛四方机车车辆股份有限公司、株洲南车时代电气股份有限公司			
兹证明编号为 SYM201、SYM205 的地铁列车 (含牵引制动设备) 已通过预验收。			
质保期开始时间 2012 年 6 月 1 日			
总工程师 日期 2012-6-15			
日期 2012-6-15			

本表由主任助理工程师填写一式 4 份, 承包商、监理单位、业主各 1 份。

Pre-acceptance Certificate (All 20 Trains)

SYDT/SBCX034-2

Documentation No.: DE10-3

Equipment Pre-acceptance Certificate

Project name: Shenyang Metro Line 2 Phase I Project No.: CLYZ10-002

Equipment description	Metro vehicle (including traction braking equipment)	Contract No.	D2/ZB SB-2007-001 D2/ZB SB-2007-003
Attn.: CSR Qingdao Sifang Co., Ltd., Zhuzhou CSR Times Electric Company Limited			
To demonstrate that the No. SYM201, SYM205 metro vehicles (including traction braking equipment) have passed the pre-acceptance.			
Starting date of warranty: June 1, 2012			
Chief Engineer: [signature] Date: June 25, 2012			
Employer's Representative: Liang Zu [signature] Date: June 25, 2012			

The form is in quadruplicate and filled by the Chief Engineer, with Contractor, Supervision Sub-division, Supervision Division and Employer holding 1 copy.

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

4. Tianjin Metro Line 3 Electric Passenger Vehicle Project

Factory Acceptance Report (Last Train)

天津地铁 3 号线
地铁车辆出厂验收报告

Factory Acceptance Report of Tianjin Metro Line 3

合同编号: DT3-CLCG-1

检验日期: 2011 年 6 月 30 日

车辆编号: TJ327

Contract No.: DT3-CLCG-1

Inspection date: June 30, 2011

Vehicle No.: TJ327

该列车已经生产完成, 并通过各级检验和型式/例行试验, 其产品质量已达到设计图纸及合同要求, 具备出厂条件, 同意发运出厂。
遗留问题按双方另行商定的时间内进行处理。

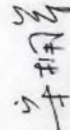
Production of the vehicle has been completed. The product quality is proved to satisfy the requirements in the drawing and contract according to each level of inspection and type/routine test, thus the product is with delivery condition and out-factory delivery is permitted.

The remaining problems will be handled within the time agreed by the two parties.

铁科院 (北京) 工程咨询有限公司:



南车青岛四方机车车辆股份有限公司代表:



Engineering Consulting Co., Ltd. of China Academy of Railway Sciences (Beijing): Sun Xinghua
[signature]

Representative of CSR Qingdao Sifang Co., Ltd.: Song Yongjun [signature]



5. Beijing Metro Line 8 Second-stage Project

车辆预验收证书

合同编号: 地铁八号线第二阶段 2009-B008/B009 验收日期: 2011-11-15

列车编号:

车辆编号	产品图号	备注
080011	SFM12	
080012	SFM12	
080013	SFM12	
080014	SFM12	
080015	SFM12	
080016	SFM12	

该列车在用户现场经过整备后,未发现较大的质量问题,经预验收小组对车辆相关资料进行审查、确认,对车辆实体进行检查,其产品质量基本已达到设计图纸及合同、规范要求,通过预验收。

遗留问题: 16 项

车辆制造单位应采取措施对上述设备检验和验收过程中出现的问题在本预验收证书签发日后 15 天内或合同双方另行商定的时间内进行修正。

买方签字:

卖方签字: 郭强

监理签字:

日期: 2011-11-15

Pre-acceptance Certificate (Train No. 1)

Vehicle Pre-acceptance Certificate

Contract No.: Metro Line eight (2) Equipment No. 2009-B008/B009

Acceptance date: November 15, 2011

Train No.:

Vehicle No.	Drawing No. of product	Remarks
080011	SFM12	
080012	SFM12	
080013	SFM12	
080014	SFM12	
080015	SFM12	
080016	SFM12	

No significant quality issues were found on the train after preparation on user's site; and the vehicle entity was checked after the pre-acceptance team has reviewed and confirmed the materials relevant to the vehicle, and the product quality can be basically meet the requirements of design drawing, contract and specification, thus the train can pass the pre-acceptance.

Remaining problems: 16 items

The vehicle manufacturing unit shall take measures to rectify all the problems found during the inspection and acceptance of the above equipments within 15 days after issuing the pre-acceptance certificate or within the time agreed by both parties of the contract.

Signature of Buyer: Yang Feng [signature] Signature of Seller: Hao Chenyang [signature]

Signature of Supervisor: Yun Enhua [signature]

Date: November 15, 2011

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

Beijing Metro Line 8 Second-stage Project (con't)

车辆预验收证书

合同编号: 地铁八(2)号线设备字第 2009-B008 号/B009 号 验收日期: 2011-12-9

列车编号:

车辆编号	产品图号	备注
080141	SFM12	
080142	SFM12	
080143	SFM12	
080144	SFM12	
080145	SFM12	
080146	SFM12	

该列车在用户现场经过整备调试后,未发现较大的质量问题,经预验收小组对车辆相关资料进行审查、确认,对车辆实体进行检查,其产品质量已基本达到设计图纸及合同、规范要求,通过预验收。

遗留问题: 18 项

车辆制造单位应采取措施对上述设备检验和验收过程中出现的问题在本预验收证书签发日后 15 天内或合同双方另行商定的时间内进行修正。

买方签字:

卖方签字:

监理签字:

日期:

2011.12.9

Pre-acceptance Certificate (Train No. 14)

Vehicle Pre-acceptance Certificate

Contract No.: Metro Line eight (2) Equipment No. 2009-B008/B009

Acceptance date: December 9, 2011

Train No.:

Vehicle No.	Drawing No. of product	Remarks
080141	SFM12	
080142	SFM12	
080143	SFM12	
080144	SFM12	
080145	SFM12	
080146	SFM12	

No significant quality issues were found on the train after preparation and commissioning on user's site; and the vehicle entity was checked after the pre-acceptance team has reviewed and confirmed the materials relevant to the vehicle, and the product quality can be basically meet the requirements of design drawing, contract and specification, thus the train can pass the pre-acceptance.

Remaining problems: 18 items

The vehicle manufacturing unit shall take measures to rectify all the problems found during the inspection and acceptance of the above equipments within 15 days after issuing the pre-acceptance certificate or within the time agreed by both parties of the contract.

Signature of Buyer: Yang Feng [signature] Signature of Seller: [signature]

Signature of Supervisor: Yun Enhua [signature]

Date: December 9, 2011

6. Beijing Metro Daxing Line Project

北京市轨道交通大兴线车辆系统（第一批）

工程竣工验收意见

2010年11月8日，在北京市交通委员会运输管理局的指导和监督下，建设单位组织设计、监理、供货商、运营等单位以及有关专家成立验收小组，在预验收合格的基础上，北京市轨道交通大兴线车辆系统在北京京地地铁有限公司、南车青岛四方机车车辆股份有限公司对18列车（第一批）进行全面检查的基础上，进行了竣工验收检查、试验，形成以下验收意见：

1. 车辆符合设计和国家、地方现行相关验收标准、规范等要求；
2. 车辆功能满足设计、合同、运营等要求；
3. 车辆外观质量良好；
4. 车辆履历簿、合格证、试验报告、图纸等相关资料齐全、齐全、有效。

验收小组一致意见：北京市轨道交通大兴线车辆系统（第一批 061-078 共 18 列）通过竣工验收，同意这 18 列车投入试运行。

验收小组人员签名

序号	单位	姓名	签字	序号	单位	姓名	签字
1	专家	皮少洋	皮少洋	10	咨询公司	杨皓	杨皓
2	专家	李平	李平	11	咨询公司	张弘江	张弘江
3	专家	侯恩华	侯恩华	12	南车四方	陈恩	陈恩
4	专家	刘和生	刘和生	13	南车四方	冯全克	冯全克
5	专家	谭国柏	谭国柏	14	南车四方	安伟	安伟
6	运输局	刘明岭	刘明岭	15	京港地铁	黄鑫江	黄鑫江
7	运输局	刘书明	刘书明				
8	建安公司	曾建宏	曾建宏				
9	建安公司	李存成	李存成				

Certificate of Completion Acceptance (All 33 trains)

Project Completion and Acceptance Comments of Beijing Metro Daxing Line Vehicle System (First Batch)

On November 8, 2010, under the instruction and supervision of Beijing Municipal Transportation Committee and Transportation Management Bureau, the construction unit organized the design, supervision, supplier, operation units and relevant experts to form an acceptance group. On the basis of the overall inspection of 18 trains (first batch) by Beijing MTR Corporation and CSR Qingdao Sifang Co., Ltd., completion acceptance inspection and test has been performed for the Beijing Metro Daxing Line Vehicle System and the following acceptance comments has been formed:

1. The vehicles conform to the design and the existing national and local acceptance standards and specification;
2. The function of vehicles can conform to the requirements of design, contract, operation, etc.;
3. The appearance of vehicles is in good conditions;
4. All the vehicle record book, qualification certificate, test report, drawings are real, complete and valid.

Agreement of the acceptance group: Beijing Metro Daxing Line Vehicle System (First Batch 061-078, 18 in total) has passed the completion acceptance and the 18 trains are agreed to be put into trail operation.

Signatures of acceptance group personnel

No.	Unit	Name	Signature	No.	Unit	Name	Signature
1	Expert	Qian Menglin	[signature]	10	Consulting company	Yang Heng	[signature]
2	Expert	Li Ping	[signature]	11	Consulting company	Zhang Zhenjiang	[signature]
3	Expert	Yun Enhua	[signature]	12	CSR Sifang	Chen Xun	[signature]
4	Expert	Liu Hesheng	[signature]	13	CSR Sifang	Feng Qianke	[signature]
5	Expert	Tan Kangbei	[signature]	14	CSR Sifang	Wu Wei	[signature]
6	Transportation Bureau	Liu Minghai	[signature]	15	Beijing MTR Corporation	Dong Xinhui	[signature]
7	Transportation Bureau	Liu Shuming	[signature]				
8	Construction management company	Cao Jiantang	[signature]				
9	Construction management company	Li Chunheng	[signature]				

6. Beijing Metro Daxing Line Project (con't)

北京轨道交通车辆系统工程（第二批）

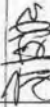

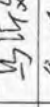
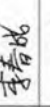


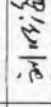


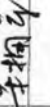



竣工验收意见

2010年12月9日，在北京市交通委员会运输管理局的指导和监督下，建设单位组织设计、监理、施工、运营等单位以及有关专家成立验收小组，在预验收合格的基础上，对北京轨道交通大兴线第二批8列车辆（079-086）的工程实体、内业资料、观感质量、使用功能等进行了竣工验收检查、试验，形成以下验收意见：

- 1、车辆实体质量满足设计和国家、地方现行相关验收标准、规范等要求。
- 2、车辆功能满足设计、合同等功能要求；
- 3、车辆外观质量良好；
- 4、车辆履历簿、合格证、试验报告、图纸等相关资料真实、齐全、有效；

验收小组一致同意：北京轨道交通大兴线第二批八列车辆（079-086）通过竣工验收，同意这8列车投入试运营。

验收小组人员签名

序号	单位	姓名	签字	序号	单位	姓名	签字
1	专家	刘文明		8	建管公司	曹建堂	
2	专家	马研文		9	建管公司	李春成	
3	专家	黄慧华		10	招拆中心	傅丹丹	
4	专家	赵燕红		11	咨询公司	张义	
5	运输局	刘明辉		12	南车四方	冯金亮	
6	运输局	刘书明		13	南车四方	宋细军	
7	专家（京港公司）	董鑫汇					

Completion and Acceptance Comments of Beijing Metro Vehicle System Project














(Second Batch)

On December 9, 2010, under the instruction and supervision of Beijing Municipal Transportation Committee and Transportation Management Bureau, the construction unit organized the design, supervision, construction, operation units and relevant experts to form an acceptance group. On the basis of qualified pre-acceptance, it performed completion acceptance inspection and test for the engineering entity, industry data, appearance quality, using function, etc. of second batch 8 trains (079-086) of Beijing Metro Daxing Line, forming the following acceptance comments:

1. The vehicle entity quality conforms to the design and the existing national and local acceptance standards and specification;
2. The function of vehicles can conform to the requirements of design, contract, etc;
3. The appearance of vehicles is in good conditions;
4. All the vehicle record book, qualification certificate, test report, drawings are real, complete and valid.

Agreement of the acceptance group: Beijing Metro Daxing Line second batch eight trains (079-086) have passed the completion acceptance and the 8 trains are agreed to be put into trail operation.

Signatures of acceptance group personnel

No.	Unit	Name	Signature	No.	Unit	Name	Signature
1	Expert	Liu Wenming		8	Construction management company	Cao Jiantang	
2	Expert	Ma Ywen		9	Construction management company	Li Chuncheng	
3	Expert	Yun Enhua		10	Command center	Cheng Dandan	
4	Expert	Zhao Yanhong		11	Consulting company	Zhang Yi	
5	Transportation Bureau	Liu Minghai		12	CSR Sifang	Feng Quanke	
6	Transportation Bureau	Liu Shuming		13	CSR Sifang	Song Yongjun	
7	Expert (MTR Corporation)	Dong Xinhui					



7. Beijing Metro Changping Line Project

车辆最终验收证书

合同编号：地铁昌平线设备第 2010-B068 号

日期：2013-3-13

列车编号	产品型号	备注
CP0011	SFM13	
CP0012	SFM13	
CP0013	SFM13	
CP0014	SFM13	
CP0015	SFM13	
CP0016	SFM13	

该列车于 2010 年 12 月 14 日完成竣工验收，通过两年质保期的稳定运行，产品质量已达到合同规范要求，通过最终验收。

建设单位签字：

林-芳

运营单位签字：

林-芳

监理单位签字：

李-芳

制造单位签字：

郭-芳

日期：

Final Acceptance Certificate (Train No. 1)

Final Acceptance Certificate of Vehicle

Contract No.: Metro Changping Line Equipment No. 2010-B068

Acceptance date: March 13, 2013

Train No.	Drawing No. of product	Remarks
CP0011	SFM13	
CP0012	SFM13	
CP0013	SFM13	
CP0014	SFM13	
CP0015	SFM13	
CP0016	SFM13	

The train was completed and accepted on December 14, 2010. After stable operation within the two-year warranty period, the product quality has met the requirements in the contract and specification. Therefore, the train has passed the final acceptance.

Signature of construction unit:

Yang Feng [signature]

Signature of operation unit:

[signature]

Signature of supervision unit:

Yun Enhua [signature]

Signature of manufacturing unit:

Hao Chenyang [signature]

Date:

Final Acceptance Certificate (Train No. 15)

Final Acceptance Certificate of Vehicle

Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

7. Beijing Metro Changping Line Project (cont')

车辆最终验收证书

合同编号: 地铁昌平线设备第 2010-B068 号 日期: 2013-3-13

列车编号	产品图号	备注
CP00151	SFM13	
CP00152	SFM13	
CP00153	SFM13	
CP00154	SFM13	
CP00155	SFM13	
CP00156	SFM13	

该列车于 2011 年 1 月 14 日完成竣工验收, 通过两年质保期的稳定运行, 产品质量已达
到合同规范要求, 通过最终验收。

建设单位签字:  运营单位签字: 

监理单位签字:  制造单位签字: 


日期:



Contract No.: Metro Changping Line Equipment No. 2010-B068
Acceptance date: March 13, 2013

Train No.	Drawing No. of product	Remarks
CP00151	SFM13	
CP00152	SFM13	
CP00153	SFM13	
CP00154	SFM13	
CP00155	SF 13	
CP00156	SFM13	

The train was completed and accepted on January 14, 2011. After stable operation within the two-year warranty period, the product quality has met the requirements in the contract and specification. Therefore, the train has passed the final acceptance.

