

Region of Waterloo  
Stage 1 Light Rail Transit Project

Design and Construction Performance Output Specifications  
Article 1  
Management Provisions

## **Table of Contents**

1.1	Project Management Requirements .....	1-1
1.2	Management Program and Project Management Plans .....	1-2
1.3	Configuration Management Plan .....	1-12
1.4	Systems Integration and Interface Management Plan.....	1-19
1.5	Reviews and Reports .....	1-24
1.6	Dependability Program.....	1-28
1.7	Phase 2 Requirements for Operations, Maintenance and Safety and Security Plans .....	1-31

**ARTICLE 1 MANAGEMENT PROVISIONS**

**1.1 Project Management Requirements**

- (a) Project Co shall establish and be fully responsible for the Project Management Plan to be employed to accomplish the Work. All elements of the Project Management Plan described or referenced in this Article or elsewhere in the Project Agreement are subject to review and approval by the Region. Project Co shall employ a system of organizing, planning, monitoring, and controlling to encompass all of the Work. The purpose of this Article is to provide project management requirements and guidelines for Project Co to use in the implementation of these requirements. Project Co's approach to management of the project shall be described in Project Co's Project Management Plan (PMP) and in supporting plans, programs, and procedures which will further explain Project Co's approach in greater detail. The presentation of specific project management requirements within this Article must not be construed to limit or modify in any way Project Co's responsibility to provide a holistic, comprehensive, and fully functional approach to project management responsibilities. Project Co may add to these requirements, revise lexicon, combine and rearrange these requirements, or otherwise make modifications as needed to enable Project Co to meet its overall responsibility to provide a holistic, comprehensive, and fully functional approach to PMP and to prepare the supporting plans and programs needed to successfully deliver all aspects of the Stage 1 LRT Project.
- (b) Project Co shall establish procedures to ensure all plans produced as a result of the requirements of this Article remain current throughout the Project Agreement performance period. All documents issued by Project Co shall be capable of revision without complete reissue of the document using appropriate document control procedures.
- (c) Project Co shall prepare and submit to the Region a Basis of Design Report: This is a technical document to be prepared and controlled by Project Co which will include Project Co's specific design solutions, will contain explicit design criteria for those solutions and other technical information, as needed, to guide all stages of the design development process. This document shall contain the design approach and criteria requirements for each design discipline and shall also incorporate and expand upon the design requirements cited in the Project Agreement or in Project Co's accepted submission at financial close. It is a living document that must be initially developed to a preliminary level that clearly defines Project Co's design approaches as part of Project Co's Design Presentation Meetings and Proposal Submission but it is not a separate document at that stage. After Financial Close it shall be developed as a stand alone document and advanced to 100% completion by the end of Phase 1. It shall be maintained and updated as needed during Phase 2 and all copies shall be controlled by Project Co to ensure all design entities and the Region have the most current version and the final Basis of Design Report shall be submitted to the Region at substantial completion.
- (d) The PMP shall incorporate and expand upon the PMP requirements cited in the Project Agreement or in Project Co's accepted submission at financial close. It is a living document that must be initially developed to a preliminary level that clearly defines Project Co's approach to managing the project as part of Project Co's Design Presentation Meetings and Proposal Submission but it is not a separate document at that stage. After Financial Close it shall be

developed as a stand alone document and advanced to 100% completion by the end of Phase 1. It shall be maintained and updated as needed during Phase 2 and all copies shall be controlled by Project Co to ensure that all members of Project Co's team and the Region have the most current version and the final PMP for the Design and Construction Phase shall be submitted to the Region at substantial completion and a stand alone document for the Operations and Maintenance phase of the work.

## **1.2 Management Program and Project Management Plans**

- (a) The nature of the Work dictates that formal plans be developed by Project Co to fully define Project Co's approach to accomplishing the work in the Project Agreement. The plans reflected herein have been grouped to minimize the total number of documents to be originated by Project Co. Project Co may, due to organization structure or for other reasons, choose to group the requirements differently and submit a different number of documents. Such variations shall be clearly identified by Project Co in the PMP and approved by the Region. It is preferred that Project Co's management documentation shall be structured so passive efforts which can be expected to require only infrequent revision and active efforts which can be expected to require frequent revision shall be included in different documents. Specifically, efforts such as Project Schedules and the Submittal List shall be packaged and submitted with frequent revision required as a consideration. Regardless how Project Co approaches the separation of management documentation, all documents shall be maintained current at all times.
- (b) For management purposes the Stage 1 LRT Project is divided into three basic phases. Phase 1 is anticipated to be approximately 100 days in length and it is expected that Project Co will mobilize its resources and enhance its designs to at least a preliminary engineering level, complete most of Standard and Directive Drawings and perform most of the data gathering needed for the commencement of Phase 2 which is the final design, construction, testing and commissioning phase. Phase 3 is the commencement of revenue service. Project Co shall submit a PMP which includes Phase 1, and Phase 2 work as well as the preparatory work needed for Phase 3. These Plans shall be consistent with the Organization and Management information presented by Project Co in its Submission. Any differences from or changes to the information provided in Project Co's Submission shall require the Region's approval. Within thirty (30) calendar days after the commencement of Phase 1, the Project Management Plan contained in Project Co's Submission shall be updated and re-submitted and reflect any refinements that surfaced within these first thirty (30) days. The PMP shall be updated at the commencement of Phase 2 and submitted within thirty (30) calendar days after the commencement of Phase 2.
- (c) The Project Management Plans shall include as a minimum the items cited in this Article. Where there are specific differences in the management or organization of the Phase 1 and Phase 2 work, these differences shall be noted in the PMP.
- (d) The PMP shall have a listing of Key personnel, together with their qualifications, responsibilities, limits of authority and involvement in the Project.
- (e) The PMP shall have a complete description of the Work Breakdown Structure (WBS), indicating the source/responsibility for completing each aspect of the Work. The WBS shall be the basis for organizing all Phase 2 Work under the Project Agreement, and used in the organization of the Project Schedule, Submittal Schedule, and Schedule of Values. The Preliminary Work Breakdown Structure is provided in Schedule 15-2 Article 19. Project Co shall add WBS

elements for any additional work scope which it foresees or where additional detail is necessary. The WBS shall focus on the Phase 2 Work and can be less detailed for the Phase 1 work.

- (f) The Project Management Plan shall describe the approach for providing cost information and cost estimating services for the duration of the Stage 1 LRT Project. These services shall involve the following items:
  - (i) Current Working Estimate (CWE)
  - (ii) Historical Costing Log
  - (iii) Cost Trending
  - (iv) Cost Estimating.

Project Co shall maintain a current working estimate including all costs incurred or forecast for the Project. The Current Working Estimate shall utilize Project Co's Schedule of Values or cost estimates for work not included in the Schedule of Values. Historical records for Phases 1 and 2 Work Items shall be kept current and include all CWE changes. When requested, Project Co shall prepare costs estimates to assist the Region in evaluating changes or impacts to the Project. Project Co shall provide cost estimating services as required under the direction of the Region to assist in cost analyses; life cycle cost studies, and/or cost impacts resulting from construction of the System. Project Co shall also assist in any cash flow and/or cost escalation analyses that the Region may require.

- (g) The Project Management Plan shall include a summary of the Critical Path Method (CPM) Project Schedule for the Phase 1/Preliminary Engineering Work. The Phase 1 section of the Baseline Schedule shall be developed using the Precedence Diagramming Method (PDM) and shall, among other things, identify one or more critical paths through the Work. The level of schedule detail shall include activities for each Work Category described in this Article for the Phase 1 Scope of Work and outlined accordingly in accordance with this Article, Schedule 15-2 Article 19 and the Project Agreement, and shall be cost loaded with the amount in the Schedule of Values for each Work Category in order to produce cash flows, and during Phase 1, and to verify Progress. Project Co may assign costs to an activity or to a milestone depending upon the nature of the work. These requirements apply to both the Preliminary Phase 1 Project Schedule submitted with Project Co's Submission and the resubmittal of the Phase 1 Project Management Plan due within the first thirty (30) calendar days after the commencement of Phase 1 containing the Phase 1 section of the Baseline Schedule.
- (h) The Project Management Plan shall, likewise, include a summary CPM Project Schedule for the Phase 2 final design, construction, testing and commissioning activities. It shall be developed using the PDM and shall, among other things, identify one or more critical paths through the Work and denote construction Work Packages for fast-tracking purposes. The activities in the Phase 2 Project Schedule shall be cost loaded by applying Project Co's Schedule of Values for each individual WBS Work Category (WBS Code 2) in combination with its applicable Specific Stations, Line Segments and Buildings (WBS Code 1) to one or more CPM network activities or milestones. This cost allocation shall occur over time in advance of the actual performance of the Work for any WBS Work Category. As the Work progresses, the resulting budgeted value for work accomplished, as calculated by scheduling software, shall be used to verify Progress. The level of schedule detail of the cost loaded Phase 2 Project Schedule for the Submission and updates shall be in accordance with Schedule 15-2 Article 19.

- (i) The Project Management Plan shall include the Phase 1 and Phase 2 Schedule of Values included in Project Co's Submission.
- (j) The Project Management Plan shall include a Submittal List and Schedule for all Phase 1 and Phase 2 deliverables and design review data. This information shall be an expansion of the information provided in Project Co's Proposal Submission.
- (k) If required, the Project Management Plan shall include separate organization charts for the Phase 1 and Phase 2, showing Project Co's organization (including subcontractors' organizations) with a narrative. The narrative shall describe how each entity interacts and interfaces during each Project Phase, defines its general and Project-specific responsibilities, and discusses how the individual entities coordinate their Work.
- (l) If required, the Project Management Plan shall include separate descriptions for the Phase 1 and Phase 2 of Project Co's plans/strategy for prosecuting the Work.
- (m) The Project Management Plan shall include a numbering system and distribution listing for all correspondence and transmittals under this Project Agreement, subject to acceptance by the Region and compliance with other submittal procedural requirements in the Project Agreement.
- (n) The elements listed below shall be included the Project Management Plans and are discussed in greater detail in this Article and in other sections of the Project Agreement. These elements include but are not limited to:
  - (i) Management Information System – Schedule 15-2 Article 1, Section 1.2 (o)(iii))
  - (ii) Performance Measurement and Performance Charts – Schedule 15-2 Article 1, Section 1.2 (o)(iv)
  - (iii) Project Schedule – Schedule 15-2 Article 19
  - (iv) Project Co Support for Progress Reviews and Audits – Schedule 15-2 Article 1, Section 1.2 (o)(vi)
  - (v) Progress Reviews and Reports – Schedule 15-2 Article 1, Section 1.2 (o)(vii) & Article 1.5
  - (vi) Submittal Report – Schedule 15-2 Article 1, Section 1.2 (o)(viii) & Article 1.5(d)
  - (vii) Engineering and Design Plan – Schedule 15-2 Article 1, Section 1.2 (o)(ix)
  - (viii) Manufacturing and Procurement Plan – Schedule 15-2 Article 1, Section 1.2 (o)(x)
  - (ix) Installation Plan – Schedule 15-2 Article 1, Section 1.2 (o)(xi)
  - (x) Construction Management Plan – Schedule 15-2 Article 1, Section 1.2 (o)(xii)
  - (xi) Configuration Management – Schedule 15-2 Article 1, Section 1.2 (o)(xiii) & Section 1.3
  - (xii) Design Review Requirements and Summary Review Schedule – Schedule 15-2 Article 1, Section 1.2 (o)(xiii)
  - (xiii) Dependability Program – Schedule 15-2 Article 1, Section 1.6
  - (xiv) Systems Integration and Interface Management Plan – Schedule 15-2 Article 1, Section 1.2 (o)(xiv) & Section 1.4
  - (xv) Safety and Security Management Program – Schedule 15-3 Article 2

