

Region of Waterloo  
Stage 1 Light Rail Transit Project

Maintenance & Rehabilitation Specifications  
Article 2  
Safety and Security Program

**Table of Contents**

2.1 Safety Representatives.....2-1

2.2 Safety and Security Management Plan .....2-2

2.3 System Safety Program Plan (SSPP) – Operations .....2-16

**ARTICLE 2 SAFETY AND SECURITY PROGRAM**

**2.1 Safety Representatives**

(a) Safety Coordinator – Region

- (i) The Region will designate a "Safety Coordinator" who will coordinate safety related matters with Project Co's Safety Manager. The Safety Coordinator shall also audit the status of LRT System activities, assist in the coordination of emergency preparedness plans and other procedures, and assist with Code compliance. The Safety Coordinator will audit the safety activities that are constructively integrated with the LRT System. The Safety Coordinator will coordinate the safety related activities within the Region to assist Project Co in the resolution of certain hazards. The Safety Coordinator's responsibility shall be to promote the safety of all persons (Project Co staff, subcontractors, Region staff, the public at large, etc.). The Safety Coordinator will audit Project Co's Work, but these audit activities do not relieve Project Co's responsibilities to ensure safety activities are integrated into all Project construction and test activities, pre-revenue testing and training, and revenue service.
- (ii) The Safety Coordinator will participate in the basic design review process. In this capacity, the Safety Coordinator will review Project Co's designs for system safety compliance, perform audits and assist in the identification of new or continuing hazards.
- (iii) The Safety Coordinator will participate in the performance Verification, Test, Acceptance and Commissioning (VTAC) process. In this capacity, the Safety Coordinator will review the System Verification and Demonstration Plan and witness testing related to safety to promote the elimination of hazards and to promote the goal that a safe LRT System operation is attained.
- (iv) The Safety Coordinator will participate on the Safety and Security Certification Review Team (SSCRT) to audit whether the Safety and Security Certification Process is proceeding in accordance with the Safety and Security Certification Plan and the safety verification and certification procedures.
- (v) The Safety Coordinator's activities will continue after the LRT System is in revenue service and include periodic review of safety problems encountered, assistance in resolution of such problems and establishment of corrective measures, including changes in design features, operating procedures and additional training as required.

(b) Safety Manager – Project Co

- (i) Project Co shall designate, at the highest levels of its organization, a Safety Manager with complete responsibility and authority over all aspects of the Project and LRT System safety throughout the Operations Term and Maintenance and Rehabilitation Term. The Safety Manager shall have absolute authority to order the cessation of construction and rail operations in the event of an unsafe condition is determined to exist. For greater clarity, should Project Co shall remain responsible for safety programs and procedures associated with its Maintenance and Rehabilitation efforts of the systems fixed facilities and vehicles should the Region opt to change the operations provider at the end of the 10 year initial Operations Term or any time thereafter in accordance with the Project

Agreement. Should this transition occur in accordance with Schedule 34 – Transition Out Procedure, the Region and Project Co shall cooperate to ensure that system operations are carried out in accordance with the Systems Safety Plan.

- (ii) The Safety Manager shall be designated by Project Co as the sole point of contact with the Region and with external agencies regarding safety related matters. The Safety Manager shall handle all safety inquiries and correspondence. This designated person shall be available during working and non-working hours to provide data and respond to inquiries and incidents as a result of construction activities, testing and pre-revenue service training, and revenue service operations.
- (iii) The Safety Manager will participate in the basic design review process. In this capacity, the Safety Manager will review Project Co's designs for system safety compliance, and identification of new or continuing hazards.
- (iv) The Safety Manager will participate in the performance Verification, Test, Acceptance and Commissioning (VTAC) process. In this capacity, the Safety Manager will oversee the System Verification and Demonstration Plan and witness testing related to safety to eliminate hazards and to ensure that a safe LRT System operation is attained.
- (v) The Safety Manager will participate on the Safety and Security Certification Review Team (SSCRT) to ensure that the Safety and Security Certification Process is proceeding in accordance with the Safety and Security Certification Plan and the safety verification and certification procedures.

