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SCHEDULE 15-2
DESIGN AND CONSTRUCTION

PART 1 DESIGN AND CONSTRUCTION REQUIREMENTS - GENERAL REQUIREMENTS

ARTICLE 1 REFERENCE DOCUMENTS AND SUBMITTALS

1.1 Application of the Reference Documents, Standards and Procedures, City Standards, Ontario Provincial Standards for Roads and Public Works and Other Manuals, Codes and Standards

(a) The Works, shall be carried out in accordance with the applicable Reference Documents, and with the following amendments:

(i) Requirements related to design and submission requirements and quality assurance in the Reference Documents do not apply; rather, the Output Specifications and express requirements of this Project Agreement, including Schedule 11 – Integrated Management System Requirements, respectively shall apply;

(ii) Requirements and specifications in the Reference Documents related to equipment for performing the Works do not apply;

(iii) Sections within the Reference Documents that are not applicable to this Project, such as payment terms, do not apply;

(iv) Any and all references to "approval by the Contract Administrator" or other such reference in the Reference Documents, in terms of acceptance of materials, permission to proceed, work methodology or end product, shall be construed as being the responsibility of Project Co, but each such instance shall be in consultation applicable Governmental Authorities;

(v) Project Co shall consult with the City to determine which Reference Documents submissions are to be submitted under Schedule 10 – Review Procedure;

(vi) Project Co shall, when required in the Reference Documents to submit for approval by the City samples of any products proposed by Project Co, submit such samples with supporting documentation to the City in accordance with the Schedule 10 - Review Procedure; and,

(vii) The OPS specifications that apply to the Works shall only include the municipal and provincial common standards in OPS Volumes 1 through 4 and the municipal-oriented specifications in OPS Volumes 7 and 8, unless specified otherwise in Schedule 15 – Output Specifications.

1.2 Reference Documents

(a) Without limiting any other provision in this Project Agreement, the Reference Documents shall apply to the Works as described in Schedule 15-2 – Design and Construction Requirements.

1.3 Order of Precedence

(a) Unless otherwise expressly provided in Schedule 15-2 – Design and Construction Requirements, if there is any conflict between any of the provisions of this Project Agreement and any of the Reference Documents, the following shall apply in descending order of precedence:

(i) Applicable laws and regulations;

(ii) the provisions of this Project Agreement;

(iii) City Standards and procedures;

(iv) OPS; and,

(v) any other applicable Reference Documents.

1.4 Reference Concept

(a) Any use by Project Co of any or all aspects of the Reference Concept in performing the design and construction Works shall be entirely at Project Co's own risk. Use of the Reference Concept as a basis for Project Co's design for any part of the Project does not guarantee the City approval of Project Co's design.

1.5 Submittals

(a) Project Co shall be responsible for determining any and all necessary Works Submittals, as specified in the relevant sections of this Schedule 15-2 – Design and Construction Requirements, whether or not a specific reference to Schedule 10 – Review Procedure is specifically mentioned.

ARTICLE 2 PHYSICAL LAYOUT

2.1 Existing Infrastructure

(a) Existing infrastructure is comprised of, but not limited to, the following existing major components:

(i) Approximately 8km of single Track from Greenboro Station north to Bayview Station used to provide Passenger service.

(ii) Approximately 4km of single Track south of Greenboro Station used to facilitate freight movements to the NRC Facility.

(iii) Passing sidings at Brookfield, Carleton and Gladstone.

(iv) Absolute block signal system, with Indusi intermittent, inductive automatic Train stop devices.

(v) Five Stations:

A. Bayview Station;

B. Carling Station;

C. Carleton Station;

D. Mooney's Bay Station; and,

E. Greenboro Station.

(vi) Dow's Lake Tunnel and associated systems

(vii) Rail Carrying Bridge Structures:

A. Rideau River Bridge (SN015290);

B. Southeast Transitway Bridges – Ellwood diamond (SN055930);

C. Sawmill Creek Bridge (SN055200);

D. Sawmill Creek Culvert (SN055470);

E. Walkley Yard Lead over Transitway (SN055900);

F. Rail Bridge over Transitway at Walkley Yard Connecting Track (SN055910);

G. Hunt Club Road Bridge (SN055350);

H. Rail Bridge over MUP at South Keys Station (SN058490);

I. South Rail Bridge over MUP at Carleton University (SN018510); and,

J. North Rail Bridge over MUP at Carleton University (SN018490)

(viii) Drainage infrastructure, including ditches, storm sewers, and Culverts, associated with the Track and passing sidings.

(ix) Perimeter fencing of the alignment and landscape features within the Existing Trillium Line corridor and from Greenboro Station to the NRC Facility.

(b) Upon commencement of the Shutdown Period, Project Co shall take full responsibility for all existing infrastructure and the Existing Vehicle Fleet including the Maintenance and Security of such infrastructure. For further clarity, upon commencement of the Shutdown Period, the Existing Trillium Line ROW including all existing infrastructure will be deemed Project Co's construction Site under the Occupational Health and Safety Act (Ontario).

(i) The Ellwood and **[REDACTED]**/Walkley diamonds are active railway crossings that are subject to crossing agreements with Railway Companies described in Schedule 16 – Encumbrances. Upon the start of the Shutdown Period, Project Co shall be required to take full responsibility for the Maintenance and operation of these crossing agreements in accordance with the requirements set out in the crossing agreements, as outlined in Schedule 16 Article B, and as further outlined in Article 5 – Implementation Constraints, of this Part 1.

(ii) Project Co shall be responsible for rail traffic control, dispatch and maintenance over the Ellwood Diamond from the start of the Shutdown Period until such time as Project Co has completed the decommissioning of the interlocking infrastructure at the diamond and **[REDACTED]** has assumed full control and responsibility for dispatch on their line.

(iii) Project Co shall be responsible for rail traffic control, dispatch (east-west movements across the Walkley Diamond or movements to the NRC Facility) and maintenance over the Walkley Diamond from the start of the Shutdown Period until such time as Project Co has commissioned and turned over the new dispatch system as outlined in Schedule 15-2 Part 3 Article 10.2 to the City and the City has assumed full control and responsibility for dispatch. Project Co shall provide flagging or other suitable rail traffic controls to enable **[REDACTED]** and NRC rail traffic through the interlocking during the construction period.

(iv) Project Co acknowledges that the Existing Trillium Line is not entirely fenced. Project Co shall determine where gaps in the fence exist and where repair work is required to the fence and shall complete fence installation and repairs prior to the Shutdown Period to ensure Security of the Site and compliance with this Article 2.

(v) Project Co shall prepare and submit, in accordance with Schedule 10 – Review Procedure, a Transition and Maintenance Plan no later than three months in advance of the Shutdown Period that outlines how Project Co intends to comply with the requirements of this Article 2 and the Project Agreement as of the Shutdown Period commencement. Project Co shall co-ordinate with the City, the City's current Maintenance providers on the Existing Trillium Line, **[REDACTED]** and **[REDACTED]** in the preparation of the Transition and Maintenance Plan.

2.2 System Infrastructure

(a) System Infrastructure shall include the following:

(i) Project Co may incorporate any of the existing infrastructure in whole or in part, modified or unmodified into the System Infrastructure with the exception of the following:

A. The Existing Walkley Yard currently located east of Albion Road; and,

B. The Dow's Lake Tunnel structure.

(ii) System Infrastructure shall consist of the following:

A. Approximately 19.5km of Guideway and Track from Bayview Station to Limebank Station;

B. A 4.5km Airport Link from South Keys Station to the OMCIA;

C. Passing sidings at Gladstone, Carleton, Brookfield, South Keys and Leitrim;

D. Passing siding at Uplands;

E. Eleven Stations on the Expanded Trillium Line:

i. Bayview Station;

ii. Gladstone Station;

iii. Carling Station;

iv. Carleton Station;

v. Mooney's Bay Station;

vi. Walkley Station;

vii. Greenboro Station;

viii. South Keys Station;

ix. Leitrim Station;

x. Bowesville Station; and,

xi. Limebank Station.

F. Two Stations on the Airport Link:

i. Uplands Station; and,

ii. Airport Station.

G. New Walkley Yard to be constructed west of Albion Road with northbound and southbound connection Tracks;

H. New rail, road and pedestrian facilities and Structures;

I. New Signalling and Train Control System;

J. New communications systems and infrastructure;

K. Perimeter fencing and landscaping;

L. Drainage infrastructure, including ditches, storm sewers, and Culverts, associated with the Track and passing sidings;

M. Dow's Lake Tunnel ventilation and drainage systems and facilities;

N. The Existing Vehicle Fleet; and,

O. The New Vehicle Fleet.

(iii) Project Co shall decommission and remove any Existing Trillium Line assets that are not being incorporated into SI and have been made redundant following the implementation of the Expanded Trillium Line, including but not limited to, existing signal bungalows, existing signal infrastructure and existing Bridges.

(b) All SI shall be designed and constructed in accordance with Transport Canada rules and regulations including, but not limited to, the Canadian Transportation Agency Code of Practice in addition to the OC Transpo Transitway and Station Design Guidelines, June 2013.

(c) All SI shall be upgraded and / or designed and constructed to meet the requirements of NFPA130 and OBC313.

(i) A consolidated NFPA requirements matrix shall be provided for review and approval by the AHJ in accordance with Schedule 10 – Review Procedure.

2.3 New Municipal Infrastructure

(a) The New Municipal Infrastructure physical layout is detailed in Article 14.4.

2.4 General Alignment Requirements

(a) The alignment falls within existing City ROW and the permanent takings as described in Schedule 33 – Lands. Project Co shall Design the Guideway alignment within the Lands as prescribed in Schedule 33 – Lands.

(b) Guideway Requirements.

(i) The Guideway shall be completely fenced and segregated from any pedestrian and vehicular traffic, with the exception of the following:

A. The Walkley diamond where the Guideway fence shall be connected to the existing fence associated with the crossing railway.

B. If required, the NRC spur line crossing of Lester Road at-grade as outlined in Schedule 15-2, Part 3, Article 10 – Signalling and Train Control System.

(ii) Fencing location, type and height shall be as outlined in Schedule 15-2, Part 6, Article 2 – Design Criteria.

(iii) Emergency egress points that will allow ESP access as per the requirements of NFPA 130 shall be provided with secure Maintenance/Emergency access gates, where fences are installed for separation as per clause (i) above. A unique identification system shall be developed for the gates in consultation with the City and signage shall be fixed to both sides of each gate for identification purposes. Maintenance access gates shall be coordinated with Emergency egress and access gates.

A. The Airport Emergency route ER-2 vehicular crossing shall be as outlined in Schedule 15-2, Part 3, Article 10 – Signalling and Train Control System.

(iv) Project Co shall provide all fencing, gates and Security required to secure the NRC spur line and the Trillium Line from the NRC Facility.

(c) Crossings

(i) The following rail and vehicular at-grade crossings shall be incorporated into the Project:

A. Walkley diamond rail crossing;

B. Airport Emergency Route ER-2 vehicular crossing; and,

C. NRC Spur Line crossing of Lester Road vehicular crossing, if required.

(d) The Airport Link is primarily located on Federal Lands leased to the OMCIAA, and is therefore subject to review by the NCC as are other components of the Project proposed on Federal Lands as outlined in the NCC Trillium Line South Extension Approval Letter dated September 14, 2017. Project Co shall be responsible for design and construction of all components of the Project on Federal Lands in accordance with the following:

(i) The National Capital Act makes the NCC responsible for coordinating and approving projects related to Federal Lands and buildings in Canada's National Capital Region. The NCC is a Crown Corporation and therefore functions at a distance from the federal government, reporting to Parliament through the Minister of Canadian Heritage.

(ii) All individuals and federal organizations need NCC approval before undertaking projects on Federal Lands and buildings in Canada's National Capital Region.

(iii) The NCC's mandate to approve federal land uses, transactions and designs is set out in sections 12 and 12.1 of the National Capital Act.

(iv) Project Co's approach to Works on Federal Lands including the Airport Link shall be subject to review by the NCC and shall be assessed in terms of compliance with the guiding principles contained within this Project Agreement:

A. Project Co shall be responsible to develop designs and design documentation to support the City and the OMCIAA in obtaining NCC approval, including but not limited to:

i. Attending meetings with the City, the OMCIAA and NCC;

ii. Providing design documentation, reports, renderings and specifications to be used in the approval process; and,

iii. Presenting the Airport Link to the Advisory Committee on Planning Design and Realty at the NCC.

2.5 Systems Requirements

(a) Project Co shall be responsible for the design, construction testing, Commissioning Plans, Commissioning Tests and Maintenance of a new S&TCS capable of providing continuous cab signaling and Train protection required for the safe and efficient operation of the Expanded Trillium Line, including a head-end management platform and dispatch function at the TOCC & BCC. The head-end management platform for the S&TC system shall be comprised of both hardware and software that provides the command and control capability for the Expanded Trillium Line's new S&TCS and shall include new operator workstations along with the graphical user interfaces connected to servers running industry standard operating systems, and the communications transmission infrastructure required to support operations, monitoring and alarm handling of the field equipment along the alignment.

(b) Project Co shall be responsible for the design, construction, testing, Commissioning Plans, Commissioning Tests and Maintenance of the following communications systems and co-ordination with the City the integration of these communications systems with the existing head-end management platform at the TOCC & BCC;

(i) CTS;

(ii) PA/PIDS;

(iii) CCTV;

(iv) IAC;

(v) T&I System;

(vi) SCADA system; and,

(vii) Voice and Data Radio System.

(c) The head-end management platform for the communications systems is the existing communications system architecture made up of both hardware and software that provides the command and control capability for the communications systems. It includes existing operator

workstations along with the graphical user interfaces connected to servers running industry standard operating systems, and the communications transmission infrastructure required to support operations, monitoring and alarm handling of the field equipment along the alignment.

(d) Project Co shall be responsible for overall Systems Integration Tests, coordination and integration between all System elements and interfacing disciplines including integration with the Revenue Vehicles, fare collection system, communications systems, and other interfacing systems. Interfacing disciplines includes but is not limited to infrastructure, facilities, subsystems, software, Operations personnel and Maintenance personnel, etc.

(e) The City shall integrate the Expanded Trillium Line's communications systems into the Confederation Line's existing head-end management platform. Project Co's physical cable and equipment demarcation for all communications systems shall be the CTS equipment cabinet at Bayview Station. Project Co shall connect the Expanded Trillium Line's new CTS to the Confederation Line's CTS. As the systems integrator, Project Co shall be responsible for the overall systems integration including the planning, scheduling, coordination, and acceptance of this work.

2.6 Vehicle Requirements

(a) Project Co shall provide all Non-Revenue Vehicles, including Maintenance Vehicles required to Maintain the SI.

(b) The City shall turnover to Project Co the existing fleet of 6 Alstom LINT 41 Vehicles. Project Co shall be responsible for all upgrades, Maintenance and retrofits required to the Existing Vehicle Fleet.

(c) Project Co shall provide appropriate standstill Maintenance on the six Alstom LINT 41 Vehicles until such time that they are required for testing and commissioning and/or to be placed into service.

(d) Project Co shall be responsible for undertaking the scheduled Alstom "F6" 8-year overhaul including a powerpack and transmission overhaul during the Shutdown Period and any other scheduled Maintenance activities that are required by the Alstom inspection and Maintenance schedule, LINT DMU rules, or other Maintenance requirements arising for the Vehicle.

(e) Project Co shall provide new vehicles as outlined in Schedule 15-2, Part 8 – Vehicles.

2.7 Facilities Requirements

(a) Station Requirements:

(i) The Stations shall be designed and constructed in accordance with any and all applicable standards regarding accessibility and Fire Life Safety, including but not limited to, Emergency egress, lighting and ventilation.

(ii) Stations shall be provided with space and Utility services provisions for installation of a fare control system including but not limited to fare control gates and Ticket Machines to be installed by the City.

A. Project Co shall provide the required supporting infrastructure to allow power and communications connections, including walker ducts and conduits.

B. Project Co shall design and construct the location of equipment as to ensure the year round operation of the fare equipment by ensuring that all fare gate equipment is protected from the weather, including rain, snow and sleet in accordance with Schedule 15-2, Part 4, Clause 2.7 (d)(iv) A.

C. All fare collection, vending, and control equipment shall be located within the Station structure. If it is not feasible to locate all fare equipment within the Station structure, the equipment shall be protected from the elements in accordance with Schedule 15-2, Part 4 - Stations.

(iii) All Stations shall be designed and constructed to accommodate the requirements of all Vehicles in the fleet.

(iv) Stations shall be designed and constructed with Ancillary Facilities as outlined in Schedule 15-2, Part 4 – Stations.

(v) The Stations shall be located along the corridor as described below (note a two-track Station requires Project Co to provide either two side Platforms or a single centre Platform):

A. Bayview Station is an existing Terminal Station and Transfer Station to the Confederation Line. Project Co shall extend the existing Platform to accommodate the Revenue Vehicles, expand the Station to provide a second Platform able to accommodate the Revenue Vehicles and provide a new fare paid entrance on the west side of the alignment with a pedestrian Bridge including vertical circulation outside of the Fare Paid Zone as detailed in Schedule 15-2, Part 4 - Stations.

B. Gladstone Station shall be a new two-Track Station located on the Existing Trillium Line.

C. Carling Station is an existing Station on the Existing Trillium Line. Project Co shall extend the single Track Platform to be able to accommodate the Revenue Vehicles and perform Station upgrades as outlined in Schedule 15-2, Part 4 – Stations.

D. Carleton Station is an existing two-Track Station on the Existing Trillium Line. Project Co shall extend both Platforms to be able to accommodate the Revenue Vehicles and perform Station upgrades as outlined in Schedule 15-2, Part 4 – Stations.

E. Mooney's Bay Station is an existing single-Track Station on the Existing Trillium Line. Project Co shall extend the single Track Platform to be able to accommodate the Revenue Vehicles and perform Station upgrades as outlined in Schedule 15-, Part 4 – Stations.

F. Walkley Station shall be a new single-Track Station located on the Existing Trillium Line.

G. Greenboro Station is an existing single-Track Station on the Existing Trillium Line. Project Co shall extend the single Track Platform to be able to accommodate the Revenue Vehicles and perform Station upgrades as outlined in Schedule 15-2, Part 4 – Stations.

H. South Keys Station shall be a new two-Track Station on the Trillium Line Extension and shall operate as a Transfer Station between the Airport Link and the Expanded Trillium Line. A new fare controlled entrance shall be provided to access the Trillium Line.

I. Leitrim Station shall be a new two-Track Station on the Trillium Line Extension. Leitrim Station shall include an expanded Park and Ride Facility and bus Platforms.

J. Bowesville Station shall be a new two-Track Station on the Trillium Line Extension. Bowesville Station shall include a Park and Ride Facility and bus Platforms.

K. Limebank Station shall be a new two-Track Station on the Trillium Line Extension and represents the terminus of the Expanded Trillium Line. Limebank Station shall include an on-street bus Facility.

L. Uplands Station shall be a new two-Track Station on the Airport Link with an on-street bus Facility.

M. Airport Station shall be a new single-Track Station on the Airport Link and represents the terminus of the Airport Link. Airport Station shall abut a new Airport Station Concourse and entry to be designed and constructed by the OMCIAA. Project Co shall ensure the design and construction of Airport Station is co-ordinated with the OMCIAA.

(b) Facilities Requirements – TOCC

(i) The City shall integrate all the Expanded Trillium Line communications systems into the head-end management platform at the TOCC including hardware, software and licenses. Refer to Schedule 15-2, Part 3 – Systems.

(ii) Project Co shall plan, design, install, test and commission all equipment required for the Expanded Trillium Line S&TC head-end management system required at the TOCC.

(iii) The City shall reserve space in one of the IT equipment rooms in the TOCC for Project Co to install the new S&TCS servers, switches, patch panels and other equipment as required to connect the field S&TCS equipment to the new workstation in the TOCC operational theater.

(iv) The City shall reserve space in the TOCC operational theater for the two new S&TCS operator workstations.

(v) The City shall reserve space in the equipment room at 875 Belfast Road TOCC for Project Co to install the new S&TCS equipment as required to connect the field S&TCS equipment to the new workstations and the BCC operational theater.

(vi) Project Co shall plan, design, install, test and commission all equipment required for the Expanded Trillium Line S&TC head-end management platform.

(c) Facilities Requirements – BCC

(i) The City shall integrate all Expanded Trillium Line communications systems into the BCC including hardware, software and licenses. Refer to Schedule 15-2, Part 3 – Systems.

(ii) The City shall reserve space in the BCC operational theater for one new S&TCS operator workstation.

(d) Facilities Requirements – New Walkley Yard

(i) Project Co shall be responsible for the complete planning, design, construction, testing and commissioning, O&M of a New Walkley Yard facility, including the supply of all equipment and Facilities to Maintain the Revenue Vehicles and SI.

(ii) The New Walkley Yard shall be designed to meet the functional, accessibility, aesthetic, environmental, Safety, Operation and technical requirements of the City as contained and described in Schedule 15-2, Part 5 – New Walkley Yard.

(iii) The New Walkley Yard shall achieve "LEED Certified Rating".

(iv) The New Walkley Yard shall be secured by fencing that is continuous with the fencing that protects the Guideway.

(v) Project Co shall provide Security for the New Walkley Yard Site.

2.8 Structure Requirements

(a) New Structures

(i) New Structures located along the Guideway shall include:

A. Rail Bridge over Hunt Club Road (SN 055440);

B. Hunt Club Road MUP Bridge (SN 058620);

C. Rail Bridge over Lester Road (SN 225620);

D. Trinity Pedestrian Bridge (SN 018430);

E. Leitrim Road Bridge (SN 225610);

F. Earl Armstrong Bridge (SN 225680);

G. High Road Bridge (SN 225670);

H. Bowesville Road Bridge (SN225690);

I. Mosquito Creek Rail Bridge (SN225050);

J. Limebank Road Bridge (SN225710);

K. Rail Bridge over MUP North of Hunt Club Road (SN 055740);

L. Pedestrian Overpass North of South Keys Station (SN 055750);

M. **[REDACTED]** Grade Separation at Ellwood diamond;

N. North Rail Bridge over MUP at Carleton University;

O. University Road Pedestrian Bridge over Rideau River (SN018750);

P. Rail Bridge over the Airport Parkway (SN 225630);

Q. Rail Bridge over Uplands Drive (SN 225640); and,

R. Elevated Guideway to OMCIA Terminal (SN 225110).

(b) The following requirements apply to existing Structures:

(i) Project Co shall perform such investigations and design checks as may be required to ensure that any existing Structure can be used to support the Guideway including a design check of existing piers for derailment loads. The design check shall be completed in accordance with all applicable codes and standards.

(ii) Project Co shall Maintain all existing Structures in accordance with the terms and conditions of Schedule 15-3 – Maintenance and Rehabilitation Requirements and shall perform design checks and investigations on all existing Structures. See Schedule 15-2, Part 2, Article 4 – Structural Design Criteria for additional requirements.

(iii) Should such design checks demonstrate that modification is required to any portion of the Structure, Project Co shall design and construct such modifications and ensure that all applicable codes are met.

2.9 Design and Construction Requirements to Accommodate Concurrent and Future Works

(a) Project Co shall coordinate with Third Party Contractors who may be performing work which may connect, complement, interfere, or in any manner impact this Project. It is the responsibility of Project Co to work with these Third Party Contractors to fully coordinate interfaces and resolve any disputes or coordination problems that may arise.

(b) Project Co shall be responsible to be aware of and obtain information related to all Third Party Contractors and their projects. A list of planned projects and projects currently underway can be found on the City of Ottawa Website www.ottawa.ca/devapps.

(c) In addition to the above, Project Co shall be aware of the following projects:

(i) The Confederation Line, which includes a new Station Platform on the Existing Trillium Line at Bayview Station, will be completed and put into Operation.

(ii) The existing Highway 417 overpass of the Existing Trillium Line will be replaced with a single span structure.

(iii) The land east of Bayview Station is planned for mixed-use development that will connect to the Trinity Pedestrian Bridge.

(iv) Current Carleton passing siding spring switches are being replaced with powered switches, adjusted Track alignment, and new signal equipment.

(v) Fare Control implementation is underway at Carleton, Carling and Mooney's Bay Stations.

(vi) Walkley Yard Interlocking project is a capital renewal project to replace ties, rail, switch machines, turnouts, and signal equipment.

(vii) **[REDACTED]** intends to add three stories to the parking garage facility located overtop the Trillium Line.

(viii) The City is planning structural and architectural upgrades to the Greenboro pedestrian Bridge during the Shutdown Period.

(ix) The City Traffic Department is planning to install fibre optic cabling from Gladstone, Mooney's Bay, Walkley, South Keys, Leitrim and Uplands Station through the Project Co installed conduits to the Project Co installed break out points as outlined in Schedule 15-2, Part 2, Clause 8.12.