- (xvi) Verification, Test and Acceptance Program – Schedule 15-2 Article 13
- (xvii) Maintainability Demonstration Tests – Schedule 15-2 Article 13, Section 13.6 (b)
- (xviii) Energy Management Plan – Schedule 15-2 Article 7
- (xix) Quality Management Plan – Schedule 11
- (xx) Phase 2 Requirements for Operations, Maintenance and Safety and Security Plans - Schedule 15-2 Article 1.7
- (xxi) Review Procedures – Schedule 10
- (xii) Design Management – Schedule 15-2 Appendix U
- (o) Project Management Plan Elements
  - (i) Project Co Organization
    - A. Project Co shall prepare and maintain current an Organization Chart reflecting Project Co's organizational structure and relative authorities in the performance of the Work and the Project Agreement. Project Co's Organization Chart shall indicate the functional responsibilities of each organization unit and each position.
    - B. Project Co shall assign a Project Manager to manage the accomplishment of the Work. All Region formal communications shall be addressed to the Project Manager, who shall have full authority to represent and to act on behalf of and for Project Co. Project Co's Organization Chart shall show the names of Key personnel in different organizational units and their reporting relationships to the Project Manager.
  - (ii) Key Personnel
    - A. Project Co shall identify all Key personnel and lead positions of the organization required to accomplish the Work. These personnel shall be identified by title and position in Project Co's organization as reflected on the Organization Chart. The titles assigned shall be reflective of responsibilities, authority, and duties. Project Co shall include a resume for each Key or Lead Person identified. These personnel shall be responsible to Project Co's Project Manager for the Work. Key personnel identification shall be based on major discipline requirements and, in addition to the Project Manager, shall include the following levels of responsibility:
      - 1. Managers
      - 2. Supervisors
      - 3. Lead Engineers/Architects
      - 4. Lead Administrators.
  - (iii) Management Information System
    - A. Project Co shall describe in the PMP the approach to implement a Management Information System to identify, control, and store data of the Work in a manner which allows the ease of retrieval and assures dissemination to affected

disciplines. The Management Information System may consist of one database management system performing all functions or several database management systems designed for specific functions. The overall Management Information System shall include all data required for the Work as well as all communications among Project Co, subcontractors, vendors, etc., and the Region which address Project Agreement information or issues. The Management Information System shall be used to produce the Monthly Progress Reports as described in the Articles herein and the Project Agreement.

- (iv) Performance Measurement and Performance Charts
  - A. Project Co shall describe in the PMP the approach for measuring performance of Project Co in fulfilling its responsibilities under the Project Agreement. One summary level performance measurement tool is the Performance Chart to reflect major program milestones contained in detail in the Project Schedule. The Chart of milestone activities shall be directly comparable to the major milestones reflected on the Project Schedule required by this Article herein, Schedule 15-2 Article 19, and the Project Agreement. The Chart format shall visually reflect progressive status between milestones, to include planned and actual percent earned value curves overlaying scheduled activities. The Project Agreement Performance Chart shall be updated and submitted monthly with the Monthly Progress Report. Other areas that Project Co shall report on performance are Earned Value, Cash flow forecasts, Safety, Design Package Status, Non conformance list and resolution, testing program, and identification of community issues and the status.
- (v) Project Schedule
  - A. See Schedule 15-2 Article 19 for detailed Project Schedule requirements.
- (vi) Project Co Support for Progress Reviews and Audits
  - A. Project Co shall provide technical and managerial support to accomplish the objectives of all reviews and audits required by the Project Agreement. The Project Management Plans shall address the various reviews and audits and summarily describe the procedures to be used to effectively schedule, address issues, assign actions, provide action follow up and closeout, and maintain and report status.
- (vii) Progress Reviews and Reports
  - A. Project Co shall implement a review and reporting system to provide status updates on the progress of the Work, as defined in this Article herein. Project Co shall include in the Project Management Plans the procedures to be used to schedule and accomplish all reviews, and to identify and track to completion all actions and reporting results of reviews, including decisions reached therein.
- (viii) Submittal Report, Submittal List and Submission Check Lists
  - A. The Submittal Report shall include all Phase 1, 2, and 3 submittals contained in this Article and throughout the Project Agreement. Project Co shall expand the requirements contained in the Preliminary Submittal List, as necessary, to ensure integration of all the deliverables is accomplished and all interdependence is



recognized. The Project Management Plans shall contain the details of how Project Co will accomplish this integration, including sample forms to be used. Project Co shall issue and maintain the Submittal Report separately from the Project Management Plan.

- B. Project Co shall prepare a Preliminary Submittal List for the Project as part of the Proposal Submission based upon the submittal requirements cited in Schedules 15-2 and 15-3 supplemented by submittals identified by Project Co during Submission preparation. Project Co shall submit an updated version covering Phase 1 and Phase 2 submittals to the Region for review and comment forty-five (30) calendar days after Financial Close. The data in the Submittal List generally does not include financial reports, invoices, and other information incidental to Project Agreement administration.
- C. Project Co shall prepare examples of the Submission Check Lists to be used by Project Co for fixed facilities and system submissions as part of Project Co's Proposal Submission. The examples accompanying the Submission shall address the Phase 1 submissions and Ready for Construction submissions. The final Submission Check Lists for each submission shall be provided no later than 60 days after the commencement of Phase 1 along with Project Co's updated design unit/package plan and updated Submittal List and shall include all intermediate submissions. The Submission Check Lists, at a minimum must provide the level of design development for each design discipline, scope, content, calculations, presentation, and special studies associated with each design submission. Project Co's Project Manager shall sign the specific Submission Check List for each submittal attesting that the actual submission meets the requirements as previously defined in the specific Submission Check List for that submission.
- D. All data submittals shall be enclosures to a Project Co transmittal letter. Project Co shall submit a sample submittal of the transmittal letter to the Region.
- E. The following identification requirements are in addition to Project Co's own identification, such as drawing or document numbers. Each submittal item in the Submittal List shall be identified by a numeric designation. Project Co shall develop a supplemental numeric designator system to identify data subcategories and subitems Project Co expects to submit. Each item may require one or more submittals and each submittal may be subjected to revision from time to time. Further identification shall be provided by Project Co as follows: Each discrete submittal item or subitem will be identified with a sequential numerical suffix beginning with ".01." This numerical suffix will identify the submittal as distinct from all others under that item or subitem. Each submittal with the numerical suffix shall be followed by an alpha suffix. The suffix "A" will denote the initial submittal of the item within a given numerical suffix. Suffixes "B," "C," "D," etc., shall denote succeeding revisions of that item.

(ix) Engineering and Design Plan

- A. Project Co shall include in the Project Management Plans an Engineering and Design Plan summarizing of all civil and system design activities required of Project Co to translate technical requirements into detailed designs to the point of release to manufacturing, construction, and procurement. In addition to any

Project Agreement requirements for milestone progress and design reviews, requirements, all internal activities within Project Co's organization, which support or drive the design efforts, shall be included in the Engineering and Design Plans. These events shall be reflected on the Project Schedules, as defined in this Article and Schedule 15-2 Article 19 and shall be initially included as supporting information. This information shall be updated and distributed through Project Co scheduling procedures and maintained current in the Project Management Plans.

- B. Project Co shall develop and submit to the Region a Design Unit/Packaging Plan which provides Project Co's approach to producing design documents in consideration of a logical sequence of construction or procurement, geographic and political boundaries, subcontracting of the work, permitting processes, and any other factor that needs to be considered to develop an efficient approach to the production of design, permitting, or other design supporting documents. Project Co's Proposal Submission for Project Management shall contain the initial design packaging plan for Phase 1 and Phase 2 which also identifies self performed work from work packages intended to be used in a bid process or a sole source procurement.
- C. The Engineering and Design Plan shall include a section on the System Engineering Management Plan (SEMP). The SEMP shall be developed by Project Co as a separated plan and submitted to the Region. Project Co shall update the SEMP if significant scope, schedule, or other project changes occur. The SEMP shall address the general system engineering principles and practices to be used through the development of the design and shall include all information necessary to guide the design including the life cycle aspects of the system. The SEMP shall include as a minimum:
- Roles and responsibilities
  - System lifecycle process description
  - High level system integration program process
  - Systems design management process
  - High level testing and commission process
  - High level configuration control process; and
  - Training requirements

Since some of the above are separate documents, they can be incorporated into the SEMP by reference.

The SEMP shall describe the main Systems Engineering tasks and activities required to be undertaken during the program development stage to ensure that the electrical, mechanical and functional aspects and systems designs and interfaces are in accordance with the Project Agreement.

The tasks and activities identified below provide further clarification of System Engineering responsibilities. Systems engineering design team main objectives

are to provide critical guidance and support throughout Project Co's organization in the following areas:

- Transform operational needs into a description of the integrated system configuration, to satisfy the operational need according to the measures of effectiveness;
- Integrate related technical parameters and ensure compatibility of all physical, functional, and technical program interfaces in a manner which optimizes the total system definition and design; and
- Integrate the efforts of all systems disciplines and engineering specialties into the total System Engineering effort.

The Systems engineering design team will evolve the technical requirements and concepts within the Project Agreement into specific design solutions for the following items:

- Operations Planning;
- System Safety;
- System Security;
- Fire Life and Safety;
- System Assurance;
- Performance and functionality;
- Subsystems and System related Fixed Facilities specific Interfaces;
- Human factors.

The above specifically applies to the implementation of the following Subsystems:

- Signaling and Train Control;
- Crossing Warning Systems;
- Trackwork;
- Power Supply and Distribution;
- Overhead Catenary;
- Communication and Radio;
- Fare Collection provisions;
- LRV Vehicle – on board equipment;
- Workshop Equipment and non-revenue vehicles;
- The overall integration between the various disciplines.