Signature of construction unit:
Yang Feng 

Signature of operation unit:


Signature of supervision unit: Yun Enhua  Signature of manufacturing unit: Hao
Chenyang 

Date:

8. Chengdu Metro Line 2 First-stage Project

成都地铁2号线一期工程地铁车辆

初步验收证书

合同名称: 成都地铁2号线一期工程地铁车辆采购合同

合同号: 2DO228-2010-005-CG030

初步验收日期: 2012年8月24日

列车编号: 10201车-10223车 (共23列)

设备名称	预验收情况	备注
2号线一期工程 地铁车辆	2012年7月13日所有车辆完成实体 预验收。 2012年8月5日所有车辆完成5000 公里稳定运行。	

上述货物按合同专用条款18.8条款之规定, 卖方已按本合同要求
提供全部货物及质量保证期之前的服务, 特此证明。

初步验收证书签字地点: 成都

初步验收证书签字日期: 2012年8月24日

买方授权代表



成都地铁有限责任公司 (公章)

Preliminary Acceptance Certificate

Metro Vehicle of Chengdu Metro Line 2 Phase I Project

Preliminary Acceptance Certificate

Contract Name: Metro Vehicle Procurement Contract of Chengdu Metro Line 2 Phase I Project

Contract No.: 2DO228-2010-005-CG030

Signing date of preliminary acceptance: August 24, 2012

Train No.: Train No. 10201-10223 (23 trains in total)

Equipment description	Pre-acceptance condition	Remarks
Metro vehicle of line 2 Phase I project	Entity pre-acceptance was been completed for all trains on July 13, 2012. All trains had completed 5000 km stable operation by August 5, 2012.	

As specified in Clause 18.8 of special terms and conditions, for the above goods, hereby certify
that the Seller has provided all goods and service within the warranty period.

Signing place of Preliminary Acceptance Certificate: Chengdu

Signing date of Preliminary Acceptance Certificate: August 24, 2012

Authorized representative of the Buyer (signature): [signature]



Chengdu Metro Co., Ltd [seal]

9. Electric Passenger Vehicle Purchasing Project of Beijing Metro Line 14

附表十

车辆竣工验收证书

合同编号：地铁14号线设备字第2012-0068号 验收日期：2013年4月25日

列车编号：239	车辆编号	产品型号	备注
	239TC1	SFM18TC1-000-00000	TC
	239MP1	SFM18MP1-000-00000	MP
	239M1	SFM18M1-000-00000	M
	239M2	SFM18M2-000-00000	M
	239MP2	SFM18MP2-000-00000	MP
	239TC2	SFM18MTC2-000-00000	TC

该列车在用户现场经过预验收及试运行后，未发现较大的质量问题，经竣工验收小组对车辆相关资料进行审查、确认，对车辆实体进行检查，其产品质量基本已达到设计图纸及合同、规范要求，通过竣工验收。

遗留问题：_____项

车辆制造单位应采取措施对上述设备检验和验收过程中出现的问题在本竣工验收证书签发日后15天内或合同双方另行商定的时间内进行修正。

买方签字：[Signature]	卖方签字：郝磊阳
监理签字：[Signature]	用户签字：[Signature]
日期：_____	

1/1

Pre-acceptance Certificate (Train No. 1)

Table 10

Vehicle Pre-acceptance Certificate

Contract No.: Metro Line 14 Equipment No. 2012-B068 Acceptance date: April 25, 2013

Train No.: 239	Vehicle No.	Drawing No. of product	Remarks
	239TC1	SFM18TC1-000-00000	TC
	239MP1	SFM18MP1-000-00000	MP
	239M1	SFM18M1-000-00000	M
	239M2	SFM18M2-000-00000	M
	239MP2	SFM18MP2-000-00000	MP
	239TC2	SFM18MTC2-000-00000	TC

No significant quality issues were found in the train after pre-acceptance and trial operation on user's site; and the vehicle entity was checked after the completion acceptance team has reviewed and confirmed the materials relevant to the vehicle, and the product quality can be basically up to the requirements of design drawing, contract and specification, thus the train can pass the completion acceptance.

Remaining problems: _____ items

The vehicle manufacturing unit shall take measures to rectify all the problems found during the inspection and acceptance of the above equipments within 15 days after issuing the completion acceptance certificate or within the time agreed by both parties of the contract.

Signature of Buyer: Yang Hui [signature]	Signature of Seller: Hao Chenyang [signature]
Signature of Supervisor: Yun Enhua [signature]	Signature of user: Dong Jinghua [signature]
Date:	



9. Electric Passenger Vehicle Purchasing Project of Beijing Metro Line 14 (cont')

附表十

车辆竣工验收证书

合同编号: 地铁14号线设备字第2012-B068号 验收日期: 2013年4月25日

列车编号: 247

车辆编号	产品图号	备注
247TC1	SFM18TC1-000-00000	TC
247MP1	SFM18MP1-000-00000	MP
247M1	SFM18M1-000-00000	M
247M2	SFM18M2-000-00000	M
247MP2	SFM18MP2-000-00000	MP
247TC2	SFM18TC2-000-00000	TC

该列车在用户现场经过预验收及试运行后,未发现较大的质量问题,经竣工验收小组对车辆相关资料进行审查、确认,对车辆实体进行检查,其产品质量基本已达到设计图纸及合同、规范要求,通过竣工验收。

遗留问题: 项

车辆制造单位应采取措施对上述设备检验和验收过程中出现的问题在本竣工验收证书签发日后15天内或合同双方另行商定的时间内进行修正。

买方签字:

卖方签字:

监理单位:

用户签字:

日期:

1/1

Pre-acceptance Certificate (Train No. 8)

4 Table 10

Vehicle Pre-acceptance Certificate

Contract No.: Metro Line 14 Equipment No. 2012-B068 Acceptance date: April 25, 2013

Train No.: 247

Vehicle No.	Drawing No. of product	Remarks
247TC1	SFM18TC1-000-00000	TC
247MP1	SFM18MP1-000-00000	MP
247M1	SFM18M1-000-00000	M
247M2	SFM18M2-000-00000	M
247MP2	SFM18MP2-000-00000	MP
247TC2	SFM18MTC2-000-00000	TC

No significant quality issues were found in the train after pre-acceptance and trial operation on user's site; and the vehicle entity was checked after the completion acceptance team has reviewed and confirmed the materials relevant to the vehicle, and the product quality can be basically up to the requirements of design drawing, contract and specification, thus the train can pass the completion acceptance.

Remaining problems: items

The vehicle manufacturing unit shall take measures to rectify all the problems found during the inspection and acceptance of the above equipments within 15 days after issuing the completion acceptance certificate or within the time agreed by both parties of the contract.

Signature of Buyer:

Signature of Seller:

Yang Hui [signature]

Hao Chenyang [signature]

Signature of Supervisor:

Signature of user:

Yun Enhua [signature]

Huang Jinghua [signature]

Date:

10. Purchasing Project for Motor Vehicle for Branch Lines of Guangzhou Metro Line 4 and Line 5

最终验收证书

正本 三份 副本 壹份

最终验收日期: 2011 年 12 月 14 日

合同编号: J4SB076

列车编号/备品备件及设备、材料序号:

数量	设备、材料状况	批注
1	第 30 列车	<p>本列车通过有条件最终验收是基于附件所列之条件:</p> <p>1、 共同开口项还在质保范围内, 延长质保期将从问题解决之日起开始计算 (共同开口项详见《广州地铁四号线列车最终 PWC 讨论会议纪要》);</p> <p>2、 本列车维修过的人部件的延长质保期见附件 1。</p>

试运行开始日期

试运行期限/公里数

试运行结束日期

预验收证书签发期

保证期开始日期

合同规定保证期限

合同规定最终验收日期

附件:

1、 更换部件清单

最终验收证书签字人:

(证书签字地点和日期)

(签字)

(签字)

买方 (印刷体)

卖方 (印刷体)

签字人姓名

签字人姓名

(印刷体)

(印刷体)

Final Acceptance Certificate (Last Train)

Final Acceptance Certificate

Original copy 3 copies Duplicate copy 0 copies

Contract No.: J4SB076 Final acceptance date: December 14, 2011

Train No./ No. of spare parts and other equipments and materials:

Quantity	Equipment and material condition	Remarks
1	Train No. 30	<p>The train has passed the conditional final acceptance basing on the conditions listed in the attachment</p> <p>1. The joint opening items are still within warranty scope, and</p> <p>2. See Attachment 1 for the prolonged warranty period for large parts repaired in the train.</p>

Beginning date of trial operation

Time limit/mileage of trial operation

Ending date of trial operation

Issuing date of pre-acceptance certificate

Starting date of warranty

Warranty period specified in the contract

Final acceptance date specified in the contract

Attachment:

1. Replacement parts list

Signature of final acceptance certificate:

(Signature)

[signature]

Buyer (printed)

Name of signatory

(Printed)

(Certificate signing place and date)

(Signature) Xia Chuanren [signature]

Hao Chengyang Zhang Liang

[signature]

Buyer (printed)

Name of signatory

(Printed)



11. Electric Passenger Vehicle Project of Beijing Metro Line 1 Blanking Engineering

最终验收证书

合同编号: CL-XY-001 (CL-XYFB-001) 日期: 2010 年 11 月 15 日

列车编号/备品备件及其他设备、材料序号:

数量	设备、材料状况	批 注
8 列	第 13 列车 -第 20 列车	G444-G451 车组已于 2008 年 2 月 28 日 ~2008 年 6 月 25 日进行了预验收, 列车各项指 标符合合同要求, 2 年质保期内车辆运营情况 良好, 最终验收予以通过。

保证期开始日期

2008 年 7 月 7 日

合同规定保证期期限

按合同规定

合同规定最终验收日期

2010 年 7 月 7 日

买方代表:

卖方代表:

3. Electric Passenger Vehicle Project of Beijing Metro Line 1 Blanking Engineering

Final Acceptance Certificate (Last Train)

Pre-acceptance Certificate

Contract No. CL-XY-001 (CL-XYFB-001) Date: November 15, 2010

Train No./ No. of spare parts and other equipments and materials:

Quantity	Equipment and material condition	Remarks
8 trains	Train No. 13 - Train No. 20	G444-G451 EMU had been pre-accepted on February 28, 2008 to June 25, 2008, with each index of the train conforming to the requirements in the contract and good operation within 2 years of warranty period. The final acceptance was qualified

Starting date of warranty: July 7, 2008

Warranty period specified in the contract: as specified in the contract

Final acceptance date specified in the contract: July 7, 2010

Representative of the Buyer:

Xu Yanhua [signature]

Representative of the Seller:

Chen Xun [signature]



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

12. Linear Motor Vehicle of Guangzhou Metro Line 6

Project was recently completed. No Certificate of Acceptance has been received to date.



13. Extension Project for Linear Motor Vehicle of Guangzhou Metro Line 5

供应商: 南车青岛四方

Supplier: CSR Sifang

广州地铁五号线增购自主知识产权车辆
预验收证书的质量报告
(PAC)

Guangzhou Metro Line 5 Quality Report of Provisional
Acceptance Certificate for the Added Vehicles with
Independent Intellectual Property (PAC)

列车号: 05A121-05B121-05C121-05D122-05E122-05A122
车辆编号: NO.61

Train No.: 05A121-05B121-05C121-05D122-05E122-05A122

原车的分发:

Vehicle No.: NO.61

南车青岛四方

广州地铁

郭良平

3/12/2014

Distribution of original copies:

CSR Sifang: Hao Chenyang [signature]

备注: 本质量报告是原车的自主知识产权预验收证书, 在验收合格后, 由供应商分发到其余两个业主的持有者手中。

Guangzhou Metro: [signature]

Remarks: any changes for the signed original copies can only be performed on the main original copies, and then it shall be distributed to the holders of other three original copies in the form of "reversion of main original copy".

13. Extension Project for Linear Motor Vehicle of Guangzhou Metro Line 5

预验收证书

合同编号: Y10SBA050003 预验收日期: 2013年12月13日
 车辆型号/备品备件及其他设备、材料序号:

数量	设备、材料状况	备注
1		

试运行开始日期: /
 试运行结束日期: /
 试运行开始日期: /
 合同规定质保期限: 2年
 合同规定最终验收日期: /

预验收证书签字人: (证书签字地点和日期)

邢磊 2013.12.13

买方 签字人姓名

3

素 2013.12.13

Final Acceptance Certificate

Original copy 2 copies Duplicate copy 0 copies

Contract No.: Y10SBA050003 Final acceptance date: December 13, 2013

Train No./ No. of spare parts and other equipments and materials:

Quantity	Equipment and material condition	Remarks
1		

Beginning date of trial operation: /
 Time limit/mileage of trial operation: /
 Ending date of trial operation: /
 Starting date of warranty: /
 Warranty period specified in the contract: 2 years
 Final acceptance date specified in the contract: /

Signature of pre-acceptance certificate: (Certificate signing place and date)

[signature] (Hao Chenyang) December 13, 2013

Buyer (printed)

Name of signatory

Name of signatory



14. Metro Vehicle Purchasing Project of Chengdu Metro Line 2
Second-Stage Project

*Project was recently completed. No Certificate of Acceptance has
been received to date.*

15. Updated Electric Passenger Vehicle Purchasing Project of Beijing Metro Line 1

预验收证书

合同号: CL-GX-001 日期: 2012年7月26日
列车编号/备品备件及其他设备、材料序号:

数量	设备/材料状况	批 注
1	G461	新造G461车组于2012年4月13日正式上线, 已经过5000公里试运营, 经北京地铁运营二分公司、北京地铁车辆装备有限公司共同验证确认, 列车基本符合合同规定要求, 预验收合格。 列车存在的开口项见附件。

试运营开始日期: 2012年4月13日
试运营期限/公里数: 31598.4公里
试运营结束日期: 2012年7月16日

卖方应采取措施对上述设备检验和验收过程中出现的全部错误和疏漏在本预验收证书签发日后15天内或合同双方另行商定的时间内进行修正。

北京地铁运营二分公司

签字: 

日期: 2012.8.10

南车青岛四方机车车辆股份有限公司

签字: 

日期: 2012.7.30

北京地铁车辆装备有限公司

签字: 

日期: 2012.7.26

Pre-acceptance Certificate (Last Train)

Pre-acceptance Certificate

Contract No. CL-GX-001 Date: July 26, 2012

Train No./ No. of spare parts and other equipments and materials:

Quantity	Equipment / material condition	Remarks
1	G461	The newly built G461 EMU was put into service on April 13, 2012 and had operated for 5000 km. Being verified and confirmed by both Second Branch of Beijing Subway Operation Co., Ltd and Beijing Subway Rolling Stock Equipment Co. Ltd, the train could basically conform to the requirements specified in the contract and the pre-acceptance was qualified. For open items of the train, see the attachment.

Beginning date of trial operation: April 13, 2012

Period / mileage of trial operation 31598.5 km

Ending date of trial operation: July 16, 2012

The Seller shall take measures to rectify all the mistakes and omissions found during the inspection and acceptance of the above equipments within 15 days after issuing the pre-acceptance certificate or within the time agreed by both parties of the contract.

Second Branch of Beijing Subway Operation Co., Ltd

Signature: Wang Guangxing [signature]

Date: August 10, 2012

CSR Qingdao Sifang Co., Ltd.

Signature: Hao Chenyang [signature]

Date: July 30, 2012

Beijing Subway Rolling Stock Equipment Co. Ltd

Signature: Li Jianmin [signature]

Date: July 26, 2012



Proposal for MBTA RFP No. CAP 27-10, Red/Orange Line New Vehicle Procurement

16. Purchasing Project of Qingdao Metro Vehicle First-Stage Project
Project is ongoing. No Certificate of Acceptance has been received to date.



