

**SCHEDULE 14****COMMISSIONING****1.1 Applicable Standards**

- (a) Project Co shall plan, schedule, coordinate and execute the Project Co Commissioning of the complete operating System Infrastructure. The System Infrastructure provided as part of the Works shall be in accordance with the standards set out in this Schedule 14.
- (b) Commissioning includes required work for LEED Certification at the MSF. Project Co shall be responsible for achieving all commissioning prerequisites and credits to achieve the LEED Certification of the MSF administration building and maintenance building.
- (c) Project Co shall comply with Good Industry Practice (Works) for Project Co Commissioning for all commissioning activities set out in this Schedule 14. Project Co shall provide all of the documentation to the City in accordance with the requirements of Schedule 10 - Review Procedure.

**1.2 Project Co Commissioning Coordinator**

- (a) Project Co shall appoint a commissioning coordinator (the “**Project Co Commissioning Coordinator**”) to perform the obligations of Project Co as set out in this Schedule 14.
- (b) The Project Co Commissioning Coordinator shall be an individual, company or agency having a minimum of 10 years experience in the design or commissioning of vehicles, systems, equipment and facilities of similar scope and complexity, shall be licensed or authorized by the Association of Professional Engineers of the Province of Ontario and shall be familiar with and knowledgeable about each of the standards set out in this Schedule 14.
- (c) The Project Co Commissioning Coordinator shall satisfy the requirements with respect to independence from the design or construction firms, as agreed by Project Co and the City 30 days prior to the start of the testing and commissioning activities.

**1.3 Project Co Commissioning Parameters**

- (a) Project Co shall be responsible for preparing and executing a commissioning plan/strategy required to successfully demonstrate the performance of the System Infrastructure in accordance with the Project Agreement. The scope of the testing and commissioning plan/strategy will include Trial Running of the System in segments and as a fully integrated System to the extent necessary to demonstrate the functional capability and safety of the System.

- (b) The testing and commissioning plan/strategy shall include, but not be limited to, the following:
- (i) Relationship to safety and security management and other related System safety and security requirements;
  - (ii) Resumes of key personnel involved detailing years of experience;
  - (iii) Organization chart of the testing and commissioning team and their discipline responsibilities;
  - (iv) Planned resources;
  - (v) Specific requirements for the City interfaces;
  - (vi) Testing regime and test documentation procedures; and
  - (vii) Scheduling of the testing and commissioning activities.
- (c) The testing and commissioning plan/strategy shall demonstrate how Project Co intends to validate and verify that the functional and technical requirements, Trial Running, performance criteria, quality and safety aspects of the system have been met or exceeded and that the overall OLRT System is fit for purpose.
- (d) The commissioning plan/strategy shall be developed and modified as required to address the evolution of the Project.
- (e) Project Co is solely responsible for all checking and verification activities relating to individual components, sub-systems, Vehicles, System, all associated equipment and facilities required prior to the formal testing and commissioning and acceptance testing programs necessary to demonstrate the fully integrated operation of the System Infrastructure to the satisfaction of Independent Certifier.
- (f) Project Co shall formally issue the test and commissioning plan/strategy 60 days in advance of the test and commissioning program. The test and commissioning plan/strategy shall undergo review and modification as the project progresses as agreed by the City and Project Co.
- (g) The test and commissioning plan/strategy shall permit the oversight and monitoring of testing and commissioning activities for the duration of the Project.
- (h) With the exception of the obligation to supply drivers and controllers for commissioning, the City accepts no responsibility for Project Co Commissioning. Each element of the System Infrastructure shall be, wherever possible, thoroughly tested and commissioned as standalone subsystems operating in simulated worst case environments prior to being placed into service. This shall be demonstrated at FAI, FAT or SAT, whichever is applicable.