(x) Manufacturing and Procurement Plan

- A. Project Co shall include in the Project Management Plans all activities relating to manufacturing and procurement in the Manufacturing and Procurement Plan which translates technical specification requirements and Project Co detail designs into factory tested and shipped products. All of Project Co's efforts relating to manufacturing and procurement shall be described. This Manufacturing and Procurement Plan shall be prepared in consonance with Quality Assurance requirements and shall be supported by Project Schedule. The Manufacturing and Procurement Plan shall be updated and distributed through Project Co as part of the scheduling updating procedures.
- (xi). Installation Plan
- A. Project Co shall summarily define, in the Project Management Plans, the activities associated with receiving inspection, site preparation, installation of equipment and materials. The Installation Plan shall reflect all critical activities associated with equipment delivery, storage (if required); release of installation drawings, procedures, and processes (where required), installation and checkout, pre-installation inspection of facilities where equipment is to be installed, and numbers of installations to be worked concurrently. Installation activities shall be fully coordinated and compatible with Quality Assurance and System Verification Testing Acceptance and Commissioning requirements. The Installation Plan shall be revised as necessary to reflect current Project Schedule. The Installation Plan shall be updated and distributed through Project Co as part of the scheduling updating procedures. Project Co shall clearly define the process by which all installation interfaces are identified and the method(s) to be used to obtain the Region's and other agencies' or jurisdictions' approval of installation support or interface requirements.
- (xii) Construction Management Plan
- A. Project Co shall summarily define, in the Project Management Plans, the activities associated with managing the construction activities. This summary shall reflect all critical activities associated with construction activities and shall distinguish between self performed construction activities and construction work being performed by subcontractors. The Construction Management Plan shall describe the construction management organization and address the following CM activities:
1. Ability to respond to local access issues and other constructed related impacts to businesses and residents during construction.
  2. Support provided by CM staff to ensure that the Manager of Quality Assurance and Quality Control can perform all QA/QC inspections or related QA/QC activities to assure compliance with the Project Co's design documents and the Project Agreement;
  3. Control and Delivery materials for material testing and sampling requirements;
  4. Review all design documents, transmittals and shop drawings prior to incorporation into the work in conjunction with the Engineer of Record;

5. Conduct and document weekly construction progress review meetings to ascertain job progress and identify and resolve problems;
  6. Prepare input for the monthly status report that includes progress, budgets, schedule, critical construction status indicators and milestones, response time for requests for information (RFIs), claims, and reporting of any non-conformance and deficiencies and the identified corrective actions;
  7. Update the cost-loaded CPMs initially and monthly including subcontractor information;
  8. Respond to all subcontractor Requests for Information (RFI) related to field construction;
  9. Create and Maintain RFI tracking system including date submitted, date returned, and disposition code;
  10. Support the Manager of Quality Assurance and Quality Control as required in tracking all non-conformance reports for closure;
  11. Process that confirm that the basic survey controls points have been checked by a qualified survey entity immediately prior to commencing work relying on the control point;
  12. Monitor and direct subcontractor forces to coordinate the work;
  13. Monitor and direct self performed construction forces to coordinate the work;
  14. Assist the Region in public involvement efforts;
  15. Monitor and track all permit requirements.
- (xiii) Configuration Management
- A. Project Co shall describe in the PMP the Configuration Management efforts to be put into place to implement all requirements of this Article herein (Section 1.3) and elsewhere in the Project Agreement. This information shall include identification of organization roles involved in Configuration Management activities and the summary procedures to be used to accomplish effective Configuration Management.
- (xiv) Design Review Requirements and Summary Review Schedule
- A. Project Co shall identify in the PMP the grouping of design submission for design review purposes and provide procedures and a summary schedule for accomplishing the reviews and incorporating changes.
- (xv) Systems Integration and Interface Management Plan
- A. Project Co shall describe in the PMP the Systems Integration and Interface Management Plan proposed to meet the requirements of this Section 1.4 herein. This information shall summarize procedures for identifying and controlling interfaces and identification of organization roles in these activities. This requirement is in addition to the detail requirements to be incorporated in the Configuration Management Plan or Installation Plan, as required in this Article.

- (xvi) Safety and Security Management Program
  - A. Project Co shall participate in and be responsible for parts of the Safety and Security Management Program as described in Schedule 15-3 Article 2 and in other section of the Project Agreement. Project Co shall include in the Project Management Plan a section devoted to the Safety and Security Management Program, detailing how Project Co's responsibilities are to be accomplished.

### **1.3 Configuration Management Plan**

- (a) Configuration Management is a process of defining and controlling a project configuration from a predetermined point (baseline) through the life of the project, thereby providing a definition of the project configuration at any point and a record of progression from the initially defined baseline. Project Co shall be responsible for maintaining strict configuration control of all aspects of the design, construction, fabrication and installation of the system through the completion of Phase 3 services. Project Co's plans to accomplish the configuration management effort shall be described in a draft Configuration Management Plan which shall be provided to the Region for approval within sixty (60) calendar days after the issuance of the Phase 1. Project Co will complete the final version of the Configuration Management Plan within 120 days after the commencement of Phase 1 Project Co shall be responsible for carrying out all aspects of this Plan.
- (b) Project Co's Configuration Management Plan shall describe how Project Co plans to establish and maintain a Configuration Management Program encompassing all system hardware and interfaces between subsystems and to also assure all of its consultants, subcontractors, vendors, etc. comply with the requirements of this Article.
- (c) The Configuration Management Plan shall describe how Project Co will maintain accurate and current configuration records, the format of which shall be subject to the approval of the Region. The current configuration records shall be available to the Region at any time throughout the period of the Project Agreement.
- (d) Project Co shall, as part of the Management Information System, employ a Database Management software program for the maintenance of the configuration records. Project Co shall provide the Region with a user license to use this software along with User Documentation and full access to the database containing all of the configuration records. Project Co shall include training for up to two personnel from the Region in all software training sessions. When requested by the Region, Project Co shall provide one (1) electronic file containing the Project's current configuration status within seven (7) calendar days of such requests.
- (e) Configuration Identification
  - (i) Project Co's technical documentation shall be prepared to acceptable documented commercial standards and be capable of defining the approved configuration of system equipment under procurement, production, test, installation, or operational use. The technical documentation shall identify the configuration to the lowest level required to install replacement parts. Parts lists, in hierarchy format, identifying all replaceable parts, shall be structured in accordance with this Article.
- (f) Release Records and Documentation
  - (i) Project Co's release records and documentation shall:

- A. Define the composition of any part, component, subassembly, or assembly, at any level, in terms of subordinate part numbers; either on the part drawing or on a utilization record tabulation.
  - B. Show the specification document, specification control drawings, or source control drawing numbers associated with any subcontractor or Project Co, industry standard or government standard items, part number, or assemblies.
  - C. Identify engineering changes and retain the records of superseded configuration requirements affecting items which are to be or which have been formally accepted.
  - D. Employ a system of identifying numbers for specifications, drawings, and associated documents which shall ensure that the differing parts, assemblies, and installations are uniquely identifiable.
  - E. Assure that the Project Agreement number is shown on all documents and drawings provided under the terms of this Project Agreement
  - F. Show each part number used by Project Co or subcontractor identifies a specific item in a specific configuration. All items, beginning with the lowest level of repair and replacement identified by the same number shall have the same physical and functional characteristics, equivalent in performance and durability, and interchangeable without alteration to themselves or associated items, other than field installation adjustments which are a part of each installation procedure. An item shall not be considered interchangeable if it must be selected for fit or performance. Project Co shall have a system that coordinates part numbers with drawings and other reference documentation. Changes to a component part number shall be tracked to the next higher level of assembly by revising the part number of the next higher level of assembly or by another method acceptable to the Region to ensure configuration control is maintained.
- (g) Drawing and Document List or Tree
- (i) Project Co shall include a preliminary drawing and document list, in subsystem oriented hierarchy format (tree), within the Configuration Management Plan. This document shall be updated no later than quarterly, or at some other frequency as determined by the Region. An estimate or firm count of the quantity and submittal status of drawings and documents in each major category shall be included.
- (h) Configuration Control
- (i) Project Co shall be responsible for and maintain strict control of the configuration of: (1) the Civil work also referred at as Fixed Facilities; (2) the Operating System; (3) the interfaces between the Operating System and all related Fixed Facilities; and, (4) the interfaces between the System and non-System facilities and entities.
  - (ii) Once the configuration for an element of the System is established (for example, at Design Reviews), the configuration of all such elements shall not be changed by Project Co without the Region's approval. Configuration Control is essential in any fast tracked construction project. Once configuration changes are approved, formal Changed Configuration Documentation shall be circulated in accordance with a distribution list, which includes the Region, developed for that purpose.

- (iii) Project Co shall maintain configuration control records of all items and the actual incorporation points (by date, lot, unit, or other specific identification) of changes. A document entitled "Configuration Data", defining the applicable configuration, shall accompany each significant item shipped to the site as determined by Project Co and Region to be significant during the Design Review process. The Region shall have access to all configuration control records related to the System.
- (iv) Project Co shall apply orderly controls to manage changes to both the Region's Project Agreement and the Region's RFP drawings from which Project Co will derive the final Specifications and Construction Drawings. . For further clarity, any changes to the Project Agreement shall be in accordance with Schedule 22. Project Co shall ensure any and all submissions for changes, whether submitted in response to either Project Agreement requirements or from Region directed changes or if proposed by Project Co or its subcontractors, are screened at all appropriate Project Co. management levels to ensure all potential impacts of such changes have been thoroughly considered and analyzed.
- (v) Engineering Change Proposals (ECP): The term "Engineering Change Proposal" (ECP) is arbitrary and Project Co may use its existing terminology to define the change control process, provided that this process is in compliance with the requirements of this Article and the Project Agreement. ECP's shall be processed against both the Region's Project Agreement documents and drawings as well as Project Co's approved Final Specifications and Final Construction Drawings, except such processing will not be finalized for Project Co's Final and Final Construction Drawings until such Specifications and Construction Drawings have been approved by the Region. The Region may initiate a change by submittal of an Engineering Change Proposal to Project Co and Project Co shall respond by processing the ECP.
- (vi) Classification of Changes:
  - A. Class I Changes - Any proposed change which affects form, fit, function, performance, interface, safety, reliability, maintainability, cost or schedule shall be considered a Class I Change.
  - B. Class II Change - Any proposed engineering change not falling within the preceding definition of a Class I change shall be designated as a Class II change. Examples of Class II changes are corrections and clarifications of documents and drawings.
- (vii) Change Processing: All proposed Class I changes shall be submitted by Project Co prior to implementation. Project Co shall submit the change proposal accompanied by all technical documentation and firm cost (where appropriate) and Project Schedule information necessary to fully evaluate the change. Each proposed change shall be consecutively numbered. All Class I changes that immediately affect safety or hazardous conditions shall, in addition, be immediately reported to the Region in writing by Project Co or in person, followed by written confirmation within twenty-four (24) hours. Class II changes are not required to have the Region approval prior to implementation, unless the change affects documentation previously approved. For these documents, the ECP shall be furnished to the Region along with document revisions prior to release.