(d) Project Co shall protect for future works in the design of the Project, including:

(i) The future twin-Track electrification of the Expanded Trillium Line and Airport Link and conversion to a higher frequency LRT technology;

(ii) A future freight by-pass around the Ellwood diamond Grade Separation;

(iii) The widening of Lester Road;

(iv) The widening of the Airport Parkway;

(v) Elements of the Riverside South Community Design Plan and the Riverside South Core Area Urban Design Guidelines including the following:

A. Future Collector Road "G" and "H" overpasses perpendicular to Earl Armstrong Road between Bowesville Station and Limebank Station to allow for future local roads parallel to Earl Armstrong Road intersecting Collectors "G" and "H" at grade at a distance not less than 80m south of Earl Armstrong Road;

B. Future Station at Collector Road 'G' to accommodate an 80m Train;

C. Future Station at Collector Road 'H' to accommodate an 80m Train; and,

D. Future Station at Collector Road 'D' or Collector Road 'E' to accommodate an 80m Train.

(vi) Future Platform extensions at Uplands Station and Airport Station to accommodate 80m Trains;

(vii) The future relocation of Mooney's Bay Station and MUP pathway from SN 018750 to the future Station;

(viii) The expansion of both the Leitrim and Bowesville Park and Ride Lots;

(ix) The expansion of the New Walkley Yard to accommodate an expanded Vehicle fleet;

(x) Future overhead connections from development on both the east and west side of Gladstone Station to a future second floor level of the Station;

(xi) Future elevator and stair construction from the Carleton Tunnel Structure to the Carleton Station entrance;

(xii) Future modification of South Keys Station to provide a Fare Paid Zone between Transitway and Train service;

(xiii) Future extension of the Pedestrian Overpass North of South Keys Station to create a fare-free pedestrian and cycling connection;

(xiv) Future provision of 10-minute headway service by extending the Brookfield siding to south of Walkley Station; and,

(xv) Future installation of solar panels overtop the Guideway from Somerset Street to Gladstone Ave.

ARTICLE 3 OPERATIONAL PERFORMANCE REQUIREMENTS

3.1 Introduction

(a) Project Co shall provide an integrated System capable of delivering public transit service in a safe, reliable and efficient manner, and in accordance with the following Operational performance parameters.

(b) The Signalling and Train Control System for the Expanded Trillium Line shall be provided as a standalone system (independent from the Confederation Line S&TCS) located within the City's TOCC at 875 Belfast Road and the BCC located at 805 Belfast Road as further outlined in Schedule 15-2, Part 3 - Systems.

(c) The communication system and all other operational control functions for the Expanded Trillium Line shall be fully integrated with the Confederation Line's head-end management platform(s) at the City's TOCC and the BCC as further outlined in Schedule 15-2, Part 3 - Systems.

(d) Safety and Security monitoring of the Expanded Trillium Line shall be functionally integrated with the City's Security control centre located at 875 Belfast Road as further outlined in Schedule 15-2, Part 3 - Systems. The Security control center will be staffed by Special Constables Unit staff that will be responsible for monitoring Passenger assistance intercoms and on-demand real-time CCTV, responding to Security incidents/Emergencies, and coordinating daily fare enforcement patrols as necessary.

3.2 General

(a) Although Operation of service will be the responsibility of the City, Project Co shall thoroughly consider the Operational needs and the functionality of a fully integrated system during design and construction Works and shall validate the Operational capabilities through performance simulation, test, and demonstration.

(b) Project Co shall be responsible to provide and Maintain the SI to meet the Operational needs and required functionality of the System.

(c) Project Co shall also be responsible for the testing, commissioning, and Safety and Security Certification of the SI, including new Revenue Vehicles in accordance with the requirements of Schedules 15-2, Part 1 – General Requirements, Schedule 15-2, Part 3 – Systems, and Schedule 14 – Testing and Commissioning to validate that the complete Expanded Trillium Line, including existing fleet and new fleet of vehicles, are ready to deliver a seamless service.

(d) Project Co shall assist the City in preparing an Operations Service Plan that includes normal, degraded, and failure modes of operation. Project Co shall prepare operating procedures, records, training, and related manuals, in consultation with the City, required to operate the System based on the final System design and results of performance simulations. Project Co shall submit the referenced documents in accordance with Schedule 10 – Review Procedure. Project Co and City shall work cooperatively, each acting reasonably, to achieve an integrated Operations Service Plan. Project Co shall submit all Operating procedures, records, and related manuals at least 9 months prior to Revenue Service.

(e) Project Co shall be responsible for the initial training of the OC Transpo Trainers in the Operation of the Revenue Vehicles as well as any new or approved revisions to the Capital Railway rules, regulations and SOP.

(f) Project Co shall also be responsible for training of the Controllers in the use and application of the S&TC System in the TOCC.

(g) Project Co shall develop, and submit for the City's review and adoption, any new or suggested revisions to existing Capital Railway rules, regulations and SOP governing Operations and Maintenance of the SI in accordance with Schedule 10 – Review Procedure, consulting with the City during their preparation and any subsequent reviews until Revenue Service commences. During Revenue Service, both Project Co and the City shall be responsible for compliance with the Capital Railway rules, regulations and SOP. If either the City or Project Co determines that adjustments to the Capital Railway rules, regulations and SOP are required or prudent, the City or Project Co will consult with the other party and draft the new or revised rule or procedure. The City shall have final approval authority over any new or revised rule or procedure.

(h) Any new or suggested revisions to the Capital Railway rules, regulations and SOP shall be derived from, and be traceable to, the City's existing rule book and operating procedures, with revisions to reflect the introduction of any new infrastructure or technology, and the different roles of Project Co and the City.

(i) During the Construction Period, the O&M manuals shall be developed and prepared by Project Co, and reviewed by the City. These manuals shall provide O&M staff with written instructions and documentation regarding the Operation of, and the Maintenance procedures associated with, each system and related piece of equipment supplied and installed by Project Co. O&M manuals shall follow the City's standard for training materials and suitable adult education training material standards.

(j) For the avoidance of doubt:

(i) Project Co shall be responsible for the development of new or revised O&M manuals, new or suggested revisions to existing Capital Railway rules, DMU rules, SOP, and training materials for SI; and,

(ii) The City or Project Co will propose and coordinate changes to the Capital Railway rules, regulations, SOP, and associated training materials.

(k) At the New Walkley Yard, Project Co shall be responsible for monitoring and controlling Revenue Vehicle movements within the yard and up to the Yard Limits.

3.3 Environmental Conditions

(a) The Train shall be capable of normal Operations under the ambient environmental conditions specified in Schedule 15-2, Part 1, Article 4 – Design and Construction.

3.4 Hours of Operation

(a) The SI design and ongoing Maintenance and Rehabilitation Services shall support the hours of Revenue Service of the Service Levels presented in Schedule 15-3 – Maintenance and Rehabilitation Requirements, Appendix A, Attachment 2.

(b) The City will have the flexibility to modify the hours of Revenue Service pursuant to Article 3 of Schedule 15-3 – Maintenance and Rehabilitation Requirements.

(c) The City will have the flexibility to operate extended hours during special events, including operating hours of 24 hours per day in limited circumstances to be agreed upon by the City and Project Co in advance, each acting reasonably.

(d) Passenger facilities in a Station shall be available for use by Passengers from 15 minutes prior to the departure of the first scheduled Train from that Station until 15 minutes after the departure of the last scheduled Train from that Station.

3.5 Service Reliability

(a) Service Reliability Standard:

(i) The City has established a Service Reliability Standard of 98.5% on-time performance, where a trip is considered on time if it is available to depart the following Terminal Stations within 30 seconds of scheduled departure time, respecting a minimum terminal time of 3 minutes for:

A. Mainline – Bayview and Limebank;

B. Airport Shuttle – Airport and South keys

(ii) During times when through-service is operated between Airport Station and Bayview Stations, on-time performance shall be assessed for the Limebank Station/South Keys Station trips.

(iii) The City may choose, but shall not be obligated, to reduce terminal time for the purposes of achieving an on-time departure.

3.6 Operational Design Requirements

(a) Operating Headway:

(i) Project Co shall design the System to support the reliable operation of a headway of 12 minutes on both the mainline service and Airport Link service utilizing the passing sidings as specified in Schedule 15-2, Part 2, Article 1 - Introduction.

(b) The SI shall support the following service plan:

(i) Trains of approximately 80m in length (single or 2-car consists) operating on 12-minute headways between Bayview Station and Limebank Station.

(ii) Trains of approximately 40m in length operating on 12-minute headways on the Airport Link between Airport Terminal Station and South Keys Station.

(iii) Occasional Airport to Bayview through-service which would also include a shuttle operation between Limebank Station and South Keys Station.

(c) South Keys Operations:

(i) Project Co shall design a System that supports efficient interface and operation of shuttle and mainline services at South Keys Station. For further clarity, the following reflects anticipated Train movements and interaction between mainline and shuttle services at the South Keys Station for both potential shuttle service patterns.

(ii) Airport Link:

A. Northbound Airport Link Train from the Airport arrives at South Keys Station ahead of northbound service from Limebank Station to Bayview Station.

B. Airport Link Train discharges passengers and proceeds into the South Keys pocket Track.

C. Northbound Bayview Train arrives at South Keys Station, services the Station and departs, and Southbound Limebank Train arrives at South Keys, services the Station and departs.

D. Airport Link Train pulls out of the pocket Track southbound, services South Keys Station and proceeds toward the Airport.

(iii) Limebank Shuttle:

A. Northbound shuttle Train from Limebank arrives at South Keys Station ahead of northbound service from Airport to Bayview.

B. Shuttle Train discharges Passengers and proceeds into the South Keys pocket Track.

C. Northbound Airport-Bayview Train arrives South Keys Station, services the Station and departs, and Southbound Bayview-Airport Train arrives South Keys, services the Station and proceeds south toward Airport.

D. Shuttle Train pulls out of the pocket Track southbound, services South Keys Station and proceeds toward Limebank.

(d) Maximum cycle time

(i) The maximum cycle time shall not exceed the following values, as demonstrated by Project Co through simulation in accordance with Clause 3.6 (e) of this Part 1:

A. Limebank to Bayview – 84 minutes.

B. Airport Link – Airport to South Keys – 24 minutes.

(ii) The maximum cycle time shall be determined by summing:

A. All Station-to-Station travel times, and the appropriate Station dwell times in both the northbound and southbound directions, following the requirements in (iii) and (iv) below; and,

B. Terminal layover times at terminal Stations, following the requirements in (v) below:

i. For the mainline service, terminal times at Bayview Station and Limebank Station; and,

ii. For the Airport Link, terminal times at Airport Station and South Keys Station.

(iii) Station-to-Station travel time shall be defined as the duration of time between the moment the Train wheels start moving at the first Station and the time the wheels come to a standstill at the next Station.

A. Station dwell times shall not be included in Station-to-Station travel times.

B. Project Co shall base the nominal Station-to-Station travel times on a maximum permissible speed of 80 km/hr and civil speed restrictions imposed by Track/alignment curvature and Platforms, as well as applicable speed restrictions on the Existing Trillium Line provided as Background Information.

(iv) Station Dwell Times

A. For purposes of calculating cycle time, and for simulation, Project Co shall use the following dwell times at each intermediate Station for the listed hours:

Table 1-3.3- Northbound Station Dwell Times

Station	Northbound Dwell Times (sec)			
	AM Peak 6am – 9am	Midday 9am – 3pm	PM Peak 3pm – 6pm	Evening 6pm – 12am
Airport	-	-	-	-
EY Centre /Uplands	20	20	20	20
Limebank	-	-	-	-
Bowesville	50	40	49	33
Leitrim	45	36	44	30
South Keys	30	26	29	23
Greenboro	44	35	42	29
Walkley	20	20	20	20
Mooney's Bay	23	21	23	20
Carleton	115	85	110	65
Carling	34	28	33	24
Gladstone	21	20	21	20
Bayview	-	-	-	-

Table 1-3.4- Southbound Station Dwell Times

Station	Southbound Dwell Times (sec)			
	AM Peak 6am – 9am	Midday 9am – 3pm	PM Peak 3pm – 6pm	Evening 6pm – 12am
Airport	-	-	-	-
EY Centre /Uplands	20	20	20	20
Limebank	-	-	-	-
Bowesville	20	20	20	20
Leitrim	20	20	20	20
South Keys	20	20	20	20
Greenboro	20	20	20	20
Walkley	20	20	20	20
Mooney's Bay	22	20	21	20
Carleton	90	67	86	52
Carling	25	22	25	20
Gladstone	22	20	22	20
Bayview	-	-	-	-

(v) Minimum Terminal Times:

A. Terminal time shall be defined as the duration of time spent at the Terminal Stations at the end of a run and before the beginning of the next.

B. For the purposes of developing the service plan for simulation, the following minimum terminal times shall be met or exceeded:

i. Bayview – 10.0 minutes;

ii. Limebank – 9.0 minutes;

iii. Airport – 3.0 minutes; and,

iv. South Keys (pocket Track) – 3.0 minutes.

(e) Simulation Requirements

(i) Project Co shall verify travel and cycle times and prove service reliability through Operations simulation of the proposed System reflecting Project Co's design according to the following requirements.

A. Operating Schedule:

i. Five full operating days (weekday) with the prescribed headways reflecting Service Level 1 hours of Operation shall be simulated.

ii. For purposes of simulation, operating performance factors (such as, but not limited to: acceleration, braking, maximum allowable speed

adherence) shall be adjusted such that Station-to-Station travel times are 8% longer than the ideal Station-to-Station travel times (i.e. Station-to-Station travel times that could be achieved with full acceleration and braking rates, with perfect adherence to maximum allowable speeds; and perfect timing of brake application) to account for Operator variability and sub-optimal Vehicle performance reflecting real-world conditions. The Proponent shall adjust and calibrate the operating performance factors to achieve the 8% increase in run time and shall document the adjustments in the simulation report. The adjusted operating performance factors shall be applied to all respective trains in all simulations.

B. Infrastructure:

i. The simulation shall reflect Project Co's final design including Track alignment, special Trackwork, curvature, grades, and Station Platform limits.

C. Rolling Stock:

i. The simulation shall reflect the parameters of the existing Alstom Coradia LINT 41 DMU Vehicle and the New Vehicle Fleet, as the case may be.

D. Train Control:

i. The simulation shall capture the influence of the proposed signal system Design and Train protection system in accordance with Schedule 15-2, Part 3 – Systems.

E. Station Dwell Times:

i. Variable dwell times shall be simulated through stochastic variation in the form of a uniform probability distribution applied around the nominal dwell times at each Station as shown in Tables 1-3.3 and 1-3.4, with minimum and maximum values as outlined below.

ii. For Carleton Station during the AM and PM peak the uniform distribution parameter shall be:

1 Minimum – Nominal dwell time minus 46 seconds; and,

2 Maximum – Nominal dwell time plus 75 seconds.

iii. For every other Station and for all operating time periods Tables 1-3.3 and 1-3.4 the uniform distribution parameters shall be:

1 Minimum – Nominal dwell time minus 12 seconds

2 Maximum – Nominal dwell time plus 17 seconds

iv. If any randomized dwell times from the uniform probability distribution result in values less than 20 seconds, they shall be adjusted upward to a minimum of 20 seconds in the simulation.

F. Service Reliability:

i. The reliability of the operation of the System shall be measured according to the Service Reliability Standards established in Clause 3.5 of this Part 1.

ii. For purposes of measuring service reliability, terminal times shall not violate the minimum terminal recovery time requirement of three minutes.

iii. The simulation report shall include statistics on the number or percentage of trains in the five simulated operating days that were not available to depart within 30 seconds of the scheduled departure time after having achieved a minimum terminal time of three minutes.

3.7 Normal Operations

(a) Personnel sign-in

(i) The City shall be responsible for scheduling Trains and rostering its staff.

(ii) City Operators will report to the New Walkley Yard or other designated location at the time designated in their roster.

(b) Opening/closing Stations

(i) Project Co shall be responsible for opening Stations each morning prior to the beginning of Revenue Service in accordance with Clause 3.4 of this Article.

(ii) Similarly, Project Co shall be responsible for securing Stations after departure of the last Revenue Service Train each day in accordance with Clause 3.4 of this Article.

(iii) Project Co shall also provide the necessary equipment for remote monitoring of the status of all Station doors.

(c) Start-Up and Shutdown and Revenue Fleet Transitions

(i) Project Co shall provide the capability for insertion of Trains in the northbound and southbound directions on the mainline from the New Walkley Yard.

(ii) Project Co shall provide the capability for removal of Trains from the mainline and into the New Walkley Yard from the northbound and southbound directions.

(iii) The insertion/removal of Trains into/from the mainline shall be coordinated by the TOCC.

(iv) For further certainty, Project Co shall be responsible for monitoring and controlling revenue trains into, and within the New Walkley Yard.

(v) Prior to the start of Revenue Service, Project Co staff shall confirm with the TOCC that the SI and Trains are ready for start-up in line with the Capital Railway rules, regulations and SOP and the current Operations Service Plan.

(vi) Pre-conditions for normal start-up shall include:

A. All Maintenance work zones cleared by Project Co and confirmation that there are no Hazards associated with the mainline infrastructure that would preclude or restrict mainline Operations: and,

B. A sufficient number of Trains, in the required configurations, are available from Project Co to support the Operations Service Plan in effect.

(vii) The TOCC will be responsible for monitoring and controlling the entry of all Trains onto the mainline in accordance with the Operations Service Plan. The protocols for movement of Trains within the New Walkley Yard and to/from the mainline shall be developed by the City in coordination with Project Co The following approach is anticipated, subject to City and Project Co coordination, each acting reasonably:

A. Project Co shall be responsible for routing and dispatching the Train between its storage berth or Maintenance Track and Yard Limits. Departing Trains shall be routed to the Yard Limits in sufficient time to support the Operational Service Plan;

B. Project Co shall assign each Operator a Train consist to board at its designated storage berth or Maintenance Track;

C. The Operators will confirm with Project Co yard control staff that essential onboard operating and communication systems are fully functional and readiness to proceed to Yard Limits; and,

D. The Operator will proceed onto the mainline only when authorized by the TOCC. The S&TCS shall prevent a manually driven Train with in-active ATP functionality from leaving the yard and entering the mainline.

(viii) The TOCC staff will be responsible for monitoring and controlling the routing of Trains from the mainline Terminal Station to the Yard Limits, in accordance with the Operational Service Plan. The process of exiting a Train from the mainline into the New Walkley Yard shall be as follows:

A. Project Co shall be responsible for ensuring the Train can be routed to a designated storage berth or Maintenance Track in accordance with protocols to be established between Project Co and the City;

B. On approach to Yard Limits, the Operator will contact Project Co yard control staff and request authorization to enter the yard; and,

C. Upon receiving authorization from Project Co, the Operator shall secure the Train at the designated storage berth or Maintenance Track location assigned by Project Co.

3.8 Failure Management

(a) The procedures and protocols for managing Failures shall be agreed by Project Co with the City, and documented as part of the Capital Railway rules, regulations and SOP.

(b) The first priority in responding to and recovering from equipment failures shall be to maintain the Safety of Passengers, staff, the general public and others. The secondary priority shall be to institute an appropriate degraded mode of Operation until normal service Operations can resume, and then recovering to normal Operations as expeditiously as possible.

(c) The City TOCC staff will have the primary responsibility to coordinate responses to equipment Failures that affect Revenue Service and/or Failures that may impact the Safety of line Operations.

(d) As appropriate, the City TOCC staff will provide direction to a) other City and Project Co staff, b) City and Project Co roving field staff, and c) City Operators. This direction will be provided in accordance with Failure recovery protocols agreed between the City and Project Co consistent with contractual obligations in terms of Failure recovery response times and acceptable service level reductions, etc.

(e) The City TOCC staff will have the primary responsibility for providing PA announcements to Passengers in Stations and on Vehicles, as appropriate.

(f) In accordance with direction from the City TOCC staff, the Operator and Project Co field staff shall support Failure recovery and assist in meeting service requirements and safe Station Operations.

(g) In accordance with direction from the City TOCC staff, and where it is safe to do so, Operators will be responsible for responding to any situation where Train performance is degraded in the course of normal Operations.

(h) The Operator will also be responsible for reporting Revenue Vehicle malfunctions/anomalies to the City TOCC staff (which may include alarms displayed on the Operator Fault Announcement Screen) as well as anomalies observed along the ROW (e.g. Track irregularities). The City TOCC staff in turn will report to Project Co staff. The Operators will also be responsible for providing PA announcements to Vehicle passengers, as appropriate.

(i) Project Co staff shall be responsible for responding to equipment Failures and performing required Corrective Maintenance, in accordance with Schedule 15-3 – Maintenance and Rehabilitation Requirements.

3.9 Emergency Situations

(a) Project Co shall ensure all procedures and protocols for managing Emergency situations are in compliance with the approved ERP, agreed upon by Project Co and the City, and documented as part of the Capital Railway rules, regulations and SOP.

(b) All City and Project Co staff shall be vigilant and respond to any real or perceived threat to the Safety of Passengers, staff, and the general public by promptly reporting such conditions to the City TOCC staff. Any perceived threat may be investigated and assessed by the City/Project Co field staff (if such investigation/assessment can be accomplished safely, and in accordance with training provided to such staff) prior to declaring an Emergency scenario and notifying ESP.

(c) Once an Emergency scenario has been declared and ESP have been notified, specific actions by ESP, the City staff and Project Co staff shall be dependent upon the severity and extent of the incident, with priority given to:

(i) Responding to the Emergency scenario, moving persons to a place of Safety and treating injured persons as expeditiously as possible;

(ii) Correcting the conditions that generated the Emergency scenario such that normal Revenue Service Operations can resume; and,

(iii) Documenting and analyzing the root cause of the incident to prevent a re-occurrence.

(d) Once on-site, ESP will manage and coordinate the response to the Emergency scenario, and shall be supported by the City and Project Co staff.

(e) The City will designate one individual, at the incident site, as a single-point-of-contact with ESP. This individual shall be responsible for all the City and Project Co staff on scene and for keeping the City TOCC staff apprised of Emergency condition status in a timely manner. Project Co shall designate one individual as a single-point-of contact with the City. The City TOCC staff will also be responsible for communicating with Passengers and public.

(f) Depending on the nature of the Emergency scenario, the City TOCC staff will attempt to maintain a degraded mode of Operation on the SI not affected by the Emergency scenario.

(g) The ESP will have control of the incident site until the site is handed back to the City.

(h) Project Co shall take whatever corrective actions may be required to provide assurance to the City that there are no remaining Hazards associated with the infrastructure and/or Trains that would preclude or restrict resuming Operations through the incident site.

(i) Once Project Co has advised the City that it is safe for the resumption of service and any operating restrictions, it will be the City TOCC staff responsibility to return to normal Operations as expeditiously as possible.

(j) To the extent appropriate and practical, the City and Project Co staff shall be responsible for ensuring that the necessary arrangements are made to ensure the preservation of evidence that may be required later to establish the cause of the Emergency scenario. This includes preserving all communications and related records and documenting the Emergency scenario in accordance with Applicable Law, regulations and the City / Project Co procedures.

3.10 Non-Emergency situations

(a) Incidents that can be addressed without the services of external ESP are not considered Emergency scenarios. The procedures and protocols for managing these non-Emergency

situations shall be agreed by Project Co and the City, and documented as part of the Capital Railway rules, regulations and SOP.

3.11 Capital Railway Rules, Regulations and Standard Operating Procedures

(a) The current Capital Railway rules and regulations shall serve as the basis for any new or revised operating rules that may be required as part of SI or Vehicles. Similarly, the City's existing SOP shall serve as the basis for any new or revised SOP that may be required as part of SI or Vehicles.

(b) Project Co shall review and update existing operating rules and procedures to ensure applicability to SI and Vehicles. Project Co shall submit to the City for review and approval suggested revisions to existing or new operating rules and SOP in accordance with Schedule 10 – Review Procedure as agreed upon by the City.

(i) Project Co shall update or develop new procedures with respect to responses to abnormal operating conditions such as:

A. weather extremes;

B. winter snow and/or freezing rain;

C. severe wind;

D. extreme rainfalls and/or hail;

E. lightning;

F. earthquakes;

G. extreme hot or cold temperatures;

H. flooding;

I. asset availability issues;

J. insufficient Trains for Revenue Service (including Failures at the yard-to-mainline interface);

K. late Station opening; and,

L. staffing availability issues.

(ii) Roles and responsibilities of the City TOCC and field Operations staff and Project Co staff shall be clearly defined.

(iii) Administrative procedures shall also be incorporated.

(c) Project Co shall comply with all Capital Railway rules, regulations and SOP in accordance with the requirements of Schedule 15-2, Part 1, Article 6 – Rail Regulatory Structure and Obligations.