- (i) Project Co shall prepare a test plan within six months of Financial Close. The test plan shall be subject to review and acceptance by the City, in accordance with Schedule 10 - Review Procedure.
- (j) In addition to the tests specified in Schedule 15-2, the City (and its representatives) shall have the right, when acting reasonably, to identify specific testing requirements that will require validation.
- (k) Project Co shall prepare individual test plans for each System test, and provide advance notice to the City 30 days prior to such testing. Individual test plans shall be subject to review and acceptance by the City, in accordance with Schedule 10 - Review Procedure.
- (l) The Project Co Commissioning Coordinator shall convene a meeting of the Commissioning Team to review the Project Co Commissioning plan/strategy, set commissioning parameters, designate the responsibilities of the various parties and establish the documentation requirements for each stage of the Works and the Project Co Commissioning.
- (m) Project Co shall create a schedule of commissioning activities (the “**Commissioning Schedule**”) and shall incorporate the Commissioning Schedule into the Works Schedule.
- (n) The Project Co Commissioning Coordinator shall submit monthly reports to the City in regards to progress of Project Co Commissioning.
- (o) Project Co is responsible for the supply, installation, start-up, testing, adjustment and cleaning of each item of the System provided as part of the Works. Where applicable, Project Co Commissioning shall be completed in accordance with the equipment vendor’s guidance.
- (p) Project Co in implementing the Project Co Commissioning plan/strategy shall verify that:
  - (i) the System Infrastructure have been installed and are operating in accordance with the requirements of this Project Agreement;
  - (ii) the System Infrastructure performance meets or exceeds the requirements of the Output Specifications and this Project Agreement;
  - (iii) training has been provided and meets or exceeds the requirements of this Project Agreement;
  - (iv) As-Built Drawings and operating and maintenance manuals have been provided in accordance with this Project Agreement;
  - (v) LEED commissioning documentation required for achieving the LEED Certification has been prepared and copied to the City; and

- (vi) LEED commissioning documentation for achieving the LEED Certification has been submitted per the requirements of LEED.
- (q) Project Co shall provide System Infrastructure orientation to the Ottawa Emergency Services, including; the Fire Departments, Paramedics, and Police pursuant to Schedule 15-2 Part 1 Article 26.

#### 1.4 Commissioning Team

- (a) The Commissioning Team (the “**Commissioning Team**”) shall be comprised of:
  - (i) a representative of Project Co including, where applicable, subcontractors;
  - (ii) a representative of the City;
  - (iii) the Project Co Commissioning Coordinator;
  - (iv) the Independent Certifier; and
  - (v) where applicable, representatives of the relevant Vehicle manufacturers and Equipment manufacturers.
- (b) Project Co and each of its Subcontractors shall assign, where applicable, individuals from each relevant trade to the Commissioning Team and shall ensure that representatives of the relevant Equipment manufacturers and testing agencies are present during the relevant Project Co Commissioning meetings.
- (c) Project Co shall provide all necessary labour, materials, equipment, testing apparatus and incidentals necessary to completely start-up, verify, performance test and commission each item System Infrastructure provided as part of the Works.
- (d) After Financial Close, the Commissioning Team shall, when applicable, meet monthly to review the progress of the Project Co Commissioning.

#### 1.5 Commissioning Procedures

- (a) Project Co shall ensure that all regulation and code references in the Reference Documents, in addition to the provisions of Schedule 15-4 – OLRT Regulatory Framework, have been fully complied with.
- (b) Project Co and the Project Co Commissioning Coordinator shall plan, prepare documentation and execute the Project Co Commissioning plan/strategy, process and procedures.
- (c) Project Co shall ensure that each of the requirements set out in this Schedule 14 and those identified in Schedule 15 are completed.
- (d) Training:

- (i) Project Co shall provide a training schedule and agenda for each training session to the City for acceptance in accordance with Schedule 10 - Review Procedure. Operational and maintenance training shall be provided for all System Infrastructure. A complete listing of all training programs that Project Co is responsible for is located in Schedule 15-2 Part 1 Article 26.
  - (ii) The Project Co Commissioning Coordinator or designated delegate shall attend a sample of every training session to ensure the agenda is maintained and that quality training is provided. One training session for each category shall be video recorded in digital format. The disks shall be submitted to the City and labelled accordingly.
  - (iii) Project Co's design consultants shall provide an overview of the System Infrastructure, including an explanation as to why types of systems and Equipment were selected, identification of the design intent and discussion of the operating procedures required to maintain the design intent. These sessions shall be video recorded in digital format.
  - (iv) A portion of the training sessions for Equipment shall be conducted at the location of the Equipment.
  - (v) A portion of the training sessions for the System shall be conducted at the System operating stations (workstations).
  - (vi) All training sessions shall be logged and personnel shall be recorded as receiving training. Further refreshers shall be scheduled in line with safety, quality and training requirements.
- (e) Integrated Revenue Service Availability Testing:
- (i) Trial Running Objectives
    - (A) Project Co shall conduct Trial Running when the integrated System has been tested and is essentially ready for Revenue Service Commencement. Trial Running will be the final step in confirming readiness for Revenue Service Commencement.
    - (B) The fundamental objective of Trial Running is to exercise the complete integrated System, including all subsystems, operating personnel and operating procedures, to confirm readiness for Revenue Service Commencement. This can be subdivided into the following key objectives:
      - (I) to familiarize the operating and maintenance staff with the operation of the integrated system and Standard Operating Procedures;

- (II) to exercise and validate the operating schedules and operational performance requirements; and
  - (III) to exercise and confirm the operating reliability of the subsystems simulated under various operating conditions (normal and emergency). The basic design requirements and safety and security requirements will have been verified through the testing and commissioning program prior to this stage of Trial Running.
- (ii) Scope of Trial Running
- (A) Project Co shall conduct the trial running for final acceptance which will be conducted for a period of 12 consecutive days following successful completion of testing and commissioning; verification by Project Co that there are no deficiencies to prevent safe running of the System; and verification that there are an adequate number of trained staff to operate the System. At the end of this exercise, the integrated system will be ready for Revenue Service Commencement.
  - (B) Trial Running shall be reviewed on a day by day basis by the Commissioning Team.
  - (C) The objective of this stage is to operate a full regular scheduled service on the full line using the peak and non-peak schedules for an extended period. Passengers will not be carried. The tests will include a variety of failure management scenarios that could reasonably be expected to occur in regular Revenue Service. The City will have the opportunity to review and approve the failure management scenarios that will be tested during Trial Running.
- (iii) Performance Criteria for Trial Running Acceptance
- (A) Project Co shall use the trial running period to collect operating data and evaluate system reliability, availability, and maintainability performance and to demonstrate that the process to collect, evaluate, and validate the operating data has been properly established. Using prescribed procedures, data on service deviations will be collected and assigned against the Vehicles and specific subsystems down to the LRU level. The database shall provide verification of system reliability to the LRU level. If the cumulative failure of any LRU exceeds 10% of the total LRU population, up to and including the completion of the Reliability Acceptance Test; Project Co shall redesign and replace the defective LRU's.
  - (B) Validation of the Trial Running acceptance shall be performed by the Independent Certifier.

- (C) The Trial Running of the System will demonstrate to the satisfaction of the Independent Certifier that the specified travel times, headways and operational performance requirements can be achieved.

## 1.6 Project Co Commissioning Submittals

- (a) Project Co shall prepare a design brief describing the System Infrastructure design and performance requirements, including the requirements of the Output Specifications prior to beginning the construction process.
- (b) Project Co shall prepare and submit to the City the Project Co Commissioning plan/strategy identified in this Schedule 14.
- (c) Project Co shall prepare and submit to the City test forms, verification forms and performance test forms for all equipment and systems. Test procedures should include but not be limited to the following:
- (i) Test objectives;
  - (ii) Required Safety methods and prerequisite training required;
  - (iii) Associated tests and pass/fail criteria;
  - (iv) Reference specifications /standards and supporting literature;
  - (v) Staffing required, including requirements from the City;
  - (vi) Test methods;
  - (vii) Test equipment, jigs and supporting systems required;
  - (viii) Test schedule;
  - (ix) Test location;
  - (x) Identification of professional personnel and resumes of those responsible for sign-off; and
  - (xi) Test results and recommendations.
- (d) Project Co shall prepare and submit to the City the performance testing and the commissioning progress management forms and the commissioning summary forms to be used for monthly reporting.
- (e) Project Co shall prepare and submit to the City a detailed Commissioning Schedule each item of System Infrastructure provided as part of the Works.