- (i) Configuration Accountability, Record Drawings and Documents, and As-Built Documentation
  - (i) Project Co shall maintain records such that the configuration of any item delivered or installed shall be identifiable in terms of its component part numbers. Differences between the As-Built configuration and the engineering release documentation, as allowed by the Quality Assurance requirements, shall be documented. The status of current change incorporations shall be recorded for points in product test, production, installation or operational usage. Project Co shall provide a Notice of Modification on forms identifying any and all changes to equipment shipped. A serialization and configuration record shall be maintained by Project Co for each major equipment assembly, and a copy of such record shall be furnished with the delivered equipment.
  - (ii) The As-Built configuration of all hardware and software of the System shall be documented in drawings, documents, notes and other descriptive material as specified herein.
  - (iii) As Work progresses, Project Co shall keep a complete and accurate field and manufacturing plant record of all changes or deviations from the Project Agreement, Project Co's subsystem and procurement specifications, and Project Co's approved equipment assembly drawings and similar documents indicating the Work as actually, fabricated and installed. All such changes shall be neatly and correctly shown on the drawings affected. This set of Record Drawings and Documents shall be kept at Project Co's offices, manufacturing plant and Project Site during fabrication/installation. At the conclusion of the Phase 2 Work, the Record Drawings and Documents shall be consolidated, organized, cataloged and submitted to the Region.
  - (iv) Mark-up Procedure: During progress of the Work, Project Co shall maintain a set of Record Record Drawings and Documents, with mark-up of actual work which varies from the Work as originally shown. Project Co shall mark whatever document is most capable of showing the actual condition, fully and accurately. Where shop drawings are marked up, Project Co shall mark cross-references on Construction Drawings at the corresponding locations. Marks shall be made with erasable colored pencil, using separate colors where feasible to distinguish between changes for different categories of work at the same general location. The mark-up shall include important additional information which was either shown schematically or omitted from original drawings. Particular attention shall be given to information on Work canceled, which would be difficult to identify or measure and record at a later date. Alternate numbers, change order numbers and similar identification shall be noted.
  - (v) On Completion of the Work and as a condition of final acceptance of the Phase 2 Work, Project Co shall deliver to the Region all Record drawings, design specifications, and design documents (the "Record Drawings and Documents Deliverables"). These Record Drawings and Documents Deliverables shall not be marked up and shall be complete in every detail so as to correctly reflect As-Built conditions. The Record Drawings and Documents Deliverables shall be segregated into three groups: (1) non-proprietary, (2) proprietary and (3) commercially available products, components, subsystems, or other items. The non-proprietary Record Drawings and Documents shall describe all aspects of the site installation work and conditions and all designs which are unique to and provided specifically for the System, including the application design data for any proprietary and commercially available items. A commercially available item is defined to be a product,

component, subsystem, or other item which is produced for a multiplicity of other purposes or can be used with other transit system technologies and not unique to Project Co's technology being supplied for the Project.

- (vi) For all "commercially available" items (including software), the Record Drawings and Documents Deliverables shall include the purchase specifications, the names and address of the Original Equipment Manufacturers (OEMs) from which the items were purchased (i.e., subcontractors or otherwise), the OEM's identifying information/model numbers for reordering, and the documentation supplied by the OEM with the items.
- (vii) The "proprietary" Record Drawings and Documents shall provide all the necessary design information (except for production tooling and manufacturing components that are not commercially available and not unique to the Project).
- (viii) Certification of As-Built: The Record Drawings and Documents shall be arranged in accordance with the approved Work Breakdown Structure and properly indexed. Project Co shall certify each of the revised Record Drawings and Documents is complete and accurate.
- (ix) Software Documentation: Special attention shall be given to documentation procedures for all computer software programs supplied as part of the System. Project Co shall submit to the Region for review and acceptance a Software Documentation Plan, indicating its proposed methods and procedures for software documentation. The Software Documentation Plan shall be submitted within forty-five (45) calendar days after the commencement of Phase 2 and be corrected by Project Co, as appropriate, within fourteen (14) calendar days following receipt of the Region's comments. For all software unique to the System and not commercially available, the Record Drawings and Documents shall include, at a minimum, all of the information necessary to make revisions in the software programs applications for the System for changes and/or expansions or extension of the System, such as functional, performance and interface requirements; descriptions of the supervisory, control, and operating software; source listings; flow charts; configuration control documentation; and programmer and user manuals incorporating appropriate modification and control procedures, including the name of any subcontractor and/or vendor if employed for preparation of this software. For all commercially available software used in the System, the Record Drawings and Documents shall include all of the documentation which is available from the supplier of such software. One reproducible master and two copies of all programmer and user manuals and other similar material shall be provided to the Region with the Record Drawings and Documents along with a complete and fully documented listing of all software programs (one electronic copy, two hard copies). See Schedule 15-2 Article 9 Intelligent Transportation Systems for Software Escrow requirements.
- (j) Design and Configuration Reviews and Audits
  - (i) The design and configuration reviews and audits specified in the following paragraphs shall be conducted by Project Co in concert with the Region. In all cases, review and/or approval by the Region shall not relieve Project Co from complying with all requirements specified. These reviews shall be conducted to evaluate the progress and technical adequacy of the design and the compatibility with the performance requirements of the Project Agreement. Project Co shall be responsible for establishing a schedule for the approval by the Region for the review of all designs under this Project Agreement.

- (ii) Design Reviews
  - A. Design reviews shall be conducted for individual or groups of system elements as defined herein for the purpose of establishing approved baselines for configuration control purposes. While review of Project Co designs will be accomplished by the Region at each of the milestone reviews, neither failure of the Region to identify a design deficiency nor the apparent satisfaction of the Region with Project Co's design shall relieve Project Co of responsibility for compliance with the requirements of this Project Agreement.
  - B. Design reviews for individual or groups of system elements shall be conducted at facilities suitable for the purpose and recommended by Project Co.
  - C. The design review requirements reflected in this Article are basic; however, specific or additional requirements may be applicable to some systems and, where applicable, are reflected in this Article.
- (iii) Production Configuration (Final Design) Review
  - A. The Final Design Review results in an approved final design baseline which subsequently falls under the Configuration Management Program and establishes the production configuration. Project Co effort to define the production configuration concurrent with the Final Design Review is significant and the effectiveness of the Configuration Management Program will greatly depend on the thoroughness of this effort. The design review data to be furnished for this review are all-inclusive of all data required to establish the production baseline. The data shall include: lists of major parts, assembly drawings, layout drawings, intended control data, logic diagrams, schematics, performance characteristics, design limitations, and details of new materials and processes. In addition, the data shall include a list of all engineering drawings, in hierarchy format, to the lowest level of repair and replacement, the documents referred to therein, and standards and specifications, all by revision or issue. The list shall include all the documentation necessary to define and identify the baseline configuration. The list shall be the basic configuration control document and shall be maintained current by Project Co throughout the performance of the Project Agreement. Once the approved production configuration baseline is established, all changes thereto shall be processed through the Configuration Management System.
  - B. In some cases, Project Co may desire to proceed with fabrication prior to completion of final design. The drawings and other documents identifying the design at time shall be considered as the production baseline and all changes thereto shall be via the Configuration Management system. Any changes required as a result of subsequent completion of Project Co activities required by the Project Agreement which result from the decision to proceed prior to final design completion shall be the responsibility and at the expense of Project Co.
- (iv) Unique Equipment Applications
  - A. If an item is supplied that is uniquely tested or calibrated by the manufacturer or user that utilizes facilities, settings, or procedures that result in selectivity peculiar to the Project or equipment that is not in the possession of the Region, a unique part number shall be applied to the object for each configuration supplied. If the

supplier makes a change in the test setup, procedure or facility, it shall cause a change in the part numbers being supplied (Class I change) and copies of the documentation describing the change shall also be supplied.

(k) Project Documentation

- (i) Project Co shall be furnished, at no charge, an electronic copy of all RFP Documents and reference drawings for this Project.
- (ii) Project Co shall maintain the field set of all drawings and specifications on the Project Site at all times and make such field set available at all times to the Region.
- (iii) Project Co shall immediately include plainly and conspicuously on the field set of drawings, and at appropriate paragraphs in the specifications, all changes and/or corrections made by addenda, Change Orders, RFIs as they are issued.
- (iv) Copies of all approved shop drawings and other submittals are to be kept on the Project Site at all times and made available at all times to the Region.

(l) Photography

- (i) Project Co shall provide color digital photographs and digital video with sharp and clearly shown details in accordance with the following requirements:
  - A. Digital Photographs and video of the Project Site or the manufacturing site shall be taken from up to ten different locations to clearly depict pre-construction conditions and the current stage of manufacturing and/or construction. The Region may prescribe specific locations for photographs required by the Region. Photographs and videos shall be taken daily over the duration of the construction. Photographs and videos shall be numbered and dated in a sequence, beginning with the number 1, and located on a key map, indicating an arrow to show the camera's line of sight.
  - B. Project Co shall setup a web based system for the Region's viewing the digital photography.

(m) Document Organization and Control

- (i) Project Co's responsibility as part of the Configuration Management Plan shall be to establish a document control system to organize, track and identify all documents, developed as part of the Work, throughout the duration of the Project. Project Co shall submit to the Region a Document Control Plan detailing how the document control system will be implemented. The Document Control System shall be included as a function in the Management Information System. As a minimum, Project Co shall serialize all correspondence and transmittals, and establish a logging system for incoming/outgoing correspondence showing action requirements and action(s) taken. Drawings, specifications, subcontract documents, reports, estimates, studies, reviews, RFIs and computer files, etc., shall be tracked by the logging system.
- (ii) Tracking logs for correspondence and documents shall be provided with all payment requests and at such other times as requested by the Region. Project Co shall establish a single source for transmitting and receiving documents and correspondence. Work from consultants, subcontractors, vendors, etc. shall be consolidated and managed by Project Co.

- (iii) Logs for correspondence and document controls shall be provided to the Region in electronic format and in hard copy for use by the Region.
- (iv) All correspondence to and from the Region and its consultants shall be serialized and separate incoming and outgoing correspondence logs maintained.
  - A. Within seven (7) calendar days after the commencement of Phase 1, Project Co and Region shall each designate in writing their authorized representatives, who shall receive copies of all or specific correspondence.
  - B. All correspondence shall include the Project name and Project Agreement number along with the specific subject of the letter. When replying to a specific letter, it is to be referenced.