17. Extended Train Project of Beijing Metro Line 4

车辆竣工验收证书

合同名称/合同号:

北京地铁线工程增购 13 列电动客车采购合同/BJ481

北京地铁线工程增购 13 列电动客车电气牵引系统采购合同/BJ481A

验收日期: 2013 年 12 月 20 日

列车编号: 041, 042, 043, 044, 045, 046, 047, 048, 049, 050, 051, 052, 053		
车辆编号	产品图号	备注
TC1	SFM05TC1-000-00000(1)B	
M1	SFM05M1-000-00000(1)B	
M3	SFM05M2-000-00000(1)B	
T3	SFM05M3-000-00000(1)B	
M2	SFM05T3-000-00000(1)B	
TC2	SFM05TC2-000-00000(1)B	

该列车在用户现场经过预验收及试运行后,未发现较大的质量问题,经竣工验收小组对车辆相关资料进行审查、确认,对车辆实体进行检查,其产品质量基本已达到设计图纸及合同、规范要求,通过竣工验收。

遗留问题: 1 项

车辆制造单位应采取措施对上述设备检验和验收过程中出现的问题在本竣工验收证书签发日后 15 天内或合同双方另行商定的时间内进行修正。

买方签字:

卖方签字:

监理签字:

用户签字:

日期: 2013.12.20

Vehicle Pre-acceptance Certificate

Contract designation/No.:

Procurement Contract for Extending 13 Electric Passenger Vehicles of Beijing Metro Line/BJ481

Procurement Contract for Extending Electrical Traction System for 13 Electric Passenger Vehicles of Beijing Metro Line/BJ481A

Acceptance date: December 20, 2013

Train No.: 041, 042, 043, 044, 045, 046, 047, 048, 049, 050, 051, 052, 053

Vehicle No.	Drawing No. of product	Remarks
TC1	SFM05TC1-000-00000(1)B	
M1	SFM05M1-000-00000(1)B	
M3	SFM05M2-000-00000(1)B	
T3	SFM05M3-000-00000(1)B	
M2	SFM05T3-000-00000(1)B	
TC2	SFM05TC2-000-00000(1)B	

No significant quality issues were found in the train after pre-acceptance and trial operation on user's site; and the vehicle entity was checked after the completion acceptance team has reviewed and confirmed the materials relevant to the vehicle, and the product quality can be basically up to the requirements of design drawing, contract and specification, thus the train can pass the completion acceptance.

Remaining problems: 1 item

The vehicle manufacturing unit shall take measures to rectify all the problems found during the inspection and acceptance of the above equipments within 15 days after issuing the completion acceptance certificate or within the time agreed by both parties of the contract.

Signature of Buyer:
Huang Jinghua [signature]

Signature of Seller:
[signature]

Signature of Supervisor:
Huang Jinghua [signature]

Signature of user:
Huang Jinghua [signature]

Date: December 20, 2013



18. Connecting Line Project Between Beijing Metro Changping Line and Beijing Metro Line 8

车辆竣工验收证书

合同编号: 地铁昌平联络线设备第2012-B016/017号 验收日期: 2013年10月31日
列车编号: 08036

车辆编号	产品图号	备注
080361	SFM12	Tc
080362	SFM12	M0
080363	SFM12	T0
080364	SFM12	M1
080365	SFM12	M0
080366	SFM12	Tc

该列车在用户现场经过预验收及试运行后,未发现较大的质量问题,经竣工验收小组对车辆相关资料进行审查、确认,对车辆实体进行检查,其产品质量已达到设计图纸及合同、规范要求,通过竣工验收。

遗留问题: _____ 项

车辆制造单位应采取有效措施对上述设备检验和验收过程中出现的问题在本竣工验收证书签发日后15天内或合同双方另行商定的时间内进行修正。

各方签字:

建设单位:

杨峰

运营单位:

曾宪钧

制造单位:

谷峰

制造单位: 谷峰

日期:

Vehicle Pre-acceptance Certificate

Contract No.: equipment No. 2012-B016/017 for liaison line for Metro Changping Line and Beijing Metro Line 8
Acceptance date: October 31, 2013

Train No.: 08036

Vehicle No.	Drawing No. of product	Remarks
080361	SFM12	TC
080362	SFM12	M0
080363	SFM12	T0
080364	SFM12	M1
080365	SFM12	M0
080366	SFM12	TC

No significant quality issues were found in the train after pre-acceptance and trial operation on user's site; and the vehicle entity was checked after the completion acceptance team has reviewed and confirmed the materials relevant to the vehicle, and the product quality can be up to the requirements of design drawing, contract and specification, thus the train can pass the completion acceptance.

Remaining problems: _____ items

The vehicle manufacturing unit shall take measures to rectify all the problems found during the inspection and acceptance of the above equipments within 15 days after issuing the completion acceptance certificate or within the time agreed by both parties of the contract.

Signature of each party:

Signature of Buyer:

Yang Feng [signature]

Signature of Seller:

Zeng Xianjun [signature]

Signature of Supervisor:

Yun Enhua [signature]

Signature of user:

[signature]

Date:

TAB I.4

TAB I.4 QUALITY ASSURANCE PLAN

I.4A. QUALITY SYSTEMS MANUAL (QSM) AND PROJECT QUALITY PLAN (PQP)

GENERAL OVERVIEW

CSR Sifang JV, through JV member CSR Sifang, currently has the capacity to produce over 1,000 world class metro cars per year. The CSR Sifang JV (including subcontractors and suppliers) has made a serious commitment to the principles of quality assurance (QA) in support of the MBTA CAP27-10 Orange and Red Line Car Project. CSR Sifang JV (and its candidate subcontractors and suppliers) have extensive experience providing quality assurance programs for substantially similar rail transit projects worldwide (sample customers): Beijing Metro & Subway, Singapore Metro (Aluminum Alloy Carbody) , Buenos Aires (Argentina) Metro Line (carbon steel carbody) , Guangzhou- Foshen metro Line (Aluminum Alloy Carbody), Tianjin Metro, Shenyang Metro, Chengdu Metro, and several others. Since 2003 CSR Sifang JV team member CSR Sifang has designed and manufactured 1,998 metro vehicles in total, with operating at speeds of 80-90 km/h.

The proposed CSR Sifang JV integrated, team based approach to design, manufacture, program management, and quality assurance activities has developed through years of successful participation in the transit industry by CSR Sifang (and qualified subcontractors). The organization of these activities will be designed to minimize the need for documented procedures and optimize response time to the MBTA and project concerns. The proposed program will provide for the proper and adequate controls to assure conformance to the technical and quality requirements of this project.

CSR Sifang JV's primary quality objectives for this project are:

- To comply with all agreed and implied requirements of the MBTA RFP CAP27-10 including all issued addendum
- To continuously monitor and optimize quality processes in the light of application-specific experience in order to achieve economic efficiency, on-time delivery and maximum benefits for the customer
- To comply with statutory requirements, guidelines, standards, and established rules of technology and environmental protection that affect any CSR Sifang JV product
- To reduce costs by eliminating wastes and prevent non-conformances
- To effectively implement and manage QSM by all subcontractors and suppliers
- To put into practice sustainability and clean tech practices
- To uphold teamwork and work effectively in groups.

CSR SIFANG JV RESPONSIBILITIES

CSR Sifang JV is ultimately responsible for all manufactured, purchased, or assembled components on this project. CSR Sifang JV will also be ultimately responsible for integrating all systems from major subcontractors and sub suppliers into the overall car design and ensure that all subcontracted systems comply with the requirements of this contract. The proposed CSR Sifang JV General Project Manager for the MBTA CAP27-10 project will execute this responsibility.

Within 90 days after NTP, CSR Sifang JV will submit a detailed quality assurance plan to MBTA for review and approval. This proposed Quality Plan will describe the following (at a minimum):

- CSR Sifang JV organization and the personnel to be used to perform the quality assurance/quality control activities for this project
- Requirements of the program
- Method of implementation
- Methods to be used
- Methods of detecting and correcting non-compliances
- Formation of a Failure Review Board (FRB) from CSR Sifang JV and MBTA
- Use of third party assessors.

QUALITY ASSURANCE APPROACH

The basic principle of the CSR Sifang JV Quality Assurance approach for the MBTA CAP27-10 project includes the following:

- Utilizing only experienced QA professionals
- Detailed plan development (defining structure, policies, and procedures)
- Ensuring equipment and system manufacturing activities based on ISO BS, EN, DIN, UIC, IEC, GB and TB standards and specifications
- Continuous improvement on subcontractor monitoring and controls
- Creating QA guidelines using proven methods.

QUALITY SYSTEM ACTIVITIES WILL BE FUNCTIONALLY DEFINED AND DIVIDED INTO TWO CATEGORIES:

- **Project Quality Plan (PQP)** will be responsible for quality assurance activities of the CSR Sifang JV project team representing quality concerns, participating in product design reviews, reporting schedule requirements and communicating with the MBTA CAP27-10 project team for the full duration of the contract;
- **Subcontractor/Supplier Quality Assurance** will be responsible for quality assurance activities at various subcontractor and sub supplier facilities. Working directly with the CSR Sifang JV project Quality Assurance manager, the CSR Sifang JV Final Assembly Site Manager will provide supervisory QA support to the final assembly contractor.

Working together, these sections will ensure that the CSR Sifang JV team products and services meet or exceed the technical and quality requirements of both CSR Sifang JV and the MBTA.

Technical requirements required of the project will be developed by CSR Sifang engineering resources. The engineering team, consisting of qualified design engineers, will utilize a disciplined development process which includes multiple design reviews and product prototyping to optimize the product design. Functional testing and computer simulation of the prototype equipment will validate the requirement that the design output can meet the design input. To facilitate a more efficient development process, CSR Sifang JV will dispatch engineering personnel to key candidate subcontractor facilities to interact and

work with other team members to create the highest quality product possible. At the conclusion of the development process, the product design will be fully documented via component and assembly (shop) drawings, computer based bills of materials, and various standards and specifications.

Inspections and tests will be performed throughout the duration of the contract to ensure that all work performed and all results produced fully conform to the requirements of this contract. It is understood that the quality assurance requirements specified by CSR Sifang JV are complementary to the requirements specified in other parts of the MBTA CAP27-10 Boston Orange and Red Line contract.

ISO CERTIFIED QUALITY ASSURANCE

CSR Sifang JV proposed quality assurance program for the MBTA CAP27-10 project is based upon the ISO 9000 and ISO 9001:2008 registration. This program is periodically reviewed to ensure continued suitability, effectiveness, and compliance with both ISO standards and MBTA requirements. These reviews include assessments of the results of internal quality audits, interdepartmental feedback, and MBTA feedback. Further, these inputs are utilized as the basis for updating procedures and practices. The ISO 9001:2008 standard sets forth twenty (20) requirement areas for a quality system as highlighted in TABLE I.4-1: 'ISO 9001 Quality System Requirements' (below).

**TABLE I.4-1
ISO 9001 Quality System Requirements**

1.	Management Responsibility	11.	Control of Inspect., Measuring, Test Equip.
2.	Quality System Manual (QA policy)	12.	Inspection and Test Status
3.	Contract Review	13.	Control of Non-conforming Product
4.	Design Control	14.	Corrective and Preventive Action
5.	Document and Data Control	15.	Handling, Storage, Packaging, Pres., Del.
6.	Purchasing	16.	Control of Quality Records
7.	Sub-contractor/supplier management	17.	Internal Quality Audits
8.	Product Identification & Traceability	18.	Training
9.	Process Control of Mfg Production	19.	Servicing
10.	Calibration, Inspection and Testing	20.	Statistical Techniques

CSR Sifang has successful ISO registrations at several of its' corporate facilities. CSR Sifang JV's final assembly plant for this MBTA project will be made ISO 9001:2008 certified. To insure timeliness, effectiveness, and compliance with all MBTA requirements and applicable ISO standards, the proposed JV Sifang QA system manual will be continually reviewed and updated noting project specific issues and functionality. A current copy of CSR Sifang ISO certificate is illustrated in FIGURE I.4-1: "ISO9001:2008 Certificate".

CERTIFIED INTERNATIONAL RAILWAY INDUSTRY STANDARD (IRIS)

The International Railway Industry Standard (IRIS) is the international sector specific standard for the railway industry, designed to improve modern, process-controlled and effective business processes. The standard aims to provide more quality and safety while at the same time lowering costs and complexity.

IRIS is based on the internationally recognized quality management standard ISO 9001, supplemented by the specific requirements of the railway sector. CSR Sifang's Management System has been certified to be in accordance with the requirements set forth in the IRIS for the activity of manufacturing, design, development, and maintenance in the scopes of IRIS certification 1(Carbody), 3 (Guidance), and 18 (Rolling Stock). CSR Sifang's certificate appears in FIGURE I.4-2: "Certificate of IRIS (International Railway Industry Standard)".

FIGURE I.4-1
ISO9001:2008 Certificate



FIGURE I.4-2
Certificate of IRIS (International Railway Industry Standard)



CSR SIFANG JV QUALITY AUDITS

CSR Sifang JV will perform audits of QMS, independent of the Project Specific audits described in the PQP. Regular and surprise quality audits are performed routinely to verify compliance with procedures for all activities affecting quality and the effectiveness of the CSR Sifang JV quality system. Qualified auditors, who have no responsibility over the organizational unit being audited, are selected to perform this work.

Any non-compliance detected during the course of an internal and external audit will require corrective action, which will be performed in accordance with CSR Sifang's established corrective and preventative action requirements. The responsibility for the implementation and effectiveness of all corrective actions is borne by the department or project managers of CSR Sifang JV team.

Project audits are included as a part of the CSR Sifang JV QMS. In addition to this annual audit plan, the Quality Assurance Manager for this project will establish a comprehensive system of periodic audits to verify compliance with all aspects of the quality assurance/quality control plan and to determine its relevance and effectiveness.

Audits will be performed on all works and services performed by CSR Sifang JV as well as work performed by suppliers and subcontractors and may be witnessed by MBTA. Specifics and frequency will be defined prior to NTP. MBTA may conduct independent audits any time during the execution of the contract. All audits will be performed in accordance with ISO 9000:2008 requirements.

DESIGN CONTROL

CSR Sifang utilizes a complete quality control system to ensure the product quality is maintained during the vehicle design, manufacturing, inspection and acceptance. It has established and maintains procedures to control and verify the design of product development (including latest revision control management), system planning, and project processing.

Design drawings and documents are internally reviewed, checked, and approved by responsible and qualified engineers. Project planning activities, organizational and technical interfaces, and review activities are included and updated within the planning documents of the various organizational units.

CSR Sifang JV will prepare a design review plan that will include organization chart of all department interfaces, including subcontractors and suppliers. The plan will be validated by the Quality Assurance Manager for the project and approved by the General Project Manager.

Design changes are dated, approved, released, and incorporated according to established procedures. CSR Sifang JV will maintain a database of design changes and will implement appropriate corrective actions based upon all design changes. The Quality Assurance Manager will monitor the process of design control. The forms used to convey, track, and account for design changes will be submitted with the quality systems manual. Particular attention is given to the approval process when dealing with any safety-related aspects.

DESIGN REVIEWS, VERIFICATION, AND VALIDATION

All design review activities, including respective areas of responsibility and authority, will be planned, established, and documented. Formal documented reviews of the design results (such as design reviews) are conducted taking into account all functions required at specified stages of the design. These reviews and meeting notes are documented and are maintained as required.

In addition to this, the design output is checked against the design input to ensure that the results meet the input requirements. These inspections and tests are conducted at the following times:

- During component, and subsystem manufacture/development
- Prior to the product being delivered to the MBTA at its operating location.

