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APPENDICES

SCHEDULE 15-2
DESIGN AND CONSTRUCTION REQUIREMENTS

PART 1
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 performed 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 form of agreement, 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 DB Co, but each such instance shall be in consultation with applicable Governmental Authorities;

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

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

(vii) The OPS specifications that apply to the Work 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 DB Co of any or all aspects of the Reference Concept in performing the design and construction Works shall be entirely at DB Co's own risk. Use of the Reference Concept as a basis for DB Co's design for any part of the Project does not guarantee the City approval of DB Co's design.

1.5 Submittals

(a) DB 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 major components;

(i) Nine Transitway Stations which are being converted to LRT Stations

A. Westboro Station;

B. Dominion Station;

C. Lincoln Fields Station;

D. Iris Station;

E. Pinecrest Station;

F. Baseline Station;

G. Bayshore Station;

H. Place D'Orléans Station; and

I. Trim Road Station.

(ii) Culvert Structures

A. Bilberry Creek Culvert under Highway OR174 (SN224510);

B. Box Culvert under Highway OR174 (SN894040);

C. Taylor Creek Culvert under Highway OR174 (SN894050);

D. Box Culvert under West Guideway (SN018230);

E. ORPP under Carling Avenue (STM69595, STM69596, STM69600, STM69601, STM69602, STM65654);

F. Graham Creek Culvert;

G. Stillwater Creek Culvert;

H. Southwest Transitway – Pinecrest Creek Kenson Park Culvert (SN018360); and,

I. Southwest Transitway – Pinecrest Creek Baseline Road Culvert (SN018370).

2.2 System Infrastructure

(a) The Project shall generally include the following SI:

(i) Approximately 28.1 km of Track consisting of at grade surface Track, Elevated Guideway Track and three below-grade Track sections.

(ii) Sixteen Stations, with 2 new Underground Stations and 14 new At Grade Stations, 3 of which are Terminal Stations. Of these 16 Stations, 8 of them are existing Transitway Stations which are being converted to LRT Stations.

(iii) LMSF located west of Moodie Drive, including maintenance building, storage building and Trackwork.

(iv) Existing Structures to be incorporated into the alignment as described in Clause 2.9 (b) of this Part 1.

(v) Modifications at Existing Confederation Line Terminal Stations including Tunney's Pasture Station and Blair Station.

(b) For clarity, SI includes the entire extent of the infrastructure constructed in, on, over or under any part of the Lands as part of the Works, but excluding NMI and New MTO Infrastructure.

(c) SI includes all aspect of the Works required for the operation of the system, including, but not limited to:

(i) All Stations and associated Facilities;

(ii) LMSF and associated Facilities;

(iii) Systems;

(iv) Guideway;

(v) Utilities associated with Guideway.

2.3 New Municipal Infrastructure

(a) The project shall include NMI Structures as identified in Schedule 15-2, Part 2, Appendix E – Confederation Line Extension Structures.

(b) The Project includes other NMI as outlined in Clause 15.4 of this Part 1 and generally includes infrastructure associated with Roadways, City Utilities, and bus Stations.

2.4 General Alignment Requirements

(a) The alignment falls within existing City ROW and the permanent takings as shown on the PRP drawings. DB Co shall design the alignment within the Lands as prescribed in Schedule 20 – Lands.

(b) A portion of the design and construction of the Project shall be comprised of the conversion of the existing Transitway into the proposed LRT alignment at the following locations: from Blair Road Station to the new proposed Flyover Structure along OR174, from Tunney's Pasture Station to Dominion Station, from Lincoln Fields Station to Baseline Station, and from Pinecrest Station to Moodie Station.

(c) The alignment shall be underground for the following sections:

(i) The Parkway Tunnel, with the East Portal located anywhere north of Rochester Field but no further west than the point with coordinates of easting: 362486.106 and northing: 5028002.223 using Modified Transverse Mercator (MTM) Zone 9 horizontal datum referenced to WGS84 (NAD 83), through NCC lands and the Richmond Road/Byron Linear Park Corridor, to the West Portal which shall daylight to the south of Richmond Road and to the north of Lincoln Fields Station. The distance from the south sidewalk of Richmond Road to the West Portal opening shall accommodate MUP connections with the south Richmond Road sidewalk over the roof of the Tunnel. Two stations shall be located in the Parkway Tunnel underground section, Cleary and New Orchard Stations which shall be below grade and open at the surface as defined in Schedule 15-2, Part 4 – Stations. The Parkway Tunnel alignment shall be located to maximize horizontal separation with the building foundations at **[REDACTED]** and **[REDACTED]** with the objective of providing similar length horizontal offset distances between the alignment and these two buildings. The vertical and horizontal alignment of the Tunnel in the vicinity of Cleary Avenue and Richmond Road shall be located such that the Tunnel can be designed and constructed without interfering with the existing West Nepean Collector underground utility. Refer to Schedule 15-2, Part 8 – Underground Structures for Tunnel design and construction requirements for the segment of the alignment crossing the WNC.

(ii) The Connaught Tunnel – a Tunnel that traverses under Connaught Ave; the portals shall be located such that the length of the Tunnel is minimized and the noise and vibration criteria specified in Section 17 for Project Operations is met with the additional requirement that the east portal be located no further west than the point with coordinates of easting 361139 and northing 5024493 using Modified Transverse Mercator (MTM) Zone 9 horizontal datum referenced to WGS84 (NAD 83). To provide some flexibility to DB Co for alignment optimization the above east portal westernmost coordinates may be modified to allow for a maximum 10m shift to the west on an axis parallel to the alignment with the design intent to maximize park space and pedestrian connectivity over the Tunnel. Shaft openings from the Tunnel to grade shall only be permitted for Tunnel ventilation and shall be located for the length of Connaught Tunnel

between the southern shoulder of Connaught Ave and the OC Transpo Storage Garage building and parking area located at 2550 Queensview Drive.

(iii) The Baseline Tunnel – an existing tunnel that is located beneath the existing Baseline Station between Navajo Drive to the north and College Avenue to the south. This is a terminus of the LRT with two Tracks for the revenue operation and two additional Tracks for Non-Revenue Vehicles and temporary storage of Revenue Vehicles.

(iv) The HWY 417 E-N/S Pinecrest Rd Ramp Tunnel – a Tunnel that traverses under HWY 417 E-N/S Pinecrest Rd Ramp with open trench Guideway and underpass structures for the HWY 417 S-W and Pinecrest Rd Ramp.

(d) The remaining alignment consists of new at grade Guideway Construction, open trench depressed Guideway Construction and the Construction of new elevated Structures.

(e) Six Transfer Stations shall be constructed – one at each of the alignment Terminal Stations – Trim Road Station, Moodie Station and Baseline Station and at three Line Stations at Bayshore, Place d'Orléans, and Lincoln Fields. Provisions for fare paid bus transfer Platforms, bus layby berths and circulation shall be designed and constructed at these locations.

(f) Guideway Requirements

(i) The Guideway shall be completely fenced and segregated from any pedestrian and vehicular traffic. Fencing location, type and height shall be as outlined in Schedule 15-2, Part 6, Article 2 – Design Criteria.

(ii) See Schedule 15-2, Part 2, Clause 1.3 for Emergency egress and access requirements.

(iii) High rail vehicle access locations shall be provided at the following locations:

A. Trim Station;

B. Blair Station (the current Existing Confederation Line access);

C. Baseline Station; and,

D. Moodie LMSF.

2.5 Tunnel Requirements

(a) DB Co shall be responsible for the complete design and construction of the Underground Structures using Cut-and-Cover methods, including but not limited to Tunnels, the access and ventilation shafts; Underground Station boxes; any required underground Facilities; mechanical and electrical facilities; and any other requirements for design and construction of the Tunnels.

(b) The upper limit of the Cut-and-Cover Tunnels shall include clearances for required Utility crossings and appurtenant mechanical, electrical and systems facilities to the following limits:

(i) within Federal Lands between Cleary Station and Dominion Station the upper limit of the Tunnel roof shall be no less than 2.5m below final grade;

(ii) located under City roadways the upper limit of the Tunnel roof shall be no less than 2m below the top of final grade; and,

(iii) Reduced cover shall also be permitted where it is necessary for the Cut-and-Cover Tunnel alignment to ascend to the portals.

(c) Rock bolts and/or tie backs shall remain within the lateral and upper limits of the alignment envelope and within the boundaries of property forming part of the Lands and identified as System Infrastructure Lands in Schedule 20 – Lands. Notwithstanding the foregoing, DB Co may install excavation support elements such as rock bolts and tie-backs not forming part of any permanent structure outside of property designated as System Infrastructure Lands to the extent that a right to undertake such installation has been secured and granted to DB Co pursuant to either Schedule 20 – Lands or Section 16(7) of the Project Agreement.

2.6 Systems Requirements

(a) DB Co shall be responsible for the design, construction and Subsystem testing of Systems required for the safe and efficient operation of the System.

(b) Systems includes

(i) Traction Power;

(ii) Tunnel Ventilation

(iii) Communications;

(iv) OCS;

(v) EMI /EMC;

(vi) Corrosion Control/Stray Current; and,

(vii) Static/Sub-system Testing.

(c) The City shall be responsible for the specification development, design, interface management, installation, integration and Commissioning of the following Systems required for safe and efficient operations:

(i) Revenue Vehicles;

(ii) Non-revenue vehicles; and,

(d) DB Co shall design the system such that the distance from the Train stop location on the Platform, to the start of the rail arrestor or buffer stop at Terminal Stations shall be a minimum of 30m for Baseline Station and a minimum of 50m for Trim Station, unless otherwise defined.

(i) DB Co shall ensure all SI including the S&TCS is designed to support these minimum dimensions while still meeting all requirements.

(ii) DB Co shall be fully responsible for any additional work, system modifications, and regulatory approvals that may be required to ensure these minimum dimensions are met.

2.7 Facilities Requirements – Stations

(a) DB Co shall provide Stations and Facilities in accordance with the following:

(i) The Stations shall be designed to meet the functional, accessibility, aesthetics, environmental, Safety, Security, operational and technical requirements of the City as contained and described in the Project Agreement.

(ii) Stations shall be designed to include the following as described in the Project Agreement:

A. Park and Ride Facilities and PPUDOs;

B. Service parking and laneways;

C. Bicycle Facilities; and,

D. Bus Facilities.

(iii) All Underground and At Grade Stations shall be designed in accordance with all applicable standards regarding accessibility and FLS, including but not limited to, Emergency egress, lighting and ventilation.

(iv) The Stations shall be designed for a fare control system to be supplied and installed by the City. DB Co shall ensure that all fare gate equipment is fully protected from the weather, including rain and snow in accordance with Schedule 15-2, Part 4, Clause 2.7(b)(iii)Bi.

(v) All Stations shall be designed to accommodate the design requirements of the City's Vehicle as well as buses where required.

(vi) All Stations shall be designed and constructed with access for maintenance personnel and equipment as required in Schedule 15-2, Part 4 – Stations.

(vii) The Stations shall be located along the corridor as described below:

A. Confederation Line East Extension:

i. Blair Station is an existing Station serving as the interim eastern terminus of the Existing Confederation Line. DB Co shall modify the existing bus terminal and access to accommodate the extension of the Track, Guideway and to satisfy the bus Facility requirements.

ii. Montreal Road Station shall be a new Line Station located at the crossing of OR174 and Montreal Road. The Station entrances shall have fare controlled access from both the eastbound and westbound lanes of Montreal Road with the Platform located directly above.

iii. Jeanne d'Arc Station shall be a new Station located at the crossing of OR174 and Jeanne d'Arc Boulevard. The Station shall be served by two fare controlled entrances located on Jeanne d'Arc Boulevard. One entrance shall serve the northbound lane one shall serve the south bound lane;

iv. Orléans Boulevard Station shall be a new Station located at the crossing of OR174 and Orléans Boulevard. The Station shall be served by two fare controlled entrances located on Orléans Boulevard. One entrance shall serve the northbound lane one shall serve the south bound lane;

v. Place d'Orléans Station is an existing Transitway Station that is located adjacent to Place d'Orléans Shopping Centre and OR174. The Station shall be converted to serve as a Transfer Station. A pedestrian bridge spanning OR174 connecting the Park and Ride, the bus terminal and Place d'Orléans Shopping Center shall remain as a non-fare controlled connection in the final configuration. The bus terminal shall be directly connected to the O-Train Platforms and shall be within the Fare Paid Zone. The Station shall be served by four fare controlled entrances, two from the pedestrian bridge, one from the existing shopping center parking lot and one from Champlain Street; and,

vi. Trim Road Station is an existing Transitway Station that is currently located southeast of the intersection of Trim Road and OR174. The existing Station shall be converted to a Terminal Station serving as the eastern terminus of the System. The existing bus terminal and Park and Ride will be reconfigured and capacity expanded to meet the needs of the Project including additional surface parking. The Station shall be served by one fare controlled

entrance located adjacent to the new Park and Ride Facility; with provision for two additional entrances; one adjacent to the south bound lanes of future Trim Road overpass and one entrance from the northeast near the existing City works yard.

B. Confederation Line West Extension:

i. Tunney's Pasture is an existing Transitway station serving as the interim western terminus of the Existing Confederation Line. DB Co shall modify the existing bus terminal to satisfy the reduced bus terminal requirements within the Lands;

ii. Westboro Station is an existing Station along the Transitway. The new Westboro Station shall be located on Scott Street between Tweedsmuir and Athlone Avenues. Off street bus Platforms and bus layby Facilities shall be located north of the existing Transitway trench. One fare controlled entrance shall be located from Scott Street and one from the non-Fare Paid Zone from the north;

iii. Dominion Station is an existing Station along the Transitway. The new Dominion Station Platform shall be located within the existing Transitway trench, the Station fare controlled entrance shall be located between Dominion and Berkley Avenues;

iv. Cleary Station is a new Station located between Richmond Road and Byron Avenue, west of Cleary Avenue within Byron Park. The fare controlled entrance shall be located no less than 25m east of the east curb line of Sherbourne Road;

v. New Orchard Station shall be a new Station located between Richmond Road and Byron Avenue, immediately east of New Orchard Avenue within Byron Park. The fare controlled entrance shall be located immediately east of New Orchard Avenue;

vi. Lincoln Fields Station is an existing Station of the Transitway network. The new Station shall be located in the vicinity of the existing Transitway Facility north of Carling Avenue, and consist of three Tracks with related Platforms. The new Station shall be integrated with the new bus Facility and PPUDO. The bus Facility shall be within the Fare Paid Zone. There shall be three fare controlled entrances; one from Carling Avenue near the new pedestrian crosswalk; one from the west at the level of the existing Transitway; and one from Carling Avenue near the existing bus entrance driveway;

vii. Iris Station is an existing Station on the Transitway network. The new Station shall be located below the new Iris Street Bridge, with access from Iris Street located on the south side of Iris Street and fare controlled entrances on both the east and west side of the guideway;

viii. Baseline Station is an existing bus Station on the Transitway. The new LRT Station Platform shall be located between College Avenue and Navaho Drive beneath the landscaped plaza just west of **[REDACTED]**. A Station fare controlled entrance and bus Facilities within the Fare Paid Zone shall be located south of College Avenue and west of the existing Park and Ride with a new pedestrian bridge connecting to the **[REDACTED]**. A second entrance shall be provided in the plaza north of College Avenue.

ix. Queensview Station shall be a new Station located to the north of Highway 417. DB Co shall design and construct the Station in a side Platform configuration. The Station shall be integrated with a new pedestrian bridge connecting the north and south side of Highway 417. The fare controlled entrance shall be located north of Highway 417;

x. Pinecrest station is an existing Station along the Transitway. The new Pinecrest Station shall be located on the north side of Highway 417 west of Pinecrest Road. The fare controlled entrance shall be located west of Pinecrest Road and North of Highway 417;

xi. Bayshore Station is an existing station along the Transitway that is currently located adjacent to Bayshore Shopping Centre and Highway 417. The Station shall be converted to serve as a Transfer Station with integrated fare controlled bus Facilities, within the Fare Paid Zone, and a future direct connection to Bayshore Mall. The Station shall have fare controlled entrances at the north side of the bus terminal, one at grade and one at the existing pedestrian level; and,

xii. Moodie Station is an existing Transitway Station that is currently located southeast of the intersection of Moodie Drive and Corkstown Road. The existing Station shall be converted to a Terminal Station serving as the western terminus of the Confederation Line. The Station shall be served by a minimum of one fare controlled entrance.

2.8 Facilities Requirements – LMSF

(a) The proposed LMSF shall be located in the vicinity of Moodie Station.

(b) LMSF shall be designed to meet the functional, accessibility, aesthetic, environmental, Safety, operational, and technical requirements of the City as contained in this Project Agreement.

(c) LMSF shall be constructed within the Lands.

(d) LMSF shall be designed and constructed to assure Revenue Vehicles are service ready in accordance with the Revenue Service schedule.

(e) The LMSF shall be designed in accordance with any applicable standards regarding accessibility and FLS, including but not limited to, Emergency egress, lighting and ventilation, as pertain to a vehicle storage facility.

2.9 Structure Requirements

(a) New Structures

(i) DB Co shall be responsible for the complete demolition and removal, of any existing Structures that have been made redundant as a result of new Structures.

(ii) DB Co shall be responsible for any impacts to existing Structures as a result of new Structures.