ARTICLE 4 DESIGN AND CONSTRUCTION

4.1 General Construction Requirements

(a) Project Co shall be responsible for the design and construction of the Project and all other construction activities, including completion, testing and commissioning of the Project, which shall be carried out in strict accordance with the Design and Construction Requirements and in such a manner as to comply with all applicable Project Agreement requirements.

(b) Limits of construction, occupation and all works, except for Site access, construction of detours and associated works and Works under the Utility Company Works Cash Allowance shall be within the Lands, Temporary Easements and Permanent Easements as shown hatched on the PRPs. See Schedule 33 – Lands for additional information.

(c) Project Co shall only construct or implement Site access, detours and associated works on existing City/public ROW/property if those Site access, detours and associated works have been approved by the City as part of Project Co's TTMP.

(d) Construction Mobilization and Staging Areas

(i) The only Properties that can be utilized as construction mobilization or staging areas, as defined in Schedule 33 – Lands, Articles 1.4.1.4 and 1.4.1.5, are indicated on the property table Schedule 33 – Lands, Article 3.

(e) Project Co shall restore or rehabilitate any disturbed areas within or extending beyond the limits of the Works, including but not limited to, road alignment, paving, Trackwork, monitoring wells, landscaped areas including plantings and /or sodding. These areas shall be cleaned of debris and have any temporary paving or structures removed and replaced with planting soil or restored to the same or better condition or as directed by the City in accordance with the requirements of Schedule 15-2, Part 6, Article 2 – Design Criteria. A review of the adjacent land uses and site development shall be completed for these locations and the most appropriate groundcover shall be selected.

(i) Project Co shall protect all City and Third Party Facilities adjacent to the Works.

A. Protect and/or transplant existing fencing, trees, landscaping, natural features, bench marks, buildings, Pavement, monitoring wells, surface or Utilities which are to remain. If damaged, restore to original or better condition unless directed otherwise. Project Co shall make reference to Schedule 15-2, Part 6, Article 2 – Design Criteria.

B. Project Co shall replace any damaged trees designated to remain in accordance with City Urban Forestry guidelines.

C. Project Co shall be responsible for installing, Maintaining and removing any temporary facilities necessary to access the Site, including but not limited to fences, gates, constructions, granular, silt fences and TCD.

D. Project Co shall be responsible for the removal of furnishing of the assets of BIA, safekeeping and restoration.

(ii) Project Co shall complete a pre-construction condition survey of the Lands covered by Third Party Access Agreements and adjacent portions of Lands and shall provide the report to the City, not less than eight calendar days prior to the commencement of the Works. Under no circumstances shall Project Co commence the Works until the pre-construction condition survey is provided to the City. Project Co shall complete a post-construction condition survey of the Lands covered by Third Party Access Agreements and adjacent lands and shall provide the report to the City not less than eight calendar days following the completion of the Works. The survey shall record, by way of photographs, videos and written reports, the status, grading, fencing, monitoring wells, and visible condition of the Lands covered by Third Party Access Agreements and immediately adjacent property.

(f) Project Co shall perform the following for all Lands:

(i) Develop hoarding/fencing plans shall be submitted in accordance with Schedule 10 – Review Procedure. The boundaries of the construction Sites shall be fenced. The boundaries of mobilization Sites shall be hoarded. The hoarding/fencing plans shall include details on location, height, materials and expected timing of installation and removal.

(ii) In addition, for Lands subject to FLUDTA, hoarding plans shall be in accordance with the NCC hoarding specifications. No use or access to adjacent NCC lands shall be permitted without the express approval by the NCC.

(iii) Maintain the construction hoarding and fencing in a good condition of repair at all times.

(iv) Project Co shall install and Maintain promotional and advertising materials to be provided by the City in accordance with Schedule 18 – Communications and Stakeholder Engagement Obligations.

(g) Construction Site camera systems:

(i) The City intends to provide a camera system to be installed by Project Co at each construction Site, at a location selected by the City. Project Co shall provide power and internet connectivity to each location selected by the City. The power shall be a hard-wired connection, unless a specific arrangement is made between Project Co and the City for solar power to be used. The internet connectivity shall be high speed, through telephone or cable lines, unless a specific arrangement is made between Project Co and the City for an LTE cellular connection to be used.

A. The construction Sites shall be each of the Stations (total of 12 locations).

B. The system being developed is closed, password protected, and not publicly accessible. The City shall own the system and the content, and reserves the right to utilize the system in order to create time-lapse videos showing construction progress over time that may be shown to the public as a promotional tool. The system shall adhere to the City of Ottawa's Surveillance System for Transit Network Access and Privacy Policy.

(ii) In the event that, upon completion of the System, Project Co wishes to have an additional camera system at any Site beyond the one that the City shall provide, Project Co can purchase the unit from the City at cost, and install it on their Site at their own cost.

(iii) In the event that the City wishes to have an additional camera system at any Site, Project Co shall install it and provide power and internet connectivity as described in (i) above.

(h) Project Co shall submit a pre-construction condition survey consisting of photographs, videos and written reports of the South Keys Station plaza area as per Schedule 33 – Lands, not less than seven calendar days prior to the commencement of Works.

(i) Project Co shall submit a post-construction condition survey consisting of photographs, videos and written reports of the South Keys Station plaza area and adjacent Lands as per Schedule 33 – Lands, not more than seven calendar days following the completion of Works.

(j) Project Co shall submit a pre-construction condition survey consisting of photographs, videos and written reports of **[REDACTED]** as per Schedule 33 – Lands, not less than seven calendar days prior to the commencement of Works.

(k) Project Co shall submit a post-construction condition survey consisting of photographs, videos and written reports of **[REDACTED]** as per Schedule 33 – Lands, not more than seven calendar days following the completion of Works.

4.2 Surveys

(a) Control Survey

(i) A control survey of the alignment has been completed by the City for this Project. Existing and new monuments were used in establishing the Project control survey.

(ii) Project Co shall evaluate its requirements for a control survey in order to perform the design and construction Works and determine if additional monuments are required. Any such additional monuments shall be of the same order as the control survey provided and installed by Project Co and shall be surveyed to tie into the Project survey control coordinate system. Project Co shall prepare a survey report including field notes, measurements, adjustments, station descriptions and reference tie drawings of each additional survey monument installed and provide a record to the City in accordance with Schedule 10 – Review Procedure.

(iii) Project Co shall be solely responsible for protecting and maintaining all existing survey control monuments. In the event that project survey control monuments have been disturbed or destroyed during the Project, then Project Co shall re-establish the survey control at construction completion and provide a survey report to the City for approval at no cost to the City, in accordance with Schedule 10 – Review Procedure.

(iv) The Project control survey shall be used as the basis for all Works.

(v) Horizontal Control

A. Modified Transverse Mercator, MTM 3 degree, zone 9 central meridian 76 degrees 30 minutes West;

B. NAD83 original as well as in NAD 83 CSRS format;

C. The horizontal coordinates for control points are 2nd order as defined by the Specification and Recommendations for Control Surveys and Survey Markers 1978, Natural Resources Canada, Part 2 – Horizontal Control; and,

D. All surveys made for the Project shall be referenced and adjusted to the control survey monuments in the Project control network and shall be adjusted by holding these monuments fixed. The adjustments to the data shall be coordinated with the City. The accuracy of these surveys shall be second order.

(vi) Vertical Control

A. The vertical control shall be based on the Canadian Geodetic Vertical Datum of CGCD1928 using HT2 Geoid Model.

B. The vertical control survey shall be conducted in accordance with Specification and Recommendations for Control Surveys and Survey Markers 1978, Natural Resources Canada, Part 1 - Vertical Control, Levelling. Vertical Deep Benchmarks shall meet or exceed 1st Order Vertical levelling criteria. Non Deep Benchmarks typically set on sidewalks shall be verified for marker stability with a minimum of one adjacent marker prior to accepting the published elevations.

(b) Aerial Photo and Digital Mapping

(i) Detailed topographic mapping for the Project has been compiled from field survey and digital aerial imagery acquired over the period from 2012 to 2015.

(ii) Project Co shall evaluate their requirements for topographic mapping and augment with additional ground control, if required.

(iii) In the event that Project Co requires additional or updated topographic mapping, then the orthophotos and digital vector mapping shall be performed in the Project control survey coordinate system.

(c) Legal Surveys

(i) The City shall be responsible for the preparation, by a qualified Ontario Land Surveyor, of reference plans to facilitate the acquisition of fee simple interests in property or long term easements forming part of the Lands as identified in the Lands Table Schedule 33 – Lands, provided however, that in the case of "Additional Property Interests" as defined in Schedule 33 – Lands, the costs of undertaking this surveying work shall be borne by Project Co.

(ii) Project Co shall be responsible for the preparation, by a qualified Ontario Land Surveyor, of reference plans describing all of the lands accommodating System Infrastructure and any other lands required for the purposes of using, operating, repairing, Maintaining, or accessing the System so that the City will have a registrable legal description of all lands forming part of the final constructed System.

(iii) Project Co shall engage, throughout the Construction Period, a duly qualified Ontario Land Surveyor.

(iv) Prior to commencing construction on any part of the Lands where construction is proposed to take place within 1m of a property limit, Project Co shall ensure that a qualified Ontario Land Surveyor stakes out the property limit in the field and prepares field notes and sketches to document the fieldwork.

(d) Post Completion Survey

(i) Project Co shall provide, at its own cost and expense, a post-completion Survey, in the form of a topographic survey of the entire corridor accurate to a scale of 1:1000, in CADD format, georeferenced to the project control not more than 90 days after the Final Completion Date.

(ii) Project Co shall be solely responsible for protecting and maintaining all existing legal survey reference monuments. In the event that Project survey monuments have been disturbed or destroyed during the Project, then Project Co shall re-establish the survey monuments at the time of the post- completion survey and provide a survey report to the City for approval at no cost to the City in accordance with Schedule 10 – Review Procedure.

4.3 Design Requirements

(a) Design Components and Design Life

(i) Project Co shall design the components of the Project to meet the requirements outlined in Table 1-4.1.

Table 1-4.1: Design Components and Design Life

Component	Design Life Required (years)
Ancillary Facilities – Structures	50
Ancillary Facilities – Finishes	40
Ancillary Facilities – Bus shelters	15
New Bridge Structures	75
New Retaining Walls	50
New Flexible Pavement (including intervene rehabilitation with initial Design Life of minimum 20 years))	40
New Rigid or Composite Pavement (including intervene rehabilitation with initial Design Life of minimum 30 years)	55
Elevated Guideway	75
Stations – Finishes	40
Stations – At-Grade Station Structures	50
Track – Ballast	20
Track – Fixed	20
Ties - Concrete	40
Ties - Hardwood	25
Switches & Cross-overs	20
Maintenance Building	40
Signalling	30
Communications	20
New Vehicles	30
New Vehicle Carbody	40

(b) Climate Data for Design

(i) Project Co shall use the following climate data where required for design, unless otherwise specified:

Extreme Maximum Temperature	38°C
Extreme Minimum Temperature	-40°C
Extreme Daily Rainfall	135mm
Extreme Daily Snowfall	56cm
Extreme Daily Precipitation*	135mm
Extreme Snow Depth	135cm
Maximum Hourly Wind Speed	80km/hr
Maximum Wind Gust Speed	135km/hr

* Freezing rain to be considered.

4.4 Site Works

(a) General

(i) Project Co obligations under this Article are in addition to the obligations Project Co has under Section 16 of the Project Agreement.

(ii) Existing Conditions

A. Existing conditions shall be verified and documented by Project Co.

B. Project Co shall identify and document all underground and surface Utility lines and buried objects prior to any construction activities and/or excavation work.

(iii) Backfill

A. Backfill work complete by Project Co shall achieve a performance characteristic not less than the adjacent undisturbed soils and to the satisfaction of the property owner, when backfilling in areas that will not carry any load from the Works and other areas than areas regulated by any applicable standards.

(b) Conduit Drainage

(i) Underground

A. All underground conduit, duct banks, and maintenance holes for electrical, communication, and systems shall be designed and constructed to prevent the accumulation of water and formation of ice in any component within the System.

(ii) Non-Underground

A. All conduit and raceways for electrical, communication, and systems shall be designed and constructed to prevent the accumulation of water to prevent moisture from entering any equipment within the System.

(c) All Project Site work shall be designed in accordance with the criteria contained or referenced within this Article, specific obligations and criteria identified in the other locations elsewhere in this Project Agreement, the Applicable Law, guidelines or practices applicable to the Project, including but not limited to the following Reference Documents:

(i) City Standards:

A. City of Ottawa Standard Tender Documents for Unit Price Contracts, current version.

B. City of Ottawa Sewer Design Guidelines, October 2012.

C. City of Ottawa Water Design Guidelines, 2010.

(ii) Geometric Design Guide for Canadian Roads (TAC-1999);

(iii) OPSS and OPSD; and,

(iv) MOECC.

4.5 Construction on OMCIAA Property

(a) Project Co shall comply with all OMCIAA policies and procedures including the Airport Security Requirements detailed below and as may be amended by the OMCIAA for all construction being performed on or adjacent to OMCIAA property.

(b) Project Co shall be responsible to ensure that all Project Co Parties comply with Airport Security Requirements on the Works Site. Personnel requiring entry to Airside areas to perform duties may be required to possess an identification pass, to be worn or produced as the OMCIAA may require.

(c) The OMCIAA and the City, at their sole discretion, may order Project Co to provide a minimum of three references and/or other information concerning persons employed or to be employed on the Works within OMCIA property.

(d) The OMCIAA and the City may at their discretion order the removal of any person from the Works.

(e) Project Co shall ensure that all construction equipment and vehicles operating near an active runway remain below the height restrictions dictated by the Obstacle Limitation Surfaces for that runway. Project Co shall provide specialized equipment in order to respect the overhead clearance to the Obstacle Limitation Surfaces as required.

(f) Project Co shall ensure that all permanent Works constructed as part of this Project adjacent to the airport respect the height restrictions set by TC through the Airport Zoning Regulations.

(g) Project Co shall obtain, abide by and complete an OMCIAA Work Permit for any work on OMCIA lands. The OMCIAA Work Permit is provided in Appendix A of this Part 1.

(h) Project Co shall co-ordinate and schedule its work with the OMCIAA and appoint a single point of contact for the Airport Link construction to facilitate this co-ordination.

(i) Project Co shall attend regular weekly meetings with the City and the OMCIAA to facilitate design and construction co-ordination.

(j) Project Co understands there may be infrequent instances (i.e. visiting head of state) whereby work in close proximity to the Airport shall need to cease.

4.6 Airport Security Requirements

(a) Airport Restricted Area

(i) Project Co shall only be permitted Airport Restricted Area access for the sole purpose of erecting Elevated Guideway components on a limited overnight basis subject to the approval of the City, OMCIAA and TC.

(ii) The OMCIAA will facilitate Project Co mobilization in the Airport Restricted Area by closing Gate 1 between 21:00 hrs – 0:500 hrs for a maximum of eight nights. Project Co shall not impact the operational area of any other aircraft gates.

(iii) Project Co shall only be permitted access to the Airport Restricted Area from 21:00 hrs – 05:00 hrs and shall fully demobilize after each shift.

(iv) Project Co shall abide by all OMCIAA and TC rules for working in the Airport Restricted Area.

(v) Airport Restricted Area access shall be limited to eight mobilizations and shall be co-ordinated with OMCIAA and the City.

(vi) Project Co shall be responsible for providing their own airside escort services.

(vii) Project Co shall be responsible for protection of airside apron Pavement.

(viii) Project Co shall be responsible for all costs and delays associated with any TC, CATSA or OMCIAA requirements as it relates to screening and or escorting required for Airport Restricted Area works.

(ix) No person shall carry or deposit lighted cigarettes, cigars, pipes, or matches on Airside. This prohibition shall apply to persons both inside and outside of vehicles and equipment. Works requiring an open flame on Airside shall be approved by OMCIAA (i.e. welding permit, available from the OMCIAA security office).

(b) Additional Project Co Responsibilities

(i) Project Co shall be responsible for completing a "Contractor's Information Check Sheet" to be provided to the City and the OMCIAA prior to the start of any Works.

(ii) Project Co shall be responsible for becoming familiar with and following all Safety and Security regulations pertaining to construction personnel. Failure to comply with federal and provincial government regulations may result in fines against Project Co or delays imposed on Works pending correction by Project Co of any deficiencies.

(c) Emergency Contacts

(i) Project Co shall provide to the City and the OMCIAA a list of responsible personnel, including sub-contractors, who may be contacted after working hours in case of Emergency.

(d) Evacuation

(i) Project Co shall immediately cease all activities and evacuate the Site as directed by the OMCIAA or the Airport Operations Manager in the event of a declared Emergency by OMCIAA.

(e) Use of Radios

(i) All equipment for radio communication required for Project Co personnel shall be supplied by Project Co. The OMCIAA security office shall be advised in order to verify that Project Co's radio frequency will not cause interference with essential communication equipment and navigational aids at the OMCIA.

ARTICLE 5 IMPLEMENTATION CONSTRAINTS

5.1 General Implementation Constraints

(a) General Requirements

(i) Project Co shall reinstate to original condition, unless otherwise indicated elsewhere in the documents, and at Project Co expense, all Lands, Roadways, MUPs and assets affected by the implementation of the Works.

(b) Access to Adjacent Properties

(i) Project Co shall provide access to all adjacent properties, tenants, and residential drives and building entrances, including maintaining access points for fire department connections in accordance with code requirements and for waste removal except as otherwise permitted. Should an existing entrance or access have to be closed or reduced, Project Co shall coordinate with the impacted parties to provide an alternative solution to have continuous access.

(c) Works Hours Limitations

(i) Project Co shall abide by all federal, provincial, and municipal statutes regarding hours of work.

(ii) Project Co shall be aware of the local community and political public events that may impact the work on the Project.

5.2 Existing Trillium Line Operational Constraints

(a) Project Co shall not have access to the Existing Trillium Line ROW for any type of construction activity while the current O-Train service is in Operation. Limited access will be granted for non-intrusive tasks such as surveying and geotechnical investigation as well as telecom utility relocations in the vicinity of the **[REDACTED]** Grade Separation at the discretion of the City and Capital Railway based on the following:

(i) Project Co will be provided up to 20 days access to the Existing Trillium Line during Revenue Service hours from Monday to Friday in order to perform any survey work required.

(ii) Project Co will be provided up to 20 nights access to the Existing Trillium Line during non-Revenue Service hours in order to perform any geotechnical investigation required.

(iii) Project Co will be provided access to the Existing Trillium Line for telecom utility relocations in the vicinity of the **[REDACTED]**Grade Separation in advance of the grade separation construction.

(iv) For all work outlined above, Project Co shall submit an access request to the City and Capital Railway no less than 2 weeks in advance of the requested date. The City and Capital Railway will review the request and advise Project Co of the confirmed access date(s) and arrange for TOP's on behalf of Project Co.

(b) The City will implement a complete shutdown of the Existing Trillium Line service to facilitate the rehabilitation and construction of Track and Facilities along this line. The Shutdown Period dates are as defined in Schedule 15-1 – Technical Terms and Reference Documents.

(c) Construction activities, including during the Shutdown Period of the Existing Trillium Line service, shall not block, restrict, interfere with signals operation or cause delay to train movements on the **[REDACTED]** nor on the **[REDACTED]**. Project Co shall abide by the terms of the City's Crossing Agreements throughout the Construction Period.

(d) Project Co shall Maintain, in service, the Transfer Segment and all supporting infrastructure required for movement of freight between **[REDACTED]** and the NRC Facility for the movement of freight throughout the Construction Period and Maintenance Period subject to the following:

(i) Construction Period:

A. Project Co shall be responsible for shepherding and coordinating the movement of freight to the NRC Facility as outlined in the Rail Car Transfer Agreement as of and from the time that Project Co mobilizes for Construction Activities on the Transfer Segment.

B. In accordance with the Rail Car Transfer Agreement, Project Co shall be permitted to interrupt the movement of freight on the Transfer Segment for a continuous single maximum duration of six months (NRC 6 Month Shutdown Period) for the Construction Activities along the Transfer Segment. Outside of the NRC 6 Month Shutdown Period, Project Co shall provide access windows of at least seven consecutive calendar days at least once every 120 calendar days for the movement of freight on the Transfer Segment (NRC 7 Day Freight Access Periods).

C. Project Co shall schedule the NRC 6 Month Shutdown Period and the NRC 7 Day Freight Access Periods in accordance with Schedule 12 – Works Scheduling Requirements.

(ii) Maintenance Period:

A. Project Co shall facilitate and coordinate the movement of freight to the NRC Facility as outlined in the Rail Car Transfer Agreement for the entire Maintenance Period.

B. Project Co shall refer to Schedule 15-3, Appendix A, Article 1.12 for their obligations to facilitate the movement of freight during the Maintenance Period.

(e) Project Co shall fully comply with Governmental Authorities, Nav Canada and OMCIAA regulations and procedures governing construction activities on or near the airport grounds.

(f) Blasting shall not be permitted in proximity to the Highway 417 overpass, specifically in areas under which the Ministry of Transportation has jurisdiction of authority.

5.3 Airport Link Implementation Constraints

(a) Project Co shall complete all Airport Station Civil Works prior to November 30, 2020 to allow uninhibited access to the OMCIAA for construction of the Airport Station Concourse.

(b) See Schedule 15-2, Part 7 - Traffic and Transit Management for restrictions on working on OMCIAA Roadways and the Airport loading dock.

(c) Project Co shall coordinate with the NRC and Airport Authority on the following items:

(i) To protect or reinstate the high-velocity impact berm; and,

(ii) Protect the porcine cemetery.

(d) Project Co shall abide by all OMCIAA construction and Security requirements as outlined in Clauses 4.5 and 4.6 of this Part 1.

5.4 Construction Planning and Constraints

(a) NCC and City MUPs shall remain open to public use during construction. Project Co shall provide temporary detours and temporary signage indicating detours if pathway closures are required. See Schedule 15-2, Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements, for further information.

(b) Project Co shall limit their material and equipment storage to within the construction boundaries and per Temporary Easement and Permanent Easement as shown hatched on the PRP's Schedule 33 – Lands for additional information.

(c) Properties that can be utilized as construction staging areas are identified in Schedule 33 – Lands. Should Project Co require additional properties beyond those shown to be provided, it is the responsibility of Project Co to acquire any additional property.

(d) See Schedule 15-2, Part 7 - Traffic and Transit Management and Construction Access for restrictions associated with events and holidays and additional implementation constraint requirements.

(e) Refer to Schedule 17 – Environmental Obligations for requirements for working around SARs.

(f) Agreement Constraints:

(i) Project Co shall coordinate the Works required for Uplands Station with the EY Centre.

(ii) Project Co shall ensure that existing truck access routes to South Keys Shopping Centre are maintained throughout the duration of construction.

(iii) Project Co shall coordinate the Works required for South Keys Station with the South Keys Shopping Centre.

(g) Walkley Yard constraints

(i) The New Walkley Yard MSF shall be constructed without interfering with access to and operations of the Existing Walkley Yard or train movements on existing rail outside of the Project limits.

(ii) Project Co shall be permitted to access the Existing Walkley Yard for the purpose of Existing Vehicle Fleet storage, Maintenance and upgrade, and delivery of new Vehicles.

(h) Noise and Vibration Mitigation

(i) Project Co shall abide by all federal, provincial and municipal statues regarding noise levels and noise mitigation. Prior to commencement of construction, Project Co shall prepare and implement a Noise and Vibration Control Plan in accordance with Schedule 17 – Environmental Obligations prepared by a Professional Engineer describing the predicted construction noise and mitigation measures required to meet the noise level limitations.

(i) Transit System constraints:

(i) Refer to Schedule 15-2, Part 7, Article 1 – General Traffic and Transit Management Requirements for restrictions and implementation constraints associated with Transit System Work.

(j) Utility Infrastructure Constraints

(i) Refer to Schedule 15-2, Part 2, Article 8 - Utility Infrastructure Design Criteria for restrictions and implementation constraints associated with Utility Works.

(k) Project Co shall complete the work within the alignment, between Louisa Street and Young Street to complete the reinstatement of the MUP and crosswalk/crossride at Gladstone Street, by May 1, 2021.

(l) Coordination with City Works

(i) Project Co is notified that Third Party Contractors and City personnel will need access to the construction Site at various times and locations during the course of the Works. Therefore, Project Co shall provide the following:

A. Coordinating their level of completeness to the City so that the City's coordination with Third Party Contractors can be performed at the appropriate time;

B. Coordinate the timing of the access to minimize disturbances;

C. Provide Site access to the Third Party Contractors and City staff;

D. Provide staging and storage areas to the Third Party Contractors and City staff for their work;

E. Provide access for the City's delivery and set up of City equipment (furniture, appliances, computer equipment, etc.) in City spaces; and,

F. At the City's request, provide up to date as built drawings of the Sites at the time of the coordination.

(ii) Anticipated coordination issues are, but are not limited to, the following:

A. Fare control equipment installation

i. Installation by OC Transpo requires one month notice prior to the installation and one week per Station for the actual installation. Access is to be staggered so that installation can be performed one Station at a time. The installation shall be scheduled to begin no more than four months prior to Trial Running.