## **2.2 Safety and Security Management Plan**

- (a) Project Co shall develop and implement a program to identify, evaluate, eliminate and mitigate hazards to the public, employees and facilities and equipment. The Program shall consist of a documented Safety and Security Management Plan (SSMP) which includes a management process for planning, identifying, eliminating and resolving hazards, a process for verification and certification prior to revenue service, and a system for timely investigation reporting and analysis of accidents and incidents during construction, during testing and pre-revenue service training, and during service of the LRT System. For greater clarity, the requirements noted in Section 2.2 and 2.3 of this Schedule 15-3, Article 2, apply only to the Design and Construction phase of the project.
- (b) Project Co shall develop the SSMP that incorporates all of the technical and management requirements of the Project Agreement. The SSMP shall comply with all OH&S Act & Regulations, Environment Canada, and shall include interfacing with Federal, Provincial, Region and local Emergency Medical Services (EMS), fire, police, and transportation departments, as well as regulatory and investigative agencies. Safety activities and responsibilities shall be defined for both the construction and pre-revenue operations phases of the Project Agreement.
- (c) The Plan shall be designed to be readily and routinely audited by Project Co, the Region or its representatives, as requested, as well as Federal, Provincial, Region, and local agencies involved in the Project. Project Co shall have complete responsibility for defining and implementing the specific requirements of the SSMP.
- (d) The SSMP shall include and address, at minimum, the following safety and security issues:
  - (i) Safety and security management commitment and philosophy

- A. The SSMP shall include and address the commitment of Project Co to safety, security, and emergency management begins at the planning and design phases and continues through construction, testing, and start-up phases for the LRT System.
- (ii) Assignment of safety and security responsibilities.
  - A. The Project Co shall assign qualified safety and security personnel who will be responsible for the development and implementation of the Safety and Security Management Plans. The SSMP shall identify each consultants, contractors and subcontractors who are tasked for implementing the Plan, in addition to the Project Co’s executive management, that is charged with the responsibility for overseeing the Construction Project safety and security implementation activities.
- (iii) Safety and Security Analysis
  - A. The qualitative safety and security analyses described herein shall be performed, documented, and furnished by Project Co. The Region shall be provided a copy for concurrence as part of the process of auditing Project Co’s efforts of incorporating adequate consideration of safety in the design process of the LRT System. The purpose of these analyses shall be to assess each system so visibility of relative safety and security risks is provided.
  - B. Safety Analysis
    - 1. Project Co shall perform a Hazard Analysis (HA) using the APTA Matrix for Hazard Risk Assessment. The HA shall be done in accordance with the FTA “Hazard Analysis Guidelines for Transit Projects” to provide an early assessment of the hazards associated with the concept and design of the Project. The following hazard analysis methods must be used to identify critical areas hazards and to consider hazardous components, interfaces, environmental constraints, as well as operating, maintenance, and emergency procedures:
      - I. Preliminary Hazard Analysis (PHA) provides an early assessment of the hazards associated with a design or concept. The PHA identifies critical areas, hazards and criteria being used, and considers hazardous components, interfaces, environmental constraints, as well as operating, maintenance, and emergency procedures. It may also be used on an operational system for the initial examination of the state of safety. The PHA is primarily used to perform an initial risk assessment and to develop safety-related requirements and specifications early in the design phase.
      - II. Failure Modes and Effects Analysis (FMEA) supports ongoing hazard analysis during final design and construction of Systems by identifying and analyzing possible failures so that appropriate actions are taken to eliminate, minimize, or control hazards. FMEA will provide information to evaluate identified hazards, identify safety critical areas, and alternatives to eliminate or control all

unacceptable and undesirable hazards, based on their combination of severity and probability of occurrence and to identify critical items.

III. Operating Hazard Analysis (OHA) identifies and analyzes interface hazards associated with personnel and procedures during commissioning, testing, training, operations, maintenance, and emergencies. The purpose of the OHA is to identify hazards that may result from human interaction with the systems and to identify the means by which those hazards can be eliminated, minimized, and/or controlled. The OHA shall serve as the primary means for identifying where cautions, warnings, special procedures, special instructions, specific training, or other special provisions or information may be needed by Project Co to maintain safe conditions.

IV. Hazard Resolution Precedence

The order of precedence for satisfying system safety requirements and resolving (eliminating or controlling) hazards will be as follows:

- Design for Minimum Risk: The primary safety effort during the design phase of a project will be an attempt to eliminate hazards through selection of design features (e.g., non-combustible, fail-safe, redundancy).
- Incorporate Safety Devices: Hazards which cannot be eliminated through design will be reduced to an acceptable level through the incorporation of appropriate safety devices.
- Provide Warning Devices: Where it is not possible to preclude the existence or occurrence of a hazard, devices will be installed for the timely detection of the hazard condition and the generation of an adequate warning signal.
- Develop Special Procedures and Training: Where it is not possible to reduce the magnitude of an existing or potential hazard through design or the use of safety and warning devices, special procedures will be developed (by Project Co, as required) to control the hazard.
- Conditionally Accept Remaining Residual Risks: Project Co Senior Management, with the concurrence from the Region, can conditionally accept the remaining risks for light rail operations based on the existing operations and maintenance procedures.