(iii) New Structures located along the Confederation Line East Extension shall include:

A. Montreal Road Flyover;

B. Westbound OR174 Bridge over Montreal Road;

C. Montreal Road Station Bridge;

D. Eastbound OR174 Bridge over Montreal Road; and,

E. Pedestrian Bridge at Trim Station.

(iv) New Structures located along the Confederation Line West Extension are:

A. Goldenrod Bridge Structure at Tunney's Pasture;

B. Roosevelt Pedestrian Bridge;

C. U Approach – Depressed Guideway Parkway East Portal;

D. U Approach – Depressed Guideway Parkway West Portal;

E. SJAM Parkway at Churchill Avenue Pedestrian Overpass;

F. SJAM Parkway at Cleary Avenue Pedestrian Overpass;

G. U Approach - Depressed Guideway Connaught East Portal;

H. U Approach - Depressed Guideway Connaught West Portal;

I. Carling Avenue Bridge;

J. Pedestrian Bridge at **[REDACTED]**;

K. Lincoln Fields Split Structure;

L. Pedestrian Bridge at Queensview Station;

M. Highway 417 Westbound Off-Ramp at Pinecrest Road;

N. Highway 417 Westbound On-Ramp at Pinecrest Road;

O. Pinecrest Road Bridge;

P. Holly Acres Bridge;

Q. Highway 417 S-W On-Ramp at Moodie Drive;

R. Moodie Drive Bridge;

S. Highway 417 N-W On-Ramp at Moodie Drive;

T. Iris Street Bridge;

U. Pinecrest Creek Culvert under Iris;

V. Pinecrest Creek Culvert under Alignment; and,

W. Baseline Station Pedestrian Bridge.

(b) Existing Structures to be used for the Guideway:

(i) DB Co shall perform such investigations and design as may be required to ensure that any existing Structure can be used to support the Guideway. The design check shall be completed in accordance with all Applicable Codes and standards.

(ii) DB Co shall perform design checks and investigations on all existing Structures which are to become Vehicle carrying Structures. DB Co shall evaluate all SI Structures to ascertain the BCI number of each Structure. BCI shall be calculated in accordance with the procedure contained in the MTO report "Bridge Condition Index (BCI) An Overall Measure of Bridge Condition". DB Co shall perform all necessary construction work to ensure each SI Structure achieves a minimum BCI of 80 at substantial completion. Substructure and soffit deficiencies on all existing structures spanning the alignment shall be repaired in accordance with Schedule

15-2, Part 2, Article 4 – Structural Design Criteria and Requirements and all Applicable Codes and standards.

(iii) DB Co shall design and construct such modifications and ensure that all Applicable Codes are met, should such design checks demonstrate that modification is required to any portion of the Structure.

(iv) A detailed condition assessment report shall be submitted in accordance with Schedule 10 – Review Procedure for all existing Structures being modified or rehabilitated. The condition assessment shall include the details of the proposed modifications and/or rehabilitation.

(v) Existing Structures to be used along Confederation Line East Extension shall be:

A. Bilberry Creek Culvert under Highway OR174 (SN224510);

B. Box Culvert under Highway OR174 (SN894040); and,

C. Taylor Creek Culvert under Highway OR174 (SN894050).

(vi) Existing Structures to be used along Confederation Line West Extension are:

A. Box Culvert under West Guideway (SN018230);

B. Graham Creek Culvert;

C. Stillwater Creek Culvert;

D. Southwest Transitway – Pinecrest Creek Kenson Park Culvert (SN018360); and,

E. Southwest Transitway – Pinecrest Creek Baseline Road Culvert (SN018370).

(c) Existing Structures to be removed, replaced, modified or rehabilitated

(i) DB Co shall be responsible for:

A. The complete planning, demolition and removal, of any existing Structures that have been identified for removal or replacement;

B. The complete planning, design and construction of any replacement of existing structures;

C. The complete planning, design, modification or rehabilitation of any existing Structures; and,

D. The complete coordination with external agencies and stakeholders during demolition staging and construction staging.

2.10 Design and Construction Requirements to Accommodate Future Works

(a) DB Co shall protect for, by not precluding, future work in the design and construction of certain elements of the Project.

(b) These future works are described below:

(i) Future western extension of the Confederation Line either from Bayshore/Moodie or Baseline Station including the necessary Bridge Structures to allow the Moodie LRT to be extended to the west as part of the Kanata LRT;

(ii) Future eastern extension from Trim Station;

(iii) Future Cumberland Transitway at Blair Road;

(iv) Future Station Platform extensions if necessary to achieve 24,000 pphpd;

(v) The future connection of the Trillium Line Track alignment at Bayview Station to the Confederation Line alignment connecting to eastbound and westbound Tracks between Bayview Station and Lebreton Station;

(vi) The future northerly interprovincial extension of the Trillium Line alignment at Bayview Station to the existing Prince of Wales Bridge over the Ottawa River;

(vii) Future expansion of the Baseline storage and cleaning facility to accommodate up to 22 Vehicles;

(viii) Future extension of the Confederation Line beyond Baseline to the south;

(ix) Future widening of OR 174 from Blair Rd to Trim Rd so that the future Roadway is contained within the existing OR174 ROW;

(x) The future development of the City works yard on the northeast quadrant of the OR174/Trim interchange including but not limited to a future entrance to Trim Station on the north side of OR 174;

(xi) Future bridge crossing of OR 174 at 10th Line Road;

(xii) New side Platform Stations at **[REDACTED]**, 10th Line Road and Orléans Town Centre;

(xiii) Future widening of Jeanne D'Arc Blvd;

(xiv) Future expansion of Highway 417 to the north, west of Moodie Drive and outlined in Schedule 15-2, Part 5 – LMSF;

(xv) Future Trim Road overpass (existing Trim Road alignment) and interchange with OR 174;

(xvi) Future Baseline Station Transit priority project;

(xvii) Future Baseline Station pedestrian bridges as outlined in the Centrepointe Development Plan;

(xviii) Connection of the east end of Bayshore Station to Bayshore Shopping Centre; and,

(xix) Future expansion of Highway 417 from Highway 416 to Maitland Avenue.

ARTICLE 3 OPERATIONAL PERFORMANCE REQUIREMENTS

3.1 Introduction

(a) DB Co shall provide the System that is seamlessly integrated with the Existing Confederation Line infrastructure and capable of delivering public transit service in a safe, reliable and efficient manner, and in accordance with the following operational performance parameters.

3.2 General

(a) Operation of rail service will be the responsibility of the City. DB Co shall meet the operational needs and the functionality of the new System through the design and construction Work and shall validate the operational capabilities of the final SI design through performance simulation and demonstrate the operational capabilities of the SI as part of testing and commissioning.

(b) DB Co shall be responsible to demonstrate through simulations and operational testing, that the Confederation Line East Works and West Works meets the operational needs and required functionality of the Project Agreement.

(c) DB Co shall be responsible for the Subsystem testing on the systems they have designed and installed. DB Co shall be responsible for Systems Integration and Commissioning and System Safety Certification and System Security Certification of new SI and NMI.

(d) Meeting the high capacity operational needs of the City shall require design and construction of the Confederation Line East Extension and Confederation Line West Extension that is highly integrated with the Existing Confederation Line and highly reliable across all major rail Systems including: Vehicle, Train Control and Signalling, Traction Power and Overhead Contact System, Stations, Tunnel Ventilation Systems, Track and Special Trackwork.

(e) DB Co shall also provide O&M manuals for any systems and equipment being supplied and installed by DB Co, and provide associated O&M training, as per a training plan and scheduled agreed to by the City. These manuals will provide operations and maintenance staff with written instructions and documentation regarding the operation of, and the maintenance procedures associated with, each new system and related piece of equipment.

3.3 Operational Design and Construction Requirements

(a) Operational Headways

(i) DB Co shall design and construct the SI to reliably support the sustained operational Headways identified in Clause 3.4 (c). Notwithstanding the above, DB Co shall design and construct the SI to support a minimum design headway of

2 minutes or less in accordance with the requirements of Schedule 15-2, Part 3, Article 10 – Signalling and Train Control System.

(ii) DB Co shall design and construct the SI to reliably support a sustained operational headway of 15 minutes during a single Track outage at any location throughout the SI to support maintenance activities and/or continued operation during unplanned outages. Terminal to terminal trip time shall not significantly increase during single tracking operations, other than as a result of speed reductions applied through maintenance work zones. For clarity, the Train Control design shall support full reverse running performance, and crossovers shall be sized to minimize any delays associated with crossover movements.

(b) Train Consist and Platform Lengths:

(i) The maximum Train consist length and Platform length shall be consistent with the Existing Confederation Line and designed in accordance with Schedule 15-2, Part 4 – Stations.

(ii) DB Co shall be responsible to ensure that the first and last door locations of the Train consist, Station Platform lengths and Train Control system are fully integrated in a manner that provides reliable Train berthing under all operating conditions for safe detraining and entraining of Passengers, utilizing all doors without undue Train performance degradation. DB Co shall be responsible for the optimal integration of the CBTC system, Platform length and placement, and for considering the Vehicle parameters that minimize any Train performance degradation while achieving reliable and consistent Train berthing at each Station. DB Co shall define and implement the optimal speed profile for this purpose to be programmed and enforced in the Train Control System.

(c) Operating Configurations

(i) DB Co shall design and construct the SI to support the specific operating configurations to be operated by the City, as follows:

A. Weekday peak periods service patterns

i. During weekday AM and PM peak periods, three service patterns will operate, as follows:

1 Baseline Station to Trim Station;

2 Moodie Station to Trim Station; and,

3 Moodie Station to Blair Station.

ii. These three service patterns will operate with the following relative frequencies of service:

1 Two out of every four trips operating through the core will operate between Baseline Station and Trim Station;

2 One out of every four trips operating through the core will operate between Moodie Station and Trim Station; and,

3 One out of every four trips operating through the core will operate between Moodie Station and Blair Station.

iii. These service patterns will operate at the headways detailed in the table below and in accordance with Appendix C of this Part 1.

AM PEAK	**2031 (Service Level 6)**	**2048 (Service Level 9)**
Segment	Operating Headway m:ss	Operating Headway m:ss
System Core: Between Lincoln Fields and Blair	2:45	2:30
Between Moodie and Lincoln Fields	5:30	5:00
Between Baseline and Lincoln Fields	5:30	5:00
Between Blair and Trim	3:38*	3:20*
* These headways are average headways, reflecting that three of four trips operate to/from Trim during the peak periods. (16.5 trips per hour per direction in 2031; 18 trips per hour per direction in 2048)		

B. Weekday Off-Peak Periods (before 11:00pm) and Weekends/Holidays:

i. Half of Trains shall operate between Moodie Station and Trim Station; and,

ii. Half of Trains shall operate between Baseline Station and Trim Station.

C. Weekday Evenings (after 11:00pm):

i. Four Trains per hour shall operate between Baseline Station and Trim Station;

ii. Four Trains per hour shall operate between Moodie Station and Lincoln Fields Station; and,

iii. Coordinated transfers will be scheduled at Lincoln Fields Station.

(ii) Lincoln Fields Station

A. The Transfer Station shall be a three Track Station with 2 centre Platforms or one centre Platform and one side Platform and a fare paid bus terminal. All three Tracks shall be utilized for the loading and unloading of Passengers.

B. The SI in the area of Lincoln Fields shall be designed to allow for efficient movement of Trains into and out of the Lincoln Fields Pocket (center) Track to support the following Train movements:

i. Eastbound:

1 Moodie to Lincoln Fields.

2 Baseline to Lincoln Fields.

3 Lincoln Fields to Trim.

ii. Westbound:

1 Lincoln Fields to Moodie.

2 Lincoln Fields to Baseline.

3 Trim to Lincoln Fields.

C. Crossovers shall be designed to minimize diverging and conflicting movements.

(d) Maximum Trip Times

(i) To ensure an efficient and effective service, the System shall support trip times that are no greater than the maximum segment trip times over the Confederation Line East Extension and Confederation Line West Extension during the peak period shown in Table 1-3.1. Segment trip times shall be demonstrated using stochastic operations simulation modeling of the proposed System under ATO operations in accordance with the parameters in this Clause 3.4.

(ii) The maximum travel time over the identified segments during the peak period, from wheel start at the beginning Station to wheel stop at the ending Station, including intermediate Dwell Times, shall not exceed the following:

Table 1-3.1 Maximum Peak Period Trip Times by Segment

From	To	EB Time	WB Time
Moodie	Lincoln Fields	9.0 min	8.8 min
Baseline	Lincoln Fields	4.6 min	4.7 min
Lincoln Fields	Tunney's	8.8 min	8.8 min

	Pasture		
Blair	Trim	14.4 min	15.3 min

(e) Simulation Requirements

(i) DB Co shall verify compliance with the minimum design headway of 2 minutes, 2031 (Service Level 6) and 2048 (Service Level 9) headways shown in Clause 3.4 (c) and with maximum travel times contained in Table 1-3.1, through operations simulation of the proposed Confederation Line East Extension and Confederation Line West Extension reflecting DB Co's design according to the following requirements:

A. For the 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 6% 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 sub-optimal performance reflecting real-world conditions. DB Co shall adjust and calibrate the operating performance factors to achieve the 6% increase in run time and shall document the adjustments in the simulation report. For purposes of calibrating the operating performance factors, the Station-to-Station travel times on the Moodie to Lincoln Fields segment (excluding dwell times) shall be utilized. The adjusted operating performance factors shall be applied to all respective Trains on all segments in all simulations

B. For purposes of simulations, stochastic variation of Dwell Times shall be applied in accordance with Clause 3.4(f) below.

C. For clarity, the stochastic variation of Dwell Times, and a 6% adjustment of the performance factors shall be included in the simulated run time which shall comply with the maximum trip times in Table 1-3.1.

(ii) Infrastructure

A. The simulation shall reflect DB Co's final design of the SI on the Confederation Line East Extension and Confederation Line West Extension (including Track alignment, special Trackwork, curvature, grades, and Station Platform limits).

(iii) Rolling Stock

A. The simulation shall reflect the parameters of the **[REDACTED]** at AW2 loading.

(iv) The simulation shall capture the influence of the CBTC signal system as outlined in Schedule 15-2, Part 3 - Systems.

(f) Dwell Time

(i) For simulation analysis purposes, stochastic dwell time variation shall be simulated through stochastic variation in the form of a uniform distribution of plus and minus 5 seconds applied to the nominal dwell times at each Station in Table 1-3.2.

Table 1-3.2: Dwell Time Assumptions

Dwell Time (sec)		
Station	Eastbound	Westbound
Moodie	-	-
Bayshore	27	20
Pinecrest	20	20
Queensview	20	20
Baseline	-	-
Iris	20	20
Lincoln Fields	23	20
New Orchard	20	20
Cleary	20	20
Dominion	20	20
Westboro	20	20
Tunney's Pasture	27	21
Blair	20	29
Montreal	20	20
Jeanne d'Arc	20	24
Orléans Blvd	20	20
Place d'Orléans	20	32
Trim	-	-

(ii) Passenger loading and unloading time at terminal Stations shall be considered part of the terminal layover time, and shall not be included in the calculation of maximum travel time.

(iii) 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.

3.4 Operational Testing

(a) System Integration Testing

(i) DB Co shall confirm their SI design is capable of supporting the required minimum headway of two minutes.

(ii) DB Co shall demonstrate the maximum travel times specified in Clause 3.4 (d), while respecting minimum dwell times specified in Clause 3.4 (f).

(iii) DB Co shall demonstrate other operational capabilities of the SI that can be tested independently of the Existing Confederation Line, including operations in normal, abnormal, and Emergency scenarios.

(b) Trial Running

(i) DB Co shall demonstrate through Trial Running of the SI for the East Works, and West Works that the following planned operational parameters can be achieved;

A. Service Level 3A headways for the East Works and Service Level 4 for the West Works as specified in Appendix C of this Part 1;

B. the operational performance; and,

C. the reliability requirements specified in Schedule 14 – Testing and Commissioning.

ARTICLE 4 DESIGN AND CONSTRUCTION

4.1 General Construction Requirements

(a) DB Co shall be responsible for the design and construction of the Project and all other Construction Activities, including completion, Commissioning and testing of the Project, which shall be performed 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, shall be within the Lands, Temporary Easements and Permanent Easements as shown hatched on the PRP's. See Schedule 20 – Lands for additional information.

(c) DB Co shall only construct or implement Site access, detours and associated Works on existing City/public rights-of-way/property if those Site access, detours and associated Works have been approved by the City as part of DB 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 20 – Lands are indicated on the property table located in Schedule 20, Part B – Lands Table.

(e) DB 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. DB Co shall complete a review of the adjacent land uses and site development for these locations and shall select the most appropriate groundcover.

(i) DB 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 underground utility lines which are to remain. If damaged, restore to original or better condition unless directed otherwise. DB Co shall make reference to Schedule 15-2, Part 6, Article 2 – Design Criteria.

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

C. DB 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. DB Co shall be responsible for the removal, safe storage, and restoration of furnishings and other assets of BIA as necessary for the Works.

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

(i) Develop hoarding plans in accordance with the NCC hoarding specifications, and 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) DB 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 DB Co at each construction Site, at a location selected by the City. DB 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 DB 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 DB Co and the City for an LTE cellular connection to be used.

A. The construction Sites shall be each of the Stations, as well as Tunney's Pasture Station (total of 18 locations).

B. The system being developed is closed, password protected, and not publicly accessible. Upon completion of the system, the City shall provide DB Co with live access to the system. The City shall own the system and the content, and reserves the right to utilize the system in order to create timelapse 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, DB Co wishes to have an additional camera system at any Site beyond the one that the City shall provide, DB 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, DB Co shall install it and provide power and internet connectivity as described in (i) above.

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) DB Co shall evaluate its requirements for a control survey in order to perform the design and construction Work and determine if additional monuments are required. Any such additional monuments shall be of the same order as the control survey provided and shall be installed by DB Co and shall be surveyed to tie into the Project survey control coordinate system. DB Co shall prepare a survey report including field notes, measurements, adjustments, Station descriptions and reference tie drawing of each additional survey monument installed and provide a record to the City.