B. Artwork

i. Access for installation by the City two months prior to Trial Running.

C. OC Transpo spaces

i. Access for fit out by OC Transpo is to be provided four months prior to Trial Running.

D. Various Communications issues, including:

i. Voice and Data Radio: Access for installation shall be provided two months prior to Train movements.

ii. Cellular telephone: Access for installation shall be provided two months prior to Trial Running.

iii. Nexus PIDS: Access for installation shall be provided two months prior to Trial Running.

iv. City Network IT: Access for installation shall be provided two months prior to Trial Running.

v. Traffic Conduit: Access for the installation of traffic fiber by City personnel shall be provided.

5.5 [REDACTED] Implementation Constraints

(a) No disruption to **[REDACTED]**'s operations shall be permitted.

(b) No modification to the **[REDACTED]** Track shall be permitted.

(c) All work within the vicinity of the **[REDACTED]** Track shall be co-ordinated with **[REDACTED]** and the City.

(d) For work within the **[REDACTED]** ROW see document "Special Provisions **[REDACTED]**". Project Co shall abide by **[REDACTED]** rules, policies, standards and procedures outlined in this document when working within the **[REDACTED]**ROW.

(i) Prior to any performance of any work within 10m of the nearest Track, the City and **[REDACTED]**shall be notified 5 Business Days in advance. Project Co shall provide a **[REDACTED]**approved flag person to protect **[REDACTED]** trains from Project Co activities. For flagging cost, see document "**[REDACTED]**".

(ii) Project Co shall be permitted to work within the **[REDACTED]**ROW between trains upon authorization from flagman.

(iii) The current schedule of trains is available on the **[REDACTED]** website at **[REDACTED]** and is as follows (subject to change):

A. Monday to Friday: from 5:30am to 11:00pm.

B. Saturday: from 6:45am to 11:00pm.

C. Sunday: from 9:15am to 11:00pm.

(iv) Between trains some small work blocks from 20 minutes to two hours may be available to work.

(v) Outside those hours, no trains are running, but the last train at approximately 11:00pm could be late on route reducing the night work block available.

(e) Project Co shall be responsible to perform Utility locates and protect all Utilities during construction if required. Fiber optics are running on both sides of the Track in the vicinity of the Ellwood Diamond.

(f) Project Co shall communicate ahead of time all activities which could disturb the nearby residents and manage residents' complaints.

(g) For the **[REDACTED]** Contractor Orientation course, it is $15 (US dollars)/individual working within the ROW.

ARTICLE 6 RAIL REGULATORY STRUCTURE AND OBLIGATIONS

6.1 Governance

(a) Transport Canada is the federal agency holding jurisdictional authority over the federal railway system as it relates to the design, construction, operation, Maintenance, Safety and Security, as well as the rates and conditions of service of the System. Specific legislation governing said activities include, but are not limited to regulations, rules, standards, orders and matters covered by the following:

(i) CTA;

(ii) RSA; and,

(iii) Canadian Transportation Accident Investigation and Safety Board Act (TSB).

(b) Project Co acknowledges that the City, as the official owner of the railway, is accountable for all aspects of the System on the Existing Trillium Line including compliance with all applicable regulatory matters. Project Co further acknowledges that the City is the single point of contact with Transport Canada as it relates to all regulatory issues. Regulatory issues affecting the System design, construction, O&M, Safety and Security as well as rates and conditions of service shall be coordinated through the City.

(c) The City operates the Existing Trillium Line System under the name Capital Railway.

(d) Project Co shall be responsible for providing information to support regulatory filings by the City including all relevant technical, O&M, and supporting documentation in support of the following work:

(i) Modification of the CTA Certification of Fitness;

(ii) Modification of Railway Operating Certificates;

(iii) Notification of Railway Works for all activities associated with the Works;

(iv) Operational risk assessments for all operational changes in compliance with Article 7 - System Safety Certification, and Article 8 – Security and Emergency Management, of this Part 1;

(v) Encroachment agreements and/or crane swing agreements to provide clarity on work methods and controls on or near the active Existing Trillium Line;

(vi) Changes to Capital Railway rules, regulations, and SOP, DMU rules, timetable and other rules affecting safe O&M of the System; and,

(vii) Grade crossing risk assessment and compliance requirements.

(e) Additional regulatory filings may be required prior to commencement of construction activities or during the Construction Period and Maintenance Period. The City and Project Co shall work together to identify design and Maintenance issues requiring such filings. Project Co shall be required to submit to the City the appropriate supporting documentation for any additional

regulatory submittals that may be required. Regulatory support documentation may be required for modifications/exemptions to existing or the introduction of new legislations, certificates, rules, standards, order, MOUs and guidelines including, but not limited to those, cited in Table 1-6.1 below.

(f) Project Co shall be responsible for designing, constructing and Maintaining the Project in accordance with all applicable legislation, certificates, rules, standards, orders, MOUs and guidelines that may include, but are not limited to, those cited in the table below.

Table 1-6.1

Applicable Legislation, Certificates, Rules, Standards, Orders, MOUs and Guidelines

Type/Title
Canada Transportation Act (CTA)
Railway Safety Act (RSA) (R.S., 1985, c. 32 (4th Supp.))
Canadian Transportation Accident Investigation and Safety Board Act (R.S. 1985, c. C-23.4)
Transportation of Dangerous Goods Act (R.S. 1992, c. 34)
Contraventions Act (S.C. 1992, c. 47)
Canadian Environmental Protection Act (R.S. 1999, c. 33)
Non-smokers' Health Act (R.S. 1985, c. 15 (4th Supp.))
Legislation - Regulations
Grade Crossing Regulations
Notice of Railway Works Regulations
Non-smokers' Health Regulations (made pursuant to the Non-smokers' Health Act)
Canada Labour Code: On Board Trains Occupational Safety and Health Regulations (made pursuant to the Canada Labour Code, Part II) Safety and Health Committees and Representatives Regulations (made pursuant to the Canada Labour Code, Part II)
Transportation Safety Board Regulations (made pursuant to the Canadian Transportation Accident Investigation and Safety Board Act)
Wire Crossings and Proximities Regulations; General Order E-11
Regulations Amending the Contraventions Regulations - "Fail to give way to railway equipment at a road crossing"
Railway Safety Management Systems Regulations (June 2015)
Prevention and Control of Fire on Line Works Regulations (June 2017
Transportation and Information Regulations
Certificates, Rules, Standards, Orders, MOUs
Memorandum of Understanding – Railway Security (Railway Association of Canada)
Railway Operating Certificate
Certificate of Fitness No. 00002-2 (Canadian Transportation Agency)
Grade Crossing Standards
Work/Rest Rules for Capital Railway
Canadian Rail Operating Rules
Standards Respecting Pipeline Crossings

Railway Employee Radio Communication Rule
Railway Freight and Passenger Train Brake Rules
Railway Medical Rules for Positions Critical to Safe Railway Operations
Railway Passenger Handling Safety Rules
Railway Rules Governing Safety Critical Positions
Rules for the Control and Prevention of Fires on Railway Rights-of-Way
Rules for the Installation, Inspection and Testing of Air Reservoirs (Other than on Locomotives)
Rules for the Protection of Track Units and Track Work
Rules Respecting Track Safety
Standard Respecting Railway Clearances
Railway Signal & Traffic Control Systems Standards
Capital Railway LINT Diesel Multiple Units Inspection and Safety Rules
Capital Railway – Railway Equipment Reflectorization Rules
Standard for LED Signal Modules at Highway/Railway Grade Crossings
Rules Respecting Minimum Qualification Standards for Railway Employees
A Guide on the Development and Implementation of Railway Safety Management Systems
Guideline on Submitting a Proposed Rule or a Revision to a Rule
Guideline: Engineering Works Relating to Railway Works
Guideline on Applying for an Exemption or Filing an Exemption Notice
Guidelines on Requesting Approval to Undertake Certain Railway Works
Guideline on Submitting Proposed Engineering Standards or Revisions to Engineering Standards
Guideline for Bridge Safety Management
Guideline for Culvert Safety Management
Guideline: Engineering Work Related to Railway Works
Fatigue Management Plans – Requirements and Assessment Guidelines

6.2 General Requirements

(a) The following lists the responsibilities of the City and Project Co with respect to regulatory requirements.

(i) The City shall:

A. Serve as single-point of contact for all regulatory matters;

B. Secure exemptions to clearance standards related to the Leitrim Road aerial structure;

C. Secure exemptions to airport zoning regulations associated with the alignment and Leitrim Road Bridge;

D. Manage operating agreements and establish tariffs for movement of freight traffic on the System;

E. Manage operating agreements with **[REDACTED]** and **[REDACTED]**; and,

F. Manage other third party agreements including but not limited to Utilities, developers, **[REDACTED]**, PSPC, MTO, NCC, etc.

(ii) Project Co shall;

A. Be responsible for compliance with all Applicable Law and regulatory requirements;

B. Consider, in consultation with the City, all current regulatory standards, regulations and requirements for the System having regard to its technical features and operating environment. Project Co shall support the City in the development of appropriate support documentation for changes, modifications or exemptions to such legislation, certificates, rules, regulations, standards, orders, MOUs, policies and guidelines;

C. identify the appropriate scope, detail and timetable for submission of supporting documentation related to modifications/exemptions to existing legislation, certificates, rules, regulations, standards, orders, MOUs, policies and guidelines based on the City's obligations to comply with Transport Canada, Canadian Transportation Agency and the TSB requirements, as shown in Clause 6.3 of this Part 1 or as prescribed in Clause 6.2 (a) (ii) D of this Part 1 and Clause 6.3 (a) (i) of this Part 1. Project Co shall ensure that the regulatory support documentation is thoroughly reviewed for accuracy and completeness by individuals knowledgeable of the applicable regulatory requirements, prior to submittal. The City shall have final review and approval authority of any support documentation submitted by Project Co prior to submission to Transport Canada. The submission of required documentation shall be in accordance with Schedule 10 – Review Procedure;

D. meet the established timetable for submission of documentation requested by regulatory agencies during the design, construction and Maintenance Period as outlined in Clause 6.3 (b) of this Part. Delays to design and construction schedules or Revenue Service date resulting from Project Co's failure to comply with regulatory submission requirements shall not entitle Project Co to a Compensation Event, Delay Event, or Excusing Cause, as applicable in the event of a delay in schedule;

E. work with the City in a cooperative and collaborative manner in the identification, development and submittal of ongoing support documentation required for meeting regulatory obligations, throughout the Maintenance Period, including the identification and adoption of such changes as the City may, in its discretion, but with the input of Project Co, deem advisable; and,

F. shall be responsible for the following in accordance with Part III, Rail Transportation, of the CTA:

i. supporting the City in the continued delivery of freight services to the NRC Facility; and,

ii. complying with the current Rail Transfer Agreement with the NRC addressing the delivery of freight service to/from the NRC Facility.

6.3 Timing and Protocol for Approval

(a) Project Co shall develop regulatory support documentation and submit the same to the City for approval according to the following process:

(i) Submission Requirements and Timing

A. from time to time during the design and construction, Project Co shall submit for timely approval by the City any regulatory support documentation required for modifications/exemptions to existing legislation, certificates, rules, regulations, standards, orders, MOUs, policies and guidelines that may be required to support the commencement and completion of scheduled work packages, programs or delineated work or service activities;

B. proposed regulatory support documentation for modifications/exemptions to existing legislation, certificates, rules, regulations, standards, orders, MOUs, policies and guidelines that are planned or scheduled to be adopted prior to or following the commencement of Revenue Service shall be submitted by Project Co for review/approval by the City and submission to Transport Canada in a manner consistent with the timeframe set forth in the specific legislation or regulation, as otherwise required or requested by a regulatory agency or a date mutually agreed to by the City and Project Co; and,

C. regulatory support documentation for modifications/exemptions to existing legislation, certificates, rules, regulations, standards, orders, MOUs, policies and guidelines shall be submitted in required format and contain all required information together with a brief explanatory note setting out the reason or purpose for the proposed modification or exemption to current regulation.

(ii) City Response and Timing

A. The City shall initially respond to each regulatory submittal within 14 Business Days of receipt of Project Co's written submission confirming either its approval or rejection (with reasons) of the proposed modifications/exemptions to current regulations, the extent to which the City requires further information from or consultation with, or training services from Project Co, if any, and the timetable in which the City requires this to occur.

B. Should the City or Transport Canada reject or return a submittal for further information or clarification, Project Co shall be responsible for responding to and resubmitting the updated document within:

i. the time period established by Transport Canada, as set forth in the specific regulation, or as otherwise required or requested by a regulatory agency; or

ii. the date mutually agreed to by the City and Project Co.

(iii) Should Project Co fail to respond to the City within the stipulated time period, then the City shall penalize Project Co pursuant to Schedule 20 – Construction Period Payments;

(iv) The City shall endeavour to complete its review of all submissions made by Project Co in accordance with the foregoing submission requirements by the later of:

A. the date mutually agreed to by the City and Project Co for each submission; and,

B. the date that falls 30 calendar days following the City's receipt of the submission from Project Co.

(b) Project Co shall not commence or perform any construction activity comprising any portion of the Works or Project Scope unless regulations or supporting documentation that may be appropriately required to support or facilitate that particular portion of the Works or Project Scope have been adopted by Transport Canada, or alternatively the City has confirmed in writing to Project Co that there are no Regulations that are required by Transport Canada to apply to such activity.

(c) Adoption and implementation date of such modifications/exemptions will be contingent upon Transport Canada approval.

ARTICLE 7 SYSTEM SAFETY CERTIFICATION

7.1 General Requirements

(a) The Works specified in this Article, as well as portions of Article 8 that refer to Security, consists of the development and implementation of a SSAP. The purpose of the SSAP is to ensure the Project systems and equipment are as safe and secure as reasonably possible including

(i) Design and operating Hazards and Security vulnerabilities are identified, evaluated, and properly controlled or mitigated, prior to the commencement of Revenue Service.

(ii) All critical system elements are evaluated for compliance with the identified Safety and Security requirements during the design, conform to the drawings and specifications during construction/installation, and function as required during testing, and start-up phases of the Project.

(iii) The Project is operationally safe and secure for customers, employees, ESP, and the general public prior to entering Revenue Service.

(iv) All Project equipment, Facilities, plans, procedures, and training programs are systematically reviewed for compliance with established system Safety and Security requirements, and so verified prior to implementation of Revenue Service.

(b) Requirements for human factors are an integral part of this program and shall be considered in the development and implementation of the SSAP plans. The System Safety and Assurance requirements shall apply to all Project Co functions during all phases of the Works including design, construction, testing, commissioning, Trial Running, in-service support, warranty, retrofits and field modifications.

(c) Objectives: The primary objective is to deliver a Project that meets or exceeds System Safety and Assurance related governmental rules, regulations, standards and industry best practices, and applicable requirements throughout the Project. Thus, leading to delivery of a safe and reliable System for the City, its employees, Project Co, Passengers and the public at large.

(d) The Project design shall be compliant with Safety and Security design criteria, codes, and regulations including Ontario Human Rights Commission *Policy and Guidelines on Disability and the Duty to Accommodate*, requirements, with Safety and Security of Passengers and employees as the most important requirement of the Project.

(e) Project Co shall be responsible for compliance with the Project's SSCP and SSeCP developed by the City through strict conformance to contractual obligations. Project Co shall be responsible to update the Project's SSCP and SSeCP throughout the Project lifecycle. Project Co shall manage its Works through design, construction and integrated testing in such a way as to support the overall success of the Safety and Security Certification processes and the ultimate acceptance by the City.

(f) Project Co shall be responsible for performing Safety Certification tasks as specified herein in accordance with EN 50126, EN 50128, EN 50129. These tasks shall be managed and performed in accordance with the Project SSCP.

(g) Project Co shall provide an SCM. The SCM shall develop and implement the Safety Certification program to verify the inclusion of Safety items in the design, construction, testing, and commissioning of the Project. The SCM shall oversee and manage all aspects of the certification process. The SCM shall be a Professional Engineer.

7.2 References

(a) Develop and implement the System Safety and Assurance Plans in accordance with the following guidelines and documents. Where the referenced documents provided below, conflict with these specifications, these specifications shall govern:

(i) NFPA 101 Life Safety Code and other relevant NFPA codes and standards.

(ii) NFPA 130, Fixed Guideway Transit and Passenger Rail Systems.

(iii) MIL-HDBK-470A, Designing and Developing Maintainable Products and Systems (Volume II), December 1997.

(iv) MIL-HDBK-781A, Handbook for Reliability Test Methods, Plans and Environments for Engineering, Development Qualification and Production, April 1996.

(v) MIL HDBK-217F, Reliability Prediction of Electronic Equipment.

(vi) MIL STD 756B, Reliability Modeling and Prediction or IEC 61078 equivalent.

(vii) MIL STD-781D, Reliability Testing for Engineering Development, Qualification and Production - Exponential Distribution.

(viii) MIL STD-470A, Maintainability Program Requirements (for Systems and Equipment).

(ix) Procedures for Performing a Failure Mode Effects and Criticality Analysis, MIL- STD-1629A or EN 60812, Analysis techniques for system reliability – Procedures for failure mode and effects analysis.

(x) EN 50126-1:2017, Railway Applications – The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS).

(xi) EN 50126-2:2007, Railway Applications – The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) – Guide to the application of EN50126-1 for Safety.

(xii) EN 50128:2011, Railway Applications – Communication, signalling and processing systems – Software for railway control and protection systems.

(xiii) EN 50129:2003, Railway Applications – Communication, signalling and processing systems – Safety related electronic systems for signalling.

(xiv) IEC 61508, Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems.

(xv) Electronic Parts Reliability Data EPRD-2014, Reliability Information Analysis Center, Quanterion Solutions Incorporated.

(xvi) Non-Electronic Parts Reliability Data NPRD-2016, Quanterion Solutions Incorporated.

7.3 System Safety Requirements

(a) General

(i) The Safety program shall establish the Safety requirements and verify Safety of the design through analyses and collaboration with the various disciplines. This approach helps assure that the Works provides for Health and Safety provisions affecting Maintenance and Operations personnel that equal or exceed the requirements of the Ontario OHSA and AODA.

(b) Safety Technical Requirements for Systems Design

(i) Safety shall be the primary design and performance requirement for the Project. The entire Expanded Trillium Line shall operate in a safe manner under all operating conditions. Safety components shall be designed according to the Safety principles (see below), and shall incorporate high reliability parts, selective redundancy, and warning and protective devices, as required, to contribute to the achievement of the specified requirements. In addition, Safety shall be provided for when elements fail or malfunction.

(ii) The Safety of the Expanded Trillium Line, when operating under normal conditions, shall preclude inadvertent/incorrect actions and/or procedures used by operating personnel. In no case shall procedures be substituted to accomplish any Safety functions provided by specific aspects, components, subsystems and/or equipment. Frequent and/or infrequent use shall not be a reason to justify unsafe or marginally safe design. At all other times (when carrying out Maintenance and/or Failure recovery), there shall be minimum dependence on correctness of actions and/or procedures used by operating and Maintenance personnel.

(iii) Whenever any Hazardous condition occurs, regardless of the cause, and the condition results in a conflicting concern between human Safety and equipment Safety; the conflict shall be resolved in favour of human Safety.

(iv) Project Co shall be responsible for designing, supplying, constructing, installing, testing and verifying and certifying the System in accordance with the requirements of the Project Agreement and the Safety principles customarily recognized by the transit industry for light rail systems. Project Co shall be responsible throughout the course of the Project for bringing to the attention of the City, in writing, any change in Laws, rules, orders, Regulations and Codes, and any condition(s), whether caused by its design, any Project Agreement requirement, or any other basis, which it believes might result in, or has resulted in, an unsafe condition. Project Co shall remain fully responsible for rectifying any such condition.

(c) Safety Principles

(i) The following Safety principles shall be followed in the design and functionality of systems, subsystems, components, and parts.

A. Hazard control shall follow the order of precedence:

i. design to eliminate Hazards;

ii. design to control Hazards;

iii. use Safety devices;

iv. use warning devices;

v. implement special procedures;

vi. accept the Hazard; and,

vii. eliminate the system/ subsystem/equipment.

B. Unacceptable Hazards shall be eliminated by design.

C. The System shall be designed such that there shall be no single-point Failures in the System that can result in an unacceptable or undesirable Hazard condition.

D. When the System is operating normally there shall be no unacceptable or undesirable Hazard conditions.

E. The System design shall require positive actions to be taken in a prescribed manner to either begin or continue System Operation.

F. The Safety of the System in the normal automatic operating mode shall not depend on the correctness of actions or procedures used by operating personnel.

G. If one Failure combined with a second Failure can cause an unacceptable or undesirable Hazard condition, the first Failure shall be detected, and the System shall achieve a known safe state before the second Failure can occur.

H. Software faults shall not cause an unacceptable or undesirable Hazard condition.

I. The criteria for accepting a Hazard risk level shall be in accordance with the Safety Management System.

J. Maintenance activities required to preserve or achieve acceptable risk levels shall be performed. Personnel qualifications required to adequately implement these activities shall also be identified.

K. Consideration shall be given at all times to the Safety of workers, Passengers and staff of Project Co and the City.

L. A failure on Safety Critical equipment shall be detected and reported back to the TOCC.

(ii) Two principles of Safety, a Fail Safe Principle and a Checked Redundancy Principle, shall govern the design of Safety Critical components and subsystems. One or both of these principles shall be used to provide a safe Expanded Trillium Line System. These principles are defined as follows:

A. Fail Safe Principle - The Fail Safe Principle applies to both hardware and software configurations, and states the occurrence of any Failure of Safety Critical hardware or software, or any combination thereof, shall not result in a condition known to be unsafe. The Fail Safe Principle shall be applied where a Failure of any critical element is likely to occur more than once in 10^6 (one million) hours of active service on the Expanded Trillium Line. For hardware this shall include, as a minimum, Failure modes; and,

B. Checked Redundancy Principle - The Checked Redundancy Principle applies to both Safety Critical hardware and software configurations, and states that the probability of any Failure or combination of Failures that would result in a condition known to be unsafe shall pose no greater risk than that associated with Fail Safe design. In the event of a Failure, the Failure shall be detected, reported/alarmed and negated (maintain fail-safe state). Each function of a component or subsystem designed in accordance with the Checked Redundancy Principle shall provide a level of Safety equivalent to that provided by the same function designed in accordance with the Fail Safe Principle.

(iii) The checked redundant control configuration, whether hardware or software, shall incorporate at least two parallel control units processing a common system characteristic, and means of comparing the output of the control units. If there is agreement from the comparison, the System may be allowed to respond in accordance with the output of the control units. If there is disagreement, the action resulting from that output shall not occur, and the System shall immediately revert to a safe state. For example, if a Vehicle is in motion, the brakes shall be applied, and if the Vehicle is not in motion, it shall not be allowed to move.

(iv) The following characteristics shall be incorporated into the checked redundancy design.

A. The checking process shall, in itself, be Fail Safe or checked redundant; "agreement" shall not be indicated unless the control units output agree.

B. The checking process shall include the comparison of control units related to Safety.

C. Any Failure of redundancy affecting the Safety of the System shall be detected. Where software is used; errors in programming shall be considered Failures.

D. All parallel control units shall be completely independent. No common environmental or power fluctuations, errors, faults, or other problems, shall cause related errors in the output of the control units. Common software modes of Failure shall be prevented by the following methods, or by similar methods, if approved:

i. Independent, different programming in the parallel control units.

ii. The use of logically complemented programs for the parallel elements of functions involving the ATP subsystem.

E. The checking process shall be comprehensive and as frequent as the number of Operations of the device or function, to provide a risk comparable to that of Fail Safe design.

F. Unless a comparative agreement occurs in the checking process, timely action shall intervene to provide Safety.

(d) SCIL

(i) Project Co shall develop a preliminary SCIL. This list shall include all equipment involved in performing a Safety-Critical function as determined by a Failure Mode, Effects and Criticality Analysis or functional Fault Tree Analysis. The SCIL shall be submitted to the City for approval and updated as required throughout the Project lifecycle. Relays certified as "vital" or Safety type shall have Failure characteristics as defined by the AAR.

(e) System Safety Design Approach

(i) Project Co shall provide a PHA for the Project. Project Co shall ensure that the analysis reflects all design changes that may impact the Safety of the Expanded Trillium Line. The PHA and resolutions shall be submitted to the City in accordance with Schedule 10 – Review Procedure.

(ii) Additionally the Safety program shall be developed to identify Hazards through the preparation of formal Hazard analyses which have been identified in the systems requirements for the specific system elements. The Hazards identified in the various analyses and the mitigation measures proposed will be reviewed and analyzed by the City for acceptance.