(e) Safety Technical Requirements for Systems Design

- (i) Safety shall be the primary design and performance requirement for the LRT System. The entire LRT System 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 LRT System elements fail or malfunction.

- (ii) The safety of the LRT System, when operating under normal conditions, shall preclude inadvertent/incorrect actions and/or procedures used by operating personnel. In no case shall procedures be substituted to accomplish any safety functions provided by specific aspects, components, subsystems and/or equipment. Frequent and/or infrequent use shall not be a reason to justify unsafe or marginally safe design. At all other times (when carrying out maintenance and/or failure recovery), there shall be minimum dependence on correctness of actions and/or procedures used by operating and maintenance personnel.
- (iii) Whenever any hazardous condition occurs, regardless of the cause, and the condition results in a conflicting concern between human safety and equipment safety; the conflict shall be resolved in favour of human safety.
- (iv) Project Co shall be responsible for designing, supplying, constructing, installing, testing and verifying and certifying the LRT System in accordance with the requirements of the Project Agreement and the safety principles customarily recognized by the transit industry for light rail systems. Project Co shall be responsible throughout the course of the Project Agreement for bringing to the attention of the Region, in writing, any change in Laws, rules, orders, Regulations and Codes, and any condition(s), whether caused by its design, any Project Agreement requirement, or any other basis, which it believes might result in, or has resulted in, an unsafe condition. Project Co shall remain fully responsible for rectifying any such condition.
- (v) Safety Principles
  - A. Two principles of safety, a Fail Safe Principle and a Checked Redundancy Principle, shall govern the design of safety critical components and subsystems where specifically referenced in the Project Agreement. One or both of these principles shall be used to provide a safe LRT System. These principles are defined as follows:
    - 1. 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. In applying the Fail Safe Principle, a failure of any element likely to occur more than once in  $10^6$  (one million) hours of active service in the Operating LRT System. For hardware this shall include, as a minimum, failure modes.
    - 2. Checked Redundancy Principle - The Checked Redundancy Principle applies to both safety critical hardware and software configurations, and states 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. 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.
  - B. 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.

- C. The following characteristics shall be incorporated into the checked redundancy design.
1. The checking process shall, in itself, be fail safe or checked redundant; "agreement" shall not be indicated unless the control units output agree.
  2. The checking process shall include the comparison of control units related to safety.
  3. Any failure of redundancy affecting the safety of the LRT System shall be detected. Where software is used; errors in programming shall be considered failures.
  4. 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:
    - Independent, different programming in the parallel control units.
    - The use of logically complemented programs for the parallel elements of functions involving the ATP subsystem.
  5. 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.
  6. Unless a comparative agreement occurs in the checking process, timely action shall intervene to provide safety.

(vi) Alternate Safety Principles

- A. Alternate safety principles to those stated in this Article will be permitted; provided they have been demonstrated through analysis, experience in service and a rigorous safety certification process to provide a level of safety equal to the stated principles. Alternate principles shall be in accordance with recognized North American, Canadian, European or International standards which is equal to or exceeds the Project Agreement requirements.

(vii) Safety-Critical Component/Equipment Failure List

- A. Project Co shall develop a preliminary Safety-Critical Component /Equipment Failure List. This list must include items typically used in railway type command and control systems. This list itemizes "failure modes" likely to occur more than once in one million ( $10^6$ ) hours. Not listed for each item are certain failure modes that occur so rarely they can be neglected in circuit design considerations; i.e., they occur less than once in one million ( $10^6$ ) hours. Relays certified as "vital" or

safety type shall have failure characteristics as defined by the Association of American Railroads (AAR).

- B. Project Co shall update and maintain this preliminary list, as necessary. Components with other modes of failure shall be identified and documented by Project Co. Components, identified by the Region or Project Co, used in a safety function, shall require appropriate failure mode documentation by Project Co. To gain approval for the use of such components, Project Co shall obtain a specific safety analysis, prior to the use of such components, from a recognized independent accredited agency with qualifications to perform such analysis acceptable to the Region.

(f) Security Analysis

(i) Threat and Vulnerability Assessment (TVA)

- A. Project Co shall conduct a comprehensive Threat and Vulnerability Assessment (TVA) to determine reasonable and appropriate evolving security trends, which need to be incorporated in the design of LRT System in order to enhance the protection of the new mass transit infrastructure and systems. Project Co may use the PHA it developed for the LRT System as a starting support platform for TVA. Subsequently, the work shall identify which hazard scenarios overlap with security threat scenarios and shall analyze if the safeguards against accidents/hazard scenarios are sufficient against the threat scenarios or additional security safeguards are needed to be implemented during design, construction, commissioning and operation of the light rail system.