DESIGN CHANGES

The processing of a document or product that has been dated, approved/released is referred to as a design change and is performed according to established procedures. All design changes are identified, documented, reviewed, approved and tracked.

DOCUMENT AND DATA CONTROL

CSR Sifang JV will integrate fully proven control devices and methods to ensure satisfactory manufacturing inspection and control, including those required of documentation. The latest revision document control plan is an essential element of our overall configuration management effort. Control of approved inspection and testing requirement definitions, audits of plans and procedures, control tests, drawings, and standardized issuance of project-wide manuals, procedures, criteria, and contract documents will become basic functions of document control and supports simplified retrieval when required.

As necessary, documents inherent to manufacturing, testing, and inspection functions will be fully dated, traceable and monitored to insure that delegated action and necessary distribution are executed on a timely basis. Documents will be recorded and indexed under a centralized records management system database which ensures simplified cross referencing and retrieval. Changes to controlled documents require formal approval by the same functional organization(s) that approved the original document before implementation and obsolete documents will be promptly removed from points of issue or use.

A control process will be established to identify the current revision of documents in order to preclude the use of superseded (revisions) or non-applicable documents. CSR Sifang uses Q/SFG 13-12 Document Management Regulations to control all documents and data.

PROCUREMENT

Procedures for the procurement of products will be based on CSR Sifang's established procedures. CSR Sifang's procurement procedures specify the following:

- Subcontractors must be evaluated and selected with regard to their quality capability and their ability to satisfy contract requirements
- Such criteria as the ability to deliver, product quality, punctuality, etc. must be taken into consideration in the evaluation of subcontractors
- System of checks and balances such as periodical review of procurement personnel for conflict of interest
- Records of the evaluation of subcontractors must be drawn up and maintained.

CSR Sifang's procurement documents contain data that clearly describes the ordered product and any supplementary requirements. It contains product name, instruction, model, grade, type plate number, any and all pertinent information for history traceability. The purchasing documents are reviewed and approved.

If CSR Sifang JV plans to verify any product on a subcontractor's premises, verification arrangements and the method of product release are specified in the purchasing documents. CSR Sifang JV is still

responsible for the quality of a product purchased from a subcontractor if the MBTA has verified the fulfillment of the specified requirements on a subcontractor's premises in accordance with the terms of the contract.

CSR Sifang JV will prepare a procurement list and identify special activities for single suppliers or components. These special activities may include the following:

- Auditing of suppliers' facilities
- First Article Inspections
- All US domestic procurement content must comply with the federal FAR regulations
- Inspections of delivered lots or material samples.

The aforementioned quality-related activities will be performed by the Quality Assurance Department and monitored by the Quality Assurance Manager for the project. Thirty days prior to the delivery start date for ordered subsystems, CSR Sifang JV will submit detailed procedures and test specifications for First Article Inspections for MBTA review. Lastly, CSR Sifang JV guarantees that all purchased products will meet MBTA requirements, and have been used in various similar urban rail transit that performs well, safe and reliable.

MONTHLY QUALITY REPORT

CSR Sifang JV shall submit a Monthly Quality Report (MQR) which highlights key elements in the PQP and other issues that arise affecting the project. TABLE I.4-2: 'MQR Specific Elements' highlights specific topics to be included within the MQR. A draft will be submitted 60 days prior to NTP.

**TABLE I.4-2
MQR Specific Elements**

1.	Date & period covered	6.	Status if any field modifications
2.	Current status of design, production	7.	Subcontractor and supplier audit results
3.	Status of PQP open issues	8.	CSR Sifang audit schedules and results
4.	FAI open issues	9.	Software quality assurance audit results
5.	Itemize Non-conforming Materials	10.	FRB major issues

The CSR Sifang JV team will conduct monthly Project Quality meetings with MBTA to discuss quality issues and review MQR. With MBTA approval, CSR Sifang JV will also hold quarterly review meetings to discuss current relevant production quality related issues with major subcontractors from preliminary design to warranty period.

PRODUCT IDENTIFICATION, MARKING AND TRACEABILITY

All products will be identified by appropriate means. The relevant procedures used for product identification and traceability are established by the various organizational units of CSR Sifang. This ensures that all products are accurately identified throughout all stages of production, delivery, and installation. CSR Sifang will insure compatibility to the MBTA system.

QUALITY ASSURANCE ORGANIZATION

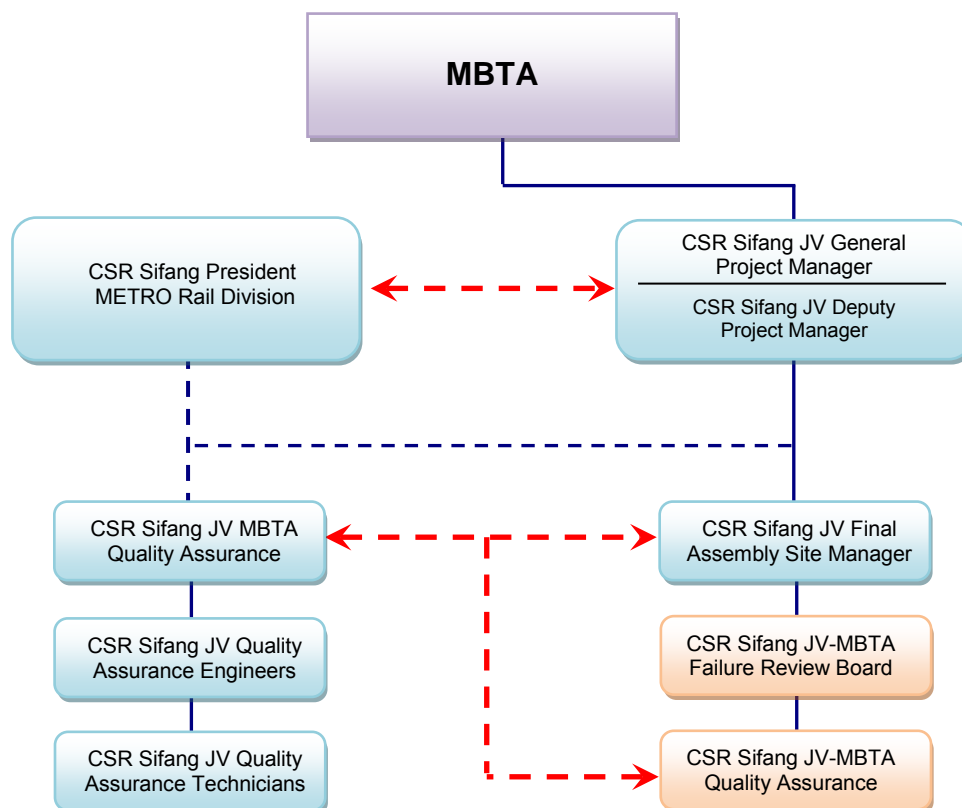
CSR Sifang JV will organize and manage the proposed project quality program by assigning personnel for key management positions. CSR Sifang JV will appoint a project Quality Assurance Manager for this project that will implement and administer the overall project quality assurance and quality control in

accordance with the specified requirements of both CSR Sifang JV and the MBTA. Reporting to the General Project Manager and the President of CSR Sifang Metro Rail Division, this CSR Sifang JV Quality Assurance Manager will provide advice and direction to both CSR Sifang senior management and its major sub suppliers/subcontractors regarding the management and administration of all project quality assurance and quality control activities.

The project CSR Sifang JV Quality Assurance Manager for this project will possess the authority and organizational freedom to identify problems, recommend solutions, and evaluate corrective actions. In addition, the Quality Assurance Manager will also have full access to all records and work areas. Timely communication of line stoppage quality issues is a vital responsibility of the Project Quality Assurance Manager.

The project CSR Sifang JV Quality Assurance Manager will further maintain an aggressive quality assurance audit program within CSR Sifang JV and its subcontractors/sub suppliers (although each subcontractor/sub supplier will retain its own quality assurance organization and process). The principle of 'partnering' will be applied between the CSR Sifang JV Quality Assurance Manager, CSR Sifang, and QA representatives and managers within subcontractor organizations. The CSR Sifang JV Final Assembly Site Manager will augment the functions of the CSR Sifang JV Quality Assurance Manager on a day-to-day basis in a liaison and oversight capacity to insure that subcontractor/sub supplier source processes reflect the requirements and standards of both CSR Sifang JV and the MBTA. FIGURE I.4-1: 'Proposed QA Organization' graphically describes the proposed CSR Sifang JV QA organization.

**FIGURE I.4-1
Proposed CSR Sifang JV QA Organization**



QUALITY ASSURANCE PROCEDURES

CSR Sifang JV team member CSR Sifang has established and maintained the following QA procedures. CSR Sifang JV intends to fully utilize these procedures either directly or through CSR Sifang, where applicable, throughout the duration of this project.

Control of Inspection, Measuring, and Test Equipment Procedure

CSR Sifang has established and maintained procedures to control, calibrate, and maintain all inspection, measuring, and test equipment to verify the conformance of all work to the specified requirements. These procedures include inspection, measuring, and test equipment includes devices, systems, and procedures (including computer-aided methods). Where specified in the contract, the technical data for this equipment will be made available to the recipient of the inspected product.

CSR Sifang inspection, measuring, jigs/fixtures and test equipment is checked for suitability, proper functioning, and accuracy before it is used in order to achieve reproducible results. Inspection, measuring, and test equipment (the accuracy of which is specified for a particular task and can change), is subject to an inspection.

Other inspection, measuring, jigs/fixtures and test equipment are released following verification of their suitability for use, are maintained when necessary, and are removed from service if they lose their fitness for use. These items may include the following:

- Computer software programs that perform simulation, registration, security or statistical functions
- Tooling, jigs and fixtures
- Computer-controlled inspection and testing systems
- Checklists for specific operational sequences, objects, or activities.

Inspection and measuring equipment is identified and documented, indicating their respective inspection and test status.

The scope and frequency of checks and the records for the control of inspection, measuring, and test equipment have been established. These records are maintained. Documentation includes the intervals between checks, record the results of checks, and document the name of the testing agency. These checks can be traced to testing agencies approved for their respective standards. Basic guidelines have been established by CSR Sifang for the performance of these checks.

The validity of previous product inspections and test results is assessed if inspection, measuring, or test equipment is found to be defective while in service or during calibration. Corrective action is determined and implemented where necessary.

All measuring equipment is calibrated against certified standards that have a known traceable relationship to the National Bureau of Standards. All calibration certifications are recorded as quality records. The customer is responsible for supplying a product of acceptable quality.

Control of Quality Records Procedure

Documented procedures have been established by CSR Sifang for the identification, collection, indexing, maintenance, destruction, access, and storage of quality records. These procedures also apply to quality records from subcontractors. Quality records include documents related to the following:

- Management reviews including MQR (Monthly Quality Report)
- Completed contract reviews
- Design reviews, revision verifications, validations
- Supplier QA audits
- Product identification and traceability
- Qualified processes and qualified personnel
- Special concessions or exemptions
- Inspections and tests that have been defined and conducted
- Approval and calibration of inspection, measuring, and test equipment
- Review and further disposition of a non-conforming product
- Results of investigations into the causes of non-conformances
- Implementation and effectiveness of corrective and preventive action
- Internal quality audits
- Planned and conducted personnel training courses.

Process Control Procedure

CSR Sifang process control procedures are monitored by defining, recording, and evaluating process characteristics and implementing corrective action, where necessary. All conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations and defects in design, material, workmanship, and equipment are promptly identified and corrected.

Workmanship criteria may contain information concerning the production, installation, and servicing equipment to be used as well as special environmental and field service conditions. These criteria may refer to acknowledged standards, regulations, specifications, or any other quality management documents, where applicable, and contain parameters and product characteristics for monitoring and control.

Where the results of work cannot be directly verified against the specified requirements, or where the verification of these results is not economically feasible, the processes concerned are subject to a special qualification procedure. Specially qualified personnel may be assigned to perform such processes, which are monitored continuously once they have been approved. The activities associated with the qualification, approval, and monitoring of these processes are documented and records are maintained. Measures have been implemented by CSR Sifang to ensure that the servicing work required maintaining the process capability of equipment is performed.

I.4B. SUBCONTRACTOR QUALITY COMPLIANCE, FAI AND FINAL ASSEMBLY**INSPECTION AND TESTING**

CSR Sifang has established procedures for inspection and testing of products, allowing for product-specific and process-specific operational sequences. Using these procedures, CSR Sifang JV will prepare a test and inspection plan that includes all tests, First Article Inspections, and inspection necessary for the qualification of components and systems. All hold points will be identified and subject to approval by the MBTA.

Inspection of Purchased Material

Purchased material will be inspected to assure that only accepted items are used in product fabrication activities. Emphasis will be placed on correct revision level, complete source and incoming inspection conducted per an approved sampling plan.

Purchased material will be inspected by Quality Assurance to the latest drawing rev and bills of material. Based on specified criteria, the inspection of material may include: material identification, visual examination of workmanship, certification evaluation, dimensional measurements and electrical tests (as required). Inspection procedures will also be used to ensure consistency in inspections of problem or critical parts. Inspection results will be documented and may include date of receipt, purchase order number, supplier code, quantity received, quantity accepted, inspection notes, inspector's unique identification code, and other such information. Only accepted material may be released to production or storeroom.

First Article Inspections

First Article Inspections (FAIs) will comply with MBTA RFP CAP27-10 Section C5.19 title inspection, procedure and test specification requirements. The CSR Sifang team will have responsibility of planning, scheduling, tracking and completing all FAIs. An FAI Plan will be submitted to the MBTA 60 days prior to the 1st scheduled FAI for review and approval.

FAI will be performed on all major components, subassemblies, systems, car structure at an agreed hold points and pilot cars. TABLE: 'Proposed FAI List of Subsystems' summarizes major subsystems which will undergo a comprehensive FAI.

**TABLE I.4-3
Proposed FAI List of Subsystems**

1.	Propulsion	9.	Air Brake Equipment and Controls
2.	Truck and major truck components	10.	ATP / ASR Equipment
3.	Aux Inverters	11.	Door Systems
4.	Low Voltage DC Power	12.	Seats
5.	HVAC	13.	Vehicle Monitoring Systems
6.	Car shell	14.	Network Integration
7.	Couplers / Draft Gear	15.	Communication Equipment: LED & LCD signage
8.	Wheel sets	16.	Lighting

It is the intent to confirm that the CSR Sifang JV's first production submittal is representative of good manufacturing processes and complies with the established specifications and requirements prior to the commencement of the production schedule. FAI inspections will:

- Validate the product according to design, quality and manufacturing processes of consistently producing a high quality product.
- Review inspection, test plans, manufacturer's capabilities, and required documentation such as maintenance and training manuals.

- Establish baseline design configuration compliant with the contractual specification and meeting the RFP requirements.

In-process Inspection and Testing

Products will undergo in-process inspection and testing as required. Any non-conformances discovered during inspection and testing will be handled in accordance with established CSR Sifang procedures for the control of non-conforming products.

Final Inspection and Testing

The inspection and testing of finished products ensure that only items that meet the specified requirements are released for further use. A product will not be released until it has satisfactorily and verifiably completed all prescribed inspections and tests and the associated results and documents made available.

Inspection and Test Records

Successful completion of inspection and testing is identified in the documents accompanying a product or the product itself. This identification is used to document compliance with the specified requirements for quality. Non-conforming products are handled in accordance with established CSR Sifang procedures for the control of non-conforming products. The inspection and test records identify the responsible inspection agency. A document entitled 'Sample Inspection and Test Report Summary' is attached to the end of this section and defines a representative (sample) inspection and test report summary record.