(iii) Project Co shall track all identified Hazards throughout the Project lifecycle using a Hazard Log and have the capability to provide status reports to the City and SSCRT for review.

(iv) Project Co shall identify all Safety Critical functions and allocate the respective SIL of each with supporting analyses.

(v) PHA: Project Co shall provide a PHA for the Expanded Trillium Line. During the progress of the Works, Project Co shall be responsible for identifying additional Hazards that are specific to the Expanded Trillium Line and updating the Hazard Log. Additional Hazards identified and analysis shall be submitted to the City for its review in accordance with Schedule 10 - Review Procedure. Project Co shall address and incorporate applicable mitigations from the Expanded Trillium Line PHA into the design of the Project.

A. Mitigations shall include design considerations, Safety devices, warning devices or recommendations for adopting special procedures or training. The resolution process shall verify but not be limited to the following:

i. That the resolution of a Hazard in one system does not create a new Hazard in another system;

ii. That Hazards involving interfaces between two or more systems have been analyzed and resolved;

iii. That all program participants are providing required analyses in a timely manner, and that determination is made where delinquent receipt is delaying Hazard Resolution; and,

iv. That proper resolutions are implemented for areas identified with Hazard Resolutions requiring a change in system design or development of special procedures.

B. Any subsequent Hazard Analysis that may be required shall be performed in accordance with EN 50126 and the Project Co's hazard management procedure.

C. Mitigations shall be compiled into an independent Hazard Log that identifies Hazards, proposed mitigations to those Hazards. All mitigation references shall state document, revision number, section and paragraph number.

(vi) Perform additional Hazard analysis as deemed necessary and agreed to by the City for the following system elements including but not limited to:

A. Signalling and Train Control System;

B. Communications;

C. Trackwork;

D. Electrical;

E. Elevators;

F. Fire/Life Safety Systems, including ventilation; and,

G. The Vehicle and the on-board Vehicle equipment as required.

(vii) Safety analysis techniques shall include, but may not be limited to:

A. System/Sub-System Hazard Analysis;

B. Software Hazard Analysis;

C. Failure Mode, Effects and Criticality Analysis; and,

D. Fault Tree Analysis.

(viii) OHA: Project Co shall perform an OHA to identify and analyze Hazards associated with personnel and procedures during production, installation, testing, training, Operations, Maintenance and Emergencies. Project Co shall provide for corrective measures to be

taken to minimize the possibility that a human error or procedure will result in injury or System damage.

7.4 Development of Safety Design Criteria

(a) Project Co shall prepare separate, and submit, in accordance with Schedule 10 – Review Procedure, Safety Design Criteria separate from Security Design Criteria at the commencement of the design effort to provide applicable Safety guidelines for proper design, construction, testing, and preparation of the Operation of the System. The purpose for separate Design Criteria documents involves the control or restriction of information that due to its sensitive and confidential nature or content that may, if disclosed or released, identify vulnerabilities to Critical infrastructures or systems. The separation of these documents allows for one criterion to be updated without impact to the other.

(i) The Safety Design Criteria shall be submitted within 120 days of Financial Close.

(b) The Design Criteria shall ensure that the Safety elements identified for the Project will become part of requirements that shall be addressed by Project Co through the development of specifications, drawings, design reviews, and final acceptance.

7.5 Safety and Security Certification

(a) Project Co's management responsibilities shall include, but are not limited to, the following:

(i) Project Co shall implement a Safety and Security Certification program which shall be compliant with the City's SSCP and SSeCP, which shall verify the inclusion of all Safety and Security items in the design, construction, testing, operation and Maintenance of the Expanded Trillium Line. An SSCRT, independent of the design activities, shall oversee the certification effort.

(ii) Project Co shall utilize the SSCP and SSeCP developed by the City that describes and outlines the Project's Safety Certification and Security Certification processes which will be compliant to the City's SSCP and SSeCP. The SSCP and SSeCP developed by the City will describe roles, responsibilities, staffing, schedule and a description of the process, at a minimum. Project Co shall be responsible to develop a project specific SSCP and SSeCP to describe how they will be complaint to the City's SSCP and SSeCP and provide a deliverable timeline in line with the Project schedule.

(iii) Project Co shall participate in meetings with the SSCRT, FLSSC, and SSORC.

A. SSCRT:

i. Shall oversee Project Co's SSCP and SSeCP;

ii. Shall conduct meetings at a minimum of quarterly to discuss safety and security concerns;

iii. Shall review Project Co's certification activities; and,

iv. Shall consist of Project Co's SCM and SeCM to liaise with the SSCRT to report status, open items and Hazard, threat and risk management/resolution.

B. FLSSC:

i. Project Co shall ensure the respective Emergency response agencies are involved including Fire, Police, Emergency Responders, etc.

ii. The FLSSC shall be a liaison with respective City representatives and local authorities as defined by Project Co.

iii. The FLSSC shall review standards and Safety and Security related designs, tests to verify compliance with FLS codes and Emergency preparedness.

C. SSORC:

i. Additional committees including an SSORC shall be established as needed to review designs, plans, manuals, rules and procedures, and other documentation necessary for certification prior to Revenue Service operation.

(iv) Cooperation and facilitation of Safety and Security Certification audits of the Works shall include.

A. Coordinating, documenting and performing training as specified in the Project Agreement.

B. Maintaining and updating files and submitting required documentation on a timely and sequential milestone schedule basis. Preparing Safety and Security Certification progress reports each month, which shall include submitting a record copy of Safety and Security Certification files to the City in accordance with Schedule 10 – Review Procedure.

(b) Project Co's responsibilities are defined in the following table. Project Co shall be responsible for the performance of the tasks/activities identified in Table 1-7.1. The SSCP and Safety Management System shall be followed when conducting tasks below. This Table also includes the RAM deliverables described in Clause 7.8 of this Part 1.

Table 1-7.1 – Project Co Deliverable Requirements by Project Phase.

PROJECT PHASE	EN 50126 LIFECYCLE PHASE	PROJECT CO RAM TASKS	PROJECT CO SAFETY TASKS
PRELIMINARY / CONCEPTUAL DESIGN	1. Concept	Review Project Agreement RAM requirements Evaluate past RAM data and experience Preliminary RAM Allocation	Review and Update the City's SSCP
	2. System definition and application conditions	RAM Program Plan Preliminary RAM Allocation Establish RAM Assurance Plan, can be part of SSAP RAM audits (internal and 3rd party)	SSAP Safety audits (Internal and 3rd party) SSPP Provide PHA
	3. Risk Analysis	Preliminary identification of Reliability Critical items	SSAP Update System PHA System Risk Analysis Interface Risk Analysis Review and update Hazard Log Software Safety Plan

PROJECT PHASE	EN 50126 LIFECYCLE PHASE	PROJECT CO RAM TASKS	PROJECT CO SAFETY TASKS
DETAILED / FINAL DESIGN	1. System Requirements	Capture RAM requirements in Traceability Matrix Update RAM Program Plan, as required Update RAM portion of SSAP, as required RAM Demonstration Plan	Hazard Log update Allocation of THR →SIL Function Apportionment Update SSPP Safety Verification and Validation Plan Review/Establish Non-Conformance Procedures and Reports Safety audits (Internal and 3rd party)
	2. Apportionment of System Requirements	RAM Allocation Report FMECA (Can be same as Safety provided it includes all information) Reliability Critical Items List Provide Lifecycle Costing for Operations and Maintenance period	SSAP update * as required SSPP update * as required Software Safety Plan update * as required PHA System Risk Analysis / Subsystem Risk Analysis Interface Risk Analysis OHA FMECA FTA Develop SCIL
IMPLEMENTATION	3. Design and Implementation	RAM Prediction Report Review and update RAM portion of SSAP, as required	Integrated System Safety Case Update Hazard Analysis (Subsystem/Interface, OHA) FMECA Test Plans and Procedures SIL Safety Function Assignment
PROCUREMENT AND MANUFACTURING	4. Manufacturing	Review First Article Inspection Maintainability Demonstration FRACAS Procedure	Hazard Log Update Safety Verification and Validation Report(s) Assess Safety related training Operation and Maintenance Manuals
CONSTRUCTION AND INSTALLATION	5. Installation	Spares List (with separate section for Safety Critical and Reliability Critical items)	SSAP Update Validation Report(s)

PROJECT PHASE	EN 50126 LIFECYCLE PHASE	PROJECT CO RAM TASKS	PROJECT CO SAFETY TASKS
TESTING & COMMISSIONING	6. System Validation	Review and update RAM Demonstration Plan as required RAM Demonstration Report FRACAS Report	System Safety Case System Test Reports Update OHA Safety Related Application Conditions (SRAC), as required Safety Audits (Internal and 3rd party)
HANDING OVER	7. System Acceptance	RAM Demonstration Report Acceptance by City for Revenue Operation	Hazard Log Update Engineering Safety and Assurance Case
OPERATIONS AND MAINTENANCE OBJECTIVES	8. Operation and Maintenance	RAM Demonstration Report during Warranty Period (Monthly Report) FRACAS Report	O&M FRACAS Review and update Hazard Log Review and Update Engineering Safety and Assurance Case Transfer and implement SSAP for Operations Update Operations and Maintenance Manuals Safety Audits (Internal and 3rd party)
	9. Performance Monitoring	RAM Demonstration Report until Warranty expiry and acceptance by City Maintain FRACAS Report	No Safety deliverables required unless assumptions found to be invalid.
	10. Modification and Retrofit	Assess RAM implications as required	Hazard Log Update Engineering Safety and Assurance Case Update as appropriate

7.6 Safety Activities

(a) Project Co shall follow the SSCP and Safety Management System, when conducting the Safety activities listed in Table 1-7.1 above along with the respective standards listed therein.

(b) Witness point: Witness point selection is a City responsibility with the purpose of defining selected points or locations where the City wishes to formally witness testing. Project Co shall be responsible for scheduling and performing the tests that include those City-selected points; and, for notifying the City at least 14 Business Days in advance of the date and time of the test. Notification procedures shall be established prior to witness point testing, scheduling or performance of testing. Selected areas shall include items of high risk, where concerns of compliance have been raised, or those selected by random sampling. The City shall have the right to attend and witness any and all testing that takes place.

(c) Safety-related tests: Project Co shall verify that subsystems and systems function safely as specified and do not contain or create unforeseen Hazards. All Safety-related tests shall be

included in the test program plan contained within its own section. The respective Safety-related tests and results shall be documented within test reports to provide Safety evidence for the respective Safety Case. Safety tests shall include, at a minimum:

(i) An initial Safety related testing conformance checklist shall be prepared for the design level of the Project Agreement. Project Co shall update the Safety related testing conformance checklist and submit it to the City for review. Project Co shall verify that all Safety related tests identified in the specifications and other Project Agreement documents are successfully performed and the completed tests have been verified within defined test parameters and the systems and subsystems function safely as specified, do not contain or create unforeseen Hazards and contain specified Safety features. All requirements on the checklists shall be verified and submitted to the City for review in accordance with Schedule 10 – Review Procedure.

(ii) At a minimum, each of the identified Safety requirements for Safety Critical Item (unit) and respective Safety function for a Certifiable Element shall be simulated and tested to verify and certify performance in normal modes and associated sequences and the Failure modes and effects, as applicable. These tests shall demonstrate the Safety requirements stated herein have been met. Should the Safety testing identify any Safety issue, they shall be listed in the Safety test reports, indicating remediation and corrective action necessary. All remediation and corrective actions required by Project Co shall be completed within 14 calendar days and documented in a Non-Conformance Report to ensure traceability. All remediation and corrective actions shall be completed prior to the completion of the Works and pre-revenue testing and training. Project Co shall audit all tasks.

(iii) Safety Testing Documentation - Safety testing shall be separately identified to allow recognition of Safety tests. Project Co shall include a matrix in the SSVM (output from the Hazard Log), addressing Safety tests only, which shall receive the concurrence by signature of the responsible person as defined by Project Co's organization chart. The matrix shall identify Safety parameters and/or other Safety considerations and a cross-reference to the test procedure accomplishing the verification and certification. This matrix shall be kept current throughout the duration of the Project Agreement and shall include the identification of the test reports which confirm verification and certification of the Safety and Security requirements. The references to the Safety tests along with reports shall be checked before every Safety Case submission to ensure that there have been no revisions or modifications.

(iv) Notification - Project Co shall notify the City in writing 30 calendar days prior to the start of any Safety or Security test. If any of the data indicate conditions which could potentially result in lack of proper Safety or protection of Operations; Project Co shall immediately indicate proposed remedies and/or corrective actions.

(v) Scheduling - All Safety tests shall be successfully completed by Project Co prior to system or equipment acceptance.

(vi) Safety Test Reports - Project Co shall ensure test reports which contain Safety verifications and certifications shall receive the concurrence, by signature, of the responsible person, defined by Project Co's organization chart. Safety Test Reports shall be attached to the respective Safety Case and referenced within the SSVM to demonstrate compliance.

A. Project Co shall report any non-compliance/non-conformance with applicable code and regulatory requirements noted as a result of Safety related testing. All non-compliances shall be rectified in accordance with applicable codes and regulations.

(d) Safety training and drills: Project Co shall be responsible for the proper coordination and successful completion of this task of Safety drills and exercises with the City and other third parties including but not limited to the **[REDACTED]**, **[REDACTED]**, NRC, **[REDACTED]** and the OMCIAA as applicable. The purpose of the training and drills verification process is to verify that key Safety related training on new equipment and procedures is adequate and appropriate for the tasks performed under typical and Emergency conditions. Project Co shall schedule, arrange, invite participants, provide equipment, and set up locations for drills to occur. Where indicated elsewhere herein, Project Co shall also provide instructors to assist performing the Safety training. This includes but is not limited to:

(i) Verifying safe System Operation through drills and exercises is an integral part of a closed-loop, pro-active System Safety process. The methodology employed by the training/drill/exercise process is to obtain written verification from the City that:

A. Training and drills are adequate and appropriate for the assigned task, and contain instructions on Safety features for typical and Emergency conditions;

B. Lessons learned from training and drills/exercises performed are reviewed and documented and that additional Hazards, vulnerabilities, or open Safety issues have been resolved; and,

C. Known issues concerning training and drills, which impact Safety, have been satisfactorily resolved.

(ii) Safety information on conformed methods and procedures necessary to maintain safe conditions shall be generated by Project Co and included in a Safety Training Program, to be provided by Project Co, for Safety training consideration of construction, Operations and Maintenance personnel. At a minimum, each of the Safety training requirements disclosed by the PHA and OHA shall be included in the training program and associated documents.

(e) Project Co shall be responsible for establishing and maintaining a Hazard Log to record and track Hazards for resolution as addressed in the Hazard analysis. The Hazard Log shall describe all identified Hazards, the measures taken to resolve each Hazard (references citing document, revision, section number) and the results of reviews, comments and approvals by the City and other outside agencies. All Hazards shall be tracked through to resolution. Project Co shall submit the most current copy of the Hazard Log to the City for review upon request. After all tracked Hazards are resolved, Project Co shall prepare a SSVM document and submit in accordance with Schedule 10 – Review Procedure.

(f) Fire Life Safety – Project Co shall be responsible for compliance with Fire Life Safety requirements included in federal, provincial, local codes and regulations, and the Project Agreement. Project Co shall incorporate these requirements into the design and construction of the Project and include all applicable certifiable Fire Life Safety elements in the appropriate SSRTM.

(g) Project Co shall support the approval process by participating in reviews, inspections and technical discussions between the City and local jurisdictional authorities and other Governmental Authorities, and incorporating the resulting agreements into the design and construction. Project Co shall be responsible for verifying that Project Co's completed design complies with the resolutions of Fire Life Safety issues, and is acceptable to the applicable Governmental Authorities.

(h) Project Safety Certification Report (Engineering Safety and Assurance Case)

(i) A signed report shall be prepared by Project Co, prior to opening, attesting to the overall Safety and Security of the Expanded Trillium Line for public use. This shall include resolution to all non-conformance Hazards and vulnerabilities previously identified through Project Co's detailed Safety Analysis. Upon completion of the Works and pre-revenue testing and training, Project Co shall issue to the City and the SSCRT a signed and sealed Final Safety Certification Report.

(ii) The signed Safety Certification Report shall certify to the City that the Works has been designed and constructed in accordance with the Project Agreement Safety requirements, and Project Co has used the Safety principles customarily applied in the transit industry for transit systems in North America and Canada. The report shall further certify the Expanded Trillium Line either meets or exceeds all applicable Federal, Provincial, City, and local Laws, Ordinances, rules, Regulations, Statutes, industry Codes, and other standards and requirements, whichever are the more stringent requirements.

(iii) As a basis for making this formal certification, Project Co shall perform a detailed accounting of all correspondence and documentation to verify and certify all Safety requirements, activities, tests, inspections, non-conformances, remediation's and actions have been completed and satisfied, documenting these results in a Safety Certification Report which shall be submitted to the City in accordance with Schedule 10 – Review Procedure.

7.7 Format for System Safety Verification Matrix

(a) Project Co shall provide an SSVM in the following format, noting that this shall be an output from the Hazard Log.

(i) Item number;

(ii) Safety requirement;

(iii) Document reference:

A. Document name; and,

B. Article number.

(iv) Evidence:

A. Method of verification by Project Co;

B. Method of validation by audit team;

C. Validated by (Name of auditor);

D. Date; and,

E. Remarks.

(b) System Safety Requirement Traceability Matrix

(i) Project Co shall develop an SSRTM for the Project. It shall be used to verify and certify that the Safety requirements have been incorporated in the design and certify that all Safety requirements of the design are constructed and/or installed in accordance with the Project Agreement. Verification reports (outputs of the SSRTM) shall be submitted in accordance with Schedule 10 – Review Procedure.

7.8 Reliability, Availability, Maintainability

(a) System Assurance

(i) Introduction

A. The SSAP shall encompass system RAM. The primary objectives of system assurance are to: ensure RAM, Safety and quality plans, processes and procedures are followed, implemented and in-line with the PA and applicable regulations and standards.

B. The general design concepts which shall be incorporated include, but are not limited to: use of standards, proven designs; use of reliable equipment, use of interchangeable, modular components; extensive and prominent labeling of parts, wires, etc.; use of standard, prewired harnesses; use of weatherproof seals and latches.

C. The systems assurance requirements are specified for specific system elements and contract specifications. Project Co shall develop and implement a System RAM Program encompassing system RAM engineering and meet quantitative RAM goals and requirements, which shall be demonstrated through analysis and test. The RAM requirements shall apply to all systems, subsystems and assemblies, software, hardware and firmware provided for the Expanded Trillium Line. The requirements apply during all phases of the work.

(b) RAM Approach

(i) Project Co shall follow, implement and meet RAM Program requirements including qualitative and quantitative requirements contained in the specific system elements requirements.

(ii) Quantitative RAM goals/requirements shall be apportioned by Project Co for subsystems/equipment/components comprising the system elements. In addition to the quantitative goals to be met, Project Co shall meet requirements defined for the RAM Program Plan, and specific analyses.

(c) RAM Program Plan

(i) The Project Co shall prepare a detailed RAM Program Plan in general accordance with applicable provisions of EN 50126. It shall include, at a minimum, the following:

A. Description of the System;

B. RAM Requirements and Critical items;

C. Task listing and time phasing for each task including RAM deliverables as stated in Table 1-7-1;

D. Organization and responsibilities of key personnel including the formation of a Failure Review Board;

E. Techniques for allocation of quantitative requirements to lower level functional elements;

F. Interfaces between RAM and other closely related programs, and support to efforts such as:

i. Logistic support and Maintenance planning;

ii. Design;

iii. Quality assurance and quality control;

iv. Standardization;

v. Systems engineering: and,

vi. Personnel subsystem program (human engineering, life support, training, and personnel resources).

G. Methods for assuring that sub-contractor's' RAM efforts are consistent with overall System requirements;

H. Provision for source selection, first article inspection, and surveillance of sub-contractor's' RAM activities;

I. Analytical methods to be used during design and development for demonstrating compliance with RAM requirements and goals;

J. Procedures and controls, including piece part selection and screening, manufacturing process controls, procurement controls, and test procedures, to be utilized during production to ensure achievement of RAM requirements;

K. Provisions to evaluate design changes for possible effects upon subsystem and functional level requirements and goals; and,

L. Description of failure management and collection.

(d) Maintenance Approach - Develop a concept of maintenance as part of the RAM Program Plan taking the following into considerations:

(i) System parameters as specified above.

(ii) Maintenance Assumptions

A. Troubleshooting and repair shall be done by qualified technician with a minimum of 2 years' experience and has attended the Maintenance training programs at a minimum; and,

B. Spare parts recommended by the Project Co shall be available.

(iii) The concept of maintenance shall define the repair, Corrective Maintenance program plans, policies, and support requirements for all equipment supplied under for this Project. It shall:

A. Minimize each level of Maintenance consistent with the specification requirements and system Reliability goals; and,

B. Recommend policies and practices which ensure that, at the time of a failure, qualified Maintenance personnel shall be promptly notified and shall have the necessary documentation, tools, test equipment, and spare parts to affect the repair in a minimum of time.

(iv) The concept of maintenance shall develop recommendations for:

A. Depth and frequency of Maintenance requirements at each level;

B. Facilities required;

C. Support equipment and tools required;

D. Skill levels and numbers of personnel required;

E. Subsystem, component, and piece part repair policy; and,

F. Detailed fault isolation and troubleshooting procedures, diagnostic equipment, and special test equipment.

(e) Maintainability Design Features

(i) The subsystems and components shall incorporate the following design features:

A. Accessibility: All routinely serviced subsystems and components shall be readily accessible for service and inspection. Accessibility of components shall be proportional to frequency of Maintenance and repair. No active electrical or mechanical components that can foreseeably require Maintenance shall be structurally embedded to preclude convenient access for repair or replacement.

B. Modular Design: Modular design principles shall be employed to the greatest extent practicable. Components shall be packaged together in replaceable subassemblies according to the logical function that they perform. Components or subassemblies requiring occasional removal shall preferably be plug-in units.

C. Interchangeability: Assemblies or components that are functionally interchangeable shall be physically interchangeable. Assemblies or components that are not functionally interchangeable shall not be physically interchangeable.

D. Adjustments: The need for adjustments shall be avoided. Where adjustment points cannot be avoided, they shall be readily accessible, adequately identified, and self-locking to prevent inadvertent adjustment or drift.

E. Special Tools: The number of special tools required for Maintenance and repair shall be minimized. However, if they are required, they shall be defined and furnished in a quantity determined as part of the Works of this Project.

F. Panels and Openings: Panels and openings shall be of sufficient quantity, size, and placement to permit ready access from normal work areas and positions. Adjustment controls, fittings, and such, shall be directly accessible through panels and openings. Self-retaining fasteners shall be used wherever possible. Special access opening tools shall not be used unless considered necessary to prevent vandalism.

G. Cable Connections: Cable connectors shall be spaced far enough apart so that they can be grasped firmly for connecting and disconnecting. Connectors shall be properly labeled and keyed so that they cannot be interchanged or improperly installed. Signal and power pins shall not be adjacent.

H. Lifting Assists: Handles, lifting lugs, or reviewed functional equivalents shall be provided on components of 18 kg or more.

I. Visual Inspection: Visual inspection of equipment shall be unobstructed.

J. Test Points: Built-in test points shall be provided and marked. Major components having test panels or test points shall be located for easy accessibility and shall permit external monitoring of Critical functions. Test points shall be protected against environmental damage and human error.

K. Fault Isolation: Failure indicators shall be provided and identified. Systematic fault isolation procedures shall be developed and included in the Maintenance manuals.

L. Labeling: All test points, fault indicators, modules, wire junctions, pipes, tubes, wires, etc., shall be identified by name plates, colour coding, number coding, or other means to assist Maintenance personnel. All ROMs, PROMs, and EPROMs shall be labeled with the version and date of stored software.

M. Hardware: Standard, commercially available industrial components and hardware shall be used wherever possible.

N. Vandalism: The use of vandal and damage resistant materials shall be used whenever possible.

(f) Preventive Maintenance Plan

(i) Project Co shall develop and submit a detailed Preventive Maintenance Plan based upon the concept of maintenance and established maintainability requirements. The Preventive Maintenance Plan shall provide all preventive Maintenance tasks needed to Maintain each subsystem/equipment, supplied for this Project, as close as possible to new condition. The Preventive Maintenance task analysis shall include all servicing, inspections, scheduled overhaul, or any task required on a scheduled basis. The elapsed time to perform specific tasks shall be defined in the analysis, and in Maintenance and servicing manuals. All tasks shall be sorted and grouped by time interval (ex. daily, weekly, monthly, etc.), as well as by Subsystem.