(g) Security Technical Requirements for Design

- (i) This Article lists technical requirements related to providing for the security of passengers and property.

- (ii) The LRT System shall be designed, constructed, operated, and maintained to prevent, to the maximum extent possible, the occurrence of personal injury, property damage and loss, and service disruptions resulting from acts of crime, vandalism, or sabotage. The LRT System shall satisfy the following at a minimum:

A. Prevention - LRT System features to forestall such activity:

1. Remote visual and auditory surveillance of facilities.
2. Barriers to deter unauthorized intrusion to non public areas of the LRT System.
3. Protective covers to prevent damage or loss.
4. Vandal resistant materials.
5. Coordinated, coded lock access plan and system.

B. Detection - LRT System features to permit timely detection of criminal acts:

1. Intrusion detection alarms at equipment rooms, communication bungalows, substations, yard access/egress points, OMSF, CCF, and administration offices, and other restricted access areas.
  2. Passenger-activated alarms in vehicles.
  3. Emergency communications devices in each vehicle, stop, and along the trackway.
- C. Restoration - LRT System features to enable rapid responses to security problems and restoration of normal service:
1. Ease of access and user-friendly design for non-System emergency personnel.
  2. Emergency procedures training programs.
  3. Maintenance procedures that minimize repair-in-place time.
  4. Security training programs.
- (iii) Security equipment shall provide audio and visual information, and shall be located conspicuously with instructions for use. Security communications equipment shall be easy for passengers, including the persons with disabilities. Security installations shall be tamper resistant, with both wiring and equipment protected and monitored. Procedures and equipment shall be provided for periodic testing of security subsystems.
- (iv) Surveillance, Alarms, and Communications
- A. Communications devices shall be provided for rapid and effective coordination between Central Control and local emergency services.
- B. Intrusion alarms shall be provided to monitor security sensitive points, including times when the LRT System is not operating. Points where entry is restricted shall be safeguarded with intrusion detectors and alarms. (Restricted areas are areas where the public or unauthorized personnel are not permitted.) Intrusion alarms shall be routed to the CCF, where they shall result in an audible alarm requiring CCF acknowledgment, a visual alarm, and a record containing an index number, location of the intrusion, time and date of the report of the alarm and time and date of the acknowledgment. Alarm coding schemes and equipment proposals shall be submitted for review during Design Review. Selected alarms, such as fire and security, shall also have provisions to be transmitted to other sites for use by Region designated emergency services personnel.
1. Power Substations - Entrance to enclosures and rooms containing power distribution equipment shall be posted with warning signs, at a minimum, and meet applicable Codes and Standards.
  2. Wayside Facilities- Wayside enclosures shall be protected by tamper resistant covers. Electrical connections shall be vandal resistant, and in vandal resistant enclosures. Enclosures with safety critical equipment shall have intrusion alarms that sound locally and send signals to Central Control.

3. Power and Communications - Power supply, telephone communications, CCTV, and electronic security lines entering Central Control, at each power substations, and along the trackway shall be located unobtrusively and protected. Cables shall be in rigid steel conduit, or shall be suitably secured in cable trays.
  4. Trackway - Project Co shall identify any location where adjacent buildings, other structures, or roadways permit access to the ballasted track, so Project Co and the Region can coordinate any necessary barriers or other solutions with others.
- (v) Access Control Subsystem
- A. Project Co shall provide an access control subsystem to control personnel access to LRT System fixed facilities, particularly restricted areas. These areas shall include, but not be limited to: wayside equipment rooms, communication bungalows and enclosures, substations, track access/egress points, the OMSF, the CCF, and the administrative offices. The subsystem shall include mechanisms required to regulate access to these areas.
  - B. Project Co shall provide the capability of remote access control from the CCF for selected doors and gates, to permit quick access by emergency services personnel. The doors to be controlled in this manner, and the method used for remote control while retaining a high level of security, shall be included in the Access Control Plan.
  - C. As part of the System Security Plan, Project Co shall submit an Access Control Plan for review and approval. This plan shall include the design of the zone structure, the areas with locks, and the program to control distribution and loss of media.
- (h) Development of safety and security design criteria
- (i) Project Co shall prepare the safety and security design criteria at the commencement of the design effort to provide the safety and security guidelines needed to properly design, construct, test, and prepare for operations of LRT System. The design criteria will ensure that the safety and security elements identified for the Project will become part of requirements that must be will addressed by the Project Co through the development of specifications, drawings, design reviews, and final acceptance.
- (i) Safety and Security Certification
- (i) Project Co shall develop and implement a Safety and Security Certification Program to verify the inclusion of all safety and security items in the design, construction, testing, operation and maintenance of the LRT System. An independent Safety and Security Certification Review Team (SSCRT) will oversee the certification effort via inspections, audits and compliance assessments on behalf of Project Co.
  - (ii) Project Co shall prepare a Safety and Security Certification Plan (SSCP) that describes the safety and security certification process. The SSCP shall include roles, responsibilities, staffing, schedule and a description of the process, at a minimum.