- (f) Project Co shall prepare and submit to the City detailed commissioning manuals for each item of System Infrastructure provided as part of the Works (the “**Commissioning Manuals**”).
- (g) All Commissioning Manuals shall include:
  - (i) name and logo as directed by the City;
  - (ii) name of the Project;
  - (iii) project number;
  - (iv) identification of each item of System Infrastructure commissioned;
  - (v) the date each item of System Infrastructure was commissioned;
  - (vi) the signature of the Project Co Commissioning Coordinator;
  - (vii) issue and date;
  - (viii) document version control; and
  - (ix) document amendments table.
- (h) All Commissioning Manuals shall include:
  - (i) test reports;
  - (ii) configuration control records;
  - (iii) equipment check sheets (start-up, verification and performance) for each item of the System Infrastructure provided as part of the Works; and
  - (iv) interim and final acceptance check sheets for each item of the System Infrastructure provided as part of the Works.
- (i) Project Co shall prepare and submit a system operation manuals in accordance with the requirements of Schedule 10 - Review Procedure.
- (j) Project Co shall prepare and submit a re-commissioning manual in accordance with the requirements of Schedule 10 - Review Procedure.
- (k) Project Co shall prepare and submit configuration control records in accordance with the requirements of Schedule 10 - Review Procedure.

### **1.7 Coordination with the City and the Independent Certifier**

- (a) The Project Co Commissioning Coordinator shall co-ordinate with the City and the Independent Certifier, throughout the Project Co Commissioning process.

- (b) This co-ordination shall include:
- (i) review of test, verification and performance test forms;
  - (ii) review of commissioning progress management forms and performance testing;
  - (iii) review of the Project Co Commissioning plan/strategy;
  - (iv) review of the Commissioning Schedule;
  - (v) sample witnessing of tests and performance testing;
  - (vi) review of the training curriculum and materials as outlined in Schedule 15-2 Part 1 Article 26 and scheduling;
  - (vii) review of the maintenance manuals;
  - (viii) sample witnessing of seasonal performance testing;
  - (ix) review of the commissioning reports;
  - (x) attend commissioning meetings; and
  - (xi) report to the City regarding the progress of commissioning.

### **1.8 Light Rail Systems and Vehicles to be Commissioned**

- (a) The Project Co Commissioning shall include the commissioning of all System and Vehicle items of the System Infrastructure provided as part of the Works including, but not limited to, the following:
- (i) Traction Power System;
  - (ii) Revenue Vehicles;
  - (iii) Non-Revenue Vehicles;
  - (iv) Train Control Systems;
  - (v) Communication system;
  - (vi) YCC/BCC and TSCC;
  - (vii) Corrosion control system;
  - (viii) Tracks; and
  - (ix) OCS.

**1.9 Guideway and Building Systems to be Commissioned**

- (a) The Project Co Commissioning shall include the commissioning of all Guideway and building system items of the System Infrastructure provided as part of the Works including, but not limited to, the following:
- (i) SCADA system;
  - (ii) Maintenance equipment systems;
  - (iii) Site development;
  - (iv) Building envelope;
  - (v) Elevators and escalators;
  - (vi) Fire protection systems;
  - (vii) Plumbing systems;
  - (viii) HVAC systems;
  - (ix) Building automation systems;
  - (x) Electrical systems;
  - (xi) Security and safety systems;
  - (xii) Communication systems (excluding radio system);
  - (xiii) CCTV;
  - (xiv) Interfaces with buildings connected to OLRT stations;
  - (xv) Passenger information systems; and
  - (xvi) Intrusion detection systems.