(ii) In addition to Preventive Maintenance tasks recommended by equipment manufacturers to enhance the Reliability/Availability of their equipment, many Safety Critical Preventive Maintenance tasks shall be required as a means of detecting Safety-significant latent failures, which would otherwise remain latent until another subsequent Failure resulted in a potentially hazardous event. The Safety Critical preventive maintenance tasks are a direct result of performing Safety analyses on all required subsystems. Project Co shall use a clear and deliberate method to identify all Safety Critical Preventive Maintenance tasks in the Preventive Maintenance Plan

(g) Project Co shall apportion and allocate MTBF and MTTR values as applicable to the various systems elements and subsystems using a Reliability Block Diagram model, which shall support and meet the top level RAM goals/requirements. Project Co may use the beneficial effects of redundancy and repair rate (repair rate = reciprocal of MTTR) to reduce the effective Failure frequency and thus increase the effective MTBF of system elements and subsystems due to equipment redundancy, and the ability to repair one failed unit in time before the second (redundant) unit fails. Project Co shall demonstrate through analysis and testing that the apportioned Availability/MTBF values which support the top level inherent RAM are achievable and the equipment shall demonstrate such MTBF through analysis and testing.

(h) MTBF shall be calculated as the total number of equipment operating hours for the entire population of like items, divided by the number of Failures (loss of function) requiring unscheduled Corrective Maintenance action anywhere within the said population of items during said total accrued operating hours by said population of items. A Failure shall be defined as loss of function. In redundant systems configuration, the function shall not be deemed "lost" until all the redundant items in the "Cut-set" of redundant items have failed. Thus Project Co shall benefit from the effects of redundancy and repair rate to reduce the effective Failure frequency of the system/ subsystems (i.e., increase the effective MTBF) due to redundancy in configuration. Also, scheduled preventive Maintenance to inspect/ repair/ replace items during non-revenue-service hours, shall not be considered chargeable Failure for MTBF calculation.

(i) RAM Prediction Report

(i) Project Co shall submit a RAM Prediction Report to demonstrate its proposed equipment will meet RAM goals/requirements. Project Co shall not furnish any equipment until calculations or data is approved by the City.

(ii) Reliability calculations shall use reliability block diagram, reliability model, probability of success equation, and preventive Maintenance strategies to achieve required MTBF. Sustained field data, Electronic Parts Reliability Data – 2014, Non-Electronic Parts Reliability Data – 2017 and MIL-HDBK-217F shall be used for reliability data in order of precedence. Any assumptions made shall be documented in the RAM Prediction Report, as a minimum shall include de-ration factors for environment, temperature, application and stress and redundancy configurations for MTBSAF calculations, as applicable.

(iii) Project Co may propose alternate method of calculating reliability, such as providing service records for proven equipment, provided Project Co can demonstrate similar function and environmental conditions, for approval by the City.

(iv) Project Co shall conduct a Maintainability analysis to be included within the RAM Prediction Report to ensure the Maintainability requirements listed herein have been achieved. Project Co shall follow IEC 60706 in general accordance.

(j) RAM Demonstration Plan and Report:

(i) Project Co shall develop a RAM Demonstration Plan outlining the equipment to be tested, acceptance criteria and test conditions to be applied. Project Co shall submit to the City for review and approval.

(ii) During testing and commissioning, Project Co shall provide the City a RAM Demonstration Report outlining the performance of the System and to demonstrate the ability to capture and analyze failure data (FRACAS system in place) in accordance to the RAM Demonstration Plan, for review and acceptance

(iii) Project Co shall provide monthly reports throughout the Warranty Period to ensure the RAM requirements are being met.

(k) FRACAS Procedure and Report

(i) Project Co shall develop a FRACAS Program and submit to the City for review and approval. The program shall outline the organization in place to support the program and the approach taken by Project Co to detect, collect, diagnose and correct the respective Failure as a minimum.

(ii) Project Co shall develop and submit to the City, on a monthly basis staring at testing and commissioning, a detailed FRACAS Report, indicating all system element Failures to the LLRU by subsystem, corrective actions to be implemented and work orders traced to the respective corrective action, identification of any pattern Failures and a summary of the most frequent failing elements.

ARTICLE 8 SECURITY AND EMERGENCY MANAGEMENT

8.1 General Security and Emergency Management Requirements

(a) The Works specified in this Article consists of the development and implementation of Security and Emergency Management requirements. Requirements for physical and cyber Security and Emergency preparedness of City ESP are integral part of this Project. These Security and Emergency preparedness requirements shall apply to all Project Co functions during all phases of the Works including design, construction, installation, testing, pre-revenue operations, in-service support, warranty, retrofits and field modifications. As well, Project Co shall ensure Security is considered in the development and implementation of the plans, training and supporting documentation including the development and implementation of an SSeAP. The purpose of the SSeAP is to ensure the Project Facilities, systems and equipment are as secure as reasonably possible including:

(i) Design and operating Security vulnerabilities are identified, evaluated, and properly controlled or mitigated, prior to the commencement of Passenger service on the Expanded Trillium Line.

(ii) All Critical system elements are evaluated for compliance with the identified Security requirements during the design, conform to the drawings and specification during construction/installation, and function as required during testing, and start-up phases of the Project.

(iii) The Project is operationally secure for customers, employees, ESP, and the general public prior to entering Revenue Service.

(iv) All Project equipment, Facilities, plans, procedures, and training programs are systematically reviewed for compliance with established system Security requirements, and so verified prior to implementation of Revenue Service.

(b) Objectives: The primary mission of the Trillium Line Extension is to provide the City with a safe, secure, reliable, and attractive public rail transportation system. As such, the Trillium Line Extension shall incorporate Security values that affect all levels of the Project activities including; the planning, design, procurement, construction, testing, commissioning, and Operations and Maintenance. Project Co shall deliver a Project that meets or exceeds Security and Emergency preparedness related governmental rules, regulations, standards and industry best practices, and applicable requirements throughout the Project. Project Co and Project Co Parties are charged with the responsibility of delivery of a secure system for the City, its employees, customers, and public at large as well as ensuring ESP are ready to respond to Emergency events through formal training and documentation development.

(c) The Works shall be accomplished by incorporating Security design features, facilitating Emergency response training drills (which shall include on Site (Guideway and Stations) and on-Train familiarization sessions, in classroom instructions, tabletop exercises and live exercises using Train, Stations, Guideway and maintenance Facilities) and implementing contractual training for the safe and efficient handling of both normal and Emergency conditions. Project Co shall design the Project with provisions to enable safe and timely evacuation of patrons and personnel from all fixed Structures, disabled Vehicles and Facilities. The provisions shall also include necessary safeguards to protect Passengers, personnel and ESP during evacuation and

shall minimize exposure to all Hazards, including those due to moving Vehicles and potential falls, weather issues and vulnerabilities due to intentional acts.

(d) The Project design shall be compliant with Security criteria, codes, and regulations and the duty to accommodate Security requirements of Passengers and employees as the most important requirement of the Project.

(e) Project Co shall be responsible for compliance with the Project's SSeCP developed by the City through strict conformance to contractual obligations. Project Co shall manage its Works and that of its Subcontractors' through design, construction and integrated testing in such a way as to support the overall success of the Security certification process and the ultimate acceptance by the City.

(f) The Expanded Trillium Line ERP shall be in accordance with the criteria contained in this Article and all Applicable Law governing Emergency planning, response and recovery. The ERP shall incorporate requirements contained in the existing "Railway Passenger Handling Safety & Emergency Response Plan".

(g) Project Co shall coordinate with the City on the development of an ERP to reflect all elements of the SI and Vehicles. This approach ensures that Project Co has considered, trained, addressed, and planned for all potential catastrophic natural and man-made disasters, and has established protocols, procedures, responsibilities and guidelines to mitigate the potential impacts and respond to and recover from the occurrence of a disaster event, in accordance with the ERP.

(h) The ERP shall be completed and submitted as part of the Works Submittals in accordance with Schedule 10 – Review Procedure.

(i) It is understood that the ERP developed by Project Co shall be incorporated into the City of Ottawa Emergency Management Plan, and the PERP. As such, the general outline, organization and structure of the ERP shall generally follow the City of Ottawa Emergency Management Plan and the PERP.

(j) This Article is provided as a general outline for the requirements of the ERP, as the ERP shall be modified, revised or changed, as appropriate, to address specific issues, needs, threats, Hazards, vulnerabilities, or concerns, including those identified in the PHA, TVA, risk assessment, Hazard analysis and FMEA related to the Expanded Trillium Line System that shall be developed during the Project Term.

(k) Project Co shall be responsible for performing Security Certification tasks as specified herein in accordance with U.S. Department of Transportation, Federal Transit Administration's Handbook for Transit Safety and Security Certification, Final Report, November 2002; FTA-MA-90-5006-02-01. These tasks shall be managed and performed in accordance with the Project SSeCP.

(l) Project Co shall provide a SeCM to develop and implement the Security Certification processes. The SeCM shall develop and implement the Security Certification Program to verify the inclusion of Security items in the design, construction, testing, and commissioning of the Project. The SeCM shall oversee and manage all aspects of the Security Certification effort.

8.2 References

(a) Develop and implement the Security and Emergency preparedness deliverables such as plans, procedures and protocols to ensure response activities are defined and outlined for incidents requiring police, fire or paramedic, in accordance with the following guidelines and documents. Where the referenced documents provided below, conflict with these specifications, these specifications shall govern:

(i) For Security: Handbook for Transit Safety and Security Certification, Final Report, November 2002; DOT, FTA-MA-90-5006-02-01.

(ii) Public Transportation System Security and Emergency Preparedness Planning Guide, January 2003, Final Report, U.S. DOT, FTA, DOT-VNTSC-FTA-03-01.

(iii) Transit Security Design Considerations, Final Report, November 2004, US DOT, FTA, DOT-VNTSC-FTA-05-02.

(iv) CPTED principles, City of Ottawa, Urban Design, A Reference Guide to Creating Great Places and Great Spaces, Planning, Transit and the Environment, Publication #2103, Summer 2007.

(v) NFPA 130, Fixed Guideway Transit and Passenger Rail Systems.

(vi) ASIS International Security strategies and procedures.

(vii) Transport Canada Rail Codes of Practice for Rail and Transit Operations.

(viii) Pathway Lighting Policy, City of Ottawa Policy on Lighting Pathways.

8.3 Security and Emergency Response Principles

(a) The following Security and Emergency response principles shall be followed in the Design and development of Security plans and procedures, ESP training and overall ESP preparedness.

(b) Security: The three fundamental principles of Security are:

(i) Confidentiality: The principle of confidentiality means that the System's operational and management control assets can be accessed only by authorized parties.

(ii) Integrity: The principle of integrity means that the System's operational and management control assets can only be modified or changed by authorized parties in authorized ways.

(iii) Availability: The principle of availability means that the System's operational and management control assets should be available to authorized parties at all times.

(c) Emergency response principles include:

(i) Emergency response procedures shall be designed and developed to align with industry accepted principles and follow the current City Emergency response protocols;

(ii) Emergency responder systems training shall include access, familiarization sessions and tours, and operation of Safety, Security and Emergency response systems;

(iii) Emergency response training and familiarization shall consider City protocols for escalation of Emergency events;

(iv) Emergency response procedures shall account for changes to the threat as outlined in the Threat Log and Risk Log; and,

(v) Emergency response shall be validated through both tabletop and full-scale exercises.

(d) Emergency response shall consider the Safety of City ESP at all times.

8.4 Development of Security Design Criteria

(a) Project Co shall prepare Security Design Criteria at the commencement of the design effort to provide applicable Security guidelines for proper design including CPTED, construction, testing, and preparation of the operation of the Security systems. The purpose for separating Safety and Security Design Criteria documents involves the control or restriction of information that due to its sensitive and confidential nature or content that may, if disclosed or released, identify vulnerabilities to Critical infrastructures or systems. The separation of these documents allows for one criterion to be updated without impact to the other.

(i) The Security Design Criteria shall be submitted within 150 days of Financial Close.

(b) The Design Criteria shall ensure that the Security elements identified for the Project shall become part of requirements that shall be addressed by Project Co through the development of specifications, drawings, design reviews, and final acceptance. These Security elements include where appropriate, and to meet the requirements as identified in the Threat Log and Risk Log:

(i) Perimeter fencing;

(ii) Alarms;

(iii) Fare gates;

(iv) Security laminates;

(v) CCTV cameras;

(vi) PA systems;

(vii) Security signage;

(viii) Intrusion detection;

(ix) Locks;

(x) Key control;

(xi) Roll down cooling grills;

(xii) Blast mitigation;

(xiii) Vehicular barriers;

(xiv) Security lighting; and,

(xv) Cyber protection for IT and SCADA systems.

8.5 Security Design Approach

(a) Project Co shall follow the Security Management System when designing and developing the Security Plan and Procedures. As outlined in Article 10 – Construction Safety Management, of this Part 1, there is a requirement to develop and implement a systematic, explicit, and comprehensive process for managing Security risks. Project Co shall develop a System Security Certification Plan to support Security integration.

(b) The Security design approach shall be founded in the TVA and Risk Assessment. As such, Project Co shall develop and maintain a current TVA to identify, mitigate, and/or control threats and vulnerabilities that might arise from design and operational deficiencies associated with the Project. During the progress of the Project, Project Co shall be responsible to update threats and vulnerabilities that are specific to the Trillium Line Extension. Additional threats and vulnerabilities identified and analyzed shall be submitted to the City in accordance with Schedule 10 – Review Procedure.

(c) Specific Security requirements for Trillium Line Extension facilities or the supporting Systems shall be based on a risk assessment that is conducted by Project Co during the earliest stages of the Project. Project Co shall address and incorporate applicable mitigations identified by the Trillium Line Extension TVA and risk assessment as outlined at Schedule 10 – Review Procedure. Mitigation of Security physical and cyber threats are to apply to the following:

(i) Train Control;

(ii) New Walkley Yard;

(iii) Trillium Stations;

(iv) Guideway;

(v) Tunnel;

(vi) TOCC and BCC;

(vii) Fare Collection;

(viii) Intrusion Access Control;

(ix) CCTV System; and,

(x) Rail Vehicle.

(d) Mitigations shall include design considerations, Security devices, warning devices or recommendations for adopting special procedures or training. These mitigations shall consider an integrated Security approach, CPTED principles and Security defence in depth. The resolution process shall verify the following:

(i) That the resolution of a threat or vulnerability in one system does not create a new one in another system;

(ii) That threats or vulnerabilities involving interfaces between two or more systems have been analyzed and resolved;

(iii) That all program participants provide required analyses results in a timely manner, and that determination is made where delinquent receipt is delaying vulnerability resolution; and,

(iv) That proper resolutions are implemented for areas identified with vulnerability mitigations requiring a change in system design or development of special procedures or additional training for ESP or City staff.

(e) The TVA methodology and the risk assessment process of identifying the likelihood of occurrence and the severity of impact shall be applied and performed in accordance with Public Transportation System Security and Emergency Preparedness Planning Guide, January 2003, Final Report, U.S. DOT, FTA, DOT-VNTSC-FTA-03-01.

(f) Mitigations shall be compiled into an independent Threat Log and Risk Log that identifies threats, vulnerabilities and among other things, proposed mitigations to vulnerabilities. This Threat Log shall be reviewed and updated on an on-going basis.

(g) The criteria for accepting a threat risk level shall be in accordance with direction provided by the City and the Security Management System.

(h) Document confidentiality and control. The TVA, Threat Log, Risk log and the information contained within the documents shall be confidential, restricted and controlled to only those people with the need to know and access the information therein. Project Co shall establish controls and criteria for accessing the documents and information. When no longer necessary, the documents shall be destroyed beyond reconstruction or recognition.

8.6 Security Certification

(a) Project Co's management responsibilities shall include, but are not limited to, the following:

(i) Project Co shall implement a Security Certification Program, which shall ensure compliance with the SSeCP by verifying the inclusion of all Security items into the design, construction, and testing of the Trillium Line Extension. The SSCRT shall oversee the certification effort.

(ii) Project Co shall utilize the SSeCP developed by the City that describes and outlines the Project's Security Certification process, which shall be compliant to the City's SSeCP. The SSeCP developed by the City will describe roles, responsibilities, staffing, schedule, deliverables and a description of the process, at a minimum. Project Co shall be

responsible to develop a Project specific SSeCP to describe how they will be complaint to the City's SSeCP and provide a deliverable timeline in-line with the Project schedule.

(iii) Project Co shall participate in meetings with the SSCRT, FLSSC and SSORC.

(iv) Cooperation and facilitation of Security Certification audits of the Works shall include.

A. Coordinating, documenting and performing training as specified in the Project Agreement.

B. Maintaining and updating files and submitting required documentation on a timely and sequential milestone schedule basis. Preparing Security Certification progress reports each month, which shall include submitting a record copy of Security Certification files to the City.

(b) Project Co's responsibilities are defined in the following table. Project Co shall be responsible for the performance of the task activity identified in Table 1-8.1. The SSeCP and Security Management System shall be followed when conducting tasks below:

Table 1-8.1 - Project Phases and Project Co Security Tasks

PROJECT PHASE	EN 50126 LIFECYCLE PHASE	PROJECT CO SECURITY TASKS
PRELIMINARY / CONCEPTUAL DESIGN	1. Concept	Review the City's SSCP
	2. System definition and application conditions	SSeCP SSeAP Security Audits (Internal and 3rd party) SSePP TVA and Risk Assessment
	3. Risk Analysis	SSeAP Update System Risk Analysis Interface Risk Analysis Review and update TVA Cybersecurity Assessment and Management Review and update Threat Log and Risk Log

PROJECT PHASE	EN 50126 LIFECYCLE PHASE	PROJECT CO SECURITY TASKS
DETAILED / FINAL DESIGN	4. System Requirements	Threat Log and Risk Log Review and Update Update SSecP Security Audits (Internal and 3rd party)
	5. Apportionment of System Requirements	SSeAP Update SSeCP update as required System Risk Analysis / Subsystem Risk Analysis Threat Log and Risk Log review and update Cybersecurity assessment and management review and update
IMPLEMENTATION	6. Design and Implementation	Emergency Preparedness (Preliminary) Test Plans and Procedures
PROCUREMENT AND MANUFACTURING	7. Manufacturing	Threat Log and Risk Log review and update Verification and Validation Report(s) Assess Security related training Operation and Maintenance Manuals
CONSTRUCTION AND INSTALLATION	8. Installation	SSeAP Update Validation Report(s)
TESTING & COMMISSIONING	9. System Validation	Security Audits (Internal and 3rd party) Conduct Emergency Training and Drills
HANDING OVER	10. System Acceptance	Threat Log and Risk Log review and update

PROJECT PHASE	EN 50126 LIFECYCLE PHASE	PROJECT CO SECURITY TASKS
OPERATIONS AND MAINTENANCE OBJECTIVES	11. Operation and Maintenance	Review and update Threat Log and Risk Log Transfer and implement SSAP for Operations Update Operations and Maintenance Manuals Conduct Emergency training and drills Security Audits (Internal and 3rd party)
	12. Performance Monitoring	No Security deliverables required unless assumptions found to be invalid.
	13. Modification and Retrofit	Review and update Threat Log
	14. De-commissioning and disposal	To be assessed at time of de-commissioning (Threat Log review and update)

8.7 Security Activities and System Testing

(a) Project Co shall follow the Security Management System when conducting the Security activities, listed in Table 1-8.1 above, along with the respective standards listed therein. The agreed upon design countermeasures identified within the TVA and the corresponding Threat Log and Risk Log shall be incorporated.

(b) Security Review Documentation - Project Co shall include a matrix in the SeVM (output from the Threat Log and Risk Log) addressing Security tests, which shall receive the concurrence by signature of the responsible person as defined by Project Co's organization chart. The matrix shall identify Security parameters and/or other Security considerations and a cross-reference to the test following the Review Procedure outlined at Schedule 10. This matrix shall be kept current throughout the Project lifecycle and shall include the identification of the test reports, which confirm verification of the Security requirements.

(c) Security Systems

(i) Project Co shall comply with the Security requirements to support systems as outlined in the references below:

A. 2.3 LRT Systems Design Submission – Schedule 3 Part 1 Tech Sub Requirements;

B. Schedule 15-2, Part 3, Article 4 – Public Address System/Passenger Information Display System;

C. Schedule 15-2, Part 3, Article 7 – CCTV System; and,

D. Schedule 15-2, Part 3, Article 10 – Signalling and Train Control System.

(d) System Security Certification Process

(i) Project Co shall conduct System Security Certification process using a minimum of the five steps outlined below:

A. Identification of Certifiable Elements and sub-elements;

B. Identification of Security requirements for each Certifiable Element and sub-element;

C. Verification and/or validation of Security requirements;

D. Tracking, review, update and documentation of certification tasks in Security Certification Checklists; and,

E. Issuance of Certification for Certifiable Element or Sub-Element's conformance to all associated Security requirements

(e) Witness point

(i) Witness point selection is a City responsibility with the purpose of defining selected points or locations where the City wishes to formally witness testing. Project Co shall be responsible for scheduling and performing the tests that include those City-selected points; and, for notifying the City at least 14 Business Days in advance of the date and time of the test. Notification procedures shall be established prior to witness point testing, scheduling or performance. Selected areas shall include items of high risk, where concerns of compliance have been raised, or those selected by random sampling. The City shall have the right to attend and witness any and all testing that takes place.

(f) Security systems tests

(i) Project Co shall verify that Security systems function in accordance with promulgated specifications. All Security systems tests shall be included in the test program plan contained within its own section. The respective Security systems tests and results shall be documented within test reports. Security systems tests shall include, at a minimum:

A. An initial Security system testing conformance checklist shall be prepared for the design level of the Project Agreement documents. Project Co shall update the Security systems testing conformance checklist and submit it for review. Project Co shall verify that Security systems tests identified in the specifications and other Project Agreement documents are successfully performed and the completed tests have been verified within defined test parameters and the systems and Subsystems function safely as specified, do not contain or create unforeseen vulnerabilities, and contain specified Security features. All requirements on the checklists shall be verified and submitted to the City for review;

B. At a minimum, each of the identified Security requirements for a Security system shall be simulated and tested to verify and certify performance in normal modes and associated sequences and the Failure modes and effects, as applicable. These tests shall demonstrate the Security systems requirements stated herein have been met. Should the Security systems testing identify any issue, they shall be listed in the Security systems test reports, indicating remediation and corrective action necessary. All remediation and corrective actions required by Project Co shall be completed within fourteen calendar days and documented in a Non-Conformance Report to ensure traceability. All remediation and corrective actions shall be

completed prior to the completion of the Works and pre-revenue testing and training. Project Co shall audit all tasks.

C. Security Systems Testing Documentation - Security Systems testing shall be separately identified to allow recognition of Security systems tests. Project Co shall include a matrix in the SeVM (output from the Threat Log and Risk Log), addressing Security tests only, which shall receive the concurrence by signature of the responsible person as defined by Project Co's organization chart. The matrix shall identify Security parameters and/or other considerations and a cross-reference to the test. This matrix shall be kept current throughout the Project lifecycle and shall include the identification of the test reports which confirm verification of the Security requirements. The references to the Security Systems tests along with reports shall be checked before every submission to ensure that there have been no revisions or modifications.

D. Notification - Project Co shall notify the City in writing thirty calendar days prior to the start of any Security systems test. If any of the data indicate conditions which could potentially result in lack of proper protection of operations, Project Co shall immediately indicate proposed remedies and/or corrective actions.

E. Scheduling - All Security tests shall be successfully completed by Project Co prior to system or equipment acceptance.

F. Security Test Reports - Project Co shall ensure test reports which contain verifications shall receive the concurrence, by signature, of the responsible person, defined by Project Co's organization chart. Security systems reports shall be referenced within the SeVM to demonstrate compliance.

i. Project Co shall report any non-compliance/non-conformance with Applicable Codes and regulatory requirements noted as a result of Security systems testing. All non-compliances shall be rectified in accordance with Applicable Codes and regulations.

(g) Security training and drills

(i) Project Co shall be responsible for proper coordination and successful completion of this task. They shall participate and provide support as defined herein. The purpose of the training and drills verification process is to verify that key Security systems training on new equipment and procedures is adequate and appropriate for the tasks performed under typical and Emergency conditions. Project Co shall schedule, arrange, invite participants, provide equipment, and set up locations for drills to occur. Where indicated elsewhere herein, Project Co shall also provide instructors to assist in performing the training in Security.

(ii) Verifying Security system operation through drills and exercises is an integral part of the Security Systems process. The methodology employed by the training/drill/exercise process is to obtain written verification from the City that:

A. Training and drills are adequate and appropriate for the assigned task, and contain instructions on Security features for typical and Emergency conditions;

B. Lessons learned from training and drills are performed, reviewed and documented to identify threats, vulnerabilities, or open Security issues have been resolved; and,

C. Known issues concerning training and drills, which impact on Security, have been satisfactorily resolved.

(iii) Security information on conformed methods and procedures necessary to maintain Security conditions shall be generated by Project Co and included in a Security Training Program, to be provided by Project Co, for Security training consideration of construction, operations and maintenance personnel. At a minimum, each of the Security training requirements shall be included in the training program and associated documents.