QUALITY ASSURANCE FEEDBACK MECHANISMS

Control of Non-Conforming Products

CSR Sifang JV's Failure Review Board (FRB) will establish and maintain procedures to ensure that work that does not conform to specified requirements is prevented from in advertent use or installation. These procedures identify and isolating the non-conforming product and, when practical, storing such items separately. In addition to this, the procedures also provide for the review and further disposition of a non-conforming product and for the notification of the organizational units and project coordinators concerned.

Review and Disposition of Non-conforming Products

The FRB decision concerning the subsequent processing of a non-conforming product in accordance with defined procedures may stipulate the following:

- Reworking
- Acceptance with or without repair by concession
- Regarding for an alternative application
- Returning the product to the subcontractor
- Scrapping.

A Sample Inspection and Test Report Summary are attached to the end of this section.

The FRB will be utilized to determine and define the aforementioned tasks. Depending upon the individual situation, the MBTA will also be consulted or notified of the results when a decision is released, where specified in the terms of the contract. Reworked or repaired items are re-inspected to the necessary

extent and are released for further use if they satisfy the specified requirements. The individual stages of processing are documented, from reporting and registering a non-conforming product, through its final release.

Corrective and Preventive Action

CSR Sifang JV's FRB has the authority that applies to procedures designed to prevent the recurrence of defects, root causes and non-conformances in products and processes. The non-nuisance failures in accordance with MIL-STD-785B will be identified and corrective actions will be implemented in a timely manner. The sources of information available for the systematic investigation of the causes of non-conformances and the definition of corrective and preventive action include the following:

- Customer complaints
- Problem reports, non-conformance reports, and service reports
- Reports of reviews and audits
- Staff initiatives and suggestions for improvement
- Evaluation of quality records and statistics.

Corrective action covers the elimination of the causes of any defects or non-conformances that have occurred. This includes the following:

- Analyzing the sources of information available for the systematic investigation of the causes and potential causes of non-conformances and the definition of corrective and preventive action
- Specifying the necessary corrective action
- Implementing corrective action and monitoring its effectiveness.

Preventive action is implemented to prevent potential non-conformances. This is also viewed from an economic standpoint and includes the following:

- Analyzing the sources of information available for the systematic investigation of the causes and potential causes of non-conformances and the definition of corrective and preventive action
- Identifying potential causes of non-conformances in new processes
- Estimating the risk involved in such cases
- Optimizing procedures and functions.

Implemented corrective and preventive action constitutes an integral component of the management review.

SUBCONTRACTOR MANAGEMENT

Proposed CSR Sifang JV subcontractors will be subject to the same contract provisions which CSR Sifang JV must maintain with the MBTA. To assure compliance with the contract provisions through product commissioning, subcontractor costs and performance will be continually monitored through the

use of detailed schedules, on-site inspection, analysis of deliverables, and verification of cost and pricing data.

Currently, the company has procedure documents Q/SFG 04-03-2011 *Supplier Management Procedures* and Q/SFG06-03-2011 *Supplier Products Quality Management Procedure* to specify the methods and processes of supplier management. CSR Sifang JV's supplier management system consists of the following:

- Implement supplier classification management
- Establish supplier access mechanism
- Supplier performance evaluation mechanism
- Strategic partner selection and supplier qualification cancellation mechanism
- Supplier first article inspection system
- Supplier manufacturing supervision system
- Supplier review system
- Supplier shift.

Supplier classification management suppliers are divided into A (critical), B (important) and C (ordinary) categories. Supplier access mechanism is implemented to determine operating risks, scale of economies, business integrity and total capabilities for different types of suppliers. Supplier financial viability assessment is also needed. Supplier performance evaluation is conducted to ensure the objectivity, fairness and effectiveness of the assessment. Monthly and annual performance review, supplier product quality assessment, and daily supervision/monitoring are methods used by multi-department team.

The company will provide a detailed step by step procedure and definitions of the Supplier Management system as itemized above in a manual, including all the forms necessary to implement traceability of manufactured parts.

CDRL (CONTRACTOR DELIVERABLE REQUIREMENT LIST)

All 8 deliverables listed on MBTA RFP#CAP27-10 Section 19.06 CDRL Items will be submitted and complied with 60 days prior to NTP. These CDRL Items include the following:

- CDRL 19-01, "Contractor's Quality Manual"
- CDRL 19-02, "Subcontractors Not ANSI/ASQ ISO 9001 Certified"
- CDRL 19-03, "CMMI-ACQ Level II for Software Acquisition Cert."
- CDRL 19-04, "CMMI-DEV Level II for Software Dev. Cert."
- CDRL 19-05, "Contractor's Project Quality Plan"
- CDRL 19-06, "Monthly Quality Report"
- CDRL 19-07, "FAI Plan – Format - Schedule"
- CDRL 19-08, "FAI Open Items List".

TAB I.4 Attachments



List of Existing Quality Management System Procedure Documents of CSR

No.	Document Name	No.
1	Document Management Provisions	Q/SFG13-12
2	Management Regulations of Product Drawings and Design Documents	Q/SFG03-15
3	Process Document Management Regulations	Q/SFG03-24
4	Product Process Scheme Design Management Regulations	Q/SFG03-25
5	Enterprise Archives Management System	Q/SFG13-21
6	Record Management Regulations	Q/SFG13-13
7	Knowledge Management System	Q/SFG03-50
8	Intellectual Property Management System	Q/SFG03-43
9	Quality Tackle and (QC) Team Management Regulations	Q/SFG06-05
10	Marketing Management System	Q/SFG02-01
11	Customer Service Management Provisions	Q/SFG02-02
12	Operation Management System	Q/SFG01-01
13	Budget Management System	Q/SFG10-01
14	Cost Accounting Management Methods	Q/SFG10-12
15	Objective Index Management Regulations	Q/SFG01-06
16	Information Exchange and Transfer Management System	Q/SFG13-11
17	Quality Information Management Methods	Q/SFG06-02
18	Management Review Management Procedure	Q/SFG01-23
19	Fixed Assets Investment Management System	Q/SFG07-01
20	Financial Capital Management System	Q/SFG10-31
21	Technical Measures Project Management Regulations	Q/SFG03-30
22	Computer Software Management Provisions	Q/SFG13-03
23	Employee Management System	Q/SFG11-01
24	Labor Management Methods	Q/SFG11-02
25	Employee Training Management Procedure	Q/SFG11-11
26	Employee Bonus-Penalty Management Regulations	Q/SFG11-03
27	Performance Appraisal Management Methods	Q/SFG11-23
28	Fixed Assets Management System	Q/SFG07-11
29	Environmental Factor Identification and Assessment Procedure	Q/SFG09-02
30	Dangerous Source Management Regulations	Q/SFG08-02
31	Field Management System	Q/SFG05-11
32	Tender Management Regulations	Q/SFG02-04
33	Product Design Control System	Q/SFG03-11
34	Process Management General Provisions	Q/SFG03-20
35	Technology Development Project Management System	Q/SFG03-41
36	Product Design Assessment Management Regulations	Q/SFG03-12
37	Product Design Verification Control Procedure	Q/SFG03-13
38	Product Design Confirmation Control Procedure	Q/SFG03-14
39	Product Design Subcontracting Management Regulations	Q/SFG03-18
40	Supplier Management Procedure	Q/SFG04-03
41	Material Procurement Management System	Q/SFG04-01
42	Import Material Procurement Management Regulations	Q/SFG04-04
43	Production Organization Management System	Q/SFG05-01
44	Process Outsourcing Management Provisions	Q/SFG05-04
45	Process Equipment Management Regulations	Q/SFG03-28
46	Lifting tools Management Regulations	Q/SFG03-29
47	Important and Special Process Management Provisions	Q/SFG03-23
48	Product Identification and Protection Control Management Regulations	Q/SFG04-13
49	Packing and Handling Management Regulations	Q/SFG 04-12
50	Customer Property Management Provisions	Q/SFG02-03
51	Logistics Management Regulations	Q/SFG04-11
52	Measuring Management System Manual	Q/SFG06-21
53	Measuring Device Circulation Management Procedure	Q/SFG06-22

No.	Document Name	No.
54	Measuring Procedure Management Procedure	Q/SFG06-23
55	Measuring Device Metrological Confirmation and Value Tracing Management Procedure	Q/SFG06-24
56	Measuring Device Confirmation Interval Control Procedure	Q/SFG06-25
57	Nonconforming Measuring Device Control Management Procedure	Q/SFG06-26
58	Product Item Management System	Q/SFG02-11
59	Project Plan Management Regulations	Q/SFG02-13
60	Project Budget Management Procedure	Q/SFG10-02
61	Project Team Establishing Management Procedure	Q/SFG02-12
62	Product Configuration Management Method	Q/SFG03-17
63	Supplier Product Quality Control Procedure	Q/SFG06-03
64	Inspection and Testing Management System	Q/SFG06-11
65	Product Delivery Management Methods	Q/SFG02-21
66	After-sales Service Management System	Q/SFG02-22
67	Life Cycle Cost Management Provisions	Q/SFG03-16
68	Legal Matters Management System	Q/SFG14-11
69	Modification Management System	Q/SFG01-25
70	Internal Auditing Management Procedure	Q/SFG01-22
71	Process Rule Management Regulations	Q/SFG03-21
72	Product Quality Control Management System	Q/SFG06-01
73	Non-destructive Examination Management Regulations	Q/SFG06-12
74	Nonconforming Goods Control Procedure	Q/SFG06-04
75	Nonconforming Process Management Regulations	Q/SFG06-08
76	Statistical Technique Application Management Regulations	Q/SFG06-06
77	Corrective and Preventive Measures Management Procedure	Q/SFG01-24

TAB I.5

TAB I.5 M/WBE PARTICIPATION**I.5A. UTILIZATION FORM****RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-86****SECTION B**
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY**M/WBE UTILIZATION FORM**

In connection with the performance of this Contract, the Offeror will cooperate with the MBTA in meeting its commitments and requirements with regard ensuring opportunities for creating a level playing field on which M/WBEs can compete fairly for opportunities. The Offeror shall complete and submit this M/WBE Utilization Form with its proposal and as part of the Contract.

What percentage of the Base Award Price will be performed or supplied by certified M/WBEs?
TOTAL BASE AWARD M/WBE UTILIZATION: 32.34 %

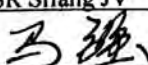
What percentage of the Total Proposal Price will be performed or supplied by certified M/WBEs?
TOTAL PROPOSAL PRICE M/WBE UTILIZATION: 34.38 %

NOTE: For each M/WBE supplying or performing a percentage of the Contract amount, you must complete the attached M/WBE Participation Schedule.

To the extent that the Offeror has not been able to secure M/WBE participation, the Offeror shall attach documentation demonstrating its good faith efforts to secure M/WBE participation.

I hereby certify that the above information is true and accurate to the best of my knowledge:

OFFEROR: CSR Sifang JV

AUTHORIZED SIGNATURE: 

NAME (PRINTED): Ma Qiang

TITLE: Assistant Director, Marketing Department, Overseas Business Division,

CSR Qingdao Sifang Co., Ltd.

DATE: May 14, 2014

I.5B. M/WBE PARTICIPATION SCHEDULE
REP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-87

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE PARTICIPATION SCHEDULE

The Offeror shall complete the following information for any M/WBE for which a percentage is given in the M/WBE Utilization Form. The Offeror shall furnish the name and telephone number of the appropriate contact person should the Authority have any questions in relation to the information furnished herein.

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
Adrian Nameplates (WBE)	PO Box 211, Essex, MA 01929 Madeline Albani 978-768-7977	Interior and exterior decals, signs and labels	2016/2022	0.04%
Ferreira Towing Inc. (WBE)	PO Box 460 Chelmsford, MA 01824 MaryJo Glywn 978-454-7914 maryjo@ferreiratowing.com	Carshell, pilot car and vehicle transporting	2017/2022	0.85%
Jafa Technologies (WBE)	1200 South Church St, Suite 19, Mount Laurel, NJ 08054 Carol Bozarth 856-206-9427	Project Scheduling	NTP/2023	0.18%
JTM Concepts (M&WBE)	420 23rd St., Rock Island, IL 61201 Doug Sands 309-794-1057	Manuals and training	NTP/ 2023	1.42%
RL Controls (WBE)	10 V. Gill St., Woburn, MA 01801 Lena Walsh 617-771-6167	Communications equipment	2016/2022	3.72%
US ECO Products (WBE)	PO Box 213, West Newbury, MA 01985 Doreen Blades 978-457-9229	Degreasers, paint thinner, spill absorbent, consumables.	2018/2023	0.07%
UTC RAS (WBE)	501 Highland Ave Morton, PA 19070 Betty Scott (610) 328-1100	Wheels and Axles	2016/2022	2.91%

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES
B-87


SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE PARTICIPATION SCHEDULE - CONTINUED

The Offeror shall complete the following information for any M/WBE for which a percentage is given in the M/WBE Utilization Form. The Offeror shall furnish the name and telephone number of the appropriate contact person should the Authority have any questions in relation to the information furnished herein.

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
Transitair (MBE)	One William K. Jackson Lane Hornell, NY 14843 Dhruv Sharma (607) 324-0216	HVAC	2016/2022	3.56%
Transitair (MBE)	One William K. Jackson Lane Hornell, NY 14843 Dhruv Sharma (607) 324-0216	Carbody Assembly	2016/2022	6.03%
Transitair (MBE)	One William K. Jackson Lane Hornell, NY 14843 Dhruv Sharma (607) 324-0216	Truck Assembly	2016/2022	5.19%
Transitair (MBE)	One William K. Jackson Lane Hornell, NY 14843 Dhruv Sharma (607) 324-0216	Wire Harnesses	2016/2022	3.17%
Transitair (MBE)	One William K. Jackson Lane Hornell, NY 14843 Dhruv Sharma (607) 324-0216	Undercar Equipment boxes	2016/2022	1.70%
Transitair (MBE)	One William K. Jackson Lane Hornell, NY 14843 Dhruv Sharma (607) 324-0216	Electrical Panels, Motorman's Consoles and Hostler Panels	2016/2022	3.50%

OFFEROR: CSR Sifang JV

AUTHORIZED SIGNATURE: 

NAME (PRINTED): Ma Qiang

TITLE: Assistant Director, Marketing Department, Overseas Business Division,

CSR Qingdao Sifang Co., Ltd.

DATE: May 14, 2014

I.5C. M/WBE LETTER OF INTEREST, CERTIFICATION AND AFFIDAVIT

CSR Sifang's M/WBE related forms and materials are contained within the attachment section of this Tab. These materials include the following (by M/WBE Firm):

- **Adrian Nameplates**
 - B-88 M/WBE Letter of Interest
 - B-89 M/WBE Affidavit
 - M/WBE Certificate
- **Ferreira Towing Inc.**
 - B-88 M/WBE Letter of Interest
 - B-89 M/WBE Affidavit
 - M/WBE Certificate
- **Jafa Technologies**
 - B-88 M/WBE Letter of Interest
 - B-89 M/WBE Affidavit
 - M/WBE Certificate
- **JTM Concepts**
 - B-88 M/WBE Letter of Interest
 - B-89 M/WBE Affidavit
 - M/WBE Certificate
- **RL Controls**
 - B-88 M/WBE Letter of Interest
 - B-89 M/WBE Affidavit
 - M/WBE Certificate
- **Transitair**
 - B-88 M/WBE Letter of Interest
 - B-89 M/WBE Affidavit
 - M/WBE Certificate
- **US ECO Products**
 - B-88 M/WBE Letter of Interest
 - B-89 M/WBE Affidavit
 - M/WBE Certificate
- **UTC RAS**
 - B-88 M/WBE Letter of Interest
 - B-89 M/WBE Affidavit
 - M/WBE Certificate

I.5D. M/WBE COMPLIANCE NARRATIVE

CSR Sifang JV acknowledges and respects the policy of the Commonwealth of Massachusetts and the MBTA to promote equity of opportunity in state contracting; and, to that end, to encourage full participation of minority and women owned businesses in all areas of state contracting, and to create a level playing field on which minority and women owned businesses can compete fairly for contracts. To that end, CSR Sifang JV will:

- Ensure nondiscrimination in the award and administration of contracts funded in whole or in part with financial assistance from the Commonwealth of Massachusetts;
- Ensure efforts to promote contracting with minority and women owned businesses are narrowly tailored in accordance with applicable law;
- Help remove barriers to the participation of minority and women owned businesses in contracts funded in whole or in part by the Commonwealth of Massachusetts; and
- Assist in the development of minority and women owned firms that can compete successfully in the marketplace.