(iii) DB 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 DB 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.

(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'; and,

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.

D. All surveys made for the Project shall be referenced and adjusted to the Control Survey monuments in the DB 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 was compiled for the Project based on 2012, 2013 or 2014, 6cm aerial imagery with an accuracy of 18cm or better 90% of the time with some possible errors up to 36cm 10% of the time. Additional aerial mapping is compiled by combining November 2015 6cm aerial imagery with high accuracy aerial LiDar, where appropriate. Accuracy is 12cm or better 90% of the time, with some possible errors up to 25cm, up to 10% of the time. The aerial mapping has been supplemented with field audit surveys for site specific locations.

(ii) Aerial triangulation was based on the Project-specific control survey datum and the datum photo control points.

(iii) DB Co shall evaluate their requirements for topographic mapping and augment the aerial triangulation adjustment with additional ground control, if required.

(iv) In the event that DB 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) Legal surveys, in the form of a reference plan of survey, intended for fee simple, permanent or temporary easement acquisition to support the Project shall be performed by the City.

(ii) The entire corridor shall be surveyed in the form of parts on reference plans.

(iii) DB Co shall ensure that, in those areas where the proposed construction is to take place within 1m of a property limit, that a licensed Ontario Land Surveyor is engaged to stake out the property limit in the field and prepare field notes and sketches to document the fieldwork.

(d) Post Completion Survey

(i) DB 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 latest Final Completion Date.

(ii) DB 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 DB 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. The survey shall be submitted in accordance with Schedule 10 – Review Procedure.

(e) DB Co shall complete a pre-construction condition survey of the Lands covered by Third Party Access Agreements (as defined in Schedule 20 – Lands) and adjacent 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 DB Co commence the Works until the pre-construction condition survey is provided to the City. DB 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 surveys 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.

4.3 Design Requirements

(a) Design Components and Design Life

(i) DB 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

	Design Life Required (years)
New Bridge Structures	75
New Retaining Walls	75
New Culverts	75
New Flexible Pavement (including intervening rehabilitation with initial Design Life of minimum 20 years)	40
New Rigid or Composite Pavement (including intervening rehabilitation with initial Design Life of minimum 30 years)	55
Elevated Guideway	75
Stations – Finishes	40
Stations – At-Grade Station Structures	50
Stations – Underground Station Structures	100
Artwork	30
Ancillary Facilities – Structures	50
Ancillary Facilities – Finishes	40
Ancillary Facilities – EEBs and Tunnel Ventilation Structures	100
Ancillary Facilities – Bus shelters	15
Tunnel – Structure	100
Tunnel – Fit Out	20
Track – Ballast	20
Track – Fixed	20
Ties - Concrete	40
Ties - Hardwood	25
Switches & Cross-overs	20
LMSF Site Buildings	40
Maintenance Building – Shop Equipment	30
Signalling	30
Communications	20
CBTC System	30
Catenary	40
Traction Power Equipment	40

(b) Climate Data for Design

(i) DB Co shall use the climate data presented in Table 1-4.2 where required for design, unless otherwise specified:

Table 1-4.2: Climate Data

Extreme Maximum Temperature	38°C

Extreme Minimum Temperature	-39°C
Extreme Daily Rainfall	135mm
Extreme Daily Snowfall	56cm
Extreme Daily Precipitation	135mm
Extreme Snow Depth	135cm
Maximum Hourly Wind Speed	80km/h
Maximum Wind Gust Speed	135km/h

4.4 Site Work

(a) General

(i) Existing Conditions

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

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

(ii) Backfill

A. Backfill work completed by DB 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 other 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 SI.

(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 SI.

ARTICLE 5 IMPLEMENTATION CONSTRAINTS

5.1 General Implementation Constraints

(a) General Requirements

(i) The intent of this section is not to define or limit DB Co's approach to the construction or the means and methods that may be chosen but to bring awareness to the Project constraints that shall be adhered to in the planning and delivery of the Works.

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

(iii) The construction planning for this Project shall consider the existing operations of the City, and the impacts to the street network within the City, as well as considering adjacent residences and businesses, with respect to pedestrian and property access and other environmental impacts. The construction sequencing shall be performed in such a manner that the existing Transitway is maintained at a service level similar to existing conditions for the maximum amount of time.

(iv) For all Lands and Lands subject to FLUDTA, DB Co shall maintain fencing at all times around the boundaries of the construction sites. No use or access will be permitted to adjacent NCC Lands without the express approval by the NCC.

(b) Access to Adjacent Properties

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

(ii) DB Co shall accommodate for pedestrian access throughout the Project providing safe passage for pedestrians impacted by the Work. Pedestrian access shall be in conformance with the AODA, CSA accessibility requirements, and the COADS, where applicable. DB Co shall prepare and implement a Pedestrian Access Plan detailing pathways, signage and Structures to accommodate pedestrian traffic nearby and through the Project site. The plan shall be submitted in accordance with Schedule 10 – Review Procedure.

(c) Work Hours Limitations

(i) DB Co shall abide by all federal, provincial, and municipal statutes regarding hours of work, except for when working within the area around the proposed Cleary Work in the vicinity of the intersection of Cleary Avenue and Richmond Road) as detailed below, in which case DB Co shall not be permitted to work at any time on Sunday. Should DB Co need to work hours outside of the statutes or the exception provision detailed here, DB Co shall provide a plan describing the Work activities, construction equipment required, proposed hours of work and mitigation efforts with respect to noise and other environmental considerations potentially impacted with the increased work hours. This plan shall be approved by the applicable Governmental Authority with respect to the specific statute. Consultation with the affected community shall be conducted in accordance with the provisions of Schedule 18 – Communication and Stakeholder Engagement Obligations.

A. The area bounded by the Cleary work area limitation is defined by the intersection of the following:

i. To the south - Byron Avenue

ii. To the north - the existing SJAMP

iii. To the east – the eastern property boundary of **[REDACTED]**

iv. To the west – the western property boundary of **[REDACTED]**

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

5.2 Construction Planning and Constraints

(a) NCC and City MUPs shall remain open to public use during construction. DB 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) Rock excavation using drill and blast methods may be used for construction of the Underground Structures in accordance with the blasting requirements of Schedule 15-2, Part 2 – Civil and Guideway, Article 7- Geotechnical Design Criteria and Requirements, Article 9 – Protection of Existing Adjacent Structures and the following project constraints

(i) Blasting shall be permitted for rock excavation of the Parkway Tunnel including New Orchard Station and the east and west portal Structures with the exception that drill and blast shall not be permitted where the Tunnel runs parallel to the WNC utility. The approximate limits of the Parkway Tunnel no-blast zone run from the intersection of Cleary Avenue with Richmond Road to the intersection of Lockhart Avenue with Richmond

Road. A minimum stand-off distance of 15m shall be provided between the beginning of drill and blast work and the WNC outside of this no-blast zone with the final stand-off distance to be determined by DB Co based on the results of the blast design CIAR of Schedule 15-2, Part 2 - Civil and Guideway, Article 9 – Protection of Existing Adjacent Structures.

(ii) Blasting shall not be permitted for rock excavation of the Connaught Tunnel and the depressed guideway west of Connaught Tunnel.

(c) DB 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 20 – Lands for additional information.

(d) Properties that can be utilized as construction staging areas are identified in Schedule 20 – Lands. Should DB Co require additional properties beyond those shown to be provided, it is the responsibility of DB Co to acquire any additional property as prescribed in Schedule 20 - Lands.

(e) See Schedule 15-2, Part 7 - Traffic and Transit Management and Construction Access for restrictions associated with events and holidays.

(f) Refer to Schedule 17 – Environmental Obligations for requirements for working around SARS.

(g) MTO Constraints/Highway 417

(i) DB Co shall ensure that all work performed in the vicinity of and affecting the Highway 417 is as per MTO requirements. DB Co shall refer to Schedule 15-2, Part 9 – Highway 417 Works, and Schedule 15-2, Part 7 – Traffic and Transit Management and Construction Access, for MTO requirements.

(ii) DB Co shall ensure that there is coordination between the TTMP required for the West Works (as per Schedule 15-2, Part 7 - Traffic and Transit Management and Construction Access) and the Highway Works TTMP (as per Schedule 15-2, Part 9 – Highway Works) by contacting involved parties from both TTMPs, so that there is no conflict between the two TTMPs.

(h) NCC/Linear Park/SJAM/Connaught Park – NCC work restrictions

(i) DB Co shall perform no work on Federal Lands without the plans and designs having first been approved by the NCC Board of Directors and a letter of approval signed by the NCC Executive Director, Capital Planning.

(ii) DB Co shall notify the NCC in writing of road closures during construction one week in advance.

(iii) DB Co shall maintain an open area between the EBL and WBL pedestrian underpass structures on the SJAM Parkway.

(iv) DB Co shall ensure that when determining mobilization sites, access roads and SJAM Parkway detours from Dominion Station to Cleary Station, they respect the restrictions regarding tree removal identified in Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements.

(v) Protected zones

A. DB Co shall install protective snow fence to secure the periphery of zones of tree preservation. Snow fence shall be kept in good condition at all times.

B. If any trees, other than those identified in the plans are to be cut, DB Co shall address a request to the staff responsible for this approval for review and, if acceptable, obtain all necessary permits.

(vi) DB Co shall complete the Work required for the installation of the site servicing for the Kitchissippi Lookout as outlined in Schedule 15-2, Part 2 – Appendix G by February 28, 2020, in order to permit NCC to begin construction on the planned pavilion.

(i) Systems Constraints

(i) Tie-in of systems with the Existing Confederation Line as identified below shall be subject to the work time restrictions identified so as to not negatively impact the operation of the Existing Confederation Line except as described below. Additional work hours may be available depending on the type of work, time of day and location. All requests for additional work time shall be submitted to the City in writing. The requests shall include a full and comprehensive plan for installation, testing, and certification subject to approval by the City. Formal engineering change management and software engineering change management processes to be implemented, subject to approval of the City, prior to any software changes, upgrades, or testing take place. Any changes that remain in place must be certified for safe operation.

A. Tracks at Tunney's Pasture Station and Blair Station can be shut down a total of six times over 48 hour weekends for tie-in systems work as follows:

i. Both Tracks at each Station once;

ii. The eastbound Track only at each Station once;

iii. The westbound Track only at each Station once.

The weekend shut downs shall not exceed 48 hours, must be scheduled six months in advance, and are subject to City approval pending a review of major events and holidays.

B. Track: non-revenue hours;

C. Train Control: non-revenue hours;

D. Communications: non-revenue hours;

E. OCS: non-revenue hours;

F. Traction Power: non-revenue hours.

(ii) Testing support requirements shall be coordinated with the City during the weekly maintenance coordination meetings.

(iii) A maintenance window or a series of maintenance windows (non-revenue hours) shall be scheduled to add new elements to the existing CMMS system, including Track, OCS, signaling apparatus, communications elements, etc.

(iv) A cutover/transition plan shall be developed for the upgrade of the CMMS – which will identify the pre-work/test configuration, all key staff, actions and constraints-- a failsafe/fall back plan shall be established in case of any system failures require DB Co to revert back to the pre-test system configuration.

(v) Communications systems elements to be added shall be implemented during revenue hours (SCADA, PA/PIDS, intrusion & access control, CCTV cameras, fire/life Safety devices, etc.) but overall systems field device tests and access control tests shall be done during non-revenue hours: a cutover plan shall be provided, and this shall be approved by OC Transpo before implementation.

(vi) Tunnel portal intrusion system installation and testing shall be coordinated in the field and at the TOCC during non-revenue hours.

(j) Structures constraints:

(i) Green's Creek Culverts

A. DB Co shall comply with NCC, DFO, City and other Governmental Authorities' regulations before accessing work areas and commencing work at Green's Creek.

(ii) Pedestrian Bridge at **[REDACTED]**

A. DB Co shall ensure that the new Woodroffe Pedestrian Bridge is constructed and commissioned prior to the removal of the existing Woodroffe Pedestrian Bridge.

(k) Noise and Vibration Mitigation

(i) DB Co shall abide by all federal, provincial and municipal statues regarding noise levels, noise mitigation, and vibration mitigation. Prior to commencement of construction, DB 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.

(l) Transit system constraints:

(i) All construction work with the exception of bus stops, within 60m of any OC Transpo infrastructure, shall be subject to review and approval by OC Transpo with respect to existing or new OC Transpo infrastructure and shall receive OC Transpo's written approval prior to construction.

(ii) Preceding any full closure of any portion of the Transitway, DB Co shall complete all temporary Stations and associated facilities for that portion of the Transitway at least 48 hours prior to cutover. Refer to Schedule 15-2, Part 7 – Traffic and Transit Management and Construction Access. In addition, all associated detours for the City bus circulation shall be in service by the City before this portion of the Transitway is allowed to be closed.

(iii) The closure and removal of the exiting Transitway Bridge over OR174 shall not be permitted until the implementation of the detour routes for existing buses that utilize this Bridge is completed.

(iv) DB Co shall not close West Transitway Segment W-1 (Tunney's Pasture to Dominion), prior to December 19, 2021.

(v) DB Co shall ensure the pedestrian Bridge connecting the existing central Station building and the existing north Station buildings at and vertical circulation elements of each, inclusive of elevators and stairs, at Bayshore Station, remain available for bus service customers for the duration of the Project. Temporary off peak closures may be permitted with prior approval from the City.

(m) Coordination with City Works

(i) Coordination with others

A. DB Co is notified that Third Party Contractors and City staff will need access to the construction Site at various times and locations during the course of the Work. Therefore, DB Co shall provide the following:

i. 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;

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

iii. Provide Site access to the Third Party contractors and City staff;

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

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

vi. At the City's request, provide up to date as built drawings of the sites at the time of the coordination; and,

vii. DB Co is required to provide the City with access to and storage space within the Moodie LMSF in accordance with the following requirements:

1 Provide access to LMSF offices and general storage Facilities six months prior to Substantial Completion. Office and storage areas shall be available for access and storage.

2 Provide access to LMSF maintenance Facilities three months prior to Substantial Completion. Maintenance Facilities shall be available for access and storage.

3 Provide access to LMSF Vehicle Storage Tracks nine months prior to Substantial Completion. Vehicle storage area shall be available for occupation. At this time, the Track switches and OCS are not required to be powered.

4 Provide full access to LMSF Vehicle Storage Tracks three months prior to Substantial Completion. At this time, the Track switches and OCS shall be operational and powered.

5 Provide access to the MYCC six months prior to Substantial Completion.

B. Anticipated coordination issues are, but are not limited to, the following:

i. Fare control equipment installation

1 Installation by OC Transpo requires one month notice prior to the installation and one week per Station for the actual installation. Access shall 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.

ii. OC Transpo spaces

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

iii. Vendors within Stations

1 Access to vendors and their contractors shall be provided three months prior to Trial Running.

iv. Various Communications issues including:

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

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

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

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

(n) Lands Constraints

(i) Bayshore Shopping Centre:

A. DB Co shall appoint a representative to co-ordinate and communicate the Work requirements on the Bayshore Shopping Centre Lands. Bayshore Shopping Centre will also provide a point of contact for such coordination.

B. DB Co shall provide 30 calendar days' notice to the City and the Bayshore Shopping Centre point of contact, prior to commencing any Work on the Shopping Centre Lands, as identified in Schedule 20 – Lands.

C. DB Co shall ensure that a minimum on one-lane of traffic is maintained on the Shopping Centre Lands during the Work.

i. Should DB Co require closure of a second lane, blocking access over the Shopping Centre Lands completely, DB Co shall obtain the approval from Bayshore Shopping Centre point of contact a minimum of 48 hours in advance of the date on which the closure of the second lane is to take place.

D. DB Co shall provide TCP to direct traffic, if requested by Bayshore Shopping Centre a minimum of 48 hours in advance of the date on which the TCP are required.

E. DB Co shall erect appropriate signage directing pedestrian traffic to the appropriate mall entrance and vehicular traffic to the parking structure.

F. The Shopping Centre Lands shall not be available for use by DB Co between November 15 and January 1 of any calendar year. DB Co shall ensure that any reinstatement required to ensure that the internal roadways located on the Shopping Centre Lands are entirely available for use during this period and is completed to the satisfaction of the Bayshore Shopping Centre point of contact.

G. Additional constraints on the use of the Lands are provided in Schedule 20 – Lands.

(ii) Place d'Orleans Shopping Centre

A. DB Co shall ensure that delivery of any site office trailers to this location shall not block traffic to and from the shopping centre and shall be delivered during off peak hours.

ARTICLE 6 REGULATORY STRUCTURE AND OBLIGATIONS

6.1 General Requirements

(a) DB Co acknowledges that the City has the authority under the Delegation Agreement to regulate any matters covered by Parts III and IV of the Canada Transportation Act and by the Railway Safety Act relating to the design, construction, operation, maintenance, Safety and Security, as well as the rates and conditions of service of the system.

(b) DB Co shall comply with adopted Confederation Line Regulations as it relates to the design and construction and Safety and Security of the system

(c) DB Co acknowledges that the Confederation Line Regulations are part of the definition of Applicable Laws in this Project Agreement as adopted by the City.

(d) DB Co and the City acknowledge that the Confederation Line Regulations and support documentation may not be required to support or facilitate all aspects of, or all activities comprising, the Work, or the system. The appropriate scope, detail and timetable for adoption of modified or supplemental Confederation Line Regulations shall be based on the City's responsibility to regulate the design, construction, operation, maintenance, Safety and Security of the system in a prudent and timely manner generally consistent with other regulatory authorities of municipal light rail transit systems in Canada and elsewhere, having regard to; the Delegation Agreement; the design, technical features and anticipated operating conditions of the system; and the Safety and Security of the public.