(h) Project Co shall be responsible for establishing and maintaining a Threat Log and Risk Log to record and track Threats and Risks for resolution. The Threat Log and Risk Log shall describe all identified threats, the measures taken to resolve each threat (references citing document, revision, section number) and the results of reviews, comments and approvals by the City and other outside agencies. All Threats and Risks shall be tracked through to resolution. Project Co shall submit the most current copy of Threat Log to the City for review upon request. After all tracked Threats and Risks are resolved, Project Co shall prepare a SeVM and submit in accordance with Schedule 10 – Review Procedure.

(i) FLS

(i) Project Co shall be responsible for compliance with FLS requirements included in federal, provincial, local codes and regulations, and the Project Agreement. Project Co shall incorporate these requirements into the design and construction of the Project and include all applicable FLS elements in the appropriate SeRTM.

(ii) Project Co shall support the approval process by participating in reviews, inspections and technical discussions between the City and local jurisdictional authorities and other Governmental Authorities, and incorporating the resulting agreements into the design and construction. Project Co shall be responsible for verifying that Project Co's completed design complies with the resolutions of FLS issues, and is acceptable to the applicable Governmental Authorities.

(iii) Certificates of Conformance shall be signed as certified by the Project Co SeCM and signed as approved by the Project Co's Technical Director and submitted to the City as per Schedule 10 – Review Procedure.

8.8 Format for Security Verification Matrix

(a) Project Co shall provide an SeVM in the following format, noting that this should be an output from the Threat Log and Risk Log:

(i) Item Number;

(ii) Security requirement;

(iii) Document reference:

A. Document name; and,

B. Article number;

(iv) Evidence:

A. Method of verification by Project Co;

B. Method of validation by audit team;

C. Validated by (name of auditor);

D. Date; and,

E. Remarks.

(b) SeRTM

(i) Project Co shall develop SeRTM for the Project. It shall be used to verify and certify that the Security requirements have been incorporated in the design and certify that all Security requirements of the design are constructed and/or installed in accordance with the Project Agreement.

8.9 Construction Site Security

(a) The information provided in this section is intended to establish the minimum requirements to be satisfied in the development of a Construction Security Plan for this Project. Project Co's Security Management Plan shall establish the procedures required to provide the Security measures necessary to achieve Site Security.

(b) The following issues shall be addressed in the Construction Security Plan and with the processes established by the Project Co, in consultations with City authorities:

(i) Project Co shall be responsible for providing Security control capability for the physical Sites throughout all phases of the Project. The physical Security plan shall incorporate identifiable elements of protection, detection, and response capabilities. The Security measures shall be aligned to ensure identifiable Security perimeters are established and access controls to and monitoring of the secured areas are established and achievable for the life of the Project.

(ii) Adequate Security safeguards shall be established to ensure the protection of the Sites is provided on a continuous basis for the life of the Project. The measures shall be sufficient to mitigate incursion to the Sites.

(iii) Policies and procedures shall be developed and implemented to ensure that any Site Security force is appropriately trained and prepared to provide initial response to Security incidents.

(iv) The Construction Security Plan shall provide flexibility in the Security approach to permit adjustments to the Sites as the Project develops. This is to allow Project Co to shift the Site perimeters as needed to meet construction schedules.

8.10 Emergency Service Personnel Preparedness

(a) Project Co shall provide support to the City in the review and update of Emergency response procedures in a timely manner to enable ESP to be ready for Revenue Service. This support shall include:

(i) Review and update of current Emergency response procedures;

(ii) Development and delivery of up to three Train the Trainer sessions for 20 Emergency response trainers for each session;

(iii) Provision familiarization training session and tours on Stations, Guideway, New Walkley Yard, Trains and Systems for ESP and supporting teams;

(iv) Development and delivery of up to five tabletop exercises of up to 50 ESP each to address specific topics and issues as designed by the City;

(v) Delivery of content to update the City of Ottawa in-house Emergency Responder software related to Confederation Line Extension, which for clarity includes quick references information for first responders such as floor plans, extinguisher locations, stairs, access points, etc.; and,

(vi) Development and delivery of a full scale exercise to include all City ESP to validate Emergency response procedures.

(b) Project Co shall provide support to the City for familiarization training of ESP Trainers on functionality of ESP Systems to include:

(i) CCTV;

(ii) ETELs:

(iii) FTELS;

(iv) AEDs:

(v) GIDS;

(vi) ICP;

(vii) Train lifting equipment;

(viii) PA;

(ix) Tunnel ventilation; and,

(x) IAC.

8.11 ESP Training

(a) Project Co shall provide training programs, with special emphasis on ESP responsibilities, for all City ESP to enable a Train the Trainer Emergency response program.

8.12 Emergency Response Plan

(a) Project Co shall implement procedures designed to provide for a safe environment throughout the Project Term and provide to the City. The ERP shall include the required scenario analyses with an incident command hierarchy between ESP and demonstrate in detail how Project Co shall respond to and recover from the occurrence(s) of catastrophic natural and man-made disasters detailed in the PHA and subsequent Safety analysis. The ERP shall be consistent and in accordance with all Applicable Law governing Emergency planning, response and recovery. The plan shall be prepared with the involvement of and input from all applicable ESP and City personnel.

(b) Project Co's new ERP, as a minimum, shall include the following:

(i) Emergency Response Policy Statement;

A. The Emergency response policy statement shall clearly articulate the purpose of the ERP; scope and applicability of the ERP; and the methodology utilized to develop and implement the ERP. The Emergency response policy statement shall be communicated to all Project Co Parties and shall be reviewed, as a minimum, and coordinated annually with all ESP and City to ensure it is current.

(ii) Situation Analyses;

A. The ERP shall be based upon an analysis of the potential Emergency situations specific to this Project.

(iii) Planning Assumptions;

A. A section describing and indicating the basic planning assumptions upon which the ERP is based. It shall include lead times, effects of Emergencies, when and how an Emergency is to be declared, what outside assistance is available and the conditions under which an evacuation may be required.

(iv) Response Capabilities; and,

A. A section describing the current response and recovery capabilities of Project Co, which shall summarize the basic capabilities both in-house and from outside sources to deal with response and recovery issues. It shall contain a general description of how resources are currently managed and deployed. It shall also identify shortfalls in response capabilities and strategies to resolve these shortfalls.

(v) Critical Facilities.

A. Identification of Critical Facilities of Project Co, providing the System name, address, contact person, property classification, primary Emergency function, the

secondary Emergency function, the primary or normal use, the priority for power restoration and the Emergency power requirements. A location map indicating the location of all Critical Facilities shall be included in this section.

(c) System Management Polices

(i) This section shall address the current management policies and practices regarding the major factors that can have an impact on the Operation of the Expanded Trillium Line. Copies of all written policies and procedures shall be included in an appendix to the plan.

(ii) This section shall contain, at a minimum, a discussion of the following factors:

A. Surveillance and Incident detection;

B. Interdepartmental dependency and communication;

C. Information dissemination;

D. Traffic Incident management procedures;

E. Interface with the TOCC, the City, Confederation Line and bus Operations;

F. Public information and notifications; and,

G. Business impact and interruption.

(d) Project Co Expanded Trillium Line Resources

(i) Project Co shall provide a listing and description of the resources that the City and Project Co have available on a day-to-day basis and a listing of Project Co Parties or outside resources that are available on an on-call or contract basis. Project Co shall also include a listing of all vehicles and equipment owned, leased or available on-call by Project Co.

(e) Day-To-Day Functions and Responsibilities

(i) Project Co shall provide details on how the various responsibilities and specific parties are organized and managed with respect to Emergencies.

(f) Basic Operations

(i) Project Co shall provide an overview of the basic operational approach to Emergency situations. Specific details and descriptions of the response organization and assign specific tasks to the agencies and organizations that may be involved in responding to an Emergency. It shall be used by Project Co to guide and direct the development of functional and Emergency specific annexes that provide specific direction and responsibilities for various types and magnitudes of incidents.

(g) Functional Annexes

(i) The functional annexes section of the ERP shall provide specific information and direction and shall focus on Operations of the Expanded Trillium Line. These annexes shall emphasize responsibilities, tasks and Operational actions that pertain to the specific functions. These annexes shall clearly define and describe the policies, processes, roles and responsibilities inherent in the various functions before, during and after any Emergency situation, including how each agency and Project Co shall perform each of the functions. An annex shall include information on the following:

A. The purpose of the function;

B. A description of the situations that trigger implementation of the function;

C. A description of the assumptions that apply to the function;

D. The concept of Operations for the function; and,

E. Assignment of responsibility for annex Maintenance, review and updating.

(h) Emergency Specific Annexes

(i) The Emergency specific annex section of the ERP shall describe and offer a means of extending functional annexes to address special and unique response procedures, notifications, protective actions and other needs generated by a specific incident. Emergency specific annexes shall follow the same structure and similar content as the Basic Operations and Functional Annexes description above.

(ii) The following specific Hazards shall be addressed:

A. Major traffic accidents and/or incidents;

B. Hazardous material incidents;

C. Nuclear or radiological incidents;

D. Terrorism incidents;

E. Earthquake;

F. Biological incident;

G. Weather related events;

H. Railroad incidents;

I. Structural or Tunnel fires;

J. Structural Failure;

K. Electrical power incidents; and,

L. Other Utility incidents.

(i) Recovery Annexes

(i) The recovery annex section of the ERP shall address the methodology and processes that shall be implemented during the recovery process and shall include, at a minimum the following:

A. Identification of the agencies with responsibility for recovery efforts;

B. Establishment of the documentation and record keeping requirements following the disaster event;

C. Establishment of the initial post disaster priorities and responsibilities (0-12 hours);

D. Addressing of human needs; and,

E. Developing and addressing mitigation strategies.

(ii) The recovery annex section of the ERP shall be updated based upon lessons learned from specific incidents

(j) Training and Exercises

(i) This section of the ERP shall identify and address the specific training program(s) and exercise schedule(s) for Project Co. It shall address, at a minimum, the following:

A. Types of training required for each Project Co Party involved in a particular incident;

B. A specific annual training program and schedule for each Project Co Party so identified; and,

C. Establishment and implementation of the exercise and training program(s) that provides both table-top and full scale training exercises based upon the potential Emergencies to which the Expanded Trillium Line System is exposed.

(ii) Project Co shall maintain detailed records of all training exercises and drills including identification and tracking of follow-up actions.

(k) ERP Update

(i) The ERP shall be updated as required throughout the Maintenance Period.

ARTICLE 9 PROJECT OFFICE

9.1 General Requirements

(a) Project Co shall provide climate controlled offices, at pre-determined, locations set out in Table 1-9.1 along the active construction Sites of the Project alignment for City use.

TABLE 1-9.1: SITE OFFICE LOCATIONS AND SIZING

Site Office Locations or within 100 metres	Required Size (based on two offices and one meeting room per location)
Gladstone Station	28 m^2
Carleton Station	28 m^2
Uplands Station	28 m^2
Leitrim Road	28 m^2

(b) With reference to the above Table 1-9-1, unless otherwise specified, Project Co shall locate the Site Offices on mobilization Sites as per Schedule 33 - Lands.

(c) Project Co shall supply a trailer Site for the City of Ottawa management staff at the following locations: Gladstone Station - 18692-PRP_041, Parcel 1; Carleton Station - 18692-PRP_046a, Parcel 8; Uplands Station - 18692-PRP_016b, Parcel 2; and Leitrim Road - 18692-PRP_003a, Parcel 3.

(d) Project Co shall ensure that Site Offices shall be compliant with COADS, have entrance/exit signs and lighting and meet the requirements of the Ontario Codes and Guides for Buildings; Fire; Sewage; Plumbing and Electrical and the MOL and WSIB.

(e) Project Co shall be responsible for all Maintenance and Operational costs in association with Site Offices for the duration of Project Co's occupancy of the Lands.

(f) The Site Offices shall include the following:

(i) a secure climate controlled, Site Office area, including all improvements and fixturing costs and all required furniture as per the City standards.

(ii) Site Office accommodations include; one meeting room capable of holding 4-6 persons and required connections for laptop display; one restroom, one large heavy duty shredder and kitchen amenities such as counter, sink and storage, small bar fridge, microwave, kettle, coffee machine, storage space for supplies and personal protective equipment;

(iii) secure door with controlled access that is only accessible by the City. Signage at each Site Office identifying the occupant and indicate a telephone number in case of Emergency;

(iv) cleaning service agreements and costs for daily services of Site Office including rubber entrance mats, commercial grade and bristled scraper type boot cleaners;

(v) voice and data cabling evaluation and installation costs, with specific location for outlets and all other requirements to be agreed in consultation with the City;

(vi) equipment such as computers, monitors, keyboards and mouse, phones, printers, copiers and fax machines, polycoms, will be provided and maintained by the City;

(vii) selection and costs related to the provision of data and voice services will be provided by the City;

(viii) office supplies and stationary will be provided by the City;

(ix) temporary buildings and trailers shall be removed upon completion and areas restored to match existing surrounding areas by Project Co; and,

(x) two reserved parking spaces for the City exclusive use at each Site Office and Maintenance of parking spaces, sidewalks and paved areas at and adjacent to the Site in a safe condition.

ARTICLE 10 CONSTRUCTION SAFETY MANAGEMENT

10.1 General Requirements

(a) The CSMP shall be in accordance with the criteria contained in this Article and all Applicable Laws, Codes and Standards.

(b) The CSMP shall be prepared and submitted in accordance with Schedule 10 – Review Procedure. Project Co shall coordinate with Governmental Authorities to ensure existing Maintenance and Safety plans are not violated.

(c) Project Co shall have an active WSIB account in good standing and shall make available a valid Clearance Certificate from the WSIB, upon request.

(d) The construction planning for this Project shall consider the existing operations of the City and OC Transpo, and the impacts to the street network within the City, as well as considering adjacent residences, landowners and businesses, with respect to pedestrian and property access and other environmental impacts.

ARTICLE 11 SYSTEMS INTEGRATION PROGRAM

11.1 General Description

(a) As the systems integrator on the Expanded Trillium Line Project, Project Co shall establish and maintain a systematic, documented, comprehensive, and verifiable systems integration process based on the IEC 15288 standard (Systems and software engineering -- System life cycle processes) to be applied throughout the duration of the Project beginning with requirements management, concept development, design, procurement, manufacture, implementation, integration and testing, through successful commissioning. 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, existing systems, existing facilities, traffic, communities, and other agencies affected by the Project. Project Co shall define methods to confirm compatibility between System elements, and perform the necessary tests or other verification to demonstrate that every element functions and performs properly, both individually and as part of the complete System. As the systems integrator, Project Co shall provide all required resources, work processes and management authority to exercise control over the planning, scheduling, co-ordination, prioritization, and delivery of the works in order to mitigate foreseen systems integration risks, secure successful Project completion and deliver an operationally resilient railway into Project service.

(b) In the course of complying with the provisions of this Project Agreement, various physical and functional interfaces of both the City's and Project Co's equipment may depend on facilities, equipment, or services of organizations not under with the City's or Project Co's control for successful Operation. The majority of interfaces exist within the Project Agreement between the City and Project Co and its consultants, subcontractors, and suppliers, while the remaining interfaces exist between new and existing facilities and equipment furnished by the City and with other third parties such as Utility companies and Third Party Contractors. It is necessary that all interfaces be identified, coordinated 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.

(c) This Article addresses the interfaces between each of the system elements and the system elements with the infrastructure, facilities, services, system information, or other work being provided by Project Co or others (including the City). 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 City, and coordinate with the City to identify and successfully comply with all interface and integration requirements in order to perform all of the work required to complete the Project as defined in broad terms throughout the Project Agreement.

(d) The City shall integrate the Expanded Trillium Line's Communications Systems into the existing head-end management platform at the TOCC and BCC. The City shall also integrate the new CTS equipment in to the existing Confederation Line's NMS.

(e) The City will assign a Systems Integration Verifier to review and provide confirmation of the successful completion of the systems integration work related to the communication integration at

the TOCC and BCC. The Systems Integration Verifier will also act as adjudicator in a fast track dispute resolution procedure to resolve any disputes as to the source of the inability to successfully complete integration of the communication system at the TOCC or BCC.

(f) During the design phase, the Systems Integration Verifier will review and comment on the Expanded Trillium Line's Systems integration design for the communications system and associated integration documents.

(g) During the installation, testing, and commissioning phases, the Systems Integration Verifier shall review and comment on the communications; (i) integration, test and commissioning plans, (ii) traceability documents, and (iii) test procedures.

(h) The Systems Integration Verifier shall review and comment on the Project Co's Testing and Commissioning Plan as it relates to the communications systems.

(i) Project Co, as the Systems Integrator shall develop the necessary Systems Engineering Management Plans, produce the integration test, produce the SIMP, produce the SIT schedule, manage the interface working groups, identify and coordinate all necessary resources required to successfully execute SIT and commissioning of the upgraded head-end management platform for all of the Trillium Line's Communications Systems. These tests shall be executed via the upgraded GUI on the existing Confederation Line's operator workstations in the operational theaters at the TOCC and BCC. Project Co shall provide personnel to coordinate (between operators and field personnel) and witness the test execution from the TOCC and BCC.

(j) Project Co shall design, procure, install, integrate, test and commission the new head-end management platforms for the new S&TCS and the new TVS. Project Co shall identify, develop, track, test and validate all interfaces between the new S&TCS and the new TVS.

(k) System Integration Manager

(i) Project Co shall appoint a Systems Integration Manager to perform the Systems Integration obligations of Project Co. The Systems Integration Manager shall have the qualifications as set out in Schedule 9 – Key Individuals.

11.2 Systems Integration Submittals

(a) Project Co shall produce a SEMP, a RMP, a Verification and Validation Plan, an EMC Control Plan, a SIMP and a preliminary Systems Interface Matrix within 60 calendar days following Commercial Close. The City as the Operator will develop a Concept of Operations, while Project Co shall develop a Concept of Maintenance. These and other plans shall be submitted in accordance with Schedule 10 – Review Procedure.

(b) Project Co shall manage requirements throughout the Project using an object orientated requirements tool (e.g. DOORS), to confirm traceability of requirements from the source through to closure. Project Co shall make available to the City the output of the Requirements Management Plan tool at design reviews and throughout the Project on request.

(c) The Interface Matrix shall address the interface of the System with itself, the communications systems head-end, the CTS integration at Bayview Station, the ROW, the existing railway systems at Walkley and Ellwood Diamonds 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. The SIMP shall also address integration of the fare control, communications systems, Existing Vehicle Fleet and New Vehicle Fleet, and new S&TCS.

(d) This SIMP and Interface Matrix shall provide the procedure by which each interface shall be defined, agreed upon and controlled. The SIMP shall contain a responsibility matrix identifying what entity is responsible for controlling the specific elements of the project. The SIMP shall be submitted to the City for review and approval. Updates to the SIMP and Interface Matrix shall be provided by Project Co when significant schedule or Project changes are made.

(e) 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 ROW, the surrounding communities, and all facilities, equipment, and systems 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.

(f) The SIMP shall list all major System elements and define which elements have a direct or indirect interface or interaction. The SIMP shall, as a minimum, define:

(i) The entity within Project Co's organization responsible for managing and engineering the integration or interface.

(ii) The agreed integration or interface arrangement (physical installation, power supply, signal levels, transfer characteristics, and other factors).

(iii) The functional, performance, Reliability, Maintainability, and Safety requirements of the individual elements forming the integration or interface.

(iv) 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.

(v) The main elements that will be demonstrated through integrated testing.

11.3 Interface Control Document & Systems Interface Matrix

(a) ICD shall be developed for specific interfaces as defined within the SIMP and managed by Project Co. Contents of these ICDs shall expand as the interface details are developed through the design reviews. Each design submittal and ICD shall be subject to Configuration Management. The ICD shall be developed by Project Co and submitted to the City for review and approval in accordance with Schedule 10 – Review Procedure. Contents in these ICDs shall be maintained current throughout the Project Agreement period Project Co shall be responsible for coordinating all aspects of the system design and the integration of the SI with all other Expanded Trillium Line systems and subsystems as required including Vehicles. The civil infrastructure shall be inclusive of the design of the Stations, Guideway (elevated, at grade exclusive & semi exclusive ROW), Tunnels, Bridges, viaducts, overpasses, underpasses, New Walkley Yard and the TOCC.

(b) A systems interface register shall be used to track each interface identified within the interface matrix and their relationships, bringing forth the issues that are critical to proper systems integration. The interface register shall be updated throughout the Project Agreement. Periodic reports are processed from the systems interface matrix and distributed for information.

(c) Project Co shall be responsible for identifying and resolving all system interfaces which contribute to successful achievement of the overall System performance requirements or other Project Agreement requirements. A preliminary list of interfaces to be addressed includes:

(i) Track/Vehicle; Wheel/Rail;

(ii) Vehicle/Facilities;

(iii) Vehicle/Station Platform;

(iv) Vehicle/Train Control/Signaling;

(v) Vehicle/Wayside Communications;

(vi) Vehicle/Operator;

(vii) Vehicle/Vehicle;

(viii) Stations/Signaling;

(ix) Stations/Power;

(x) Stations/ SCADA;

(xi) Stations/Track;

(xii) Stations/Fire detection;

(xiii) Stations/Communications;

(xiv) TOCC/Signaling;

(xv) TOCC/SCADA;

(xvi) TOCC/Fire detection;

(xvii) TOCC/Communications;

(xviii) Existing systems/new systems;

(xix) Corrosion Control/Wheel/Rail; and,

(xx) Train Control/Tunnel Systems.

(d) The SIMP shall list all major System elements and define which elements have a direct or indirect interface or interaction. The SIMP shall, as a minimum, define:

(i) The entity within Project Co's organization responsible for managing and engineering the integration or interface.

(ii) The agreed integration or interface arrangement (physical installation, power supply, signal levels, transfer characteristics, and other factors).

(iii) The functional, performance, Reliability, Maintainability, and Safety requirements of the individual elements forming the integration or interface.

(iv) 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.

(v) The main elements that will be demonstrated through integrated testing.

(e) Project Co shall add other integration or interfaces as the design and system integration process proceeds.

(f) The following provide additional requirements on the contents of the Systems Integration Program:

(i) 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 Works 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 City immediately when any interface information changes or is found to be incorrect.

(g) Project Co shall plan, schedule, and lead coordination meetings and finalize all interfaces as required. Updates of the SIMP shall be provided by Project Co whenever significant changes are made to the Works or the Project Works Schedule.

(h) Design of all elements of the various system designs shall be developed to operate reliably in the environment in which they are installed. Project Co shall design all systems elements to integrate with the environmental conditions present including ambient temperature range, humidity, precipitation and other environmental factors that will impact Operation.

(i) Failure to list interfaces between systems does not absolve Project Co of their responsibility for integration of the System.

11.4 Design and Coordination Elements

(a) Preliminary listing of design elements and required coordination are provided below

(b) Revenue Vehicles;

(i) Project Co shall develop all designs to accommodate the New Vehicle Fleet and the Existing Vehicle Fleet. Typical coordination elements between the SI and the Vehicle are:

A. Vehicle dimensions shall be coordinated with the Guideway design;

B. Vehicle weight shall be coordinated with the Guideway design and selected Vehicle;

C. Guideway and alignment design shall be developed to meet the requirements of the braking and propulsion system;

i. Project Co shall coordinate with the Vehicle manufacturer to ensure that any limitations (thermal or other) are consistent with Vehicle needs;

D. the System Track infrastructure design shall be coordinated with the Vehicle wheel/rail interface criteria;

E. Vehicle dynamic and static envelopes for Guideway clearances shall be coordinated with the Guideway design, SI design, and selected Vehicle;

F. Vehicle to Platform interface including:

i. Vehicle door threshold height above top of rail to Platform edge; and,

ii. Platform lateral gap to Vehicle door threshold shall be provided for accessibility as well as to maximize Station pass through speed;

G. coordination and integration of Vehicle borne elements of the communications and signals systems with the Vehicle suppliers;

H. Project Co designed onboard elements including S&TCS and communication systems shall be EMC/EMI compliant with the Vehicles; and,

I. Track Design shall coordinate with the Vehicles to ensure that noise and vibration requirements are in conformance with Schedule 15-2, Part 8 - Vehicles.

(c) S&TCS

(i) Project Co shall coordinate the systems elements and Vehicle between Project Co and the Vehicles supplier for interface design, spacing, mounting and functioning of system elements within the Vehicles.

(ii) Project Co shall coordinate the systems elements and the Vehicle between Project Co and the Vehicle suppliers for installation and commissioning of on- board equipment.

(iii) Project Co shall coordinate the integrated testing of equipped Vehicles in all types of ROW throughout the System.