Project Co's approved SSCP shall be submitted to the Region within one hundred twenty (120) calendar days after commencement of Phase 1.

- (iii) To be able to create a balanced management approach for the safety and security certification process and to identify the specific responsibilities for each member of Project Co's team, Project Co shall divide the Certifiable Elements List (CEL) in three (3) lists as following:
  - A. Certifiable Elements List A – LRT Main Line
  - B. Certifiable Elements List B – Operating, Maintenance and Storage Facility (OMSF)
  - C. Certifiable Elements List C – Light Rail Vehicle (LRV)
  - D. After all of the above project elements are certified, the SSCRT will prepare the Final Safety and Security Certificate for signature by the Region.
- (iv) The following steps, at a minimum, shall be included in the SSCP:
  - A. Design Criteria for Safety and Security Verification Process
    - 1. Project Co, using the safety and security design criteria, shall ensure system safety considerations are an active part of the design review process and system safety staff participates in the review, especially regarding safety input, review comments, failure mode and criticality assessments, assessments against design safety goals and criteria, trade-offs and recommendations, as appropriate. Project Co shall provide personnel cognizant of safety issues to support these reviews as necessary.
  - B. Certifiable Elements Lists (CEL)
    - 1. Project Co must develop the Certifiable Elements Lists (CEL) that include each certifiable element and sub-element (List A, List B and List C), and identify the person responsible and organization responsible for certification verification (Certifier). The Certifier is responsible for determining compliance with the defined requirements and concurrence of the design and construction of that element, and for presentation of the safety certificates to the SSCRT for acceptance. For each certifiable item, Project Co must attain and substantiate the basis from which to judge compliance with safety and security requirements; Project Co specifications, design criteria, applicable codes and industry standards that constitute that basis for certification.
  - C. Safety and Security Criteria Conformance Checklists
    - 1. The checklists, developed and issued by Project Co for each certifiable element, shall contain all of the required safety and security design criteria and specification requirements applicable to the LRT System and the Project Agreement. It shall be used to verify and certify that the safety and security design criteria have been incorporated in the design

and certify that all safety and security requirements in and by design are constructed and/or installed in accordance with the Project Agreement.

**D. Testing/Integration Testing**

1. As part of the Verification, Testing, Acceptance and Commissioning Plan, a formal Integrated System Verification and Certification Plan shall be developed by Project Co in conjunction and coordination with Region's Safety Coordinator, to verify the performance of all Work and required safety certification testing, including system integration testing has been incorporated and completed in accordance with the Project Agreement.
2. At a minimum, each of the identified safety requirements for a Certifiable Element shall be simulated and tested to verify and certify performance in normal modes and associated sequences and the failure modes and effects, as applicable. These tests shall demonstrate the safety requirements stated herein have been met. Should the safety testing identify any safety issue, they shall be listed in the safety test reports, indicating remediation and corrective action necessary. All remediation and corrective actions required by Project Co shall be completed within fourteen (14) calendar days. All remediation and corrective actions shall be completed prior to the completion of the Work and pre-revenue testing and training. Project Co shall audit all tasks.
3. Safety Testing Documentation - Safety testing shall be separately identified to allow recognition of safety tests. Project Co shall include a matrix in the Integrated System Verification and Certification Plan, addressing safety tests only, which shall receive the concurrence by signature of the responsible person as defined by Project Co's organization chart. The matrix shall identify safety parameters and/or other safety considerations and a cross-reference to the test procedure accomplishing the verification and certification. This matrix shall be kept current throughout the Project Agreement and shall include the identification of the test reports which confirm verification and certification of the safety requirements.
4. Notification - Project Co shall notify the Region thirty (30) calendar days prior to the start of any safety test. If any of the data indicate conditions which could potentially result in lack of proper safety or protection of operations; Project Co shall immediately indicate proposed remedies and/or corrective actions.
5. Scheduling - All safety tests shall be successfully completed by Project Co prior to system or equipment acceptance.
6. Safety Test Reports - Project Co shall ensure test reports which contain safety verifications and certifications shall receive the concurrence, by signature, of the responsible person, defined by Project Co's organization chart. Safety Test Reports must be attached to the Safety and Security Criteria Conformance Checklists for each Certifiable Element tested to demonstrate compliance.