#### **1.4 Systems Integration and Interface Management Plan**

##### **(a) General**

- (i) The Project Co shall be responsible for all Work required to design, build, operate, and maintain the Stage 1 LRT System, with the exception of those tasks explicitly identified and defined in the Project Agreement as the responsibility of the Region.
- (ii) In the course of complying with the provisions of this Project Agreement, various physical and performance interfaces of Project Co's developed equipment may depend on facilities, equipment, or services of organizations not under Project Co's control for successful operation. The majority of interfaces exist within the Project Agreement between Project Co and its consultants, subcontractors and suppliers, while the remaining interfaces exist between facilities and equipment furnished by the Region and with other third parties such as utilities. It is necessary all interfaces be identified and controlled by Project Co to assure the design at the interface is understood and agreed to by affected parties. Any changes to one side of the interface shall be accepted and accommodated by the opposing interface. Project Co shall include, in the Configuration Management Plan, the process by which interfaces are identified and controlled.
- (iii) Project Co shall provide a Systems Integration and Interface Management Plan, within sixty (60) calendar days following the issuance of Phase 1, regarding the interface of the System with itself, the Right-of-Way and any infrastructure contained therein; any adjoining facilities; electric, telephone, gas and other utilities; the City's water and sewer systems; the City's Fire and Police Departments; and any facility not provided by Project Co but which is used by Project Co for the System. This document shall identify each specific interface and provide the procedure by which each interface will be defined, agreed upon and controlled. The Systems Integration and Interface Management Plan shall contain a responsibility matrix identifying what entity is responsible for controlling the specific elements of the project. It shall be submitted to the Region. Updates shall be provided by Project Co when significant schedule or Project changes are made.
- (iv) This Article addresses the interfaces between each of the system elements and the system elements with the infrastructure, facilities, services, data, or other work being provided by Project or others. This Article is not intended to provide Project Co with a detailed description of all such interfaces; rather, it is a broad description focused on general interface areas and the systems integration needs of the project. Project Co shall inspect the related work, review the drawings and documentation provided by the Region, and

coordinate with the Region to identify and successfully comply with all interface and integration requirements in order to perform all of the work required to complete the Stage 1 LRT Project as defined in broad terms throughout the Project Agreement.

- (v) Project Co shall coordinate and integrate all System interfaces so that the System is properly integrated with itself and into the Project area, including the right-of-way, the surrounding communities, and all facilities, equipment, and data provided by others. This integration effort is critical to allow public and commerce activities to continue with minimal interruption throughout the construction, installation, testing, and commissioning phase of the Project.
  - (vi) Project Co shall establish and maintain a systematic, documented, comprehensive, and verifiable systems integration process to be applied throughout the duration of the Project. This process shall ensure that interfaces and interaction between infrastructure, facilities, subsystems, software, and operations and maintenance personnel have been identified and engineered to function together as a system. At a minimum, Project Co's system integration effort shall systematically identify and formally document all human interfaces with the elements of the System and all interfaces with external systems. External systems interfaces include other facilities, traffic, communities, and other agencies affected by the Stage 1 LRT Project. Project Co shall define methods to confirm compatibility between System elements, and carry out the necessary tests or other verification to demonstrate that every element functions and performs properly, both individually and as part of the complete System.
  - (vii) Interface Control Documents (ICD) shall be developed by Project Co and submitted to the Region. These Interface Control Documents shall be maintained current throughout the Project Agreement period and included as design data at all design reviews. Upon approval of any system, subsystem, or assembly contained in any ICD as a design baseline, the total ICD shall be subject to Configuration Management System Control unless specifically excluded by the Region.
- (b) Systems Integration Plan Submittal
- (i) Project Co shall submit a Systems Integration Plan to provide a detailed description of the integration of all Project Co provided construction, equipment, installation, and testing with the right-of-way, the surrounding communities, and all facilities, equipment, and data provided by others. The Systems Integration Plan shall confirm that all facilities and systems provided by Project Co are designed and constructed to comprise a fully integrated light rail system. The Systems Integration Plan shall further confirm that any facilities, equipment, and data provided by others accommodate Project Co's equipment and facilities and, where appropriate, that Project Co equipment and facilities fit with existing and planned adjacent facilities.
  - (ii) The Systems Integration Plan shall list all major System elements and define which elements have a direct or indirect interface or interaction. The Systems Integration Plan shall, as a minimum, define:
    - A. The entity within Project Co's organization responsible for managing and engineering the integration or interface
    - B. The agreed integration or interface arrangement (physical installation, power supply, signal levels, transfer characteristics, and other factors)

- C. The functional, performance, reliability, maintainability, and safety requirements of the individual elements forming the integration or interface
  - D. The proposed method and schedule for verifying the interface integrity, the individual element performance, and the combined integration or System performance, with appropriate pass/fail criteria for each.
  - E. The main elements in the Integrated System Demonstration Program
- (iii) Project Co shall be responsible for identifying and resolving all system interfaces which contribute to attainment of the overall System performance requirements or other Project Agreement requirements. A preliminary list of interfaces to be addressed includes:
- A. Track/Vehicle; Wheel/Rail
  - B. Vehicle/Facilities
  - C. Vehicle/Station Platform
  - D. Vehicle/Train Control/Signaling
  - E. Vehicle/Wayside Communications
  - F. Vehicle/Traffic Signal Systems
  - G. Vehicle/Traction Power Supply
  - H. Vehicle/Operator
  - I. Vehicle/Vehicle – including freight railroad
  - J. Communications/Fare Equipment
- (iv) Project Co shall add other integration or interfaces as the design and system integration process proceeds.
- (v) The following provide additional requirements on the contents of the Systems Integration Plan:
- A. For each of the interfaces identified by Project Co, Project Co shall, at an early stage of the design and procurement processes, investigate the interaction between interfacing elements, record the ICD for the interface, and verify that the design characteristics of the individual elements have been correctly specified.
  - B. If Project Co fails to provide necessary interface information, or if such information provided by Project Co is incorrect or subsequently changed, Project Co shall be responsible for all facility and equipment redesign and rework, whether the impacted facility and equipment are the responsibility of Project Co or others, or for modifying its Work or any Project Co provided subsystem to match the facility, or for modifying any facility, systems, or subsystems to match systems or subsystems provided by Project Co. Project Co shall also be responsible for any delay to others caused by delaying the furnishing of information, by furnishing incorrect information, or by subsequently changing information for which Project Co is responsible. Project Co shall notify the Region as soon as any interface information changes or is found to be incorrect.

- C. Project Co shall participate in coordination meetings with the Region and its representatives to develop and finalize all designs and interfaces as required. Updates of the Systems Integration Plan shall be provided by Project Co whenever significant changes are made to the Work or the Project Schedule.
- (c) Fixed Facilities
- (i) The System shall be contained entirely within the right-of-way and any additional Right-of-Way identified by Project Co is subject to the approval of the Region.
- (ii) Track
- A. This includes the equipment, attachments, and other appurtenances such as tracks, crossovers, switches, emergency walkways, and vehicle interfaces with ATP and crossing warning systems and communications, so that all of the requirements of the Project Agreement are met.
- B. The horizontal alignment, vertical profile, and longitudinal and lateral grades of the tracks are contained in the approved right of way. Minor adjustments may be made by Project Co to suit its specific technology and alignment. Project Co shall identify to the Region any increase in grades or decrease in curve radii as well as any additional right of way that Project Co's alignment may require beyond the right of way shown on the drawings provided by the Region. Any deviation from the Region's track alignment shall be identified by Project Co's and submitted for review by the Region and the Region reserves the right to reject changes that result in additional right of way impacts.
- C. Project Co shall establish detailed design and construction criteria and tolerances for the track, including superelevation, and shall verify the accuracy of the constructed track so that the vehicle ride comfort requirements of the Project Agreement are met.
- D. Track and OCS structures and equipment shall minimize visual impact by design and by concealment of equipment. All communications, power, and other wiring shall be in conduits, cable trays, and wireways along the track, concealed from view.
- E. The tracks, structure, equipment, and appurtenances shall minimize the collection of debris. Means shall be provided so that water draining from the trackway shall not cause harm to persons or property below. Drainage shall be provided for any precipitation which can accumulate in or under the trackway or its equipment and appurtenances. All trackway drainage components and similar appurtenances shall be concealed.
- F. Project Co shall be responsible for coordinating the interfaces with existing and pending infrastructure elements. This responsibility shall include generating designs, implementing demolition, and the relocation and restoration of utilities, sidewalks, and roadways. Any utilities crossing the track alignment shall be relocated as required, and roadways shall be reconfigured to restore existing functions and capacities. Project Co shall participate in development of relocation concepts and review of designs prepared by others, as required.



- (iii) LRT Stops
  - A. The general configurations of the LRT Stops and a typical configuration are shown on the Regions drawings. Except as provided herein, Project Co shall provide all aspects of the trackway and platform structure at LRT Stops, as well as all ancillary components and facilities, including electrical, ATP, mechanical, and communication spaces and equipment, necessary for the operation of trains. Conduit runs for fare vending, power, communications, and SCADA systems within the LRT Stop areas or embedded in the LRT Stop structure shall be properly integrated and interfaced within the LRT Stop and its surroundings.
  - B. Project Co shall provide support for the Region’s work with the various groups and organizations that will influence the design, to achieve the most appropriate solutions for each of the LRT Stops.
- (iv) Power Supply
  - A. Electrical power distribution equipment for System propulsion, auxiliary power, all facility housekeeping, Project Co furnished equipment located at stations, the Central Control Facility (CCF), the Operations, Maintenance and Storage Facilities (OMSF), and other locations shall be tested and installed by Project Co.
  - B. Power substation facilities shall be provided by Project Co at locations approved by the Region. These substations shall be the sources of all traction power, and shall in most cases power all other System equipment and facility housekeeping.
  - C. Project Co shall identify the power interfaces required for all its equipment in the Systems Integration Plan and fully detail them in Interface Control Documents.
  - D. Project Co shall identify the power interfaces for its equipment at the OMSF in the Systems Integration Plan and fully detail them in Interface Control Documents.
  - E. Uninterruptible power supplies (UPS) shall be provided by Project Co including all power wiring for equipment connected to the UPS equipment. All equipment that will supported by UPS shall be cited in Project Co’s submission.
  - F. Project Co shall provide and install all control wiring in each LRT Stop, at the OMSF and elsewhere, as required to interconnect System equipment and to connect such equipment with equipment, facilities, and services provided by others.
  - G. All electrical connections and equipment shall meet the requirements of, and properly interface with, the electric power utility. Project Co shall design and install the power distribution system and all power distribution interfaces in accordance with the electric power utility requirements. Project Co is responsible for conformance to these and all other Project Agreement requirements for design, interfaces, and installation.
  - H. Project Co shall coordinate the design of all power facilities and equipment with the Region. Project Co shall include a complete power system load analysis and describe the coordination required by the above sections in the Systems Integration Plan.
  - I. Project Co shall coordinate all aspects of the design and construction phasing of the power distribution system with the appropriate electric power utilities. Project Co

shall obtain electric power utility approvals for these and for final power distribution system acceptance. Project Co shall be responsible for any electric power utility design and coordination charges. Project Co shall arrange for all electric power utility service connections and shall pay any connection charges.