As the MBTA strongly encourages the use of Minority Owned and Women Owned Business Enterprises (M/WBE) as consultants, contractors, sub consultants, subcontractors, and suppliers, CSR Sifang JV sought experienced and capable firms in preparation of the offer, in addition to applying all other equal opportunity employment requirements of this program. CSR Sifang JV, guided by 49 CFR Part 26, utilized the MA Supplier Diversity Office resources in seeking opportunities for M/WBE participation and exercised good faith efforts to succeed. CSR Sifang JV included in the offer only M/WBEs 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.

OFFER PREPARATION ACTIVITIES:

CSR Sifang JV intends to ensure overall compliance with the MBTA's policy of promoting equity and opportunity for M/WBEs. The CSR Sifang JV strategy to identify and contact M/WBEs for their participation included the following actions:

1. Identifying M/WBE suppliers from the December 3, 2013 MBTA New Orange Red Line Vehicle Procurement Pre-Proposal Meeting sign-in sheets.
2. Contacting and confirming certification of the M/WBEs that signed in and sending them an invitation to bid that included links to the MBTA RFP documents and a suggestion for systems or components to consider as they reviewed the RFP TP.
 - i. Ref.
https://www.mbta.com/business_center/bidding_solicitations/materials_management/invitation_for_bids/Default.asp
3. Accessing the Supplier Diversity Office (SDO) website and downloading the WBE and MBE directories from <https://www.somwba.state.ma.us/BusinessDirectory/BusinessDirectory.aspx>
4. Searching the directories and contacting firms providing services or products applicable to the manufacture of rail vehicles.
5. Contacting the SDO office on March 18, 2014 for suggestions on how best to search the directories.
6. Contacting the SDO office on March 25, 2014 to discuss other resources available through that office and to talk with the SDO representative overseeing this RFP.
7. Contacting the SDO office on March 26, 2014 for a list of firms that have successfully performed for the MBTA or its primes in the past.

8. Placing a notice in the "*Boston Globe*" inviting M/WBEs to participate. The "*Globe*" is the largest general circulation newspaper in Massachusetts
9. Placing a notice in the Springfield "*Republican*" inviting M/WBEs to participate. The "*Republican*" is a large newspaper in western Massachusetts
10. Placing a notice on the MBE Magazine website (mbemag.com) inviting M/WBEs to participate. "*Minority Business Entrepreneur*" (MBE) magazine is the largest national MBE-focused magazine in the USA.
11. Placing a notice in Passenger Transport (the APTA magazine) inviting M/WBEs to participate. "*Passenger Transport*" magazine is the APTA bi-weekly and the public transportation industry's leading publication
12. Following up with firms (see bullets 2 and 4, above) to check on progress, answer questions, discuss other portions of the contract to bid based on their skill/manufacturing resources, and to inquire of possible issues hindering their participation.

See TABLE I.5D-1: 'M/WBE Firms Contact Activities' which identifies all M/WBEs contacted, and the M/WBE Participation Schedule which includes M/WBEs utilized. CSR Sifang JV made itself available to ease the bidding effort of the M/WBEs by providing phone and e-mail contact information and providing the opportunity for bidders to ask questions.

**TABLE I.5D-1
M/WBE Firms Contact Activities**

Cert	At Pre-Proposal (Y/N)	Business Name	Address / Contact	Service / Material	Possibilities / History/Notes	Contact
WBE	Y	Adrian Nameplates	PO Box 211, Essex, MA 01929 Madeline Albani 978-768-7977 sales@adriannameplates.com	labels 14.02.24	Proposal received.	
WBE	N	Davis Freight Management	13238 Broadway, Alden, NY 14004 Wendy Davis Schlabach 716-902-4244 wendy.davisfrt@verizon.net	Hauling	Proposal Received	
WBE	N	Jafa Technologies, Inc.	1200 South Church Street, Suite 19, Mount Laurel, NJ 08054 Carol Bozarth 856-206-9427 cbozarth@jafatech.com	Scheduling	Proposal received	
M/WBE	N	JTM Concepts	420 23rd St Rock Island, IL 61201 Tracey Masamoto 309-794-1057 tmasamoto@jtmconcepts.com	Tech pubs	Proposal Received	
WBE	Y	RL Controls, LLC	10 V. Gill St., Woburn, MA 01801 Lena Walsh 617-771-6167 lena@rlcontrols.com	Communica- tions	Proposal received	
MBE	N	Transitair	One William K. Jackson Ln, Hornell, NY 14843 Dhruv Sharma 607-324-0216 dsharma@transitairusa.com	Car Assembly, HVAC, trucks	Proposals received	
WBE	Y	USEco Products	P O Box 213, West Newbury, MA 01985 Doreen Blades 978- 457-9229	Consumables for manufact- uring	Proposal received	

Cert	At Pre-Proposal (Y/N)	Business Name	Address / Contact	Service / Material	Possibilities / History/Notes	Contact
WBE	N	Ferreira Towing	PO Box 460 Chelmsford, MA 01824 MaryJo Glywn 978-454-7914 maryjo@ferreiratowing.com	hauling	Proposal received	
WBE	N	Avid Ironworks, Inc.	40 Rose St., Springfield, MA 01104 Janice Visconti 413-788-0770 janice@avidironworks.com	Metal Fab.	Handrails. No proposal offered.	3/18, 3/19, 3/27, 3/28, 4/2, 4/3
M/W	Y	Bevco	202 W. Selden St. Boston, MA 02120 - Beverly Johnson 617-438-2767 bjohnson@bevcoassociates.com castbiz.net	Coordinates events with the public.	Past involvement with MBTA. Provided resume and list of services.	3/11 phone and e-mail, 3/14 e-mailed RFP
M/W	Y	Code Red	319 N. 4th St Suite 608 St. Louis, MO 63102 Ronald Humphrey 678-296-4217 Rhumphrey@coderedBS.com John Lewis (former CO/engineer/train control expert) jlewis@coderedBS.com 617-945-6505	Safety Services and Equipment, Asset Management	Worker Safety Training, Safety Manuals, Procedures, Audits. No proposal offered.	3/11 phone and e-mail, 3/13 phone, 3/25 e-mail, 4/2, 4/4, 4/28
WBE	N	Success Strategies	94 Merrymount Rd. Quincy, Ma 02169 Paula Sara Stanziani 617-902-8787 paula@docwhiz.biz	Tech Pubs and Training	Received proposal.	3/18 e-mail & call
WBE	N	Draper Elevator Cab Co., Inc.	260 Centre Street, Holbrook, MA 02343 John Giblin 781 961-3146 john.giblin@draperelevator.com	Metal Fab.	grab bars, stanchions. No proposal offered	4/4/14 e-mail & phone
MBE	Y	Holley Contracting	116 Chittick Rd., Hyde Park, MA 02136 - Cassie Farmer 617-361-1145 cfarmer@holleycontracting.com	Snow removal and landscaping	In Boston area. Facility grounds maintenance. No proposal offered.	3/11 e-mail, 3/21 call, 3/24
MBE	N	J & J United Industries, LLC	17901 Woodland Drive, #200, New Boston, MI 48164 John Pierce 734-443-3737 johnp@fab-united.com	Fabricator	grab bars, stanchions. No proposal offered	3/18
M/WBE	N	K.L.I., Inc.	304 Roma Jean Parkway Streamwood, IL 60107 - Lisa Jurgens Carso (630) 213-1282 Lisa@kli-inc.com	Wiring harnesses	Has not done 70' car before. Will not bid.	3/26 phone & e-mail
WBE	N	KNS Editorial Consultants	360 Winnacunnet Road, Hampton, NH 03841 Karen Neville-Cullen (603) 601-2523 k.neville@comcast.net	Tech pubs	No proposal offered.	3/18
MBE	N	Matrix Railway	69 Nancy St. Babylon, NY 11704 631-643-1483 Nelson Rivas, nrivas@matrixrailway.com	lighting, control boxes	No proposal offered.	3/14 phone & e-mailed RFP, 3/17
WBE	Y	Modern Auto Glass	1635 Shawsheen Rd. Tewksbury, MA 01876 Deb Arena 978-278-2000 Rob Rose (owner) rrose@modernautoglass.com & davena@modernautoglass.com	glass	windshield, passenger windows, wind screens. No proposal offered.	3/11 e-mail, 3/14, 3/17, 3/26, 3/27, 4/6, 4/7

Cert	At Pre-Proposal (Y/N)	Business Name	Address / Contact	Service / Material	Possibilities / History/Notes	Contact
WBE	Y	Precision Engineering	PO Box 546 Uxbridge, MA 01569 - Liora Stone 508-278-5700 lstone@precisionengineering.com	Metal forming kitting, powder coating	No proposal offered. Suggested t RL Controls for panel fab.	3/11 e-mail, 3/14, 3/17
M/WBE	Y	Roxbury Technology	57 Sprague St., Hyde Park, MA 02136 - Dom Williams 617-524-1020 salesdw@roxburytechnology.com	Printer cartridges	No response or proposal offered.	3/11 e-mail
WBE	N	Split Excavating	PO Box 471 Hadley, MA 01035 Brenda Fydenkevez (413) 582- 1262 brendaf@splitexcavating.net	Snow removal exterior cleaning	No proposal offered.	3/21 phone & e- mail
MBE	Y	Supplies Exchange Systems	204 Washington St. Dorchester, MA 02121 William Netter 617- 265-6300 suppliesexchangesystems@yaho o.com	Unknown	website does not list products. No response.	3/11 e-mail
NA	Y	Solis Group	145 Vista Ave #104, Pasadena, CA 91107 - Lindsey Robinson 626-685-6989	Outreach, Labor Training	Not yet MA WBE and does not do technical manuals	3/11 e-mail 3/14
DBE	Y	Advanced Transit Manufacturing	14 S. Main St, Canisteo, NY 14823 Daniel Barnett 607-698- 4606	Wiring Harnesses	Not a WBE in MA yet	3/11 e-mail 3/14 phone & e- mailed RFP , 3/26
M/WBE	Y	LRC	11 Hallett St., Dorchester, MA 02122 Lydia Rivera 617-851- 1095	Unknown	No response	3/11 phone message
M/WBE	N	Lawrence Training	530 Broadway St. Bldg. 12 Lawrence, MA 01841 978-689- 7370	Training	No response	3/14 e-mail
WBE	N	Coghlin Electrical Contractors, Inc.	100 Prescott St., Worcester, MA 01605 Susan Mailman (508) 793-0300	Wiring Harnesses	They make no wiring components	3/26 phone
WBE	N	A J Cleaning, Inc.	34 Mallon Road, Dorchester, MA. 02121 - Alvera Payne 617-506- 0210 alverapaynejones@hotmail.com	Janitorial	Pending final facility Selection	

GOOD FAITH EFFORTS

Though the MBTA set no M/WBE goal in the RFP documents, CSR Sifang JV has made it a priority to include M/WBE involvement for this project. To that end, CSR Sifang JV has solicited M/WBE's and communicated its intent to prime contractors. CSR Sifang JV identified and contracted firms from the M/WBE directory at the SDO website and reached out to the SDO for additional information.

I.5E. M/WBE COMPLIANCE DURING CONTRACT PERFORMANCE

The CSR Sifang JV's mission is to provide opportunities for M/WBEs to share in CSR Sifang JV's total expenditures for goods and services. In administering its M/WBE program, CSR Sifang JV will not, directly or through contractual or other arrangements, use criteria or methods of administration that have the effect of defeating or substantially impairing accomplishment of the objectives of the M/WBE program with respect to individuals of a particular race, color, sex, or national origin.

CSR Sifang JV will consult internally with its M/WBE Liaison Officer, administrative, sourcing and project management members and externally with minority, women's and general contractor groups, community organizations, and other officials or organizations to obtain information concerning the availability of disadvantaged and non-disadvantaged businesses, the effects of discrimination on opportunities for M/WBEs, and CSR Sifang JV's efforts to establish a level playing field for the participation of M/WBEs.

CSR SIFANG JV M/WBE TERMINATION POLICY

CSR Sifang JV acknowledges the termination limitations established by the MBTA and chose M/WBE partners most experienced and equipped to succeed. CSR Sifang JV does not anticipate terminating for convenience any M/WBE subcontractor(s) listed in the M/WBE Participation Schedule and then performing the work of the terminated M/WBE subcontractor with our own forces or an affiliate, without the MBTA's prior written consent. Should an M/WBE subcontractor fail to complete its work on the program for any reason, CSR Sifang JV will secure MBTA's written consent to terminate and then make good faith efforts to find another M/WBE subcontractor to substitute for the original M/WBE. The MBTA will be notified in writing of the CSR Sifang JV efforts to replace the original M/WBE.

IMPLEMENTATION RESPONSIBILITY

The Director of Procurement has been delegated as the M/WBE Liaison Officer. In that capacity, the Director is responsible for implementing all aspects of the M/WBE program. The Director of Procurement will disseminate this policy statement to all of the impacted portions of our organization.

As the corporate department interfacing with suppliers and vendors, the Procurement Department will be the corporate leader of the MBE/WBE utilization effort. The CSR Sifang JV Director of Procurement has the authority and responsibility to:

1. Communicate the CSR Sifang JV M/WBE utilization effort throughout the Company and request feedback.
2. Assign adequate staff to administer CSR Sifang JV's M/WBE Participation Schedule.
3. Dedicate a staff member to liaison with each M/WBE firm.
4. Assign a staff member to report monthly to Manager, and quarterly to MBTA and/or SDO, as required per project, on new M/WBE contracts and the progress of existing contracts.
5. Institute corrective actions if M/WBE participation lags.
6. Identify certified manufacturers and suppliers in cooperation with the MA SDO and with outreach efforts.
7. Create procurement/solicitation documents with wording to encourage M/WBE proposals/quotations/estimates and convey M/WBE participation requirements to prime suppliers.
8. Create small bid items to allow maximum opportunity/participation and competition among M/WBEs.
9. When subcontractors seem eligible for certification (51% owned and controlled by a minority or woman) recommend the firm apply for certification.
10. If M/WBE firms are repeatedly nonresponsive and/or non-competitive, provide the names to the MA SDO.

11. Annually issue summary M/WBE participation report and objective for the next year.

To kick-off the post-award effort, an initial list of potential facility and employee related services aimed at utilizing M/WBE firms, in addition to those related to the vehicles, was developed and includes, but is not limited to:

1. Legal Services
2. Insurance
3. Building Cleaning, Maintenance & Repair Management Services
4. Employment Services
5. Printing, copying (document reproduction) services
6. Rental of Capital Equipment or Supplies
7. Environmental Services
8. Security & Guard Services
9. Telecommunications Services
10. Industrial Engineering Services
11. Training Services
12. Warehousing Services

PROMPT PAYMENT MECHANISMS

CSR Sifang JV will include the following clause in each prime contract:

The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than thirty (30) days from the receipt of each payment the prime contract receives from the Authority. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the Authority. This clause applies to M/WBE and non-M/WBE subcontracts.