6.2 Scope of Service

(a) Modified or supplemental Confederation Line Regulations and support documentation will be consistent with the requirements of this Project Agreement, and based on generally recognized and/or adopted codes, standards, practices, design references, Safety and Security principles and guidelines for other light rail transit systems operating in comparable conditions.

(b) DB Co shall provide to the City for review in accordance with Schedule 10 – Review Procedure and the City's Safety Certification Plan and Security Certification Plan, the following elements taking into considerations the Existing Confederation Line existing analysis and findings:

(i) System Safety Program Plan;

(ii) SSeCP;

(iii) TVA; and,

(iv) PHA.

ARTICLE 7 SYSTEM SAFETY CERTIFICATION

7.1 General Requirements

(a) The Work specified in this Article, as well as portions of Article 8 of this Part 1 that refer to Security, consists of DB Co's requirement to develop and implement a SSAP. The purpose of the SSAP is to ensure the Project systems and equipment are safe and secure including:

(i) Design and operating hazards and Security vulnerabilities are identified, evaluated, and properly controlled or mitigated, prior to the commencement of passenger 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 specification 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, emergency response personnel, 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 integral part of this program and shall be integrated into the development and implementation of the SSAP plans. The system Safety and assurance requirements shall apply to all DB Co functions during all phases of the Work including design, construction, installation, testing, pre-revenue operations, in-service support, warranty, retrofits and field modifications.

(c) Objectives: The primary objective for DB Co is to deliver a Project that meets or exceeds Safety, Security and systems 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, DB Co, customers and the public at large.

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

(f) In the event that a subsystem or equipment being supplied by DB Co for the Confederation Line Extension has a Safety Case(s) (Generic Product, Generic Application) for the Existing Confederation Line that has been approved by the City, with no modifications to form, fit or function from the Existing Confederation Line, then DB Co may state in the respective Safety Case certified by similarity and append the previous approval and necessary documentation. The Project's SSCP shall be followed for Cross-Acceptance as described therein.

(g) In the event that a Safety Case(s) has been provided for a subsystem or equipment that has been approved by the City for the Existing Confederation Line that is to be supplied for this Project, with minor modifications to form, fit or function from the Existing Confederation Line, then DB Co shall perform the respective Safety analyses on the respective change/modification to the design. These analyses along with the respective approved Safety Case and a description of the change/modification shall be submitted to the City for approval to proceed. DB Co shall ensure the Project's SSCP is followed for the change/modification with the respective Safety evidence as well as the Cross-Acceptance criteria.

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

(i) DB Co shall provide a SCM to develop and implement the Safety Certification processes. 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 Safety Certification effort. The SCM shall be a Professional Engineer.

7.2 References

(a) Develop and implement the System Safety and Assurance Program 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 (2015) 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) EN 50126-1:2017, Railway Applications – The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS).

(vi) 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.

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

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

(ix) IEC 61508, Functional safety of electrical/electronic/programmable electronic safety-related systems.

(x) RIAC Handbook 217Plus.

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

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

(xiii) MIL STD 756B, Reliability Modeling and Prediction or EN 61078, Analysis techniques for dependability – Reliability block diagram and boolean methods.

(xiv) MIL STD-781D, Reliability Testing for Engineering Development, Qualification and Production - Exponential Distribution or IEC 60605, Equipment Reliability Testing.

(xv) MIL STD-470A, Maintainability Program Requirements (for Systems and Equipment) or IEC 60706, Guide on maintainability of equipment..

(xvi) 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.

7.3 System Safety Requirements

(a) General

(i) DB Co's 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 Work 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 DB Co's primary design and performance requirement for the Project. The Confederation Line Extension 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 Confederation Line Extension, 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) DB 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. DB 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. DB Co shall remain fully responsible for rectifying any such condition.

(c) Safety Principles

(i) The following Safety principles shall be incorporated into the Design and operations 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. DB Co shall eliminate Unacceptable Hazards through design.

C. DB Co shall design and construct the system to eliminate single-point failures in the system that result in an unacceptable or undesirable Hazard condition.

D. DB Co shall design and construct the system to eliminate unacceptable or undesirable Hazard conditions under normal operating 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. A failure on Safety Critical equipment shall be detected and reported back to Central Control.

J. The criteria for accepting a Hazard risk level shall be in accordance with the Hazard Log provided by the City from Stage 1 and the Safety Management System.

K. 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.

L. Consideration at all times to the Safety or workers, Passengers and staff of the DB Co and the City.

(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 Confederation Line Extension 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 Confederation Line. For hardware this shall include, as a minimum, failure modes.

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) DB 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) Hazard Analyses have been performed by the City for the Existing Confederation Line. DB Co shall review the Hazard Log and take into consideration as a PHL. The Hazard resolutions shall be submitted to the City in accordance with Schedule 10 – Review Procedure.

(ii) Additionally the Safety program shall be developed by DB Co 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) DB Co shall be provided the Hazard Log from the Existing Confederation Line by the City for review and continued development for this Project based on DB Co's Hazard Analyses. DB Co shall track all identified Hazards throughout the Project and have the capability to provide status reports to the City and SSCRT for review.

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

(v) PHA: DB Co shall be responsible for identifying Hazards that are specific to the Confederation Line Extension which shall be included and analyzed independently from the City's Hazard Log developed for the Existing Confederation Line. Additional Hazards identified and subsequent analysis shall be compiled into an independent Hazard Log and submitted to the City for its review. DB Co shall address and incorporate applicable mitigations from the Confederation 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 Hazard Management Procedure.

C. Mitigations shall be compiled into an independent Hazard Log that identifies Hazards and, proposed mitigations to those Hazards. All 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, but not limited to, the following system elements:

A. Signaling and Train Control

B. Traction Power

C. Communications

D. Special Trackwork

E. Electrical

F. Elevators/Escalators

G. FLS (Systems, including ventilation)

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

A. System/Sub-System Hazard Analysis/Interface Hazard Analysis

B. Software Hazard Analysis

C. Failure Mode, Effects and Criticality Analysis

D. Fault Tree Analysis

(viii) OHA: DB Co shall perform an OHA to identify and analyze Hazards associated with personnel and procedures during production, installation, testing, training, and Emergencies. DB 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) DB Co shall prepare Safety Design Criteria and submit in accordance with Schedule 10 – Review Procedure at the commencement of the design effort to provide applicable Safety and Security guidelines for proper design, construction, and testing, 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 DB Co through the development of specifications, drawings, design reviews, and final acceptance.

7.5 Safety and Security Certification

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

(i) DB Co shall implement a Safety and Security Certification Program which shall be compliant with the City's System Safety Certification Plan and System Security Certification Plan, which shall ensure by verifying the inclusion of all Safety and Security items in the design, construction, and testing of the

Confederation Line Extension. An SSCRT, independent of the design activities, shall oversee the certification effort.

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

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

A. SSCRT:

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

ii. Shall conduct meetings at a minimum of quarterly to discuss Safety and Security concerns;

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

iv. Shall consist of DB 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. DB 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 DB 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. The SSORC shall review plans, manuals, rules and procedures necessary for Revenue Service operation.

(iv) Cooperation and facilitation of Safety and Security Certification audits of the Work 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.

(b) DB Co's responsibilities are defined in Table 1-7.1 below. DB Co shall be responsible for the performance of the task activity identified in the SSCP and Safety Management System shall be followed when conducting the tasks below. This Table also includes the RAM deliverables described in Clause 7.8.

Table 1-7.1 - DB Co Deliverable Requirements by Project Phase

PROJECT PHASE	EN 50126 LIFECYCLE PHASE	DB CO RAM TASKS	DB 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 Safety Certification Plan
	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 Review, update and continue to develop the City provided Hazard Log from Existing Confederation Line
	3. Risk Analysis	Preliminary identification of reliability critical items	SSAP Update System Preliminary Hazard Analysis System Risk Analysis Interface Risk Analysis Review and update Hazard Log Software Safety Plan

PROJECT PHASE	EN 50126 LIFECYCLE PHASE	DB CO RAM TASKS	DB CO SAFETY TASKS
DETAILED / FINAL DESIGN	4. System Requirements	Capture RAM requirements in SRTM 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)
	5. 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 Safety Critical Items List
IMPLEMENTATION	6. 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
T AND MANUFACTURING	7. Manufacturing	Review First Article Inspection Maintainability Demonstration FRACAS Procedure	Hazard Log Update Verification and Validation Report(s) Assess Safety Related Training Operation and Maintenance Manuals
CONSTRUCTION AND INSTALLATION	8. Installation	Spares List (with separate section for Safety Critical and reliability critical items)	SSAP Update Validation Report(s)

PROJECT PHASE	EN 50126 LIFECYCLE PHASE	DB CO RAM TASKS	DB CO SAFETY TASKS
TESTING & COMMISSIONING	9. System Validation	Review and update RAM Demonstration Plan as required RAM Demonstration Report FRACAS Report	System Safety Case System Test Reports Update OHA SRAC, as required Safety Audits (Internal and 3rd party)
HANDING OVER	10. System Acceptance	RAM Demonstration Report Acceptance by City for Revenue Operation	Hazard Log Update Engineering Safety and Assurance Case
OPERATIONS AND MAINTENANCE OBJECTIVES	11. Operation and Maintenance	Review and confirm acceptance of RAM Demonstration Report during Warranty Period (Monthly Report) FRACAS Report	Warranty FRACAS Review and update Hazard Log Review and Update Engineering Safety and Assurance Case Transfer and Implement SSAP for Operations Safety Audits (Internal and 3rd party)
	12. 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.
	13. Modification and Retrofit	Assess RAM implications as required	Hazard Log Update Engineering Safety and Assurance Case Update as appropriate Update Operations and Maintenance Manuals

7.6 Safety Activities

(a) DB 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. DB Co shall be responsible for scheduling and performing the tests that include those City-selected points; and, for notifying the City at least fourteen (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.

(c) Safety-related tests: DB Co shall verify that Subsystems and systems function safely as specified and do not contain or create unforeseen Hazards. Safety-related tests cover both intra-discipline and integrated tests. 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 documents. DB Co shall update the Safety-related testing conformance checklist and submit it for review. DB 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 or vulnerabilities, and contain specified Safety or Security features. All requirements on the checklists shall be verified and submitted to the City for review;

(ii) At a minimum, each of the identified Safety requirements for a Safety Critical items (unit) and respective Safety function 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 DB 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 Work and pre-revenue testing and training. DB Co shall audit all tasks.

(iii) Safety Testing Documentation - Safety testing shall be separately identified to allow recognition of Safety tests. DB Co shall include a matrix in the SVM (output from the Hazard Log), addressing Safety tests only, which shall receive the concurrence by signature of the responsible person as defined by DB Co's organization chart. The matrix shall identify Safety parameters and/or other Safety 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 Safety 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 - DB Co shall notify the City in writing thirty 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; DB Co shall immediately indicate proposed remedies and/or corrective actions.

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

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

A. DB Co shall report any noncompliance/non-conformance with Applicable Codes 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: DB Co is 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 Safety-related training on new equipment and procedures is adequate and appropriate for the tasks performed under typical and Emergency conditions. DB Co shall schedule, arrange, invite participants, provide equipment, and set up locations for drills to occur. Where indicated elsewhere herein, DB Co shall also provide instructors to assist preforming the training in both Safety and Security.

(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 performed, are reviewed and documented and that additional Hazards, vulnerabilities, or open Safety issues identified 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 DB Co and included in a Safety Training Program, to be provided by DB 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) DB 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. DB Co shall submit the most current copy of Hazard Log to the City for review upon request. After all tracked Hazards are resolved, DB Co shall prepare a SVM document and submit in accordance with Schedule 10 – Review Procedure.

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

(g) DB 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. DB Co shall be responsible for verifying that DB Co's completed design complies with the resolutions of FLS issues, and is acceptable to the applicable Governmental Authorities.

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

(i) A signed report shall be prepared by DB Co, prior to Confederation Line East Extension or Confederation Line West Extension Substantial Completion, attesting to the overall Safety and Security of the Confederation Line for public use. This shall include resolution to all non-conformance Hazards and vulnerabilities previously identified through DB Co's detailed Safety Analysis. Upon completion of the Work and pre-revenue testing and training, DB Co shall issue to the City and the SSCRT a signed and sealed Final Safety Certificate.

(ii) The signed Safety Certification Report shall certify to the City that the Work has been designed and constructed in accordance with the Project Agreement Safety requirements, and DB Co has used the Safety and Security principles customarily applied in the transit industry for transit systems in North America and Canada. The report shall further certify the Confederation Line Extension 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, DB Co shall perform a detailed accounting of all correspondence and documentation to verify and certify all Safety and Security requirements, activities, tests, inspections, non-conformances, remediation's and actions have been completed and satisfied, documenting these results in a Safety and Security Certification Report which shall be submitted to the City in accordance with Schedule 10 – Review Procedure.

7.7 Format for SSVM

(a) DB 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 DB Co;

B. Method of Validation by Audit Team;

C. Validated By (Name of Auditor);

D. Date; and

E. Remarks.

(b) SSRTM

(i) DB Co shall develop SSRTM for the Project as an output from the Compliance Verification and Validation Matrix. 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 and tested in accordance with the Project Agreement.

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 are, but not limited to: use of standards, proven designs; 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 contract specifications. The DB 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 Confederation Line Extension. The requirements apply during all phases of the Works.

(b) RAM Approach

(i) DB 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 the DB Co for Subsystems/equipment/components comprising the system elements. In addition to the quantitative goals to be met, the DB Co shall meet requirements defined for RAM Program Plan, specific analyses, RAM prediction, and RAM demonstration tests.

(c) RAM Program Plan

(i) DB Co shall prepare a detailed RAM Program Plan in general accordance with applicable provisions of EN 50126-3. 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-contractors' 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.

L. Description of Failure management and collection.

(ii) DB Co shall follow, implement and meet Maintainability requirements such that for each system element and its constituent equipment, it shall be designed to permit ease of access for maintenance. Maintenance personnel shall have access to perform all maintenance functions, including failure location and isolation, disassembly and reassembly, removal/replacement, and repair as well as routine inspection/testing. The installation, maintenance, removal and replacement accessibility requirements for all serviceable equipment shall be coordinated and demonstrated. Equipment access ways, lifting eyes and other needed equipment accessibility features shall be provided.

(iii) Quantitative Maintainability goals/requirements shall be apportioned by the DB Co for system elements within its scope. In addition to the quantitative goals to be met, the RAM Program Plan shall address Maintainability analyses, predications, and demonstration tests.

(iv) DB Co shall develop the design of the SI in a way that considers maintenance of the assets through industry-standard maintenance practice. DB Co shall ensure

that no design element shall result in a gross (non-industry-standard) inefficiency in the delivery of the maintenance services for the SI.

(d) Maintenance Approach - Develop a maintenance concept as part of the Operation and Maintenance Manuals taking the following into considerations:

(i) System parameters as specified above.

(ii) Maintenance Assumptions:

A. Troubleshooting and repair shall be done by an individual with a high school graduation, and who has had 2 years of relevant qualifying technical school training and 2 years of experience; has attended the maintenance training programs at a minimum.

B. Spare parts recommended by the DB Co will be available.

C. Maintenance will be performed at three discrete levels: on-line, off-line, and bench.

i. On-line maintenance is that performed on an in-place and operational equipment element. Test points or built-in indicators shall facilitate identification of interfaces with other system elements. On-line maintenance shall not disrupt service.

ii. Off-line maintenance is that performed on in-place but out-of-service equipment elements.

iii. Bench maintenance is that which is performed on out-of-place and service equipment elements. This maintenance is to be performed in a shop area where standard test equipment and fixtures are available. Test equipment and procedures shall allow maintenance to the lowest pluggable component part level.

(iii) The maintenance concept shall define the repair, corrective, and preventive maintenance program plans, policies, and support requirements for all equipment supplied under this Contract. It shall:

A. Minimize each level of maintenance consistent with the specification requirements and system Reliability goals.

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

(iv) The maintenance concept 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 Work of this Contract.

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 (40 lbs) 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, color 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) DB Co shall develop and submit a detailed Preventive Maintenance Plan as part of each Operation and Maintenance Manual based upon the maintenance concepts and established Maintainability requirements. The Preventive Maintenance Plan shall provide all preventive maintenance tasks needed to maintain each Subsystem/equipment, supplied under this Contract, 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 will 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 will 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. The DB Co shall use a clear and deliberate method to identify all Safety Critical preventive maintenance tasks in the Preventive Maintenance Plan.

(g) DB Co shall apportion and allocate availability, MTBF, MTBSAF and MTTR values as applicable to the various systems elements and Subsystems using a r eliability block diagram model, which shall support and meet the top level RAM goals/requirements. DB 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. DB Co shall demonstrate through analysis and testing that the apportioned Availability/MTBF values which support the top level inherent Reliability/Availability are achievable and the equipment shall demonstrate such Availability/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 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, in redundant system, shall be defined as loss of function. T he function shall not be deemed "lost" until all the redundant items in the "cut-set" of redundant items have failed. Thus the DB 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) DB Co shall submit a RAM Prediction Report to demonstrate its proposed equipment will meet RAM goals/requirements. DB 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. Substantiated field data, Electronic Parts Reliability Data – 2014,

Non-Electronic Parts Reliability Data – 2017 and RIAC Handbook 217Plus 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) DB Co may propose alternate method of calculating Reliability, such as providing service records for proven equipment, provided DB Co can demonstrate similar function and environmental conditions, for approval by the City.

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

(j) RAM Demonstration Plan and Report:

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

(ii) During testing and commissioning, DB Co shall provide the City a RAM Demonstration Report outlining the performance of the System in accordance to the RAM Demonstration Plan for review and acceptance.