- (v) Central Control Facility
  - A. Project Co shall be responsible for completely finishing, furnishing, and equipping the CCF and for coordinating its final design with the Region. Project Co shall be responsible for all communications interfaces within the System and with outside communication systems, such as those provided by the local common carrier. Project Co shall coordinate with the local or airport weather stations to provide for appropriate weather monitoring capabilities at the CCF.
  - B. Project Co shall define the power interfaces for its equipment in the Systems Integration Plan.
- (vi) Operations, Maintenance and Storage Facilities
  - A. The site for the OMSF will be provided by the Region as shown on the Region's drawings. Project Co shall be responsible for coordinating with the Region the detailed design of this facility and its construction, finish out, furnishings, and equipping, including the supervisory offices, shops and other rooms, and vehicle storage areas. Project Co's System Integration Plan shall provide detailed information regarding these interfaces.
- (vii) Fare Collection
  - A. Project Co shall be responsible for the provisions for the fare collection system and shall identify these provisions in the Systems Integration Plan and fully detail them in Interface Control Documents.
- (d) Integrated Testing
  - (i) Prior to commissioning any segment of the System, Project Co shall test the elements of the System to demonstrate compliance with the characteristics defined in the Systems Integration Plan. As soon as practicable after testing the elements of the System, Project Co shall perform an integrated test for each identified interface, demonstrating the efficacy of the elements operating together. Refer to other Articles of the Project Agreement for additional information and in particular Schedule 15-2 Article 13.

## **1.5 Reviews and Reports**

- (a) General
  - (i) The reviews and reports addressed herein reflect only those data associated with Project Co Management System, and do not include reports resulting from activities such as tests, inspections, and other requirements which are addressed elsewhere in the Project Agreement.
  - (ii) Project Co shall provide technical and managerial support for reviews required by this Project Agreement. Reviews and review meetings shall be pre-arranged and held at Project Co's Project office. Project Co shall notify the Region fourteen (14) calendar days in advance of all pre-arranged review meetings.

(b) Initial Activities Report

- (i) The Initial Activities Report, submitted by Project Co within ten (10) calendar days after the issuance of Phase 1, shall identify critical activities to be initiated within the first sixty (60) calendar days of the Project Agreement. The Initial Activities Report shall, at a minimum, recommend the timing and content of Project Co/Region initial organizational meetings, identify data required by Project Co and not furnished in the Project Agreement documents, and identify the processes for defining the interfaces between Project Co furnished equipment and Region furnished facilities, equipment, and other third parties. The report shall include major Project Co activities which will occur prior to submittal of plans in all discipline areas. Due to the comparatively short amount of time after the commencement of Phase 1 this report is issued to identify all of the material to be contained in this document, the report may be by letter and forego the normal formality of reports to be submitted to the Region. Project Co may issue supplements to this report as the need for additional data is recognized within the sixty (60) day period.

(c) Progress Meetings and Reports

- (i) Progress Review Meetings - Project Co shall attend Progress Review Meetings every two weeks, to allow the Region to assess the Project's status. During the manufacturing and fabrication phase of the Project, Progress Review Meetings may, at the discretion of the Region be held at least once per quarter at the various Project Co facilities involved, and shall include tours of the facilities and Work-in-progress. The Region will notify Project Co at least forty-five (45) calendar days in advance to hold a Progress Review Meeting at one of the various Project Co facilities. As described in this Article, a Monthly Progress Report will be required from Project Co in advance of every other two-week Progress Review Meeting.
- (ii) Project Co shall establish the review agenda for all Progress Review Meetings to address the following topics, as applicable:
- A. Schedule Status with a Three Week Look Ahead
  - B. Events Planned vs. Events Accomplished
  - C. Recovery Program for Events Not Accomplished
  - D. Technical/Design Problems Experienced
  - E. Technical/Design Problems Anticipated
  - G. Fabrication/Procurement Problems Anticipated
  - H. Field Construction Problems Experienced
  - I. Field Construction Problems Anticipated
  - J. Installation Problems Experienced
  - K. Installation Problems Anticipated
  - L. Field Test Problems Experienced
  - M. Field Test Problems Anticipated
  - N. Activities Planned for Next Quarter and Expected Results

- O. Safety
  - P. Community Relations
  - Q. Quality
  - R. Other Issues
- (iii) The proposed agenda for each Progress Review Meeting shall be prepared by Project Co and furnished to the Region seven (7) calendar days in advance of such meetings, and any required agenda changes shall be returned to Project Co by the Region in sufficient time to allow preparation for the changes.
- (iv) Project Co shall assure availability of Project Co personnel to address or support issue discussions which have been scheduled. The following disciplines from Project Co's organization shall be represented at the Progress Meetings, as applicable, per the approved agenda:
- A. Project Management: project management, program control, contract administration, construction management, construction safety, quality, community relations and systems facilities design
  - B. Systems: vehicles, traction power, train control and communications, system assurance (safety, dependability, security, etc.), operations
  - C. Facilities: civil (e.g., field installation), architectural (e.g., Central Control Room layout, lighting, interfaces with others, etc.)
- (v) Monthly Progress Reports
- A. Project Co shall prepare and submit to the Region five (5) copies of a Monthly Progress Report at least five days before the applicable Progress Meeting. The initial format and detail level required for the Monthly Progress Report shall be established jointly by the Region and Project Co within thirty calendar (30) days after the commencement of Phase 1 based on a proposed format prepared by Project Co. Thereafter, the format and level of detail will change as the Work progresses. Topics to be covered in the Monthly Progress Report shall include, but not be limited to:
    - 1. Executive Summary
    - 2. Schedule and Resource Status
    - 3. Status of Payments, Retention and Withholding
    - 4. The status of Earned Value, as defined in Schedule 15-2 Article 19 of the PSOS, associated with Milestones, as defined in Schedule 21 of the Project Agreement, and a forecast of the dollar amounts of individual Milestone Payment Applications for the next six month period
    - 5. Status of Action Items including utility coordination, real estate issues and permitting issues
    - 6. Submittal status
    - 7. Drawing Schedule and Transmittal Status

8. Subcontractor
  9. Task Activities Planned for Next Month
  10. Monthly Task Activity and Accomplishments
  11. Identification of any Quality Assurance Problems
  12. Construction and Manufacturing Critical Design Issues
  13. A list of major equipment and material received in plants or at the Work Site
  14. Quality - Status of FAT, Inspections, Testing, Acceptance and Non-conformances
  15. Manpower and Task Completion Variance Analysis, Achieved vs. Planned
  16. Planned or Proposed Schedule or Budget Revision or other Remedial Actions
  17. Identification and Analysis of any Scheduling, Coordination or Other Problem Areas
  18. Copies of Logs for Incoming and Outgoing Correspondence and Documents for the Report Period
  19. Progress Photos and Videos
  20. Updated submittal schedule on a time-scaled bar chart showing scheduled and actual progress to date which is derived from the computerized Network Analysis.
- B. When requested by the Region, at least fourteen (14) calendar days in advance, the Monthly Progress Report shall also contain appendices dealing with the following topics:
1. Equipment Deliveries Schedule Status. Project Co shall provide a schedule status for equipment delivered to the factory and Work Site for all installed equipment. The report shall be based on the Network Analysis and show the major steps of procurement, fabrication/manufacturing, shipping and delivery. Planned dates shall be compared to actual and forecast each month.
  2. Field Construction Status. The progress and status of each field construction project or major activity shall be reported based upon the Network Analysis. The major steps of field construction shall be discussed, along with the planned and actual dates of progress and completion forecasts made.
  3. Resource Status. The resource status report shall show the actual person hours expended for each task. This will provide the Region with a basis for comparing the measured percentage completion for tasks shown in the invoice with the number of person hours which Project Co estimated would be required to achieve the percentage completion shown in the invoice. If the measured completion varies by more than 10% from the percent

calculated using actual and estimated person hours, Project Co shall submit a variance report with the invoice explaining reasons for the difference. The Region will evaluate the variance and provide recommendations for corrective action to Project Co if it is determined the variance indicates a scheduling/ budgeting problem.

4. Equipment Utilization. Project Co shall summarize, each month, the major construction equipment used during installation comparing planned usage vs. actual usage.

(d) Submittals Report

- (i) In order to ensure that the deliverables are thoroughly integrated and any cross-dependency between one submittal and another is recognized, Project Co shall develop a form and record thereon, for each submittal, the following:
  - A. Title
  - B. Identifying Number
  - C. Project Agreement Specification reference
  - D. Detail Description of Data to be Submitted
  - E. Approval Requirements (Project Co and the Region)
  - F. Frequency of Submittal
  - G. Identification of other Data Submittals which constrain this Submittal or which would be affected by a change to this submittal.
- (ii) These forms shall provide the basis of a Submittals Report to be provided by Project Co on a monthly basis along with any Project Co information which will assist in evaluating the submittals or describing Project Co internal procedures for accomplishing this task. This report shall be maintained current throughout the term of both the Phase 1 and Phase 2 Work.

**1.6 Dependability Program**

- (a) Project Co shall establish and maintain a Dependability Program encompassing the design, manufacturing, installation, testing and O&M activities of the Project Agreement. Elements that need to be addressed in the Dependability Program in order to achieve acceptable levels of dependability are:
  - (i) Specific requirements set out in the Project Agreement, including the requirements set forth in the specifications prepared by Project Co or included in Project Co's Submission.
  - (ii) A thorough listing of each lowest line replacement component with its design reliability, testing and life cycle requirements.
  - (iii) Vigorous enforcement of Quality Assurance Program requirements.
  - (iv) Vigorous enforcement of Testing requirements.
  - (v) Vigorous enforcement of Warranty requirements.
- (b) Dependability Plan

- (i) Project Co shall prepare a Dependability Plan which shall identify the activities, organization and the means of implementation of Project Co program to ensure compliance with the Project Agreement requirements. A preliminary draft of the Dependability Plan shall be developed by Project Co within ninety (90) calendar days after the issuance of Phase 1, and submitted to the Region for review and approval. Thereafter, the draft Plan shall be distributed to Project Co's design engineers and subcontractor working on the Project to assure the design and implementation of the Project accurately reflects approved operational concepts. During the course of the Work, the Dependability Plan shall be revised and updated by Project Co as necessary, and resubmitted for additional review and concurrence.
  - (ii) The Dependability Plan shall integrate the dependability engineering function with other program elements throughout the design, parts selection, manufacturing, installation, testing and Project Co's Operations and Maintenance (O&M) Work. At a minimum, the Dependability Plan shall include the following:
    - A. Program objectives
    - B. Program schedule and milestones
    - C. The means of implementation of the Dependability Plan relative to Project Co's personnel, their qualifications and relationships with management, design, fabrication, procurement, spares and logistics planning, installation, testing and O&M activities.
    - D. List of tasks and procedures planned to implement the program:
      - 1. Translation of Project Agreement requirements into Project Co's final designs.
      - 2. Subcontractor control.
      - 3. Design reviews.
      - 4. Organizational responsibilities.
      - 5. Incident reporting system for reporting of abnormal or unexpected events throughout the equipment test program as well as during the first year of O&M. During the manufacturing and field test activities of the Phase 2 Work, Project Co shall report all factory and field test failures monthly by lowest line replacement unit, including the part and serial numbers, and evaluate the data for possible patterns of failure.
      - 6. Dependability Demonstration Test after the commencement of Phase 3. After the issuance of Phase 3, Project Co shall report all hardware and software failures and evaluate the data for possible patterns of failure.
- (c) Dependability Requirements
- (i) The Region shall have the right during the term of this Project Agreement to have any failed item disassembled, photographed and documented by any means necessary in order to permit examination and analysis of the discrepancy jointly with Project Co, whether or not such failure occurs before or after the issuance of Phase 3. The cause of the discrepancy shall be categorized to determine if corrective action by Project Co should be in the area of design, quality, materials selection, maintenance actions or operating practices or

procedures. When the appropriate corrective action has been implemented by Project Co, a monitoring period shall be instituted to assure the corrective action has been effective. If the monitoring period produces favorable results, the corrective action shall be deemed appropriate. If the monitoring period does not produce favorable results, Project Co shall repeat the joint examination and analysis portion of the program again.