MONITORING PAYMENTS TO M/WBE'S

CSR Sifang JV will require prime contractors to maintain records and document payments to M/WBEs for three years following the performance of the contract. These records will be made available for inspection upon request by any authorized representative of the MBTA. This reporting requirement also extends to any certified M/WBE subcontractor.

CSR Sifang JV will perform interim audits of supplier contract payments to M/WBEs to ensure the actual amount paid to M/WBE subcontractors equals or exceeds the dollar amounts stated in the M/WBE Participation Schedule.

MONITORING AND ENFORCEMENT MECHANISMS

CSR Sifang JV will apply a monitoring and enforcement mechanism to ensure compliance with M/WBE requirements as defined in MBTA RFP CAP 27-10, Section C7, including, but not limited to, the following:

1. Ensuring nondiscrimination in the award and administration of contracts funded in whole or in part with financial assistance from the Commonwealth of Massachusetts;
2. Ensuring efforts to promote contracting with minority and women owned businesses are narrowly tailored in accordance with applicable law;
3. Helping remove barriers to the participation of minority and women owned businesses in contracts funded in whole or in part with financial assistance from the Commonwealth of Massachusetts;
4. Utilize M/WBEs certified, at the time of Proposal opening, by the Massachusetts Supplier Diversity Office (SDO) formerly known as the State Office of Minority and Women Business Assistance.
5. Not terminate for convenience the M/WBE subcontractor(s) listed in the M/WBE Participation Schedule and then perform the work of the terminated M/WBE subcontractor with its own forces or an affiliate, without the MBTA's prior written consent. When an M/WBE subcontractor is terminated or fails to complete its work on the Contract for any reason, CSR Sifang JV shall make good faith efforts to find another M/WBE subcontractor to substitute for the original M/WBE and immediately notify the Authority in writing of its efforts to replace the original M/WBE.
6. Submit quarterly written reports to the MBTA summarizing the total M/WBE value for this Contract. These reports shall provide the following details:
 - a. M/WBE utilization established for the program;
 - b. Total value of expenditures with M/WBE firms for the quarter; and
 - c. Total value of expenditures with M/WBE firms from inception of the program. Reports and other correspondence will be submitted to the Contracting Officer with copies provided to the Project Manager. Reports shall continue to be submitted quarterly until final payment is issued or until M/WBE participation is completed.
7. CSR Sifang JV shall permit the MBTA access to necessary records to examine information as the MBTA deems appropriate for the purpose of investigating and determining compliance with the M/WBE participation provisions, including, but not limited to, records of expenditures, invoices, and contract between CSR Sifang JV and other M/WBE parties entered into during the life of the program.

DISPUTE RESOLUTION PROCEDURES

To legally insure fair and consistent administration of MBTA policy, CSR Sifang JV will "flow down" the same dispute resolution procedures the MBTA requires of CSR Sifang JV and fellow Bidders (such as Section C8.05 - CLAIMS AND DISPUTES) upon CSR Sifang JV's subcontractors, including M/WBEs.

1. Any dispute arising at any time under the program which is not disposed of by agreement through a Change Order, shall be decided in the first instance by CSR Sifang JV, who shall reduce its decision to writing without unreasonable delay.
 - If CSR Sifang JV's Subcontractor fails to submit a claim within thirty (30) days of CSR Sifang JV's dispute of the Change Order request pursuant to Section C11.00, that claim shall be deemed waived by CSR Sifang JV's Subcontractor without further recourse.
 - Any other claim must be brought to the attention of CSR Sifang JV within three (3) months of the event which raised the claim. If CSR Sifang JV's Subcontractor fails to bring the claim within the three (3) month period, the claim shall be deemed waived by the Subcontractor without further recourse.
2. The decision of CSR Sifang JV shall be final and conclusive unless, within thirty (30) days from the date of receipt of such copies thereof, CSR Sifang JV's Subcontractor mails or delivers to the MBTA a written notice of rejection, in which event the decision of CSR Sifang JV shall have no further effect and either party may have the dispute and the subject matter thereof settled by a court of competent jurisdiction located within Suffolk County in the Commonwealth of Massachusetts.
3. In the event CSR Sifang JV fails to make a decision as aforesaid on any dispute within a reasonable period after being requested to do so by CSR Sifang JV's Subcontractor, then either party may have the dispute and the subject matter thereof settled directly by a court of competent jurisdiction located within Suffolk County in the Commonwealth of Massachusetts.

GOAL SETTING AND ACCOUNTABILITY

If the awards, commitments and payments are less than the goal, CSR Sifang JV will analyze the reason for the difference between the overall goal and the actual awards/commitments; and establish a corrective action plan with milestones to correct the problems identified in the analysis.

MEETING CONTRACT GOALS

CSR Sifang JV will apply the maximum feasible portion of its contract using race and gender neutral means of facilitating M/WBE participation utilizing MA SDO and industry resources.

TAB I.5 Attachments

TAB I.5 ATTACHMENTS

M/WBE FORMS: ADRIAN NAMEPLATES

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-88

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITYM/WBE LETTER OF INTENT
(TO BE COMPLETED BY M/WBE FIRM)Name of Offeror Firm: CSR, QUIGDAO SIFANG CO., INC.
Address: 300 N. LASALLE ST. SUITE 2240
City: CHICAGO State: IL Zip: 60654Name of M/WBE Firm: ADRIAN NAME PLATES
Address: P.O. Box 211
City: ESSEX State: MA Zip: 01929
Telephone: 978-768-7977

Description of work to be performed by M/WBE firm:

RFP CAP 27 sec. 14.02.24 - Interior Graphics and Signs
14.03.17 - Exterior Graphics and Signs

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: Madelina Alluin - owner
(Signature and Title of Authorized Official)Date: 5/8/14

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.)

ME1 16604817v.2

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-89

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF Massachusetts Date: 5/8/14COUNTY OF ESSEX S.S.

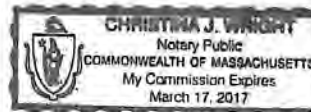
The undersigned being duly sworn, deposes and says that he/she is the

SOLE OWNER

(Sole Owner, Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)

of ADRIAN NAME PLATES

(name of M/WBE)

and certifies that since the date of its certification by
Massachusetts Supplier Diversity Office
(SDO)the certification has not been revoked nor has it expired nor has there been any change in the minority
status of ADRIAN NAME PLATES
(Name of M/WBE)Madeline Allin, owner
(Signature and Title of Person Making Affidavit)Madeline AllinSworn to before me this 8th day of May, 20 14Notary Public: Christina J. WrightMy commission expires: March 17, 2017

NOTE: The Offeror must attach the M/WBE's most recent certification letter or other documentation establishing M/WBE certification to this affidavit.



M/WBE FORMS: FERREIRA TOWING

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-88

**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: CSR Qingdao Sifang Co., Ltd.Address: 300 N. LaSalle Street, Suite 2240City: Chicago State: IL Zip: 60654Name of M/WBE Firm: Ferreira Towing IncAddress: 293 Littleton RoadCity: Chelmsford State: MA Zip: 01824Telephone: 978454-7914**Description of work to be performed by M/WBE firm:**transportation

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: Mary Ellen Sullivan President
(Signature and Title of Authorized Official)Date: march 31, 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.)

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-89

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF MA Date: 3-28-14COUNTY OF Middlesex 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 Ferreira Towing, Inc. - Mary Jo Glynn
(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 WBE / DBE
(Name of M/WBE)

(Signature and Title of Person Making Affidavit)

Sworn to before me this 28 day of March, 20 14Notary Public: Judi E Farmer

My commission expires: _____



JUDI E. FARMER
Notary Public
Commonwealth of Massachusetts
My Commission Expires
October 9, 2020

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

May 1, 2013

Ms. Mary-Jo Glynn
Ferreira Towing, Inc.
293 Littleton Road, Route 110
Chelmsford, MA 01824

Dear Ms. Glynn:

The Supplier Diversity Office (SDO) is in receipt of your certification renewal information (application). This consists of your request to renew the certification of Ferreira Towing, 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 Ferreira Towing, Inc. as a woman-owned business enterprise (WBE) with the business description of TOWING; SPECIALIZED TRANSPORT OF CONSTRUCTION AND HEAVY EQUIPMENT UTILIZING LOWBED; LANDOLL, AND DUMP TRAILER SERVICES; RECOVERY AND REPAIR OF AUTOMOBILES AND LIGHT- MEDIUM- HEAVY-DUTY TRUCKS; FLEET MAINTENANCE; RELATED TRAFFIC CONTROL, TRUCKING; AND MASSACHUSETTS AUTHORIZED INSPECTION STATION FOR PASSENGER AND COMMERCIAL VEHICLES AND TRAILERS 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 April 27, 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 April 27, 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

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M/WBE FORMS: Jafa Technologies

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-88

**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: CSR Qingdao Sifang Co., Ltd

Address: 300 N. LaSalle Street, Suite 2240

City: Chicago State: IL Zip: 60654

Name of M/WBE Firm: Jafa Technologies, Inc.

Address: 1200 S. Church Street, Suite 19

City: Mt. Laurel State: NJ Zip: 08054

Telephone: 856-206-9427

Description of work to be performed by M/WBE firm:

CPM Project Scheduling and Project Controls using MS Project or Primavera, as required by the customer.

Technical documentation of manuals and specifications.

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: Carol Bozarth, President
(Signature and Title of Authorized Official)Date: May 8, 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.)

ME1 16604817v.2


RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-89

SECTION B
**PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY**

M/WBE AFFIDAVIT

STATE OF NEW JERSEY Date: March 27, 2014COUNTY OF BURLINGTON 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 Jafa Technologies, Inc.
(name of M/WBE)and certifies that since the date of its certification by
June 4, 2013
(SDO)the certification has not been revoked nor has it expired nor has there been any change in the minority
status of Jafa Technologies, Inc.
(Name of M/WBE)
(Signature and Title of Person Making Affidavit)Sworn to before me this 8 day of May, 20 14Notary Public: My commission expires: BRIAN J. SCOTT
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires 7/20/2016NOTE: 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

June 4, 2013

Ms. Carol Bozarth
JAFA Technologies, Inc.
1200 South Church Street, Suite 19
Mount Laurel, NJ 08054

Dear Ms. Bozarth:

The Supplier Diversity Office (SDO) is in receipt of your certification renewal information (application). This consists of your request to renew the certification of JAFA Technologies, 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 JAFA Technologies, Inc. as a woman-owned business enterprise (WBE) with the business description of TECHNICAL CONSULTING SERVICES IN ELECTRONIC TOLL COLLECTION AND RELATED INTELLIGENT TRANSPORTATION SYSTEMS; AS WELL AS SUBCONTRACTOR SERVICES INCLUDING PROJECT MANAGEMENT, DOCUMENTATION, TESTING, TRAINING AND LANE CONTROLLER SOFTWARE APPLICATIONS 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 May 24, 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 May 24, 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

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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)."

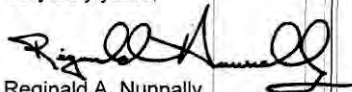
Furthermore, you have a continuing duty to notify SDO of a change in any information that is relevant to the firm's certification eligibility and to ensure that the information and documentation relied upon by SDO to certify or to maintain the certification of the business enterprise is accurate, complete 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

M/WBE FORMS: JTM CONCEPTS

REF NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-88

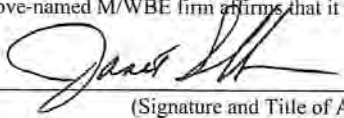
**SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY****M/WBE LETTER OF INTENT
(TO BE COMPLETED BY M/WBE FIRM)**Name of Offeror Firm: CSR Qinqdao Sifang Co., LTDAddress: 300 N. LaSalle Street, Suite 2240City: Chicago State: IL Zip: 60654Name of M/WBE Firm: JTM Concepts, Inc.Address: 420 23rd StreetCity: Rock Island State: IL Zip: 61201Telephone: 309.794.1057**Description of work to be performed by M/WBE firm:**Technical publications/documentation and training.

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:  President
(Signature and Title of Authorized Official)Date: April 15, 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.)

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RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-89

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

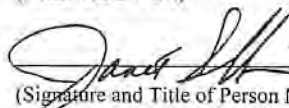
STATE OF Illinois Date: April 14, 2014COUNTY OF Henry S.S.

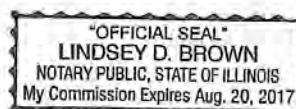
The undersigned being duly sworn, deposes and says that he/she is the
President
(Sole Owner; Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)

of JTM Concepts, Inc.
(name of M/WBE)

and certifies that since the date of its certification by
The Commonwealth of Massachusetts, Operational Services Division,
(SDO) Office of Supplier Diversity

the certification has not been revoked nor has it expired nor has there been any change in the minority
status of JTM Concepts, Inc.
(Name of M/WBE)

 President
(Signature and Title of Person Making Affidavit)

Sworn to before me this 14th day of April, 2014Notary Public: Lindsey D. BrownMy commission expires: August 20, 2017

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

June 4, 2013

Ms. Tracey Masamoto
JTM Concepts, Inc.
420 23rd Street
Rock Island, IL 61201

Dear Ms. Masamoto:

The Supplier Diversity Office (SDO) is in receipt of your certification renewal information (application). This consists of your request to renew the certification of JTM Concepts, 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 JTM Concepts, Inc. as a minority and woman-owned business enterprise (MBE and WBE) with the business description of TECHNICAL PUBLICATIONS, INFORMATION SYSTEMS, INTERNET AND INTRANET APPLICATIONS, COMPUTER ENGINEERING AND PROGRAMMING, DATABASE MANAGEMENT, 3D SIMULATION DEVELOPMENT AND DEPLOYMENT 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 10, 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 10, 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

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TDD: (617) 727-2716

Fax: (617) 502-8841

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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

M/WBE FORMS: RL CONTROLS**REF NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-88****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: CSR Qingdao Sifang Co., Ltd.Address: 300 N. LaSalle Street, Suite 2240City: Chicago State: IL Zip: 60654Name of M/WBE Firm: RL Controls, LLCAddress: 10-V Gill StCity: Woburn State: MA Zip: 01801

Telephone: _____

Description of work to be performed by M/WBE firm:

as per Assembly work plan
org-Red 0001-Labor

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] Principal/owner
(Signature and Title of Authorized Official)Date: 5/16/14**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.)

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RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-89

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF Massachusetts Date: 4/29/14COUNTY 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)

Glen Rubish Principal owner
(Signature and Title of Person Making Affidavit)

Sworn to before me this 29th day of April, 2014Notary Public: [Signature]My commission expires: 8/18/18

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 02108-1552Deval L. Patrick
GovernorGlen Shor
SecretaryGary 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;

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TDD: (617) 727-2716

Fax: (617) 502-8841

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- 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

M/WBE FORMS: TRANSITAIR

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-88

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: CSR Qingdao Sifang Co., Ltd.Address: 300 N. LaSalle, St., Suite 2240City: State: Zip: Chicago, IL 60654Name of M/WBE Firm: TransitairAddress: One William K. Jackson LaneCity: State: Zip: Hornell, New York 14843Telephone: (607) 324-7860**Description of work to be performed by M/WBE firm:**Heating, Ventilating and Air Conditioning Systems

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: Michael L. Nisbet
Michael L. Nisbet, Managing Director & CFO (Signature and Title of Authorized Official)Date: April 23, 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.)

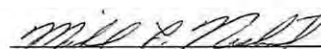
RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-89

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF NEW YORK Date: April 23, 2014COUNTY OF STEUBEN S.S.