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

(k) FRACAS Procedure and Report

(i) DB 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 DB Co to detect, collect, diagnose and correct the respective failure as a minimum.

(ii) DB Co shall develop and submit to the City, on a monthly basis staring at testing and commissioning and ending upon receipt from the City the end of the Warranty Period, a detailed FRACAS Report, indicating all system element failures to the Lowest Line Replaceable Unit 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.

(l) FMECA

(i) DB Co shall provide to the City for review and approval a FMECA following EN 60812. The FMECA shall identify each respective RAM Failure Category. DB Co

may submit a single FMECA for RAM and Safety provided the respective criticalities are defined for each.

(m) RAM Failure Category

(i) Significant Failure: A failure that prevents Train movement or causes a delay to service greater than an operating headway in effect.

(ii) Major Failure: A failure that must be rectified for the rolling stock to achieve its specified performance and does not cause a delay to service more than a headway in effect.

(iii) Minor Failure: Any failure of equipment and that of which does not meet the criteria of Major or Significant.

(n) RAM Measurement Methodology

(i) MTBF: All failures that are attributed to all RAM Failure Categories. Failures which involve No Fault Found and Nothing To Report shall be tracked via the FRACAS program.

A. MTBF (hours): Operating Hours in Period / Σ All failures (Minor, Major, Significant)

(ii) MTBSAF: applies to the RAM Failure Category of Significant.

A. MTBSAF (hours): Operating Hours in Period / Σ Significant Failures

(iii) MTTR: shall be calculated for equipment elements as defined as either an LRU or LLRU. All elements defined with the same part number or piece of equipment performing the same function within the failed unit shall be used for the calculation. Note the MTTR shall be calculated for all in-service corrective maintenance and out-of-service corrective maintenance

A. MTTR (hours): Cumulative Repair Time for the respective element over the sampling Period / Number of Work Orders for the respective element

(o) RAM Targets:

(i) RAM Targets are defined in Schedule 15-2, Part 3 - Systems. The RAM targets specified therein shall be demonstrated by DB Co. If DB Co is not able to meet the specified RAM targets, justification and evidence shall be provided for approval by the City.

ARTICLE 8 SECURITY AND EMERGENCY MANAGEMENT

8.1 General Security and Emergency Management Requirements

(a) The Work specified in this Article consists of the development and implementation of a 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 DB Co functions during all phases of the Work including design, construction, installation, testing, pre-revenue operations, in-service support, warranty, retrofits and field modifications. As well, DB Co shall ensure Security is considered in the development and implementation of the plans, training and supporting documentation including the development and implementation of a SSAP. The purpose of the SSAP 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.

(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 Confederation Line Extension is to provide the City with a safe, secure, reliable, and attractive public rail transportation system. As such, the Confederation Line Extension shall incorporate security values that affect all levels of the Confederation Line Project activities including; the planning, design, procurement, construction, testing, commissioning, and operations and maintenance. The primary objective is to 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. DB Co personnel, consultants, and contractors associated with the Project are charged with the responsibility to deliver 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 Work shall be accomplished by incorporating Security design features, facilitating Emergency response training drills (which will 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. The design of the Project shall include provisions to enable safe and timely evacuation of Passengers 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) DB Co shall be responsible for compliance with the Project's SSeCP developed by the City through strict conformance to contractual obligations. DB Co shall manage its Work 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) At the City's request, DB Co shall support the City in the review and update the current ERP to reflect elements of the new SI. DB Co's support to updating the ERP shall be timely and in accordance with the City's schedule.

(g) 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 Threat Log, Risk Log, PHA, Risk Assessment, Hazard analysis and FMECA related to the new SI developed during the Project Term.

(h) It is understood that the updated ERP shall be incorporated into the City of Ottawa Emergency Response Plan, and the Province of Ontario PERP.

(i) DB 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.

(j) DB 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 Plans, documentation and training 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.

(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, emergency responder training and overall Emergency Responder 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 tabletops and a full scale exercises.

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

8.4 Development of Security Design Criteria

(a) DB 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 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.

(b) The Design Criteria shall ensure that the Security elements identified for the Project will become part of requirements that shall be addressed by DB 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 coiling grills;

(xii) Blast mitigation;

(xiii) Vehicular barriers;

(xiv) Security lighting; and

(xv) Cyber protection for IT and SCADA systems.

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

8.5 Security Design Approach

(a) DB Co shall follow the Security Management System when designing and developing the Security Plan and Procedures. As outlined Schedule 15-2, Part 1, Article 10, there is a requirement to develop and implement a systematic, explicit, and comprehensive process for managing security risks. DB Co will develop a System Security Plan to support security integration.

(b) The Security Design Approach shall be founded in the TVA and Risk Assessment. As such, DB Co shall review, update and continue to develop the City-provided TVA from Existing Confederation Line. DB Co shall be responsible for identifying threats and vulnerabilities that are specific to the Confederation Line Extensions which shall be included and analyzed independently from the City's TVA and Threat Log and Risk Log. Throughout the Project, DB Co shall develop and maintain an updated TVA to identify, mitigate, and/or control threats and vulnerabilities that might arise from design and operational deficiencies associated with the Project. 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 Confederation Line Extension facilities or the supporting systems will be based on a Risk Assessment that is conducted by DB Co. during the earliest stages of the Project and documented within the Risk Log. DB Co shall address and incorporate applicable mitigations identified by the Confederation 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) Maintenance Storage Facilities;

(iii) Confederation Line Extension Stations;

(iv) Guideway;

(v) Tunnel;

(vi) Control centres;

(vii) Fare collection;

(viii) IAC;

(ix) CCTV System;

(x) OCS and

(xi) 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.

(g) The criteria for accepting a threat Risk level shall be in accordance with the TVA provided by the City from the Existing Confederation Line and the Security Management System

(h) Document confidentiality and control. The TVA, the 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.

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

(i) DB Co shall implement a System Security Certification Program which shall be compliant with the City's SSCP, which shall ensure by verifying the inclusion of all Security items in the design, construction, and testing of the Confederation Line Extension. The SSCRT shall oversee the certification effort.

(ii) DB Co shall utilize the SSeCP developed by the City that describes and outlines the Project's Security Certification process which will 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. DB Co will 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) DB Co shall participate in meetings with the SSCRT, FLSSC and SSORC.

(iv) Cooperation and facilitation of Security Certification audits of the Work 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) DB Co's responsibilities are defined in Table 1-8.1. DB 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 PHASE	EN 50126 LIFECYCLE PHASE	DB CO SECURITY TASKS
PRELIMINARY / CONCEPTUAL DESIGN	1. Concept	Review and update the City's Security Certification Plan
	2. System definition and application conditions	SSAP Security Audits (Internal and 3rd party) SSePP Review, update and continue to develop the City-provided TVA from Existing Confederation Line
	3. Risk Analysis	SSAP 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	DB 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	SSAP Update SSeCP update *as required System Risk Analysis / Subsystem Risk Analysis Threat Log and Risk Low Review and Update Cybersecurity Assessment and Management Review and Update
IMPLEMENTATION	6. Design and Implementation	Emergency Preparedness (Preliminary) Test Plans and Procedures
T 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	SSAP Update Validation Report(s)
TESTING & COMMISSIONING	9. System Validation	Security Audits (Internal and 3rd party)
HANDING OVER	10. System Acceptance	Threat Log and Risk Log Update Transfer and Implement SSAP for Operations
MAINTENANCE OBJECTI	11. Operation and Maintenance	Review and update Threat Log and Risk Log Update Operations and Maintenance Manuals Security Audits (Internal and 3rd party)

8.7 Security Activities and System Testing

(a) DB 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 2013 Threat Vulnerability Assessment and the corresponding Threat Log and Risk Log shall be incorporated.

(b) Security Review Documentation - DB 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 DB 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 - DB Co shall comply with the security requirements to support systems as outlined in the references below:

(i) LRT Systems Design Submission– Schedule 3 Part 1 Tech Sub Requirements;

(ii) PA system broadcast – Schedule 15-2, Part 3, Article 4;

(iii) CCTV System – Schedule 15-2, Part 3, Article 7;

(iv) Signaling and Control System – Schedule 15-2, Part 3, Article 10;

(v) Traction Power System – Schedule 15-2, Part 3, Article 13;

(vi) Overhead Contact System – Schedule 15-2, Part 3, Article 14.

(d) System Security Certification Process – DB Co shall conduct system security certification process using a minimum of the five steps outlined below:

(i) Identification of Certifiable Elements and Sub-Elements;

(ii) Identification of Security Requirements for each Certifiable Element and Sub-Element;

(iii) Verification and/or validation of Security Requirements;

(iv) Tracking, review, update and documentation of certification tasks in Security Certification Checklists; and,

(v) Issuance of Certification for Certifiable Element or Sub- Element’s conformance to all associated Security Requirements

(e) 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.

DB 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: DB 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:

(i) An initial security systems testing conformance checklist shall be prepared for the design level of the Project Agreement documents. DB Co shall update the security systems testing conformance checklist and submit it for review. DB 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;

(ii) 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 DB 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 Work and pre-revenue testing and training. DB Co shall audit all tasks.

(iii) Security Systems Testing Documentation - Security Systems testing shall be separately identified to allow recognition of security systems tests. DB 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 DB 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.

(iv) Notification - DB 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, DB Co shall immediately indicate proposed remedies and/or corrective actions.

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

(vi) Security Test Reports - DB Co shall ensure test reports which contain verifications shall receive the concurrence, by signature, of the responsible person, defined by DB Co's organization chart. Security Systems Reports must be referenced within the SeVM to demonstrate compliance.

A. DB 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: DB Co is 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. DB Co shall schedule, arrange, invite participants, provide equipment, and set up locations for drills to occur. Where indicated elsewhere herein, DB Co shall also provide instructors to assist preforming the training in Security.

(i) 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 Security, have been satisfactorily resolved.

(ii) Security information on conformed methods and procedures necessary to maintain security conditions shall be generated by DB Co and included in a Security Training Program, to be provided by DB 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) DB Co shall be responsible for establishing and maintaining a Threat Log and Risk Log to record and track Threats 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. DB Co shall submit the most current copy of Threat Log and Risk Log to the City for review upon request. After all tracked Threats and Risks are resolved, DB Co shall prepare a Security Verification Matrix document and submit in accordance with Schedule 10 – Review Procedure.

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

(i) DB 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. DB Co shall be responsible for verifying that DB Co's completed design complies with the resolutions of FLS issues, and is acceptable to the applicable Governmental Authorities.

(ii) Certificates of Conformance will be signed as certified by the DB Co Security and signed as approved by the OLRT-C Technical Director, and submitted to the City as per Schedule 10 – Review Procedure.

8.8 Format for Security Verification Matrix

(a) DB Co shall provide an SeVM in the following format, noting that this shall 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 DB Co;

B. Method of Validation by Audit Team;

C. Validated By (Name of Auditor);

D. Date; and,

E. Remarks.

(b) Security Requirement Traceability Matrix

(i) DB Co shall develop SeRTM for the Project as an output from the Compliance Verification and Validation Matrix. 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 and tested 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. DB Co's Construction Security 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 DB Co, in consultations with City authorities:

(i) DB Co shall be responsible for providing security control capability for the physical sites throughout all phases of the Project. The physical security plan must incorporate identifiable elements of protection, detection, and response capabilities. The security measures must 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 will 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 Security Plan shall provide flexibility in the security approach to permit adjustments to the sites as the project develops. This is to allow DB Co to shift the site perimeters as needed to meet construction schedules.

8.10 Emergency Responder Preparedness

(a) DB 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 four train the trainer sessions for up to 40 Emergency response trainers for each session(to be completed six months prior to Substantial Completion);

(iii) Provision familiarization training session and tours on stations, guideway, maintenance facilities, trains and systems for ESP and supporting teams(to be completed three months prior to Substantial Completion);

(iv) Development and delivery of up to five tabletops 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 Emergency Responder Application related to Confederation Line Extension; and,

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

(b) DB Co shall provide support to the City for Familiarization Training of Emergency Responder Trainers on functionality of Emergency Responder Systems to include:

(i) CCTV;

(ii) ETELs:

(iii) FTELS;

(iv) AEDs:

(v) GIDs;

(vi) (ICPs;

(vii) Train lifting equipment;

(viii) PA; and,

(ix) IAC.

8.11 Emergency Responder Training

(a) DB Co shall provide training programs, with special emphasis on ESP, for all City ESP to enable a train the trainer Emergency response program.

ARTICLE 9 PROJECT OFFICE

9.1 General Requirements – City Offices

(a) DB Co shall provide climate controlled offices (the "Site Offices"), at pre-determined, locations set out in Table 1.9-1 along the active construction sites of the Project alignment. The intent is that site offices will form the basis of the City compliance monitoring team.

TABLE 1.9.1: SITE OFFICE LOCATIONS AND SIZING

Site Office Locations	Required Square footage (based on 17 m^2 per person)
Moodie LMSF	46 m^2
Baseline Station	46 m^2
Pinecrest Station	46 m^2
Lincoln Fields	46 m^2
Rochester Field/Richmond Road	46 m^2
Montreal Road Station	46 m^2
Trim Road Station	46 m^2

(b) With reference to the above Table 1-9-1, unless otherwise specified, DB Co shall locate the site offices on mobilization sites as per Schedule 20 – Lands.

(c) DB Co shall supply a trailer site for the City of Ottawa management staff at the following locations: **[REDACTED]**. References to PRP shall be the latest version.

(d) DB Co shall ensure that Site Offices shall meet the requirements of AODA, 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 Ontario Ministry of Labour and WSIB.

(e) DB Co shall be responsible for providing site office including all maintenance and operational costs for a period lasting from 30 days prior to, until 30 days after DB Co construction Work in the area of each site office location.

(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) one meeting room capable of holding 4-6 persons and 8-10 persons for larger site offices with 50" TV and required connections for laptop display; one restroom, one large heavy duty shredder and kitchen amenities including counter, sink and

under sink storage, small refrigerator, 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 IT Representative.

(vi) equipment including 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 will be removed upon Work completion and areas restored to match existing surrounding areas by DB Co.

(x) Three 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.

9.2 General Requirements – Contractor Offices

(a) DB Co shall be permitted to provide local site offices for construction operations at each Station construction site including those not designated as mobilization site in Schedule 20 – Lands. Those Station locations not designated as mobilization sites shall have limited material and equipment storage restricted to material and equipment specific to that station location required to construct that specific Station.

(b) DB Co shall ensure that site offices shall meet the requirements of AODA, have entrance/exit signs and lighting and meet the requirements of the OBC and OFC and other relevant codes and the MOL and WSIB.

(c) DB Co shall be permitted to provide limited onsite parking spaces for DB Co employees and subcontractors at those Station locations not designated as mobilization sites.

(d) DB Co shall be permitted to provide limited subcontractor trailer space at those Station locations not designated as mobilization sites

(e) DB Co shall be responsible for all maintenance and operational costs in association with site offices identified in this Clause 9.2 for the duration of DB Co's occupancy of the Lands.

(f) At those Station locations not designated as mobilization sites, temporary buildings and trailers shall be removed upon Station construction completion and areas restored to match existing surrounding areas by DB Co.

ARTICLE 10 CONSTRUCTION SAFETY MANAGEMENT

10.1 General Requirements

(a) DB Co shall prepare the CSMP in accordance with the criteria contained in this Article and all Applicable Laws, and applicable standards.

(b) The CSMP shall be prepared and submitted in accordance with Schedule 10 – Review Procedure. DB Co shall coordinate with applicable Governmental Authorities to ensure existing maintenance and Safety plans are not violated.

(c) DB 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 Confederation Line, DB 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 of both the Confederation Line East Extension and Confederation Line West Extension. 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, DB 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 Existing Confederation Line, other Facilities, existing systems, existing facilities, traffic, communities, and other agencies affected by the Project. DB 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, DB 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 DB Co's equipment may depend on facilities, equipment, or services of organizations not under DB Co's control for successful operation. The majority of interfaces exist within the DB Co Agreement between DB 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 utilities and other contractors. It is necessary that all interfaces be identified and controlled by DB 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. DB Co shall include, in the Interface Control Document, the process by which interfaces are identified and controlled.

(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 DB Co or others. This Article is not 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. DB Co shall inspect the related work, review the drawings and documentation 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) DB Co, as the Systems Integrator shall develop the necessary Systems Engineering Management Plans, 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 Confederation Line East Extension and Confederation West Extension's communications systems. DB Co shall provide personnel to coordinate (between operators and field personnel) and witness the test execution from the TOCC, MYCC, BYCC and BCC.

11.2 Systems Engineering and Integration Submittals

(a) DB Co shall produce a Systems Engineering Management Plan, a Requirements Management Plan, a Verification and Validation Plan, a SIMP, and a preliminary Systems Interface Matrix and submit each within 60 calendar days following Commercial Close in accordance with Schedule 10 – Review Procedure.

(b) The SIMP shall address the interface of the system with itself, the right-of-way and any infrastructure contained therein; any adjoining facilities; electric, telephone, gas and other Utilities; the water and sewer systems; Fire and Police Departments; and any facility which is used by or for the SI. The SIMP shall provide the procedure by which each interface will 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. Updates to the SIMP shall be provided by DB Co when significant schedule or Project changes are made.

(c) DB Co shall manage requirements throughout the Project using an object orientated requirements tool (e.g. DOORS), to ensure traceability of requirements from the source through to closure. DB Co shall make available to the City the output of the Requirements Management tool at design reviews and throughout the Project upon request.

(d) DB Co shall coordinate and integrate all System interfaces so that the system is properly integrated with itself and into the Project area, including the right-of-way, the surrounding communities, and all facilities, equipment, and 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.