(d) Service Restoration Analysis

(i) Project Co shall perform a Service Restoration Analysis of the entire System. This analysis shall ensure:

- A. Clear, unambiguous criteria are developed for determining when and where maintenance personnel are dispatched.
- B. Clear, unambiguous criteria are developed for determining whether the disruption results from a wayside fault and initiating the necessary repair or replacement.
- C. Clear, unambiguous criteria are developed for determining whether the disruption results from a LRV fault and establishing the appropriate recovery response.
- D. Timely options for short-term disposition of disabled LRV's are investigated and provided; criteria for choosing the appropriate option are developed.
- E. Control procedures provide a clear path for disposal of disabled LRV's, re-entry of pushing LRV's, if used, and introduction of spare vehicles onto the System.
- F. Procedures for passenger transfer from disabled LRV's for all failure modes are in place.

(ii) The objective of the Service Restoration Analysis shall be to minimize system downtimes, and to provide realistic estimates for the System Dependability Allocation Analysis (SDAA), described in this Article.

(iii) The Service Restoration Analysis shall be prepared by Project Co within ninety (90) calendar days after the commencement of Phase 1. Once approved, this document shall serve as a primary input to the Systems Operations Plan and Operations/Maintenance Manuals.

(iv) As part of the Service Restoration Analysis, the capability of the System to provide degraded service modes shall be analyzed. These service modes shall be used to reduce the impact of a fault or service disruption. This analysis shall assess the time required to implement the degraded service mode, the practicality of LRV insertions or rerouting, the resultant effect on line capacity and passenger service, and the time to reconfigure to normal scheduled service.

(v) The Service Restoration Analysis shall recommend the degraded service modes found most effective. The appropriate logic, software and procedures shall be implemented for the modes recommended and approved.

(e) System Dependability Allocation Analysis

(i) As part of the Dependability Program, no later than one hundred twenty (120) calendar days after issuance of Phase 1, Project Co shall perform a System Dependability Allocation Analysis (SDAA) and prepare a report containing the results thereof. The SDAA shall define significant faults causing System service disruptions and delineate their effect on the



System and System elements availability. These faults shall include both failures in the classical reliability sense, and other causes external to the System equipment. For each fault, the System restoration procedure shall be defined, the service restore time shall be estimated and the individual fault rates shall be predicted in terms of faults per operating hour per unit of equipment. An overall prediction shall be derived for the dependability for each element and the System as a whole.

- (ii) "Significant" faults shall be listed to a level of detail at which 10 to 20 elements together will account for at least 90% of the total System. Data used to compile this list shall be based on records from the system supplier's baseline system.
- (iii) The SDAA shall be used to focus the service restoration response and reliability efforts of this program. Results of subsystem testing shall be used to update the SDAA when appropriate.

### **1.7 Phase 2 Requirements for Operations, Maintenance and Safety and Security Plans**

#### **(a) System Operations and Maintenance Management (SOMMP) Plans**

- (i) Project Co shall develop a series of plans during Phase 2 which, taken together, shall constitute a System Operations and Maintenance Management Program and serve as the basis for both the Phase 2 design and testing Work as well as for the O&M period. A minimum of three plans are required. The Operations Plan shall be developed as per the requirements of this Article, Schedule 15-4 Article 1 and other sections of the Project Agreement as applicable. The Maintenance Plan shall be developed as per the requirements of this Article, Schedule 15-3 Article 1 and other sections of the Project Agreement as applicable. The System Safety and Security Management Plan (SSMP) shall be developed as per the requirements of this Article, Schedule 15-3 - Article 3, and other sections of the Project Agreement as applicable. These plans shall be developed and compiled into a System Operations and Maintenance Program to guide the Phase 2 design, installation and test Work as well as for developing definitive plans for both the Operations and Maintenance functions of the System. A draft System Operations and Maintenance Management Program shall be developed within ninety (90) calendar days following the commencement Phase 1 and submitted to the Region for approval. Thereafter, it shall be revised, as appropriate, throughout Phases 1, 2 and 3.

#### **(b) SOMMP Procedures**

- (i) The focus of the System Operations and Maintenance Management Program shall be to maximize System safety, dependability, availability and to minimize operating costs. This shall be accomplished by configuring the System for ease of operation and providing all procedures necessary for safe, reliable and efficient operations. Project Co shall establish procedures to ensure all plans produced as a result of the requirements of this Article remain current throughout the Project Agreement performance period.

#### **(c) Personnel Qualifications and Authority**

- (i) Project Co's System Operations and Maintenance Management Program shall be structured to assure qualified operations and maintenance personnel are involved in the design, fabrication, installation and/or field construction to the extent necessary to verify operability and availability requirements shall be met. In addition, these personnel shall have the authority to make necessary decisions and ensure that corrective actions shall be

implemented. Project Co shall ensure operations and maintenance management plans and procedures are developed; and personnel are properly trained, including certification where required, to operate and maintain the System, and meet the other requirements of the Project Agreement.

(d) Form and Updates of Documentation

- (i) All plans and manuals required in this Article shall be submitted by Project Co to the Region for review and approval. Project Co shall establish a process to update parts of each plan and manual as required and as new information becomes available from testing and operating and maintenance experience. This process shall be submitted to the Region for review and approval. This process shall be followed throughout the testing, demonstration, and operating and maintenance periods. Copies of all updates shall be provided to the Region. All manuals and plans shall be originally prepared in the Canadian English language and written using text, terminology, diagrams and drawings that are clear, concise, and understandable by the operators, technicians, supervisors, managers and engineers who will use them for work and training. All materials, manuals, procedures, plans, catalogs and lists provided as required in this Article shall be delivered in the quality specified.

(e) Normal and Contingent Operations Plan

- (i) The basic requirements for System LRT train operations are described below.
- (ii) Normal Operations
  - A. The normal operations for the LRT lines will be a right-hand-running trains operating between the terminal stations at Fairview Mall and Conestoga Mall. Each train will stop at each LRT Stop on its route. When the trains are within Semi Exclusive Roadway Right of Way, reverse running is not permitted under normal operations. When the trains are within Semi Exclusive LRT Right of Way and under ATP reverse running is possible within the limits of Project Co design for Train Control Systems and procedures established for reverse running.
  - B. The normal operations for the LRT shall include the incorporation of one northbound movement of freight railroad service during evening off peak LRT service hours.
- (iii) Contingent Operations
  - A. Project Co shall design the LRT System for contingent operations to address conditions that may result from failure management and maintenance-related operations. Reverse running within Semi Exclusive Roadway Right of Way may be necessary to remove failed trains or to use the turnback crossovers located near the Pine Street and Cedar Street stations as part of revenue service contingent operations. The design of the traffic control signals shall assist in reverse running at these designated turnback locations.
  - B. The continent operations for the LRT shall include the incorporation of one southbound movement of freight railroad service during off peak LRT service morning hours.
- (iv) Start-Up, Shut-Down and Service Transitions

- A. The System shall maximize the level of service during daily start-up, shut-down and peak/off-peak service transitions. The need for operations and maintenance staff shall be minimized. Procedures shall be developed to ensure that trains entering service are safe, fully functional, and that cleanliness standards are met. Procedures shall also be developed to ensure that trains leaving service contain no passengers. Procedures shall also address the use of passenger information, such as destination signs and public address announcements.
- (v) Failure Management
  - A. The System and its operation shall be developed such that in the event of failures, the inconvenience to passengers is minimized. As in all aspects of System operations, safety must be assured as the highest priority. Project Co shall develop a Failure Management Plan section in the Systems Operations Plan to support design development and review, and to develop operational procedures for failure management conditions. The Failure Management Plan shall at a minimum:
    - 1. Address to the extent possible design solutions such as turnback crossovers for potential failure modes of all System elements that may impact operations
    - 2. Establish operational principles and guidelines for dealing with failures to facilitate timely return to normal operations while prioritizing safety and maximizing System Service Availability
    - 3. Support System Performance Analysis (see below) as a tool for optimizing the System design
    - 4. Place particular emphasis on both likely and high impact failure modes.
- (f) System Train Simulation and Performance Analysis
  - (i) Project Co shall develop a computer based model of System operations to support development of the design and to evaluate conformance to the requirements of this Section. The model shall be reasonably accurate to predict the operation and interaction of trains on all routes of the System and may consist of a combination of train and traffic simulation software if required. The Proposal Submission shall contain a detailed description of the model and the initial model results. The final model shall be provided to the Region no later than 365 days prior to revenue service. The model shall be capable of providing the data required to calculate the System Service Availability for a given time period. The model shall have the capability to be used to evaluate alternative failure management strategies, assist in training supervisors and in the analysis alternative train service schedules.
- (g) Types of Operation Plans
  - A. The Project Co shall provide the plans for System Operations Plan, Rail Activation Plan, Emergency Response Familiarization Program Plan, and other documents as defined below and in Schedule 15-3 Article 3, Schedule 15-4 Article 1:
    - (i) System Operations Plan
      - A. The System Operations Plan shall describe how the System will be operated, maintained and staffed. The Plan shall address operations in the initial year for

operations (2017) and up to and including 30 years of O&M service (2047). The Plan must address at least subjects listed below:

1. Service Objectives
2. Forecast Ridership
3. Service Patterns
4. Train Statistics
5. Track Configuration
6. Terminal Operations
7. Facility and System Descriptions
8. Normal, Contingent, Abnormal, and Emergency Operations
9. Maintenance and Contract Services
10. Organizational Structure
11. Job Descriptions
12. Operations/Maintenance Budget.