(iv) Project Co shall coordinate the location and mounting of the trackside access points, the location and mounting of termination points, and the cable routing to the signal equipment including:

A. locations of S&TCS duct banks along the ROW to support system installation;

B. locations of S&TCS equipment and conduit interfaces throughout Expanded Trillium Line; and,

C. location of duct banks and conduit interfaces.

(d) Communications systems

(i) Project Co shall coordinate the location and mounting of elements noted below, routing of cabling to each element, termination of cabling to each element, and routing to the main communications equipment either in an equipment room or cabinet including:

A. quantity and sizing of ducts within communications duct banks and conduits;

B. CTS;

C. SCADA system elements;

D. PA/PIDS elements;

E. Radio elements;

F. CCTV system;

G. T&I system;

H. all communication systems control equipment;

I. IAC system elements;

J. FLS System elements; and,

K. Power provisions for a fare collection machines and ticket gates.

(e) Trackwork

(i) Project Co shall coordinate the integration of the Track to meet the needs of the Expanded Trillium Line with the existing and new civil interface as well as with other elements including:

A. Track form shall be developed to adhere to the requirements of the Vehicles as specified in Schedule 15-2, Part 8 - Vehicles;

B. Track form shall be developed to comply with the noise and vibration requirements set out in Schedule 15-2, Part 2, Article 3 – Trackwork;

C. Track form shall be developed to integrate along the ROW and to maintain required clearances along the ROW considering:

i. use of ballasted, direct fixation, embedded and other Track forms shall ensure that no unsafe condition exists due to physical interferences with required Vehicle clearances and surrounding infrastructure;

D. bonding, insulated joint requirements, and associated cables, conduit, and duct banks shall be identified in conjunction with the S&TCS as well as the communication systems;

E. electrical design related to the location of powered wayside Track equipment and electrical outlets along the ROW to support Track Maintenance activities;

F. wayside Track equipment includes switch machines, switch element heaters, switch blowers, rail lubricators, and associated cables, wires, conduit, and duct banks;

G. Operational requirements to identify special Trackwork locations and configuration, high rail wear locations and superelevation;

H. civil, structural and geotechnical disciplines to determine Track Drainage interface with municipal sewers, Roadway requirements, rail expansion accommodation and Emergency Guard Rail requirements on elevated structures, reinforcing steel requirements, Track foundation type and characteristics; and,

I. provisions for protection where required in areas of special Trackwork to allow for Vehicle Operators of short-turn or stored trains, to disembark and walk to opposite end of train, without facing Hazards of adjacent traffic and Vehicle flow in opposite direction.

(f) Corrosion control system

(i) Project Co shall be responsible for development of an overall approach to corrosion control. Project Co shall coordinate corrosion control designs with the following:

A. Track systems to identify the location and typical arrangement for any corrosion control mitigation equipment;

B. Utility Companies to identify sensitive Utilities that may require relocation and/or protection; and,

C. locations of monitoring and measuring points.

(g) Non-Revenue Vehicles

(i) Project Co shall coordinate all Non-Revenue Vehicles with the following:

A. Non-Revenue Vehicle dimensions shall be coordinated with the Guideway design and selected Non-Revenue Vehicle type;

B. Non-Revenue Vehicle weight shall be coordinated with the Guideway design and selected Non-Revenue Vehicle type;

C. the wheel/rail interface criteria shall be coordinated with the Guideway design and selected Non-Revenue Vehicle type; and,

D. Non-Revenue Vehicle dynamic and static envelopes for Guideway clearances shall be coordinated with the Guideway design.

(h) Emergency Services

(i) Project Co shall coordinate with Emergency services to develop trackside elements in the areas of the Guideway required for ESP access including:

A. Track construction type;

B. special Trackwork layout and equipment protection;

C. CTS and S&TCS trackside equipment location; and,

D. any additional information to accommodate access with Emergency Services.

(ii) Project Co shall ensure that any trackside element placed within the Guideway is designed to withstand the worst case loading of an Emergency vehicle.

(i) Third Party Facilities and systems work

(i) Project Co shall coordinate all work that requires modification, extension, replacement, or temporary re-configuration of any existing third party infrastructure with the impacted third party.

(ii) Any modification, update, or new construction to be operated and maintained by others, including the City, shall be performed in compliance with that agencies existing design criteria, requirements, and manuals or as specifically identified in this Schedule 15-2 – Design and Construction Requirements.

ARTICLE 12 OPERATIONS TRAINING

12.1 Operations Training Curriculum and Materials

(a) Project Co shall be responsible for the development of all Operations Training Programs referenced in this Article, including training curriculum and materials. Training programs developed by Project Co shall follow the City's standard for training materials and suitable adult education training material standards.

(b) The City shall be given an opportunity to review the curriculum and all training materials associated with any of the operations training programs referenced in this Article. Project Co shall be responsible to submit all documentation associated with any of the training programs referenced in this Article to the City at a minimum six months prior to the specific training program's commencement in accordance with Schedule 10 – Review Procedure and Schedule 12 – Works Scheduling Requirements.

(c) Training programs shall be subject to review by the City, in accordance with Schedule 10 – Review Procedure. During the six month interval between the submission of the training program and the commencement of training, the City shall review and suggest changes to any of the material that is submitted. Suggested changes to the training programs shall be incorporated prior to the commencement of training. In addition, Project Co shall abide by the provisions of Schedule 14 – Testing and Commissioning, Clause 1.5 (d). The review of the training curriculum and materials apply to programs provided by Project Co Trainers, in addition to those programs provided by the City or other designated individuals.

12.2 OC Transpo Operator Training Simulator

(a) OC Transpo maintains an operator training simulator for the Existing Trillium Line.

(b) Project Co shall support the City in the update of the simulator for the Trillium Line Extension by collaboratively providing information requested by the City.

(c) Requested Information may include, but is not limited to the following:

(i) Infrastructure-Related

A. Videos/photos for existing portions of the alignment (used as aspect reference for the whole alignment);

B. Tracks and ROW: drawings, Track charts, designs, maps; and,

C. Stations:

i. Design documents (2d/3d CAD maps / mass and sections);

ii. Accurate location of Platforms along the Tracks;

iii. Ground marks accurate location (if applicable); and,

iv. Furniture: design documentation, photos of existing.

(ii) Vehicle and Systems – Related

A. Vehicle

i. Aspect / 3D model: Measurements, design documents, CAD files; and,

ii. Sounds: Equipment, Rolling/Aerodynamic, Horn/bell, doors, Operator cab alarms/alerts.

B. Signals

i. Signals library: For each kind of signal: Measurements, Aspects (pictures or drawings), Available states, Logic (block, interlocking, switches protection, etc.); and,

ii. Accurate locations (along Tracks): Signals, Signs, Other signaling elements (loops, Track circuits limits, magnets, etc.).

(d) For clarity, the City is responsible for updating the simulator. Project Co is only responsible for providing the required information, working collaboratively and in good faith.

(e) The requested information shall be provided 9 months prior to the start of OC Transpo Operator training.

(f) Project Co shall be responsible for all costs associated with any translation from other project documents, assembly, transfer of information, or any other efforts associated with supporting the City with the simulator update.

12.3 Training Provided to Project Co Operators

(a) Trained and certified Project Co Operators shall be permitted to operate Revenue Vehicles within the confines of the New Walkley Yard. All movement of Revenue Vehicles on the mainline will be the responsibility of qualified City personnel.

(b) Project Co Operators shall be trained and certified by Project Co Trainers prior to operating Revenue Vehicles within the confines of the New Walkley Yard.

(c) The Project Co Operator Training program shall utilize a fully developed curriculum, with all training materials, classroom and field training, testing, pass/fail criteria and certification. The Project Co Operator Training program shall be consistent with the City Operator training program and shall conform to all applicable standards, rules and regulations. The fully developed curriculum and records of certification shall be provided to the City for review to ensure that the City maintains its ongoing regulatory obligations.

(d) The Project Co Operator Training program shall include a provision for verifying that all potential Project Co Operator candidates possess a valid Driver's license that allows for operating an automobile in the Province of Ontario.

(e) Project Co shall be responsible for all costs associated with the training of Project Co staff holing responsibility for operating Vehicles within the confines of the New Walkley Yard.

12.4 Training Provided to the City or Other Designated Individuals - Train the Trainer Program

(a) Project Co shall be responsible for training and certifying a maximum of eight designated OC Transpo Trainers (Train the Trainer Program) on new operating rules and procedures, Vehicle Operations, and SI. For clarity, the following minimum criteria shall apply:

(i) Field training is preferred and no more than 50% of training time shall be in the classroom provided that classroom materials are highly visual in nature and include hands-on exercises such as paper based mock cab control layouts;

(ii) For any onboard Vehicle operations training, the training shall have a limit of one instructor to two students (Train the Trainers) in order to minimize downtime for students; and,

(iii) Vehicle training hours should be guided as follows: Vehicle Familiarization (equipment, controls, configuration) 16 hours; Vehicle Operations (normal operations, Station operations, and degraded operations) 24 hours; Vehicle Troubleshooting (doors, engine, brakes, Train Control, other) 24 hours; Vehicle Emergency Operations (Safety equipment, towing, special operations) 16 hours; and, additional hours as required for training on system, signal, and rail network familiarization.

(b) Project Co's Train the Trainer Program (provided by a Project Co Trainer with at least five years of adult education experience) shall ensure that OC Transpo Trainers have been trained and certified to instruct and certify employees who are assigned to or have any duties and responsibilities on the Expanded Trillium Line. The program shall utilize a fully developed curriculum, with all training materials, classroom and field training, testing, pass/fail criteria and certification. The curriculum shall follow an adult education based approach to teaching and learning. For additional clarity:

(i) Comprehensive training materials shall include systematic procedures required by Operators for all aspects of Train operation. Procedures shall include but are not limited to: start-up/shutdown, changing ends, diagnosing faults, fault recovery, isolating doors, etc.;

(ii) Clear graphics that visually represent each step of a procedure shall be included;

(iii) Training content shall be reflective of OC Transpo's operational rules and procedures for the Trillium Line;

(iv) Reference material shall be easy to use and structured in a logical sequence; and,

(v) Technical details in the training program shall be relevant to the role of the Operator.

(c) Project Co shall be responsible for all costs associated with the Train the Trainer Program. The sole exception will be that the City will bear the cost of providing the employees being trained as designated OC Transpo Trainers.

(d) Training of the designated OC Transpo Trainers and Operators shall be coordinated with the City and scheduled to ensure adequate Operators will be trained and certified on new operating rules and procedures, Vehicle Operations, Vehicle Troubleshooting, Vehicle Emergency Operations, and the SI and available to support new Vehicle and system testing and commissioning.

Designated OC Transpo Trainers shall be trained at least six months prior to commencement of Trial Running on the System.

(e) Trial Running on the System shall commence when Project Co has fulfilled the criteria identified in Schedule 14, Article 1.5, including but not limited to demonstrating to the City that all testing and commissioning has been successfully completed, all outstanding rail system (signal, Track, communications) defects have been corrected, and all Vehicles are commissioned and ready for Revenue Service.

12.5 Operator Training

(a) Designated OC Transpo Trainers will be responsible for training and certifying Operators on new operating rules and procedures, Vehicle Operations, and SI.

(b) The Operator training program shall utilize a fully developed curriculum, with all training materials, classroom and field training, testing, pass/fail criteria and certification. The training curriculum and materials shall be developed by Project Co, and shall be submitted in accordance with Schedule 10 – Review Procedure.

(c) The training of Operators shall be coordinated between the City and Project Co and scheduled to ensure an adequate number of Operators are trained and certified to support Revenue Service Operations, as identified by the City. At a minimum:

(i) Beginning 75 days prior to Trial Running, Project Co shall provide the City with a minimum of 14 hours per day of full System Track access to ensure the requisite number of Operators are trained and certified on the System and new Vehicles.

(ii) Project Co shall develop a Track access permit process that allows the City access to the mainline during the 75 day period for Operator training and certification. Project Co shall work cooperatively with the City in the issuance of Track access permits.

(iii) Project Co shall ensure the eight Vehicles are available to support the City's Operator training program, as required by the City.

(iv) Operator training shall be completed prior to Trial Running.

(d) Project Co shall be responsible for the maintenance of the SI and all associated costs related to the maintenance of the SI in support of Operator Training. The sole exception will be that the City will bear the cost of providing the employees being trained as Operators.

12.6 Training Provided to Controllers

(a) Project Co shall be responsible to train Controllers in accordance with all applicable standards, rules and regulations

(b) Project Co's Controller Training Program (provided by a Project Co Trainer) shall ensure that all Controllers have been trained and certified to safely perform all dispatching functions associated with the System including the use and application of the S&TC System in the TOCC and in accordance with all applicable standards, rules and regulations. The program shall utilize a fully developed curriculum, with all training materials, classroom and hands on, including field and on-

the-job training, testing, pass/fail criteria and certification. Project Co Trainers for the Controller training program shall have a minimum of five years railroad dispatcher experience.

(c) Project Co shall be responsible for all costs associated with the Controller training program. The sole exception will be that the City will bear the cost of providing the employees being trained as Controllers.

(d) Project Co shall be responsible for ensuring that 12 Controllers are trained and certified on operating rules and procedures, Vehicle Operations, and SI prior to the commencement of Vehicle movements on the Mainline SI. The development of the Project Co delivered training program will be coordinated with the City and be completed a minimum of 9 months prior to the commencement of Vehicle Operation on the SI. The commencement of Controller training shall be based upon the duration of the proposed Controller training program and as coordinated between the City and Project Co.

12.7 Training Provided to Emergency Service Providers

(a) Project Co shall develop a training program for ESP.

(b) Project Co's Train the Trainer Program for ESP trainers (provided by a Project Co Trainer) shall ensure that up to 8 ESP trainers have been trained and certified on all aspects of the SI and Vehicles that they may be required to be knowledgeable of in the event of an Emergency. The program shall utilize a fully developed curriculum, with all training materials, classroom and field training, testing, pass/fail criteria and credentialing. The training curriculum and materials shall be developed by Project Co, and be subject to Schedule 10 – Review Procedure.

(c) Training of ESP trainers shall be scheduled such that training is complete six months prior to the start of Trial Running.

(d) Project Co shall be responsible for all costs associated with the ESP Train the Trainer Program. The sole exception will be that the City will bear the cost of providing the employees being trained as Trainers.

(e) In addition to Project Co's Train the Trainer program and in order to facilitate an appropriate level of understanding of the new system and Vehicle fleet with the ESP, Project Co shall organize and provide appropriate technical support resources for the following events:

(i) Site orientation to New Walkley Yard for up to 12 ESP (upon completion);

(ii) Two Vehicle Familiarization sessions for the New Vehicle fleet for up to 12 ESP each;

(iii) Preliminary review of lifting scenarios; Emergency access, cab access, and Vehicle Safety features for new Vehicles (prior to start of new Vehicle dynamic testing);

(iv) Final review of lifting scenarios; Emergency access, cab access, and Vehicle Safety features (three months prior to Trial Running); and,

(v) New alignment and Station familiarization session for up to 12 ESP (three months prior to Trial Running).

ARTICLE 13 DEMOLITION, REMOVALS AND DISPOSAL

13.1 General

(a) Project Co shall demolish any buildings or other Structures on the Lands as required for construction and obtain all Permits, Licenses, Approvals and Authorizations required for Demolition. All Demolition refuse and materials shall be the property of Project Co, with the exception of any materials identified as salvageable materials as outlined in Clause 13.1 of this Part 1. Project Co shall dispose of all such refuse and materials in accordance with Applicable Law and leave the Lands in a clean and tidy condition upon completion of the Works.

(b) Performance Criteria

(i) Project Co shall remove obstructions encountered in the construction of the Project elements that hinder the installation of said elements. Obstructions may include but are not limited to – pipes, conduits, duct banks, foundations, debris, poles and any other object.

(ii) Project Co shall remove existing Roadway and sidewalk pavements obstructing the construction of the Project. Use equipment and methods of removal and hauling which protect underlying Pavement or existing Pavement not designated for removal.

(iii) Project Co shall remove or relocate existing Utilities where required as per City standards and in accordance with Schedule 15-2, Part 2, Article 8 – Utility Infrastructure Design Criteria.

(c) Specific Requirements

(i) Existing Facilities

A. The following Stations shall be selectively demolished and rehabilitated or renovated:

i. Bayview Station, Trillium Line Platform area only;

ii. Carling Station;

iii. Carleton Station;

iv. Mooney's Bay Station; and,

v. Greenboro Station.

B. To the fullest extent possible, all materials shall be recycled.

C. The reuse and re-cycle of material shall be reflected in the priorities and objectives of the Sustainability Plan and reported in the Sustainability Annual Report Card as detailed in Schedule 17 – Environmental Obligations, Part 3.

(ii) Leitrim Park and Ride

A. Project Co shall remove:

i. All Passenger amenities including shelters, signage, Platforms, lighting and foundations for the same;

ii. All paved surfaces not reused in Project Co's design including, Roadways, curbs, parking areas; and,

iii. All civil infrastructure not reused in Project Co's design.

(iii) Other specific Project Lands:

A. Private properties being used for development that contain existing structures include:

i. **[REDACTED]**

B. Project Co shall perform removals and Demolition as follows:

i. Completely remove all existing sidewalks and pavement:

ii. Completely remove all Structures on the Site:

iii. Removal of structures shall include complete removal of all building foundations;

iv. Remove all Utility services on Site. Utilities shall be removed to the point of connection to the Utility service in the ROW and capped in accordance with Utility requirements; and,

v. All materials shall be recycled in according to Good Industry Practice and standards.

(iv) Rail Bridge over Southeast Transitway (SN055930)

A. The existing rail bridge over the Transitway shall be removed as per the following:

i. The entire Structure, including retaining walls, shall be removed to 1m below top of existing ground.

ii. Grade surrounding area to match existing. A minimum of 600mm earth material, that shall sustain plant materials as described in Schedule 15-2, Part 6, Article 2 – Design Criteria, shall be installed.

(v) Sawmill Creek Bridge (SN055200)

A. The existing rail bridge over Sawmill Creek shall be removed as per the following:

i. The entire Structure shall be removed to 1m below top of existing ground. The existing gabions shall be removed and the approach embankments regraded accordingly.

ii. Grade surrounding area to match existing. A minimum of 600mm earth material, that shall sustain plant materials as described in Schedule 15-2, Part 6, Article 2 – Design Criteria, shall be installed.

(d) All Demolition shall be completed in accordance with City of Ottawa Design Standards.

(e) The Demolition, selective Demolition and or removals shall be coordinated with the City for any salvageable materials the City may want to reuse elsewhere.

(f) Materials

(i) Project Co shall dispose of all materials removed in accordance with City of Ottawa Standards and OPSS and applicable regulations.

(ii) Project Co shall manage hazardous materials in accordance with City of Ottawa Standards, OPSS and applicable regulations. Project Co shall not store materials on Site without precautions to prevent adverse effects of adjacent watercourses, groundwater, the migration of materials offsite, nor allowing the development of a nuisance condition.

(iii) Project Co shall properly stockpile the materials resulting from removals and/or Demolition by using separate stockpiles for waste materials and reusable or recyclable materials.

(iv) Project Co shall manage Contamination and excess excavated materials in accordance with Schedule 17 – Environmental Obligations.

(v) DSS reports have been prepared for structures/facilities/properties that have been identified for removal. Refer to Schedule 17 – Environmental Obligations.

ARTICLE 14 NEW MUNICIPAL INFRASTRUCTURE

14.1 Responsibility for New Municipal Infrastructure

(a) Project Co shall be responsible for the design and construction, including completion, testing and commissioning, of any New Municipal Infrastructure.

(b) The New Municipal Infrastructure includes new City infrastructure.

(c) All design and construction in connection with the New Municipal Infrastructure shall be completed by Project Co and shall incorporate the applicable design and construction standards of the City.

(d) All design and construction in connection with the New Municipal Infrastructure to be constructed by Project Co shall be subject to the Review Procedure as outlined in Schedule 10 – Review Procedure of the Project Agreement.

(e) New Municipal Infrastructure shall be turned over to the City after the completion of the construction and testing and commissioning of New Municipal Infrastructure. Project Co shall not be responsible for the ongoing maintenance of the New Municipal Infrastructure, with the exception of the warranty provided for within the City of Ottawa Standard Tender Documents for Unit Price Contracts, Volume 1 and 2.

14.2 Design Standard

(a) In addition to the City Standards identified in Schedule 15-1 – Technical Terms and Reference Documents, New Municipal Infrastructure shall be designed in accordance with the City of Ottawa Standard Tender Documents for Unit Price Contracts, Volume 1 and 2.

(b) Where the design and construction of New Municipal Infrastructure includes material types and product types that are covered by the material specifications included in Volume 2 of the City of Ottawa Standard Tender Documents for Unit Price Contracts, only specific materials and products that are listed therein as approved shall be utilized in the Works.

(c) Pavement design for New Municipal Infrastructure shall be in accordance with Schedule 15-2, Part 2, Article 6 - Roadways, Bus Terminals, and Laybys.

14.3 Record Drawings

(a) Record Drawings for New Municipal Infrastructure shall be produced in accordance with the requirements of Article 15 - Record Drawings, of this Part 1.

14.4 Scope of Works

(a) In general, the following types of assets shall be considered New Municipal Infrastructure:

(i) New retaining walls required for road construction and grading, and not associated with the Guideway.

(ii) New watermains.

(iii) New street lights and illumination.

(iv) New storm and sanitary sewers.

(v) New traffic signals.

(vi) New Utilities.

(vii) New Culverts.

(viii) New Roadways (Local, Provincial, Federal).

(ix) New bus terminals and connections, operator facilities, Park and Ride Facilities, and PPUDO areas.

(x) MUPs on third party lands.

(b) Any proposed Culverts, storm, or sanitary sewers that exclusively serve the System and falls entirely within the Lands shall be considered SI.

(c) The items that are to be included in the Works as New Municipal Infrastructure are included in Table 1-14.1 below.

Table 1-14.1 – New Municipal Infrastructure

Asset Name / Structure Number (if applicable)
Bowesville Park and Ride
Leitrim Park and Ride
Leitrim Road Bridge (SN225610) – Roadway portion only
Earl Armstrong Bridge (SN225680)– Roadway portion only
University Road Pedestrian Bridge over Rideau River (SN018750)
Bowesville Road Bridge (SN225690) – Roadway portion only
Limebank Road Bridge (SN225710) – Roadway portion only

ARTICLE 15 RECORD DRAWINGS

15.1 General

(a) The Design Team shall track and document all changes from the IFC drawings up to, and including, the preparation of the Record Drawings which shall be in accordance with Schedule 10 – Review Procedure.

(b) Project Co shall keep a record of the As-Built condition and the reasons for any changes from the IFC documents, including any necessary authorizations. Where the As-Built condition deviates from the IFC documents, but continues to meet the requirements of the Output Specifications, such that any changes fall within the design and specification tolerances and do not require engineering sign-off by the responsible engineer, Project Co shall ensure that the drawings are marked up with the relevant information required to represent the As-Built condition, highlighting the difference from the IFC documents. At Substantial Completion, Project Co shall sign and seal the Record Drawings as required in Schedule 14 – Testing and Commissioning.

(c) Where changes in the As-Built condition mean that the constructed Works would no longer meet the specifications outlined in the Output Specifications or would require Design Data to demonstrate compliance with the Output Specifications, then the responsible engineer shall revise the IFC documents and submit the Design Data as a Construction Document Submittal in accordance with Schedule 10 – Review Procedure, and shall be subject to the requirements outlined in this Article 16.

(d) Project Co shall provide Record Drawings for any New Municipal Infrastructure in accordance with the requirements of any third party owner of such New Municipal Infrastructure as outlined in Schedule 14 – Attachment 1.

(e) Project Co shall provide separate Record Drawings in both CAD and pdf format for each of the following works within 30 calendar days of completion of those works.

(i) Carleton Tunnel as outlined in Schedule 15-2, Part 4, Clause 3.5 (e).

(ii) Elevated Guideway to OMCIA Terminal as outlined in Schedule 15-2, Part 2, Clause 4.8 (d) (i).

(iii) Airport Station as outlined in Schedule 15-2, Part 4, Clause 3.13.

(f) Record Drawings for New Municipal Infrastructure shall be produced in accordance with the requirements of the CADD Standards Manual, prepared by the City.

(g) Temporary Detour Routes/Work

(i) As constructed engineering design drawings prepared in accordance with City design standards for each closure, detour route, lane shift, and diversion, or modification thereof, carrying public traffic or transit vehicles and intended to be in service for longer than six months shall be submitted in accordance with Schedule 10 – Review Procedure prior to requesting authorization from the Roadway authority for the closure and/or to utilize the detour route, lane shift or diversion or modified version thereof.

(ii) As constructed engineering design drawings prepared in accordance with City design standards for each intersection with a new temporary or permanent traffic control signal, or modification to an existing temporary or permanent traffic control signal, shall be submitted in accordance with Schedule 10 – Review Procedure within 30 calendar days of the activation of the traffic control signal, or within 30 days of the modification being made.