(e) 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 DB 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

(a) ICDs shall be developed and managed by DB Co. Contents in these ICDs will expand as interfaces are identified but it shall be maintained current throughout the Project Agreement period and included as design data at all design reviews. ICDs shall be subject to Configuration Management. DB Co shall be responsible for coordinating all aspects of the system design and the integration of the SI with all other Confederation Line systems and Subsystems as required including vehicles. The civil infrastructure shall be inclusive of the design of the stations, stops, Guideway (elevated, at grade exclusive & semi exclusive ROW), Tunnels, Bridges, viaducts, overpasses, underpasses, MSF 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. Periodic reports shall be processed from the systems interface matrix and distributed for information.

(c) DB 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/Traction Power Supply;

(vii) Stations/Traction Power;

(viii) Stations/Signaling;

(ix) Stations/Power;

(x) Stations/SCADA;

(xi) Stations/Track;

(xii) Stations/Fire detection and suppression;

(xiii) Stations/Communications;

(xiv) TOCC/BCC/Traction Power;

(xv) TOCC/BCC/Signaling & Train Control;

(xvi) TOCC/BCC/Power;

(xvii) TOCC/BCC/SCADA;

(xviii) TOCC/BCC/Fire detection and suppression;

(xix) TOCC/BCC/Communications;

(xx) MYCC/LMSF/BYCC Traction Power

(xxi) MYCC/LMSF/BYCC Signaling & Train Control

(xxii) MYCC/LMSF/BYCC SCADA

(xxiii) MYCC/LMSF/BYCC Fire Detection & Suppression

(xxiv) MYCC/LMSF/BYCC Communications

(xxv) Existing Systems/New Systems;

(xxvi) Corrosion Control/Wheel/Rail;

(xxvii) Train Control/Tunnel systems; and,

(xxviii) Train Control/Tunnel systems.

(d) DB Co shall add other integration or interfaces as the design and system integration advances.

(e) The following provide additional requirements for the Systems Integration Program:

(i) DB Co shall be responsible for all facility and equipment redesign and rework, whether the impacted facility and equipment are the responsibility of DB Co or

others, or for modifying its Work or any DB Co provided Subsystem to match the facility, or for modifying any facility, systems, or Subsystems to match systems or Subsystems provided by DB Co. DB 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 DB Co is responsible. DB Co shall notify the City and any affected parties as soon as any interface information changes or is found to be incorrect.

(f) DB Co and its representatives shall develop and finalize all interfaces as required. Updates of the SIMP shall be provided whenever significant changes are made to the Work or the Project Schedule.

(g) This article provides a listing of the systems elements, the coordination required between these elements and the SI elements.

(h) Design of all elements of the various system designs shall be developed to operate reliably in the environment in which they are installed. DB Co shall design all systems elements to integrate with the environmental conditions for Ottawa including ambient temperature range, humidity, precipitation and other environmental factors that will impact operation.

(i) Failure to list interfaces between systems does not absolve DB 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

(i) Revenue Vehicles

A. Typical coordination elements between the SI and the Vehicle are:

i. Vehicle dimensions shall be coordinated with the Guideway design;

ii. Vehicle weight shall be coordinated with the Guideway design and selected Vehicle;

iii. Guideway and alignment design shall be developed to meet the requirements of the braking and propulsion system;

iv. The City, or City Party, shall coordinate with the Vehicle manufacturer to ensure that any limitations (thermal or other) are consistent with Vehicle needs;

v. the system Track infrastructure design shall be coordinated with the Vehicle wheel/rail interface criteria;

vi. pantograph/contact wire interface criteria shall be coordinated with the Guideway design, the OCS design and selected Vehicle;

vii. Vehicle dynamic and static envelopes for Guideway clearances shall be coordinated with the Guideway design, SI design and selected Vehicle;

viii. Vehicle to Platform interface including;

1 Vehicle door threshold height above top of rail to Platform edge; and

2 Platform lateral gap to Vehicle door threshold shall be provided for accessibility as well as to maximize station pass through speed;

ix. coordination and integration of Vehicle borne elements of the communications and signals systems with the Vehicle supplier;

x. The City designed onboard elements including S&TCS hardware and communication systems shall be EMC/EMI compliant with the Vehicle; and

xi. Track Design shall coordinate with the Vehicle to ensure that noise and vibration requirements are in conformance with the existing Vehicles;

(ii) Traction Power Supply System

A. DB Co shall coordinate the cable routing from the TPSS to the Tunnels and other Guideway segments, and provide pullboxes, switches and SCADA monitoring and control as follows:

i. positive cable routing;

ii. negative cable routing;

iii. communication cable routing; and,

iv. suitable electromagnetic segregation of cables in the duct bank and conduits.

B. DB Co shall coordinate the following Traction Power System elements:

i. Traction Power requirements shall be coordinated with the Vehicle;

ii. TPSS shall be designed to integrate within the right-of-way and surroundings including minimizing visual impacts along the alignment;

iii. coordinate with the local utilities to provide the necessary power feeds to the TPSS; and,

iv. DB Co shall ensure that the location of Traction Power disconnects and sectionalizing requirements are developed to support operational needs of the system;

C. The City shall integrate new equipment into the existing head-end to accommodate the new Traction Power SCADA System equipment.

(iii) OCS

A. DB Co shall coordinate the OCS wire support system hardware, messenger wire, contact wire, feeder wire termination points and appropriate switchboxes including:

i. OCS foundation integration along the ROW;

ii. OCS electrical clearance requirements according to regulatory and industry standards;

iii. OCS mounting and support integration into the right-of-way to minimize visual impact and with necessary restrictions for Tunnel installation;

iv. messenger wire installation arrangements;

v. contact wire installation arrangements;

vi. disconnect/ bypass or isolation switches;

vii. OCS to Vehicle interface to include contact wire stagger and sweep to achieve uniform pantograph wear;

viii. OCS to Vehicle interface to conform to Vehicle wire height requirements, rate of OCS height change to ensure good contact and current collection; and,

ix. protection device coordination to minimize service disruption whilst optimizing life and equipment protection.

(iv) Signals and Train Control System

A. The City shall coordinate between the Systems elements and the Vehicle supplier for the on-board Vehicle interface design, spacing, mounting and functioning of system elements within the Vehicle.

B. The City shall coordinate the system elements and the Vehicle supplier for installation and commissioning of on- board equipment.

C. DB Co shall coordinate the integrated testing of equipped Vehicles in all types of ROW throughout the system.

D. DB Co shall coordinate the complete design, installation and integrated testing of the S&TCS for all interfaces associated with S&TCS, except as noted in Clauses 11.4 (a)(iv)A and 11.4 (a)(iv)B above.

(v) Communications Systems

A. DB 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:

i. locations of communication duct bank and conduit interfaces to communication rooms/cabinets throughout Confederation Line;

ii. quantity and sizing of ducts within communications duct banks and conduits;

iii. location and quantity of pull boxes, manholes, and hand holes;

iv. CTS;

v. SCADA system elements;

vi. Fare Collection equipment;

vii. PA/PIDS;

viii. CCTV elements;

ix. Telephone system;

x. all communication systems control equipment;

xi. IAC System elements;

xii. Fire system elements;

xiii. GIDS elements;

xiv. Radio repeater system equipment

xv. Cell coverage system equipment

xvi. Wi-Fi system equipment, and

xvii. Blue light station equipment

xviii. Locations, equipment connectivity, conduit routing and power provisions for fare collection equipment and cables provided by others.

(vi) Trackwork

A. The City shall coordinate the integration of the Track to meet the needs of the Confederation Line with the existing and new interface as well as with other elements including:

i. Track form shall be developed to adhere to the requirements of the Vehicles;

ii. Track form shall be developed to comply with the noise and vibration requirements set out in Schedule 17 – Environmental Obligations;

iii. Track form shall be developed to integrate along the right of way and to maintain required clearances along the right of way considering;

1 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; and

2 Track form shall be integrated with the provisions for Structures and Underground Structures;

iv. Civil and Infrastructure system elements to provide corrosion control and stray current mitigation along the corridor;

v. OCS pole spacing and positioning shall be dependent on Track alignment, Special Trackwork layout, Track construction type, intersection and Emergency Services access locations;

vi. 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;

vii. electrical design related to the location of powered wayside Track equipment and electrical outlets along the ROW to support Track maintenance activities;

viii. wayside Track equipment includes switch machines, switch element heaters, switch blowers, rail lubricators, and associated cables, wires, conduit, and duct banks;

ix. operational requirements to identify Special Trackwork locations and configuration, high rail wear locations and superelevation;

x. civil, structural and geotechnical disciplines to determine Track drainage interface with municipal sewers, Track, roadway requirements, rail expansion accommodation and Emergency guard rail requirements on elevated structures, reinforcing steel requirements, Track foundation type and characteristics; and,

xi. provisions for protection where required in areas of Special Trackwork to allow for Operators of short-turn or stored Trains, to disembark and walk to opposite end of Train, without facing Hazards of adjacent traffic and Train flow in opposite direction.

(vii) Corrosion Control System

A. DB Co shall be responsible for development of an overall approach to corrosion control. DB Co shall coordinate corrosion control designs with the following:

i. Traction Power and Track systems to identify the location and typical arrangement for any corrosion control mitigation equipment;

ii. Utility Companies to identify sensitive utilities that may require relocation and/or protection;

iii. locations of monitoring and measuring points; and,

iv. stray current monitoring plan and system.

(viii) Non-Revenue Vehicles

A. The City shall coordinate all Non-Revenue Vehicles with the following:

i. Non-Revenue Vehicle dimensions shall be coordinated with the Guideway design and selected Non-Revenue Vehicle type;

ii. Non-Revenue Vehicle weight shall be coordinated with the Guideway design and selected Non-Revenue Vehicle type;

iii. the wheel/rail interface criteria shall be coordinated with the Guideway design and selected Non-Revenue Vehicle type;

iv. the pantograph/contact wire interface criteria shall be coordinated with the Guideway design, the OCS Design and selected Non-Revenue Vehicles;

v. Non-Revenue Vehicle dynamic and static envelopes for Guideway clearances shall be coordinated with the Guideway Design; and,

vi. Tunnel ventilation to accommodate requirements related to Non-Revenue Vehicle exhaust emissions.

B. DB Co shall ensure that any trackside element placed within the trackway is designed to withstand the worst case loading of an Emergency vehicle;

(ix) Tunnel Ventilation System

A. DB Co shall coordinate the designs of the S&TCS, Traction Power System, and Tunnel ventilation system to support the Tunnel ventilation vent zone requirements in accordance with NFPA 130.

11.5 Systems Integration Manager

(a) DB Co shall appoint a Systems Integration Manager to perform the systems integration obligations of DB Co. The Systems Integration Manager shall have the qualifications as set out in Schedule 9 – Key Individuals.

ARTICLE 12 ARTWORK

12.1 General Requirements

(a) This article describes artwork that shall become part of the SI and outlines the process for the implementation of the Art Program.

(b) The primary objective of the Art Program is to make the transit experience user-friendly, aesthetically pleasing and reflective of the communities serviced while fostering opportunities for creative collaboration between the artists, designers and community groups, creating a sense of local ownership.

(c) The mandate of the Art Program shall comply with the City of Ottawa's Public Art Policy. The City of Ottawa's Public Art Policy is overseen and administered by the City of Ottawa Public Art Program Office.

(d) The Art Program budget for Confederation Line shall be administered as the Art Cash Allowance in accordance with Project Agreement Section 11.30.

(e) The scope of the Art Program generally includes but is not limited to the following types of artwork:

(i) Permanent integrated public art projects that form part of a Structure or landscape that is part of the transit system and permanent, non-integrated projects that do not form a physical part of a Structure or landscape and includes stand-alone art projects which can be fabricated independently. DB Co shall provide appropriate means of fabricating (optional) affixing and/or supporting stand-alone, non-integrated projects to allow the projects to be periodically rotated or changed; and.;

(ii) Temporary public art projects are original artworks by an artist created for a specific occasion, timeframe or event situated at a particular site on a temporary basis and may be periodically rotated or changed.

(f) DB Co shall consult with the Federal Department of Canadian Heritage for artwork proposed to be located on Federal Lands.

(g) DB Co shall fully install all art projects prior to Final Completion for Confederation Line East Extension and Confederation Line West Extension.

(h) DB Co shall protect existing artwork located along the Transitway west of Tunney's Pasture Station in conformance with Good Industry Practice for art handling and conservation, such as practices published by Canadian Conservation Institute.

(i) Artwork shall not interfere with Passenger flow and shall be planned and implemented in accordance with CPTED principles. DB Co shall include artwork in all Schedule 10 – Review Procedure submissions for Stations and Ancillary Facilities including drawings and reports.

(j) Artwork installations shall meet property and Station maintenance demands, and reasonably anticipated exposure to weather conditions including but not limited to use of de-icing materials in winter.

(i) Requirements for Maintenance and access of the Artwork as prescribed by the Artist shall be taken into consideration when determining the Artwork installation location during the design phase of the Project

12.2 Art Program Responsibilities

(a) City responsibilities;

(i) Provide an Art Consultant to provide guidance to DB Co to ensure the City Public Art Policy is adhered to.

A. Develop a Public Art Plan and consult with DB Co on the implementation of the Public Art Plan. The Public Art Plan will include proposed transit sites (including Stations) to receive artwork, potential opportunities for public art, scope management and resources, general scope of work, preliminary budget allocations and implementation timelines. The Public Art Plan will be used to develop a City procurement process including a Request for Qualifications and Request for Proposals and guide the selection and evaluation of artist teams in accordance with the City Public Art Policy.

B. As appropriate, consult with the Federal Department of Canadian Heritage on artwork that is proposed to be located on federally owned lands.

C. Within four months of Commercial Close, and based on an RFQ process, shortlist artists/artist teams and lead a juried selection of three artists/artist teams that will enter into contract with DB Co.

D. Lead a community art social engagement process for the Byron Linear Park and Richmond Rd Complete Streets Initiative and coordinate artwork locations and technical review with DB Co.

(ii) In co-ordination with DB Co, manage the competition and selection process for artist teams for the artwork.

A. Public Art related community consultation, outreach and communications.

B. At the end of Project transition, including transfer of the ownership of artwork to the City Art Collection.

(b) DB Co responsibilities;

(i) Retain an Art Manager with a minimum of 5 years' experience managing complex urban development projects that included an artwork program. The Art

Manager shall be a member of DB Co's design team and shall liaise with the Art Consultant throughout the Project.

(ii) recognize and champion the importance of artistic excellence consistent with the standards and guidelines outlined in the Public Art Plan.

(iii) work collaboratively with the artist/artist teams and ensure that they are recognized as equal members of the DB Co design team.

(iv) adhere to the responsibilities as detailed in the Public Art Plan that include but are not limited to:

A. Ensure compliance with the City of Ottawa's Public Art Policy and the Public Art Plan;

B. Co-ordinate all aspects of DB Co's participation and deliverables of the Project artwork;

C. Act as the single point of contact with the City of Ottawa Public Art Program Office and liaise with stakeholders;

D. Ensure fair and equitable involvement of the Project artist teams, consistence with Good Industry Practice and artwork copyright and artist moral rights and provide support to and coordination of artists teams at all stages including concept design, pre-final design, final design, tender and construction, fabrication and installation as detailed in the Public Art Plan;

E. Co-ordinate review process at each stage for the Project public art, including but not limited to concept design, pre-final design, final design, and tender design packages for artwork and,

F. Meet regularly with, and provide project managements reports and documents in a timely manner, including financial reports as required, to the City Public Art Program Office.

(v) Identification of locations suitable for the artwork installations in consultation with the City and the City's Art Consultant. Placement of artwork installations shall provide an integrated approach with the placement of landscape architecture, Station architecture, signage and wayfinding, advertising and fare media that provides functionality for each element and promotes a positive customer experience.

A. Identification of locations suitable for artwork to be provided by the City within Byron Linear Park and Richmond Road Complete Streets. Provide technical review of the proposed installation.

(vi) Develop integrated art strategies for each of the three Station groupings including one on the Confederation Line East Extension and two on the Confederation West

Extension, including a project management plan, with construction schedule at a WSB 4 level of detail consistent with the approved budget available and the City's recommendations. DB Co shall provide appropriate means of affixing and/or supporting, and lighting any temporary artwork. At least three sites for temporary artwork shall be identified for temporary art projects (two on Confederation West Extension and one on Confederation East Extension. DB Co shall consider their Final Design Development submission of each artwork package as a binding submission and shall work with the City to incorporate the cost and scope of the artwork project fully into the Project Agreement.

(vii) Provide input to the City with respect to the development of the terms of reference and the preparation of the RFP documents including but not limited to;

A. Provision of general commercial terms and conditions in the form of a template contract to be included in artist team selection Request for Proposal;

B. Deliverable requirements required by DB Co to implement the Artwork Program;

C. Schedule dates for artwork deliverables that co-ordinate with the DB Co. design and construction schedules;

D. Work collaboratively with the City with respect to the process to select and assign artist teams to specific locations with the transit system;

E. Provision of technical information, drawings and Design Criteria; and,

F. Other support for the artist team selection.

(viii) Participate in the final artist selection jury and provide general support to the City in the final artist selection process including the assignment of artist teams to specific locations.

(ix) Support the City in outreach and consultation as it relates to the Artwork Program.

(x) Execution of agreements to retain the individual selected artist teams under standard terms and conditions.

(xi) Once individual artist contracts have been executed, in collaboration with the artist, develop integrated art concepts for each Station consistent with the budget available for the incremental cost of each integrated project.

(xii) Co-ordinate, integrate, deliver and install the Confederation Line artwork into the Project through the Art Cash Allowance outlined in Clause 12.3 below.