E. Safety Training

1. Safety information on conformed methods and procedures necessary to maintain safe conditions shall be generated by Project Co and included in a Safety Training Program, to be provided by Project Co, for safety training consideration of construction, operations and maintenance personnel. At a minimum, each of the safety training requirements revealed by the FHA and OHA shall be included in the training program and associated documents.

F. Operational Readiness Verification

1. Safety and Security Certification Plan (SSCP) must include a formal verification and certification program developed by Project Co to certify all operating procedures, Rule Book, LRT training, operator training, equipment, emergency drills, and other important activities are performed on the Project. Upon completion of the Work and the pre-revenue testing and training, Project Co shall issue to the Region and to SSCRT signed and sealed Safety and Security Conformance Checklist for each Certifiable Element.

G. Safety Certification Report

1. A signed and sealed report shall be prepared by Project Co, prior to LRT System opening, attesting to the overall safety and security of the LRT System for public use. This shall include resolution to all non-conformance and hazards previously identified through Project Co's detailed Preliminary Hazard Analysis (PHA). Upon completion of the Work and pre-revenue testing and training, Project Co shall issue to the Region and the SSCRT a signed and sealed Certificate of Compliance.
2. The signed and sealed Safety Certification Report shall certify to the Region that the Work and LRT System have been designed and constructed in accordance with the Project Agreement safety requirements, and Project 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 LRT System either meets or exceeds all applicable Federal, Provincial, Region, and local Laws, Ordinances, rules, Regulations, Statutes, industry Codes, and other standards and requirements, whichever are the more stringent requirements.
3. As a basis for making this formal certification, Project Co shall carry out 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 Certification Report which shall be submitted to the Region.

(j) Safety during Construction and Testing

- (i) For the purpose of this Article the term ‘Constructor’, as defined in the Occupational Health and Safety Act, shall mean Project Co. Project Co shall ensure that provisions of all acts, regulations and by-laws pertaining to the duties, obligations and safe performance of the Work, in accordance with the obligations of the ‘Constructor’ as set out in the Occupational Health and Safety Act, are observed.
- (ii) At the discretion of Project Co’s Representative, the Constructor designation may be transferred to/from Project Co to other contractors at any time at no additional cost to the Region.
- (iii) Whether Project Co or other contractor is the Constructor, Project Co shall provide, in writing, the name of the Contractor’s representative who will be named on the ‘Notice of Project’ as the ‘Supervisor in charge of the Project’. The Contractor’s representative shall assume the duties of the Constructor and ensure that these responsibilities are fulfilled on the Site.
- (iv) Project Co shall identify and implement provisions for minimizing hazards to the construction personnel, public, utilities and equipment during the field construction and testing period. During the field construction phase, the prime concern shall be in protecting employees and the neighboring community from the effects and hazards of construction.
- (v) The Construction/Testing Safety Plan shall be submitted by Project Co for approval not later than thirty (30) calendar days after commencement of Phase 2. At a minimum, this Plan shall include and be coordinated with the all relevant Articles in the Project Agreement:
  - A. Providing sufficient manpower and plant to secure all work sites from unauthorized traffic and pedestrian access:
    - 1. Daily maintenance of barricades, etc. segregating pedestrian traffic from work areas.
    - 2. Daily maintenance barricades, etc. segregating vehicular traffic from work areas.
    - 3. Daily securing all of work and storage areas.
    - 4. Daily maintenance of entries and exits for all buildings, trailers, worker parking lots, Project Co employee parking, Sub-contractor trailer and parking, storage yards, etc.
    - 5. Providing a system for monitoring dust and noise. Project Co shall include in this system the means and methods to control dust and noise to the level prescribed by OH&S Act and Regulations, Federal, Provincial, Region and local Codes, Laws, Ordinances, Regulations, Statues, and other applicable regulatory agencies.
    - 6. Developing a traffic, pedestrian, cyclist, business access and event staging plans which effectively handles all traffic and conditions adjacent to and the through all field construction areas. This includes detours, lane closures, and other similar methods to ensure smooth flow.
    - 7. Maintaining access and providing assistance, as necessary, for all EMS, fire and police through the Work.