(ii) Rail Activation Management Plan

A. A Rail Activation Management Plan shall be required for the start-up of system operations and maintenance. The Plan shall identify all of the critical tasks that must be accomplished prior to revenue operations and provide management controls to monitor the successful and timely completion of each task. Each task shall be listed under the following functions:

1. Staffing
2. Training
3. Transportation
4. Maintenance/Engineering
5. Security
6. Safety
7. Verification, Test & Acceptance
8. Service Integration
9. Monitoring Fare Collection Equipment
10. Public Information
11. Laws, Regulations, and External Agreements

(iii) Emergency Response Familiarization Program Plan

A. An Emergency Response Familiarization Program Plan shall be developed and submitted to the Region to inform the emergency response agencies serving the rail corridor of the safety critical elements of the System. This plan shall provide a high

level description of the System and instructions to safely access it during times of emergencies including fatalities, injuries, derailments, fires, etc.

- (iv) Operating Rules, Procedures, and Training Programs
  - A. Project Co shall develop operating rules, procedures and training programs necessary to safely operate the System. These documents must be well integrated and shall be developed in the order as listed below. The Operating Rule Book and the Standard Operating Procedures shall be developed initially to address system commissioning, and shall be updated as appropriate to address revenue operations.
- (v) Operating Rule Book
  - A. An Operating Rule Book shall include at least the following:
    - 1. Safety Rules
    - 2. General Rules
    - 3. Conduct Rules
    - 4. Operating Rules.
  - B. The Rule Book shall provide the critical instructions for the safe and efficient operations of the System. The Rule Book shall apply to all those working on or about the light rail system, including contractors, employees, and visitors. Project Co shall assist in the development of rule books developed by other entities such as emergency responders, municipalities, utilities, or other third parties who may be to access the LRT right of way in the performance of their duties. Project Co shall be responsible for enforcing compliance with the Rule Book.
  - C. The Rule Book shall provide the basis for the Standard Operating Procedures and the Training Programs as defined below.
- (vi) Standard Operating Procedures
  - A. The Standard Operating Procedure Manual shall provide instructions during normal, contingent, abnormal and emergency operations and shall address at least the following subjects.
    - 1. General and Administrative
    - 2. Equipment and Troubleshooting
    - 3. Train Control
    - 4. Traction Power
    - 5. Train Operation
    - 6. Special Operations
    - 7. Passenger Relations
    - 8. Radio Network Control and Use.
  - B. Each procedure shall include:
    - 1. Standard Operating Procedure (SOP) Title

2. SOP Number
  3. Date of Issuance
  4. Revision #
  5. Classification of personnel affected
  6. Other Departments affected
  7. Signature block(s) by the appropriate Manager(s) authorizing the procedure.
- (vii) Training Programs
- A. Training Programs shall be developed to instruct staff on their duties in accordance with the operating rules and procedures and to ensure a safe and efficient working environment. Training shall be provided for staff such as:
    1. Central Control Operators
    2. Line Supervisors
    3. Maintenance Personnel
    4. Mechanics operating in limited capacity in the yard and Mainline
    5. Flagpersons
    6. Hi-rail Equipment Operators.
  - B. Workbooks, Worksheets and tests shall be developed for each program. Tests shall be successfully passed by each employee before engaging in safety critical tasks on or about the System.
- (h) System Maintenance Plan
- (i) Project Co shall develop and implement a comprehensive maintenance program for the System facilities and systems, which shall minimize operating costs and life cycle maintenance costs; maximize availability of facilities and systems; provide for System safety; maximize reliability and convenience of service for passengers; and provide adequate protection for employees, facilities, equipment, and parts. The maintenance program shall, as a minimum, provide the elements specified below and in Schedule 15-3 Article 1.
  - (ii) System Maintenance Plan Submittal
    - A. Project Co shall develop a System Maintenance Plan, which shall define the goals for maintaining the System; describe the inspection and maintenance functions required to meet those goals; and define the organization of resources and the schedule anticipated to perform those functions. Key elements of the System Maintenance Plan shall be the design, layout, and utilization of the OMSF, the maintenance manuals and training.
    - B. The System Maintenance Plan shall include, as a minimum, the following:
      1. Maintenance organization and staff responsibilities;
      2. Maintenance staff qualifications and training;

3. Quality assurance program to achieve the service quality standards established in the System Operations Plan;
  4. Description of maintenance manuals;
  5. Description of maintenance service to be subcontracted to outside entities
  6. Description of Maintenance Management Information System;
  7. Approach to scheduling of Preventive Maintenance work;
  8. Approach to Corrective Maintenance (scheduled and non-scheduled)
  9. Approach to diagnostic analysis of failures;
  10. Configuration control after start-up of System operations, as part of the Configuration Management Plan.
- C. The System Maintenance Plan shall describe the preventive maintenance program, as well as the process of responding to reports of non-functioning systems, subsystems, and equipment, and the corrective maintenance criteria for restoring these to fully functional status.
- D. Corrective maintenance programs shall be based on the principle of exchanging the lowest line-replaceable unit (LLRU) in the field, in order to minimize the mean time to repair. Insofar as possible, the use of external test equipment shall be minimized by the use of buffered, built-in annunciation of an LLRU fault condition. The System Maintenance Plan shall define the time to restore full function, for individual systems and subsystems, as follows:
1. Immediate response and restoration;
  2. Response and restoration during the current shift;
  3. Response and restoration by the end of the following shift;
  4. Response and restoration within 24 hours;
  5. Response and restoration requiring longer than within 24 hours.
- E. The System Maintenance Plan shall describe staff maintenance coverage, by category, as follows:
1. Continuous coverage 24 hours per day, 7 days per week;
  2. Coverage 7 days per week, but less than 24 hours per day;
  3. Coverage less than 7 days per week.
- (iii) Routine Cleaning, Inspection and Servicing
- A. The System Maintenance Plan shall require a program of routine periodic cleaning and servicing of System vehicles, facilities, and equipment. The cleaning shall be performed regularly and frequently, so that the System exhibits a neat and attractive appearance to passengers at all times and passengers and employees are not exposed to potential hazards due to unclean conditions. The objective of cleaning is to maintain all elements of the System as close as possible to new condition.

This is a particular requirement when removing graffiti, in that care must be exercised so that no damage results from the cleaning process.

- B. The System Maintenance Plan shall require a program of routine periodic inspections and servicing, including replacement of consumable items, lubrication, and calibration, with the objective of maximizing the probability that all System vehicles, facilities, and equipment are fully functional and operate correctly.
- C. In the Proposal, Project Co shall describe in some detail, Project Co's program for performing rail car fleet, LRT stop, and trackway inspections as required to support the System Service Availability requirements as per Schedule 15-3 Article 3. The type and frequency of the inspection program shall be advanced to a prefinal level as part of the Phase 1 submission and the final program shall be provided to the Region no later than 365 days prior to revenue service

(iv) Scheduled Preventive Maintenance

- A. Preventive maintenance shall be performed to keep all System elements in a state of good repair, to maximize reliability and equipment life, and to identify incipient failures, especially those that may affect revenue service.
- B. The System Maintenance Plan shall require Project Co to implement a program of scheduled preventive maintenance for every element of the System. The program may be based on time, distance, condition, reliability trends, or a combination thereof. Regardless of the basis, preventive maintenance shall be performed on a regular routine. The cycle of preventive maintenance shall be documented in the maintenance manuals and shall be consistent with equipment specifications.

(v) Unscheduled Corrective Maintenance

- A. The System Maintenance Plan shall include a program for unscheduled corrective maintenance for every element of the System. Project Co shall adopt a maintenance strategy that minimizes System downtime and maximizes System Availability. The requirements of corrective maintenance shall be considered during the design phase, so that the reliability of every System element contributes to high reliability and low operating costs.
- B. Project Co shall prioritize correcting failures on the basis of safety first, then on System Availability. Essential corrective maintenance shall not be deferred beyond the next scheduled preventive maintenance examination.
- C. Under no circumstances shall equipment that has failed in a manner that could render it unsafe be used in service.

(vi) Spare Parts Procurement, Cataloging and Inventory Control

- A. The System Maintenance Plan shall require implementation of an integrated materials procurement and inventory control program, which shall comprise the specification, purchase, inspection, storage, issuance, and use of spare replacement parts. All spare parts, whether new or remanufactured, shall be equal to or better than the original equipment parts.

(vii) Replenishment of Consumables



- A. The System Maintenance Plan shall require Project Co to monitor the use of spare parts and consumable items in conjunction with its reliability and maintainability programs, and to maintain an adequate supply of replacements on hand at all times. Project Co shall manage the inventory on a first-in-first-out basis, such that the oldest items in inventory are used first, and shall further provide that no items are retained in inventory that have exceeded their specified shelf life.
  - B. Spare parts and consumables shall be kept only at the OMSF or other location approved by the Region.
  - C. Project Co shall adjust the required inventory of spare parts and consumables, based on the experience gained during System operation and maintenance under the Project Agreement, to maintain required System Service Availability.
  - D. Project Co shall provide to the Region a complete List of Inventory Items which shall be updated annually. The List of Inventory Items shall encompass all spare parts and consumables in inventory, categorized by subsystem, assembly or component, and listed with the product or part name, model or part number, source, manufacturer, current price, and quantity on hand. The list shall be arranged by assemblies and subassemblies corresponding to the expanded assembly drawings, pictorials, and assembly instructions in the maintenance manuals.
  - E. Project Co shall maintain an inventory of spare parts and consumables at the level specified for initial provisioning and shall, upon completion of the Project Agreement, furnish to the Region a complete inventory of spare parts and consumables at the initial provisioning level or such revised provisioning level as may be approved by the Region. All spares shall have the same configuration or modification status as the comparable items in active service.
- (viii) Maintenance Requirements
- A. As a supplement to preventive maintenance requirements which should be established by Project Co to meet the requirements cited elsewhere in the Project Agreement including Schedule 15-3 Article 1 and the requirements for asset preservation, summary of specific minimum maintenance requirements for selected System elements are provided below:
    - 1. LRT Stops, Parking Lots and Other Areas Accessible to the Public - Project Co shall schedule litter pick up at least daily. Graffiti shall be removed or painted over before the start of the following day's operations or at a maximum within 24 hours of discovery or notification. LRT Stops shall be thoroughly cleaned weekly. LRT Stop equipment shall be operational at all times and shall be functionally checked on a daily basis. Defective lights shall be replaced within 24 hours of discovery or notification. Holes in fences and defective security lighting shall be repaired without delay.
    - 2. Track - Track shall be maintained to the most restrictive requirements of the standards of CTA class 4, requirements to meet the ride, noise, vibration, or rail car requirements, or safety criteria. All running rails, ties, ballast, mounting pads, and special track work shall be visually inspected at least weekly, and shall be maintained according to best industry practices.

Project Co shall plan a regular program of frog and switch point grinding, as well as rail grinding, based on wheel and rail wear and generated noise, and to ensure that an adequate margin of safety against derailment is preserved. Project Co shall plan a regular program, but no less than once a year, of rail to earth resistance measurement to ensure that an adequate margin of safety against corrosion by stray current is preserved.

3. Vehicles - Standards for passenger amenities and safety shall be achieved before a vehicle can enter service. In addition to the requirements provided in the Project Agreement, Project Co and the Region shall agree on other standards for passenger amenities.