The undersigned being duly sworn, deposes and says that he/she is the

Managing Director & CFO
(Sole Owner; Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)of Transitair
(name of M/WBE)and certifies that since the date of its certification by
The Commonwealth of Massachusetts
(SDO)the certification has not been revoked nor has it expired nor has there been any change in the
minority status of Transitair
(Name of M/WBE)
Michael L. Nisbet, Managing Director & CFO
(Signature and Title of Person Making Affidavit)Sworn to before me this 23 day of April, 2014Notary Public: Helen M. ShickMy commission expires: 3/29/15

HELEN M. SHICK
Notary Public, State of New York
No. 01SH5010291
Qualified in Steuben County
Commission Expires March 29, 2015

NOTE: The Offeror must attach the M/WBE's most recent certification letter or other
documentation establishing M/WBE certification to this affidavit.

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-88

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: CSR Qingdao Sifang Co., Ltd.
Address: 300 N. LaSalle, St., Suite 2240
City: State: Zip: Chicago, IL 60654

Name of M/WBE Firm: Transitair
Address: One William K. Jackson Lane
City: State: Zip: Hornell, New York 14843
Telephone: (607) 324-7860

Description of work to be performed by M/WBE firm:

Electrical Panels – Motorman’s Consoles – Hostler Panels

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: Michael L. Nisbet
Michael L. Nisbet, Managing Director & CFO (Signature and Title of Authorized Official)

Date: April 23, 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.)

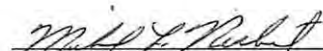
RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-89

SECTION B
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STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF NEW YORK Date: April 23, 2014COUNTY OF STEUBEN S.S.

The undersigned being duly sworn, deposes and says that he/she is the

Managing Director & CFO
(Sole Owner; Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)of Transitair
(name of M/WBE)and certifies that since the date of its certification by
The Commonwealth of Massachusetts
(SDO)the certification has not been revoked nor has it expired nor has there been any change in the
minority status of Transitair
(Name of M/WBE)

Michael L. Nisbet, Managing Director & CFO
(Signature and Title of Person Making Affidavit)Sworn to before me this 23 day of April, 2014Notary Public: Helen M. ShickMy commission expires: 3/29/15

HELEN M. SHICK
Notary Public, State of New York
No. 01SH5010291
Qualified in Steuben County 15
Commission Expires March 29, 2015

NOTE: The Offeror must attach the M/WBE's most recent certification letter or other
documentation establishing M/WBE certification to this affidavit.

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-88

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: CSR Qingdao Sifang Co., Ltd.Address: 300 N. LaSalle, St., Suite 2240City: State: Zip: Chicago, IL 60654Name of M/WBE Firm: TransitairAddress: One William K. Jackson LaneCity: State: Zip: Hornell, New York 14843Telephone: (607) 324-7860**Description of work to be performed by M/WBE firm:**Undercar Equipment Boxes & Misc Fabrication

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: Michael L. Nisbet
Michael L. Nisbet, Managing Director & CFO (Signature and Title of Authorized Official)

Date: April 23, 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.)

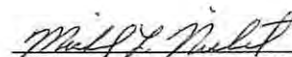
RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-89

SECTION B
**PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY**

M/WBE AFFIDAVIT

STATE OF NEW YORK Date: April 23, 2014COUNTY OF STEUBEN S.S.

The undersigned being duly sworn, deposes and says that he/she is the

Managing Director & CFO
(Sole Owner; Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)of Transitair
(name of M/WBE)and certifies that since the date of its certification by
The Commonwealth of Massachusetts
(SDO)the certification has not been revoked nor has it expired nor has there been any change in the
minority status of Transitair
(Name of M/WBE)

Michael L. Nisbet, Managing Director & CFO
(Signature and Title of Person Making Affidavit)Sworn to before me this 23 day of April, 20 14Notary Public: Helen M. ShickMy commission expires: 3/29/15 **HELEN M. SHICK**
Notary Public, State of New York
No. 01SH5010291
Qualified in Steuben County
Commission Expires March 29, 2015NOTE: The Offeror must attach the M/WBE's most recent certification letter or other
documentation establishing M/WBE certification to this affidavit.

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-88

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: CSR Qingdao Sifang Co., Ltd.
Address: 300 N. LaSalle, St., Suite 2240
City: State: Zip: Chicago, IL 60654

Name of M/WBE Firm: Transitair
Address: One William K. Jackson Lane
City: State: Zip: Hornell, New York 14843
Telephone: (607) 324-7860

Description of work to be performed by M/WBE firm:

Wire Harnesses (Carbody & Truck), Cabling & Trainline

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: Michael L. Nisbet
Michael L. Nisbet, Managing Director & CFO (Signature and Title of Authorized Official)

Date: April 23, 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.)

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-89

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF NEW YORKDate: April 23, 2014COUNTY OF STEUBEN

S.S.

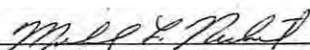
The undersigned being duly sworn, deposes and says that he/she is the

Managing Director & CFO
(Sole Owner; Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)

of Transitair
(name of M/WBE)

and certifies that since the date of its certification by
The Commonwealth of Massachusetts
(SDO)

the certification has not been revoked nor has it expired nor has there been any change in the
minority status of Transitair
(Name of M/WBE)


Michael L. Nisbet, Managing Director & CFO
(Signature and Title of Person Making Affidavit)

Sworn to before me this 23 day of April, 2014Notary Public: Helen M. ShickMy commission expires: 3/29/15

HELEN M. SHICK
Notary Public, State of New York
No. 01SH5010291
Qualified in Steuben County
Commission Expires March 29, 2015

NOTE: The Offeror must attach the M/WBE's most recent certification letter or other
documentation establishing M/WBE certification to this affidavit.

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-88

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: CSR Qingdao Sifang Co., Ltd.
Address: 300 N. LaSalle, St., Suite 2240
City: State: Zip: Chicago, IL 60654

Name of M/WBE Firm: Transitair
Address: One William K. Jackson Lane
City: State: Zip: Hornell, New York 14843
Telephone: (607) 324-7860

Description of work to be performed by M/WBE firm:

Car 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: 
Michael L. Nisbet, Managing Director & CFO (Signature and Title of Authorized Official)

Date: April 23, 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.)

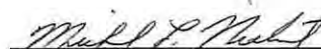

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-89

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF NEW YORK Date: April 23, 2014COUNTY OF STEUBEN S.S.

The undersigned being duly sworn, deposes and says that he/she is the

Managing Director & CFO
(Sole Owner; Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)of Transitair
(name of M/WBE)and certifies that since the date of its certification by
The Commonwealth of Massachusetts
(SDO)the certification has not been revoked nor has it expired nor has there been any change in the
minority status of Transitair
(Name of M/WBE)
Michael L. Nisbet, Managing Director & CFO
(Signature and Title of Person Making Affidavit)Sworn to before me this 23 day of April, 2014Notary Public: My commission expires: 3/29/15

HELEN M. SHICK
Notary Public, State of New York
No. 01SH5010291
Qualified in Steuben County
Commission Expires March 29, 2015

NOTE: The Offeror must attach the M/WBE's most recent certification letter or other
documentation establishing M/WBE certification to this affidavit.

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-88

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: CSR Qingdao Sifang Co., Ltd.Address: 300 N. LaSalle, St., Suite 2240City: State: Zip: Chicago, IL 60654Name of M/WBE Firm: TransitairAddress: One William K. Jackson LaneCity: State: Zip: Hornell, New York 14843Telephone: (607) 324-7860**Description of work to be performed by M/WBE firm:**Truck 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: Michael L. Nisbet
Michael L. Nisbet, Managing Director & CFO (Signature and Title of Authorized Official)

Date: April 23, 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.)

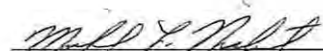
RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-89

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

STATE OF NEW YORK Date: April 23, 2014COUNTY OF STEBEN S.S.

The undersigned being duly sworn, deposes and says that he/she is the

Managing Director & CFO
(Sole Owner; Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)of Transitair
(name of M/WBE)and certifies that since the date of its certification by
The Commonwealth of Massachusetts
(SDO)the certification has not been revoked nor has it expired nor has there been any change in the
minority status of Transitair
(Name of M/WBE)
Michael L. Nisbet, Managing Director & CFO
(Signature and Title of Person Making Affidavit)Sworn to before me this 23 day of April, 2014Notary Public: Helen M. ShickMy commission expires: 3/29/15

HELEN M. SHICK
Notary Public, State of New York
No. 01SH5010291
Qualified in Steuben County
Commission Expires March 29, 2015

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 DIVISIONOne Ashburton Place, Suite 1017
Boston, MA 02108-1552Deval L. Patrick
GovernorGlen Shor
SecretaryGary J. Lambert
Assistant Secretary for
Operational Services

April 11, 2014

Mr. Dhruv Sharma
TRANSITAIR, INC.
1 William K. Jackson Lane
Hornell, NY 14843

Dear Mr. Sharma:

Congratulations on your certification! The Supplier Diversity Office (SDO) is pleased to notify you that your firm was certified as a minority-owned business enterprise (MBE) with the certified business description, ASSEMBLY AND MANUFACTURE: RAILROAD EQUIPMENT, VENTILATING AND AIR CONDITIONING, SUPPLY OF CURRENT CARRYING DEVICES, AND ELECTRONIC CONTROL EQUIPMENT; AND SHEET METAL FABRICATION. **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 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 April 10, 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;

Tel: (617) 720-3300

www.mass.gov/osd

TDD: (617) 727-2716

Fax: (617) 502-8841
Follow us on Twitter: @Mass_OSD

- 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 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

M/WBE FORMS: US ECO PRODUCTS

REP NO. CAP 27-10

NEW ORANGE AND RED LINE VEHICLES

B-88

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: CSR Qingdao Sifang Co., Ltd
Address: 300 N. LaSalle St. Suite 2240
City: Chicago State: IL Zip: 60654

Name of M/WBE Firm: US Eco Products, Corporation
Address: 16 Hillview Dr.
City: Cleveland State: OH Zip: 44134
Telephone: 978-457-9229

Description of work to be performed by M/WBE firm:


Supplier of Green Safety equipment, Green
cleaning products and Ice melt.
May add products during the contract

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 and Title of Authorized Official)

Date: 5/5/2014

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.)

MS1 166048170.1

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-89

**SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY**

M/WBE AFFIDAVIT

STATE OF MA Date: 3/11/2014

COUNTY OF Essex S.S.

The undersigned being duly sworn, deposes and says that he/she is the
Noreen Madros
(Sole Owner, Partner, President, Treasurer, or Other Duty Authorized Official of a Corporation)
of US Eco Products, Corporation
(name of M/WBE)

and certifies that since the date of its certification by
May 18, 2012
(SDO)

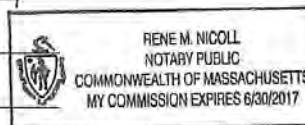
the certification has not been revoked nor has it expired nor has there been any change in the minority
status of US Eco Products, Corporation
(Name of M/WBE)

Noreen Madros, President
(Signature and Title of Person Making Affidavit)

Sworn to before me this 11th day of March, 2014

Notary Public: Rene M. Nicoll

My commission expires: _____



NOTE: The Offeror must attach the M/WBE's most recent certification letter or other documentation establishing M/WBE certification to this affidavit.

DEVAL L. PATRICK
GOVERNORTIMOTHY P. MURRAY
LIEUTENANT GOVERNORREGINALD A. NUNNALLY
EXECUTIVE DIRECTOR**COMMONWEALTH OF MASSACHUSETTS**
DEPARTMENT OF BUSINESS AND TECHNOLOGY
STATE OFFICE OF MINORITY AND WOMEN BUSINESS ASSISTANCEMassachusetts Transportation Building
Ten Park Plaza, Suite 3740, Boston, MA 02116

www.mass.gov/somwba

TELEPHONE:
(617) 973-8692FACSIMILE:
(617) 973-8637

May 17, 2010

Ms. Doreen Blades
US Eco Products Corporation
P O Box 213
West Newbury, MA 01985

Dear Ms. Blades:

Congratulations on your certification! The State Office of Minority and Women Business Assistance (SOMWBA) is pleased to notify you that your firm was certified as a woman-owned business enterprise (WBE) with the certified business description, WHOLESALER OF "SAFE PAW" GREEN ICE MELT PRODUCT.

Your company will be listed in both the SOMWBA Directory and in the Massachusetts Central Register, which are published at regular intervals. The SOMWBA 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 SOMWBA 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 SOMWBA to certify or to maintain the certification of the business enterprise is accurate, complete and not misleading. You are required to notify SOMWBA 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 SOMWBA 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 13, 2012, and every two years thereafter, please send SOMWBA the following documents to renew your certification:

- 1) All company financial statements since the date of the company's then most recent SOMWBA certification;



Page 2

- 2) A signed copy of all U.S. Tax Returns and Schedules since the date of the company's then most recent SOMWBA 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

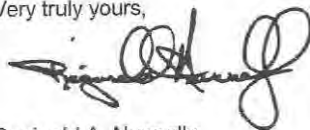
PLEASE NOTE THAT THE FOLLOWING ITEMS 4-6 CAN BE COMBINED ON ONE NOTARIZED STATEMENT:

- 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 SOMWBA certification as defined in State regulations 425 CMR 2.00 State Office of Minority and Women Business Assistance."
- 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 SOMWBA 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 SOMWBA certified." List all contract names, contract amounts and the names of the agencies with which you have contracted from the date of your last SOMWBA 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 SOMWBA 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 SOMWBA 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 SOMWBA 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

M/WBE FORMS: UTC RAS

02/14/2013 01:53 6172920433

CRE MANAGEMENT

PAGE 01/02

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES B-88

**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: CSR Qingdao Sifang Co., Ltd.
Address: 300 N. LaSalle Street, Suite 2240
City: State: Zip: Chicago, IL 60654

Name of M/WBE Firm: UTC RAS 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:

TRUCK ASSEMBLY
WHEEL/SET

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: Blair A. Slatt CEO/PRESIDENT
(Signature and Title of Authorized Official)

Date: 5-10-2014

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.)

RFP NO. CAP 27-10 NEW ORANGE AND RED LINE VEHICLES R-82

SECTION B
PART B TECHNICAL PROPOSAL AND
STATEMENTS AND CERTIFICATIONS REGARDING ELIGIBILITY

M/WBE AFFIDAVIT

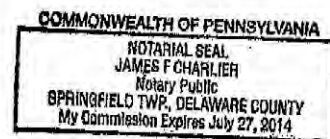
STATE OF PENNSYLVANIADate: 5/10/2014COUNTY OF DELAWARE

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 UTC2AS 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 UTC2AS INC
(Name of M/WBE)Betty A. Scott CEO/PRESIDENT
(Signature and Title of Person Making Affidavit)Sworn to before me this 10 day of MAY, 2014Notary Public: James F. CharlierMy commission expires: JULY 27, 2014NOTE: The Offeror must attach the M/WBE's most recent certification letter or other
documentation establishing M/WBE certification to this affidavit.

MAY-07-1998 16:06

P.02/03

**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 02108-1552Deval L. Patrick
GovernorGlen Shor
SecretaryGary J. Lambert
Assistant Secretary for
Operational Services

May 12, 2014

Ms. Betty Scott
UTCRA, 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;

Tel: (617) 720-3300

www.mass.gov/osd

TDD: (617) 727-2716

Fax: (617) 502-8841
Follow us on Twitter: @Mass_OSD

MAY-07-1998 16:07

P.03/03

- 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

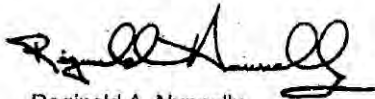
PLEASE NOTE THAT THE FOLLOWING ITEMS 4-6 CAN BE COMBINED ON ONE NOTARIZED STATEMENT:

- 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 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

TOTAL P.03