(xiii) Work collaboratively with the City, the Art Consultant and the Artist to resolve any contractual issues.

(xiv) Prepare the site and provide utilities to receive the artwork.

(xv) As required, provide safe and efficient access by the artist teams (or the artist's sub-contractor) to the site of the artwork for the installation of any artwork.

(xvi) Develop and execute a review process at each step as outlined in the Public Art Plan that includes review of the Artist's concepts and provide comments on constructability, suitability of materials, Safety, security, Maintainability, compliance with specified material standards, and design and construction costs of the artwork concepts.

(xvii) Address any implications of the Artwork Projects across all design disciplines during the design, construction and implementation of the Project.

(xviii) Confirm, at time of submission, in accordance with Schedule 10 – Review Procedure, the scope, budget and cost breakdown of each art concept to be implemented as part of the Art Program.

(xix) Co-ordinate and attend meetings for artists and DB Co during design and implementation phases.

(xx) Facilitate the resolution of aesthetic issues between the Artists, DB Co, and the City.

(xxi) The substitution of standard architectural finishes in Stations in favour of the specified art projects designed by the artist.

(xxii) Coordinate the integration of the art projects into the overall Station architectural finishes to ensure complete integration from a design, specification, tendering, material selection and construction perspective.

(xxiii) Collaborate with the City, with respect to any sustainability/maintenance issues related to the fabrication, construction or integration of the artwork.

(xxiv) Install stand-alone (non-integrated) public artwork and temporary public artwork including but not limited to the necessary base support structures to install artwork.

(xxv) Install lighting to properly illuminate integrated, stand-alone (non-integrated) and temporary artwork, working in collaboration with the artist.

(xxvi) Co-ordinate and integrate artwork provided by the City for the Byron Linear Park and Richmond Road Complete Streets.

(xxvii) Materials purchased by DB Co shall, in respect of the cost, installation and/or fabrication of integrated artwork be of the quality identified and agreed upon by the City and the artist, both acting reasonably.

(c) Artist team responsibilities

(i) Once the artists' teams have been selected, they shall join the DB Co teams as an integral member of the design team in all phases in the implementation of the public art project for the artist teams.

(ii) Artist teams shall adhere to the responsibilities as set out in the Public Art Plan that include but are not limited to the following:

A. Participate in meetings with DB Co design staff, community stakeholders and committees as required.

B. Develop integrated art concepts such as drawings, 3-D models/maquettes and cost estimates for the transit Station and/or landscape public artwork for approval by the City in coordination with DB Co.

C. Meet and present preliminary art concept(s) for review at the Pre-Final Design Submission as outlined in Schedule 10 – Review Procedure.

D. Participate in preparation of, and present preliminary designs for review including preliminary cost estimates, material samples, fabrication and installation plan, and maintenance plan that demonstrates that each individual artwork concept is compliant with architectural finish materials specified by the City, in particular for integrated artwork, and is maintainable over the life of the art installation.

E. Work with the DB Co design team to refine and finalize the approved preliminary design including approved cost estimates, materials, and fabrication, installation and maintenance plans and schedule. Prepare any final drawings depicting both the fabrication and installation of public artworks for each site/Station area identified. The design shall fully depict the attachment/integration details to any site/Station component as jointly developed with DB Co. Artist teams shall be responsible for obtaining all required information for the preparation of the design including site measurements.

F. Provide any technical expertise required to deliver the final concept package.

G. Provide plaque text to accompany the artwork including translation in up to three languages.

H. Provide artwork documentation (both written and photographic).

I. Provide artwork maintenance manual.

J. Inspect and oversee the fabrication. If DB Co or the City request to inspect the public artworks, the artist shall coordinate such inspections.

K. Supervise the integration and/or installation of the work by DB Co and support DB Co in a review of artwork installation.

12.3 Implementation of Art Cash Allowance

(a) The Art Cash Allowance is intended to cover the cost to implement the Artwork over and above any credits for architectural and landscape treatments that would otherwise have been required. DB Co, and not the artist, shall be responsible for the production, review, signing and sealing of any and all engineering drawings required to implement artwork.

(i) The substitution of standard architectural finishes at the site in favour of the specified art projects designed by the artist and the resulting delta or cost credit shall be applied to the Project to augment the art budget, supported by appropriate documentation as detailed in the Public Art Plan.

(b) DB Co shall be responsible for certain aspects of the Art Program that are not eligible to be funded out of the Art Cash Allowance as outlined above. For clarity, this includes participation in technical review of artworks during the competition for artists prior to the selection jury, the provision of lighting, communications and the support structures to install the artwork, as well as engineering drawing production, review and sealing of engineering drawings, inspection and oversight.

(c) Budget for all aspects of the procurement processes for the Artists and selected artwork associated with the Art Program including the supply and installation of the finished pieces shall not exceed the Art Cash Allowance as outlined in the Project Agreement.

(d) This Art Cash Allowance is comprised of the following incremental costs to implement art over and above credits for standard Station finishes:

(i) The artists' fees including the necessary design and production work to understand, develop and implement the art concept, consistent with the Public Art Plan;

(ii) Fabrication of the Artwork;

(iii) Provision of plaques and/or didactic signage with artist team statements for each Artwork;

(iv) The cost to implement and install the specified integrated and non-integrated permanent, art projects, above and beyond any required support structures for the artwork;

(v) The cost for the artist teams to prepare artwork submittals, develop drawings/specifications and input to tender packages in cooperation with DB Co to implement the art projects;

(vi) The cost for the artist teams (or a subcontractor agreed to by the artist teams) to produce any artwork as part of the Construction Documents or as part of the

fabrication/installation of the artwork including the production of any prototypes that may be required to demonstrate the art concept;

(vii) Except for the cost to affix/support and light temporary artwork, the City is responsible for the costs associated with the procurement process and fabrication of temporary artwork.

(e) The Art Cash Allowance excludes and may not be used toward:

(i) Legal, accounting, professional or administrative time that may be required in administering contracts with the artists or integrating the art projects into the design of the Works;

(ii) Preparation of reports for Art Cash Allowance submissions;

(iii) Increased artist design fees due to re-work requested by DB Co;

(iv) Station renderings that incorporate artwork; and,

(v) Cost to design and construct supporting structures that are part of Station design and construction.

ARTICLE 13 CITY BRANDING INTEGRATION

13.1 General

(a) DB Co shall be responsible for the integration of the City branding requirements with their design solutions for the Project not limited to but in accordance with the 2016 edition of the OC Transpo Visual Design Standards.

ARTICLE 14 DEMOLITION, REMOVALS AND DISPOSAL

14.1 General

(a) DB Co shall demolish any buildings or other Structures on the Lands as required for construction and obtain all Permits, Licenses and Approvals required for demolition. All Demolition refuse and materials shall be the property of DB Co and DB 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 Work.

(b) Performance Criteria

(i) DB 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, ductbanks, foundations, debris, poles and any other object.

(ii) DB 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) DB Co shall remove or relocate existing Utilities connected to buildings or other Structures being demolished including but not limited to – pipes, conduits, ductbanks, and overhead wires as per City standards.

(iv) DB Co shall submit a Demolition Plan covering all Works required by this Article in accordance with Schedule 10 – Review Procedure.

(c) Specific Requirements

(i) Existing Transitway

A. Demolition of Transitway facilities and Transitway shall be coordinated such that no interruption to service is incurred until temporary facilities and detours are functional.

B. The existing Queensway Transitway Station shall be removed as per the following:

i. Removal of all existing features currently located at the Highway 417 WB level and at the existing Transitway level including reinstatement of area to match surrounding areas. Removal shall not affect the structural integrity of surrounding structures. Removal shall not affect the existing MUP.

ii. Removal shall not affect the use of the 417 EB Station Platform as an Emergency access point. Including preserving and protecting

the elevator, stairs, electric room and electric service, plumbing and drainage.

iii. Removal of footings/foundations to below frost level.

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.

v. Remove existing ramps used to access the Transitway from the Highway 417 level. The Pavement structure and bedding shall be removed, subgrade scarified and regraded to maintain one drainage swale on the interior of the Transitway ramp. A minimum of 600 mm earth material, that shall sustain plant materials as described in Schedule 15-2, Part 6, Article 2 – Design Criteria, shall be installed.

vi. Reinstatement of area to match surrounding areas.

C. The following Transitway Stations shall be completely removed or demolished:

i. Dominion Station;

ii. Lincoln Fields Station;

iii. Iris Station;

iv. Pinecrest Station;

v. Jeanne D'Arc Station; and,

vi. Trim Station.

D. The following Stations shall be selectively demolished and rehabilitated or renovated:

i. Tunney's Pasture Station;

ii. Westboro Station;

iii. Baseline Station;

1 Two lanes of the existing Transitway shall remain and the rest shall be removed between College Avenue and Navaho, and the existing bus staging area. The Pavement structure and bedding shall be removed, subgrade scarified and regraded to maintain one drainage swale on the interior

of the Transitway ramp. 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.

iv. Bayshore Station; and,

v. Blair Station.

E. The demolition, selective demolition and or removals shall be coordinated with City for any salvageable materials that City may want to reuse elsewhere.

F. To the fullest extent possible, materials shall be recycled.

G. The reuse and re-cycle of material will be reflected in the goals and objectives of the Project Sustainability Plan and reported in the Sustainability Annual Report Card as detailed in Schedule 17, Part 3 – Environmental Management and Sustainability.

(ii) Other specific Project Lands:

A. Private properties being used for development that contain existing structures include:

i. **[REDACTED]**;

ii. **[REDACTED]**;

iii. **[REDACTED]**;

iv. **[REDACTED]**; and,

v. **[REDACTED]**.

B. DB Co shall perform removals and demolition as follows:

i. Completely remove all existing internal roadway, parking lots sidewalks and Pavement;

ii. Completely remove all Structures located 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 to the fullest extent possible.

C. Prior to the Commencement Date, as defined in Schedule 20 – Lands, for **[REDACTED]**, the City will demolish the existing building, will decommission the existing gasoline service station and will remediate soil and groundwater to MOECC Table 3 standards. Specifically, the City will excavate all soil with contaminant concentrations above standards for Residential / Parkland / Institutional Land Use on Parcel 1 of 18689-PRP_018. To the extent possible without disturbing existing Utilities, the City will excavate contaminated soils on Parcel 2, and will delineate the south end of the excavation with polyethylene sheeting. DB Co shall extend the excavation for the Guideway Tunnel north to the polyethylene sheeting, thereby removing and disposing of all remaining contaminated soil on Parcel 2. References to the PRP shall be the latest version as provided in Schedule 20 – Lands.

D. DB Co shall develop and implement a Remedial Action Plan for **[REDACTED]**, as noted in Schedule 17, Article 4.5 (d) and Schedule 20 - Lands. DB Co shall perform all removals of contaminated soil and groundwater at **[REDACTED]** to achieve compliance for the entire property with the Table 3 Soil Standards for Coarse Textured Soils and Residential/Parkland/Institutional Property Use and the Table 3 Ground Water Standards for Coarse Textured Soils and All Types of Property Use provided in "Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act" dated April 15, 2011. Where remedial excavations approach private property boundaries, shoring and other means shall be taken to maximize removals for the purpose of achieving these standards. DB Co shall be prepared to excavate vertical side slopes to 11m depth, if necessary. Where remedial excavations approach City of Ottawa Right-of-Way, DB Co shall consult with City staff to coordinate removals, also for the purpose of achieving these standards. Verification sampling of excavation walls and floor shall conform to the requirements of O. Reg. 153/04 (Record of Site Condition – Part XV.1 of the Act), and where concentrations of contaminants of concern in the verification samples exceed the Table 3 standards, DB Co shall construct measures to prevent re-contamination of the property.

(iii) Existing East Transitway Bridge (SN224880)

A. The existing Transitway bridge over OR174 shall be removed as per the following:

i. The entire Structure shall be removed to frost depth.

ii. Regrade surrounding area. 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.

(iv) **[REDACTED]** Pedestrian Bridge (SN018380)

A. The entire Structure shall be removed to frost depth.

(v) SJAM Parkway Improvements

A. There are existing utilities within the limits of the SJAM Parkway Improvements limits of construction that shall be addressed as follows:

i. DB Co shall remove and not just cap all utilities that once facilitated the Transitway;

ii. DB Co shall cap all connections to the ORPP that are no longer required with the removal of the Transitway within the Project limits of construction at the ORPP and shall completely remove the remaining segments of each connections from the Transitway to the ORPP;

iii. DB Co shall examine all existing utilities that once facilitated the Transitway and also facilitate an area to remain to determine if rehabilitation is required and if rehabilitation is required outside the Project limits of construction notify the NCC of the existing utility that requires rehabilitation. DB Co shall not be responsible for any rehabilitation that may be required.

B. DB Co shall manage excavated materials in accordance with Schedule 17, Part 4. Soil quality information for some parts of SJAM Parkway is provided in **[REDACTED]**.

(vi) OR174 Concrete Slab

A. There is an existing composite Pavement structure on OR174 between Blair Road and Green's Creek. DB Co shall remove the existing composite Pavement structure and replace with an appropriate flexible Pavement as per Schedule 15-2, Part 2, Clause 6.11.

(vii) Transitway pavement removal

A. DB Co shall remove the roads and parking lots associated with the existing Transitway that are no longer being used and are within the Lands but not within the proposed Guideway limits. The Pavement structure and bedding shall be removed and replaced with fill material that shall sustain plant materials as described in Schedule 15-2, Part 6, Article 2 – Design Criteria.

B. The removal of the existing Transitway shall not be completed until Revenue Service is completed and the Transitway is no longer required to be utilized by bus traffic.

(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 applicable Governmental Authorities and/or the City for any salvageable materials that they may want to reuse elsewhere.

(f) Materials

(i) DB Co shall dispose of all materials removed in accordance with City of Ottawa Standards, OPSS and applicable regulations.

(ii) DB Co shall manage hazardous materials in accordance with City of Ottawa Standards, OPSS and applicable regulations. DB 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) DB 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) DB Co shall manage 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 15 NEW MUNICIPAL INFRASTRUCTURE

15.1 Responsibility for New Municipal Infrastructure

(a) DB Co is responsible for the design and construction, including completion, Commissioning and testing, of any NMI.

(b) NMI includes new City of Ottawa Infrastructure.

(c) All design and construction in connection with the NMI to be constructed by DB Co shall incorporate the applicable design and construction standards, of the City.

(d) All design and construction in connection with the NMI to be constructed by DB Co shall be subject to the Review Procedure as outlined in Schedule 10 – Review Procedure of the Project Agreement.

(e) NMI shall be turned over to the City after the completion of the construction and Commissioning of NMI. NMI shall be subject to the warranty provision of the City of Ottawa Standard Tender Documents for Unit Price Contracts, Volume 1 and 2, including inspection requirements.

15.2 Design Standard

(a) In addition to the City Standards identified in Schedule 15-1 – Technical Terms and Reference Documents, NMI 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 NMI 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 NMI shall be in accordance with Schedule 15-2, Part 2, Article 6 - Roadways, Bus Terminals and Lay-bys.

15.3 Record Drawings and As-built Drawings

(a) Record Drawings and As-built Drawings for NMI or Third Party Infrastructure shall be completed and submitted in accordance with Article 16 – Record Drawings, of this Part 1.

15.4 Scope of Work

(a) In general, the following types of assets shall be considered NMI.

(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, and PPUDO areas.

(x) New pedestrian connections (bridges) to Stations that don't exclusively provide access to a Fare-Paid Zone of the Station.

(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 specific items that shall be included in the Work as NMI are included in Table 1-15.1 below.