8. Conducting operations in coordination with affected utilities and Third Party's to prevent service disruption to subscribers.
  9. Designating a responsible and qualified person(s) to act as liaison with the community and with authority to take immediate corrective action to respond to valid complaints.
- (vi) In addition to safeguarding the community, this effort shall provide for the protection of authorized personnel assigned to, as well as those who must occasionally pass through, the Work Site. Personnel covered by these provisions shall include employees of consultants, Project Co, Subcontractors, Suppliers, Vendors, Third Party's, Utility workers and Federal, Provincial, Region and City employees.
- (vii) The following provisions shall be incorporated in the Field Construction and Testing Activities Safety Program:
- A. An indoctrination and safety evaluation program for all and any new employees during the duration of the Work and Project Agreement.
  - B. Quarterly Audits, at a minimum, Monthly Stand Down and Daily Tool Box Talks safety meetings with Project Co management, operational and maintenance staff, consultants, engineers, administrative office staff, superintendents, foremen, labor, subcontractors, suppliers, vendors, and other personnel, discussing job safety and providing a continuing safety education program.
  - C. A tracking system which monitors the status of safety on the Project, which shall:
    1. Provide a means for eliminating violations of OH&S Act & Regulations and other applicable Governmental Rules, including immediate corrective action to be taken and long-term procedures to be developed to prevent further occurrence.
    2. Monitor equipment and tools, means and methods, business access, cyclist, pedestrian and vehicular traffic control, etc. and provide for an ongoing inspection and corrective action program.
    3. Monitor work methods and encourage programs for recognition and awards of subcontractor and individual employee safety efforts and their contribution toward improved work methods and Zero Harm.
    4. Provide a system for notification of emergency agencies and the Region in the case of an accident.
    5. Provide for the control of the necessary safety equipment, including employee protective equipment, and emergency, fire fighting equipment, and police.
    6. Provide the Project with first aid stations and provide for staffing the work force with personnel experienced in first aid procedures and CPR.
    7. Coordinate with the Region's Safety Coordinator the Work and take the necessary steps to immediately implement any appropriate recommendations.
- (viii) For the testing phase prior to revenue service, the Safety Program shall provide normal safety constraints applying to application of power, vehicle motion and maintenance operations. Whenever such normal constraints are not provided, the Safety Program shall

specifically define which safety provisions are not provided and delineate a mechanism or procedures for ensuring safety.

- (ix) In addition, Project Co shall provide such additional measures as are necessary to restrict the movement of unauthorized traffic through the testing area.
- (k) **Operations and Maintenance Personnel Safety**
  - (i) The LRT System shall provide for the safety of maintenance and operations personnel working on the vehicles, on or near the tracks, in stations, at CCF, in power substations, in the OMSF or in the Administration Area. Activities necessary for the operation and maintenance of the LRT System shall be convenient, safe, and simple, to reduce possible hazards. Personal safety items and protective covers and/or screens for equipment shall be provided to protect personnel.
  - (ii) Support equipment, handbooks, manuals, and procedures shall be analyzed and evaluated to incorporate provisions to minimize hazards to personnel and equipment or property that could be generated by the use of the handbook, manual, or procedure in conjunction with related support equipment. This shall apply during construction and systems installation, testing, operations, and maintenance including training of LRT System operations and maintenance personnel.
  - (iii) The LRT System shall permit shutdown of portions of the LRT System for ordinary or emergency maintenance. Devices, such as disconnect switches and lockouts, shall be provided along the tracks, where necessary, to prevent accidental activation when shut down for maintenance. These devices shall be designed and installed for authorized personnel access only. There shall be similar provisions for LRT Stop maintenance activities requiring interface with the track.
  - (iv) The design of the OMSF and its furnishings and equipment shall consider the nature of activities required to service and store vehicles, assemble and separate trains, conduct pre-service testing, and make energized vehicle adjustments and/or repairs required for LRT System operations and maintenance. The applicable Building Code, OH&S Act & Regulations and other applicable Codes shall be followed. Operations and Maintenance hazards analyses shall be performed to identify potential unsafe conditions and activities during operations and maintenance of the LRT System. The OMSF and the CCF shall be provided with the required first aid equipment and measures for notification of local emergency services.
  - (v) Project Co's procedures for emergencies and emergency equipment shall be submitted to the Region.
- (l) **Non-User Safety**
  - (i) The LRT System and its elements shall not jeopardize the safety of non-users on and/or near the LRT System. Non-users shall be reasonably protected from:
    - A. System generated debris, fluid leaks, objects dropped from the vehicle or knocked from the trackway, or other by-products of normal operations, maintenance, and LRT System failures; and,
    - B. The acts of passengers, such as dropping projectiles from or on a vehicle.

- (ii) The LRT System shall prevent, to the maximum extent practicable, access to OMSF and substations by unauthorized personnel. The LRT System shall preclude ground level hazards. Warnings wherever potentially hazardous conditions exist shall be provided to pedestrians and motorists by signs or other devices.
- (iii) Means shall be provided to alert local emergency services personnel to protect people in structures and areas adjacent to the LRT System from fire or other hazardous conditions. Means shall also permit emergency operations for situations in or near the LRT System.