Table 1-15.1 – NMI/Third Party Infrastructure

Asset Name / Structure Number (if applicable)
New Woodroffe (Pinecrest Creek) Stormwater Management Pond (SWP)
West Transitway South Rock Wall (SN019991) W of Tunney's Pasture Station
West Transitway North Rock Wall (SN019992) W of Tunney's Pasture Station
West Nepean Collector
Ottawa River Parkway Pipe (ORPP)
Signalized pedestrian crossing at Rochester Field, including concrete approach slabs and unit paving
SJAM Parkway modifications and new traffic control signals at Kitchissippi Lookout and street lighting system
Modifications to SJAM Parkway westbound overpass structure at Westboro Beach, including electrical ducts for street lighting
Construction of new access to the existing parking area north/west of SJAM Parkway and Kitchissippi Lookout intersection
Construction of a new 4-lane SJAM Parkway between north of 30 Cleary Avenue to Dominion
Goldenrod Bridge Structure at Tunney's Pasture (SN016255)

Asset Name / Structure Number (if applicable)
W Twy - Ross Av O/P Transitway (SN016260)
W Twy - Northwestern Av O/P (SN016270)
W Twy - Carleton Av O/P (SN016330)
W Twy - Island Park Dr O/P (SN016280)
W Twy - Lanark AV O/P Transitway (SN016290)
Utility Hydro Bridge @ McRae over W Transitway (SN019890)
W Twy - Tweedsmuir Av O/P Transitway (SN016300)
W Twy - Athlone Av O/P Transitway (SN016310)
W Twy - Churchill Av O/P (SN016320)
W Twy - Roosevelt Av Ped Bridge O/P W Tway (SN018220)
SJAM Parkway at Carleton Avenue Pedestrian Overpass (North/South bridges) (SN018620 / 018621)(349969)
SJAM Parkway at Lanark Avenue Pedestrian Overpass (North/South bridges) (SN018610 / 018611)(349972)
SJAM Parkway at Churchill Avenue Pedestrian Overpass (SN018920)
SJAM Parkway at Cleary Avenue Pedestrian Overpass (SN018910)
Carling Avenue Bridge at Lincoln Fields Station (SN016070)
Pedestrian Bridge at **[REDACTED]** (SN018470)
Highway 417 Westbound Off-Ramp at Pinecrest Road (SN015160)
Highway 417 Westbound On-Ramp at Pinecrest Road (SN015170)
Pinecrest Road Bridge (SN015180)
W Twy - Bayshore Dr 417 WB Off Ramp O/P (SN116410)
W Twy (Ext) - Richmond Rd (West Section) O/P (SN116420)
Richmond Road O/P Bayshore Drive (SN116110)
W Twy (Ext) - Richmond Rd On Ramp O/P (SN116430)
Graham Creek Culvert (SN117440)
Highway 417 E-N/S Ramp at Moodie Drive (SN116390)
Highway 417 S-W On Ramp at Moodie Drive (SN116370)
Moodie Drive Bridge (SN116350)
Highway 417 Moodie Drive Underpass (SN114030)
Highway 417 N-W On-Ramp at Moodie Drive (SN116330)
SW Transitway U/P Queensway (SN014490)
Iris Street Bridge (SN015210)
Pinecrest Creek Culvert under Iris (SN018350)
SW Twy - Baseline Rd O/P Transitway (SN016080)

Asset Name / Structure Number (if applicable)
E Twy - Blair Rd O/P Transitway (SN226780)
E Transitway - Hwy 174 WB Blair Rd Off-Ramp O/P Tway (SN226790)
Eastbound OR174 Bridge over Montreal Road (SN224851)
Westbound OR174 Bridge over Montreal Road (SN224850)
Green's Creek Culvert under OR174 (SN227110)
Green's Creek Pedestrian Bridge (SN221250)
Sir George-Etienne Cartier Parkway O/P Hwy 174 (SN224860)
Jeanne d'Arc Blvd O/P Hwy 174 (SN224870)
Orleans Blvd O/P Hwy 174 (SN224240)
Bilberry Creek Culvert under OR174 (SN224510)
Place d'Orléans Pedestrian Bridge over OR174 (SN228030)
Champlain St O/P Hwy 174 (SN224890)
Tenth Line Rd O/P Hwy 174 (SN894010)
Hwy 174 BCulvert OS Con 1 Lot 33 (SN894040)
Hwy 174 Taylor Creek BCulvert (SN894050)
Miscellaneous Culverts and Sewers:
- Transitway Culvert (T224630)
- Hwy 174 Culvert (A224700)
- Hwy 174 Culvert (A224720)
- OR174 Culvert (A220420)
- OR174 Culvert (A224810)
- OR174 Culvert (A224840)
- OR174 Culvert (A224820)
- OR174 Culvert (A224860)
- OR174 Culvert (A224880)
- OR174 Culvert (A224900)
- OR174 Culvert (A224902)
- OR174 Culvert (A224908)
- OR174 culvert (220660)
- OR174 Culvert (220670-1)
- OR174 Culvert (220670-2)
- OR174 Culvert (A224940)
- OR174 Culvert (A224950)
- Storm Sewer Outlet (STM79592)

Asset Name / Structure Number (if applicable)
- OR174 Culvert (A224960)
- OR174 Culvert (A224980)
- OR174 Culvert (A224985)
- OR174 Culvert (220690-1 and 220690-2)
- Storm Sewer Outlet (STM67980)
- OR174 Culvert (898510)
- OR174 Culvert (A894640)
- OR174 Culvert (A894680)
- OR174 Culvert (A898560)
- OR174 Median outlet (new)

ARTICLE 16 RECORD DRAWINGS

16.1 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. Record Drawings shall be prepared for all aspects of the Work, including SI, NMI and New MTO Infrastructure.

(b) DB 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, DB 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. DB Co shall sign and seal the Record Drawings as required in Schedule 14 – Testing and Commissioning, and provide them as soon as possible and in any event no later than 60 calendar days after each applicable Substantial Completion.

(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) DB Co shall provide Record Drawings for any NMI in accordance with the requirements of any third party owner of such New Municipal Infrastructure.

    (i) In addition, for City water and sewer NMI, full scale copies of As-built Drawings shall be provided to the City at each New Municipal Infrastructure Component Acceptance Date.

(e) Record Drawings for NMI shall be produced in accordance with the requirements of the CADD Standards Manual, prepared by the City.

(f) 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.

(g) DB Co shall provide Record Drawings for any SI in accordance with the requirements of this Part 1 and Schedule 14 – Testing and Commissioning. Record Drawings for SI shall be produced in accordance with the requirements of the **[REDACTED]** Confederation Line Drawing Standards.

ARTICLE 17 OPERATIONS TRAINING

17.1 Operations Training Curriculum and Materials

(a) At the City's request, DB Co shall support the City in their review and update of operations training programs, including training curriculum and materials to ensure compatibility with any new SI. The review of the training curriculum and materials apply to programs currently in use by the City for the Existing Confederation Line or under development for the Confederation Line system. DB Co's support to updating the operations training programs shall be timely and in accordance with the City's schedule.

(b) DB Co shall be responsible for submitting suggested modifications to the training programs to the City for review and approval a minimum 12 months prior to East Substantial Completion or West Substantial Completion, whichever is earliest. Any new technical systems which require training material shall be developed by DB Co, and be subject to the review provisions of this article.

(c) During the 12 month interval between the submission of suggested modifications to existing training programs and East Substantial Completion or West Substantial Completion, whichever is earliest, the City shall review and incorporate accepted modifications into the respective training programs. In addition, DB Co shall abide by the provisions of Clause 1.5(d) of Schedule 14 – Testing and Commissioning. The review of the training curriculum and materials apply to programs provided by DB Co, in addition to those programs provided by OC Transpo Trainers.

17.2 Track Availability For Operator Training

(a) Track access to the full Confederation Line Extension for Operator training and certification will be required in advance of Trial Running to ensure the requisite number of Operators are trained and certified on the System Infrastructure to support Trial Running and revenue service operation, as identified by the City. At a minimum:

(i) Confederation Line East Extension: Beginning 84 days prior to Substantial Completion, DB Co shall provide the City with a minimum of eight consecutive hours per day of full system access for Operator training and certification between 0600 and 2400 hrs (Monday – Saturday);

(ii) Confederation Line East Extension: Beginning 56 days prior to Substantial Completion, DB Co shall provide the City with a minimum 16 consecutive hours per day of full system access for Operator training and certification between 0700 and 2300 hrs (Monday – Saturday);

(iii) Confederation Line West Extension: Beginning 84 days prior to Substantial Completion, DB Co shall provide the City with a minimum of 10 consecutive hours per day of full system access for Operator training and certification between 0600 and 2400 hrs (Monday – Saturday);

(iv) Confederation Line West Extension: Beginning 56 days prior to Substantial Completion, DB Co shall provide the City with a minimum 16 consecutive hours per day of full system access for operator training and certification between 0700 and 2300 hrs (Monday – Saturday);

(v) Operator training and certification shall be conducted utilizing a fully functional CBTC system on the Confederation Line Extension and fully upgraded and functional CBTC headend system in the TOCC/BCC, reflective of the new line segments for use by City Controllers; and,

(vi) The City shall require the use of up to eight Vehicles for Operator training and certification on both the Confederation Line East Extension and Confederation Line West Extension. Vehicles for Operator training and certification will be provided by the City/**[REDACTED]**.

(b) DB Co shall provide a minimum of three months' advance notice of when Track access will be available for commencement of Operator Training and certification on the Confederation Line Extension.

(c) DB Co shall develop a Track access permit process that allows the City access to the full Confederation Line Extension during referenced periods for Operator training and certification. DB Co shall work cooperatively with the City in the approval of Track access requests and issuance of Track access permits for Operator training and certification.

17.3 Operator Training Simulator

(a) OC Transpo maintains an Operator training simulator for the Existing Confederation Line.

(b) DB Co shall support the City in the update of the simulator for the Confederation Line East and West Extensions by collaboratively providing information requested by the City.

(c) Requested Information may include, but is not limited to the following:

(i) Infrastructure-Related:

A. Tracks and ROW: drawings, Track charts, designs, maps;

B. 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);

iv. Furniture: design documentation; and,

v. PID signs: accurate location along the Platforms.

(ii) Systems – Related:

A. Signals:

i. Accurate locations (along Tracks): signals, signs, other signaling elements.

B. TPSS:

i. Accurate locations.

(d) For clarity, the City shall be responsible for updating the simulator. DB Co shall only responsible for providing the required information, working collaboratively and in good faith.

(e) The requested information shall be provided nine months prior to the start of OC Transpo Operator Training.

(f) DB 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.

17.4 [REDACTED] Operational Training and Support Requirements

(a) DB Co shall provide the following **[REDACTED]** operational training and support requirements:

(i) Update and provision of all **[REDACTED]** training material to support a rail controller train-the trainer model including: instructor notes, interim quizzes and tests; classroom presentation materials; key exercises for standard and degraded modes of operation; student reading materials and theory; and pool of final examination materials and questions;

(ii) One standard 80-hour **[REDACTED]** controller training course for pool of new rail controllers / superintendents;

(iii) One 40 hour **[REDACTED]** controller Train-the-trainer course to qualify the City's instructors with the ability to deliver the training;

(iv) **[REDACTED]** oversight of the City's instructor's first 80-hour training class of new rail controllers;

(v) Two weeks of on-site **[REDACTED]** control room support during launch of Confederation Line East: Monday – Friday, 04:00 – 12:00 (AM peak), and,

(vi) Four weeks of on-site **[REDACTED]** control room support during launch of Confederation Line West: Monday – Friday, 04:00 – 12:00 (AM peak).

ARTICLE 18 REMAINING WORKS

(a) The following items, detailed elsewhere in this Schedule 15-2 – Design and Construction Requirements, shall be considered Remaining Works and the completion date of these items shall be permitted to follow Substantial Completion of the Confederation Line East Extension and Confederation Line West Extension, as applicable.

(i) The full completion of the Richmond Road Complete Streets work as outlined in Schedule 15-2, Part 2 – Civil and Guideway and Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements.

(ii) Landscaping work at Dominion Station, Iris Station and the reinstatement of the existing Transitway in the vicinity of Lincoln Field Station, as outlined Article 14 – Demolition, Removals and Disposal, of this Part 1 and in Schedule 15-2, Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements.

(iii) Work required for the implementation of the Tunney's Pasture Station design solution as outlined in Schedule 15-2, Part 4, Clause 3.1 (a).

(iv) The reinstatement/removal of the infrastructure required for the implementation of the Transitway detours as outlined in Schedule 15-2, Part 7, Clauses 3.6 through 3.15.

(v) The reconfiguration of the traffic lanes on OR174 after the removal of buses from the bus only lanes and the layout of the planned traffic lanes as outlined in Schedule 15-2, Part 2, Clause 6.19 (a).

ARTICLE 19 DESCRIPTION OF CONFEDERATION LINE WEST, CONFEDERATION LINE EAST AND HIGHWAY WORKS

19.1 Description of Confederation Line West Extension (West Works)

(a) The West Works shall involve completion of all components and systems necessary to independently run Revenue Vehicles between Tunney's Pasture Station to Baseline Station and Moodie Station, excluding Train Control and final Systems Integration. These works shall include, but not be limited to, all Guideway, Track, grading, drainage, Structures, landscaping, SWM, Utilities, geotechnical works, electrical works, environmental works, facilities, Traction Power, communications, corrosion control, OCS, signaling, LMSF, Tunnels, Tunnel ventilation, retaining walls and roadworks.

(b) As a minimum, West Works shall include all Works in respect of:

(i) Stations at the following locations:

A. Westboro Station;

B. Dominion Station;

C. Cleary Station;

D. New Orchard Station;

E. Lincoln Fields Station;

F. Queensview Station;

G. Pinecrest Station;

H. Bayshore Station;

I. Moodie Station;

J. Iris Station; and,

K. Baseline Station.

(ii) Structures at the following locations:

A. Goldenrod Bridge Structure at Tunney's Pasture;

B. U Approach – Depressed Guideway Parkway East Portal;

C. U Approach – Depressed Guideway Parkway West Portal;

D. SJAM Parkway at Churchill Avenue Pedestrian Overpass;

E. SJAM Parkway at Cleary Avenue Pedestrian Overpass;

F. U Approach - Depressed Guideway Connaught East Portal;

G. U Approach - Depressed Guideway Connaught West Portal;

H. Carling Avenue Bridge;

I. Pedestrian Bridge at **[REDACTED]**;

J. Lincoln Fields Split Structure;

K. Pedestrian Bridge at Queensview Station;

L. Holly Acres Bridge;

M. Iris Street Bridge;

N. Pinecrest Creek Culvert under Iris;

O. Pinecrest Creek Culvert under Alignment;

P. Roosevelt Pedestrian Bridge; and,

Q. Baseline Station Pedestrian Bridge.

(iii) Cut and cover tunnel elements at the following locations:

A. SJAM Parkway & Richmond Tunnel – New LRT tunnel that commences at east portal adjacent to Rochester Field and emerges at west portal located between Richmond Road and Lincoln Fields Station. The tunnel traverses underneath the SJAM, Richmond Road and Byron Linear Park with direct connection to two underground stations; Cleary and New Orchard Station. Approximate length 2,900m

B. Connaught Tunnel – New LRT tunnel that traverses under Connaught Avenue Approximate length 380m

C. HWY 417 E-NS Pinecrest Road Ramp Tunnel – New LRT tunnel that traverses under HWY 417 E-NS Pinecrest Road Ramp. Approximate length 100m

(iv) Roadwork:

A. Richmond Road – reconstruction of Richmond Road between Redwood Avenue and Edgeworth Avenue.

B. Realignment of the SJAM Parkway between Dominion Station and Cleary Avenue.

C. Reconfiguration of the Hwy 417/Pinecrest Road Interchange ramps including N-W, S-W and E-N/S.

(v) Storm Water Management:

A. Pinecrest Stormwater Management Facility

(vi) LMSF:

A. An LMSF for approximately 34 vehicles in 2023 on a site to be determined by the Moodie LRT EA currently underway.

19.2 Description of Confederation Line East Extension (East Works)

(a) The East Works shall involve completion of all components and systems necessary to independently run Revenue Vehicles between Blair Station and Trim Station, excluding Train Control and final Systems Integration. These works shall include, but not be limited to, all Guideway, Track, grading, drainage, Structures, landscaping, SWM, Utilities, geotechnical works, electrical works, environmental works, facilities, Traction Power, communications, corrosion control, OCS, signaling, retaining walls and roadworks.

(b) As a minimum, East Works shall include all Works in respect of:

(i) Stations at the following locations:

A. Montreal Road Station;

B. Jeanne d'Arc Station;

C. Orleans Boulevard Station;

D. Place d'Orléans Station;

E. Trim Road Station; and,

F. Protection for future stations Gloucester High School, Orléans Town Centre and Tenth Line Road.

(ii) Structures at the following locations:

A. Montreal Road Flyover;

B. Westbound OR174 Bridge over Montreal Road;

C. Montreal Road Station Bridge;

D. Eastbound OR174 Bridge over Montreal Road;

E. Greens Creek structure under OR 174; and,

F. Pedestrian Bridge at Trim Station.

(iii) Roadwork:

A. Widening of OR174 at Montreal Road to accommodate new Montreal Road Station structure in median;

B. Reconfiguration of OR 174/Montreal Road interchange ramps to accommodate widening;

C. Reconfiguration of westbound ramps at Jeanne d'Arc Boulevard to accommodate station entrance requirements;

D. Widening of the OR174 median from east of Blair Road to east of Montreal Road to accommodate median LRT as well as some localized median widening at some station locations;

E. Construction of new Trim Road/OR174 interchange including localized road reconfigurations to accommodate; and,

F. Culvert replacements/rehabilitations along OR174 and ramps.

19.3 Description of Highway Works

(a) Highway Works shall involve completion of the prescribed Highway Works at the prescribed locations below. Within the prescribed locations, these works shall include, but not be limited to, grading, drainage, Structures, landscaping, Utilities, geotechnical works, electrical works, environmental works, retaining walls, roadworks and signage.

(b) As a minimum, Highway Works shall all include:

(i) Construct retaining walls within the limits of the Highway 417 ROW where deemed necessary, and to facilitate the reconfigured ramps N-W, S-W and E-N/S at Pinecrest Road and the reconfigured Holly Acres N/S-W ramp.

(ii) Replace and/or install new Drainage features, as required along the reconfigured ramps N-W, S-W, and E-N/S at Pinecrest Road and the reconfigured Holly Acres N/S-W ramp.

(iii) Replacement of existing or new overhead sign structures, signage and required appurtenances, deemed necessary for the reconfigured ramp E-N/S at Pinecrest Road, the reconfigured Holly Acres N/S-W ramp, and any that are in conflict with the new Pedestrian Bridge at Queensview Station.

(iv) Replacement/and/or relocation of ramp light and illumination features and appurtenances, as required at the reconfigured ramps N-W, S-W and E-N/S at Pinecrest Road and the reconfigured Holly Acres N/S-W ramp.

(v) Replacement of required highway signage and roadside Safety equipment, as required.

(vi) Install new sidewalk and parapet wall on the west side of Moodie Drive including the sidewalk connections along the north and south approaches to the ramp terminals.

(vii) Structures at the following locations:

A. Highway 417 Westbound Off-Ramp at Pinecrest Road;

B. Highway 417 Westbound On-Ramp at Pinecrest Road;

C. Pinecrest Road Bridge;

D. Graham Creek south extension to facilitate Temporary Transitway detour if warranted by Transitway operation performance specifications;

E. Highway 417 S-W On-Ramp at Moodie Drive;

F. Moodie Drive Bridge over Highway 417;

G. Highway 417 N-W On-Ramp at Moodie Drive; and,

H. Overhead Sign Supports where required.