**2.3 System Safety Program Plan (SSPP) – Operations**

- (a) Project Co shall develop and implement a written System Safety Program Plan (SSPP) that must include a signed policy statement, a clear definition of the goals and objectives for the SSPP, an overview of the management structure, management responsibilities, implementation of the hazard management program and all of the processes for issuing or changing operating rules, procedures, inspection and maintenance programs affecting the safety of the transit system.
- (b) The SSPP shall define Project Co’s safety organization; safety activities and responsibilities for implementation; procedures for program documentation; and routine Project Co, Region and local EMS, fire and police department interface, along with a process for periodic external audits.
- (c) The content and level of detail shall be relevant to a modern light rail transit system. APTA’s Manual for the Development of Rail Transit System Safety Program Plans shall be used as a guide.
- (d) Project Co must submit the SSPP to the Region. The submission shall include a schedule for the periodic update of the SSPP.
- (e) The SSPP shall be oriented toward requirements to safely protect and transport the public and protect employees from operational hazards, such as derailments, collisions, fire and other emergency conditions.
- (f) The SSPP shall include a description of the process used Project Co to ensure that planned and scheduled internal safety reviews are performed to evaluate the system safety.
- (g) In addition to the items listed above, System Safety Program Plan (SSPP) that must include the following:
  - (i) Safety Procedures
    - A. Where the FMEA, OHA, or Hazard Resolution Precedence require analysis, indicates caution, warning signs, special procedures and/or other information needed to maintain safe operating condition, Project Co shall provide such information, in a format conforming to Federal, Provincial, Region and local as well as OH&S Act & Regulation guidelines and recommendations. Project Co shall incorporate safety procedures in appropriate manuals with appropriate labels for the affected equipment, to be applicable for corrective or preventive (planned) maintenance activities. Other relevant Codes and Specifications affecting safety, such as IEEE and NFPA, shall be observed and obeyed by Project Co.
  - (ii) Accident and Incident Investigation

- A. Project Co shall prepare and implement written procedures for the notification, reporting, investigation and follow-up analysis of any accident, near accident, and/or incident involving the public, patrons, employees, third party's, facilities and/or equipment.
  - B. Notification of Traffic and Passenger Accidents - Project Co shall immediately report any accident, near accident, and/or incident during the operations phase to the appropriate authorities, including the Federal, Provincial, Region and local EMS response agencies and/or firms. Project Co shall document the causes and impacts of any accident and/or incident in a standard format, and maintain the information in a secure, computerized database.
  - C. Notification of Occupational Accidents - Project Co shall immediately report any death and/or injury to any employee during the operations and maintenance phase of the Project Agreement to the appropriate authorities, including local emergency response agencies.
  - D. Investigation of Accidents - Project Co shall promptly investigate any accident, near accident, and/or incident to determine its cause(s), secure and maintain any evidence relevant for subsequent claims and/or litigation, and take the necessary action(s) to preclude a re-occurrence.
  - E. Filing of Reports - Project Co shall prepare all required reports and associated documentation to government agencies to report patron, employee and/or equipment related accidents or incidents, including the Federal, Provincial, Region, and local EMS, fire, police and transportation agencies.
  - F. Analysis of Corrective Actions - Project Co shall implement a process to identify the cause of any accident and/or incident to determine required design and/or procedural changes to prevent a re-occurrence.
  - G. Safety Trend Analysis - As part of the Operations Performance Reports, Project Co shall plot the trends of key safety indices, including lost work days, accidents, injuries, slips, trips, falls, deaths, workers' compensation claims, and other data as may be agreed with the Region.
- (iii) Substance Abuse Policy
- A. Project Co shall have a documented pre-employment and employment substance abuse and testing policy and comply with all aspects of applicable substance abuse Laws, Regulations and Statutes. Any violations of the policy and/or Laws, Regulations and Statutes shall be brought to the Region's immediate attention.
- (iv) Safety Audits
- A. The Region will audit Project Co's SSPP using its own staff or other Consultant staff. The Region shall give notice of any such appointment to Project Co. Project Co shall fully cooperate and respond to audit requests and/or corrective actions. The audits will continue throughout the operations period of the Project Agreement and include technical conferences, standard operating procedure reviews, emergency procedure reviews and witnessing vehicle operations at mutually agreeable times and places.

- (h) System Security Plan - Operations
  - (i) A prerequisite for the success of the LRT System will be a high level of actual security and user perception of security while riding the LRT System. Security and safety have been assigned high priorities; neither will be compromised. The goal will be a level of security for users, employees and property which will meet those both required by the Region as well as local and Federal, Provincial, and Region law enforcement agencies, as applicable.
  - (ii) A System Security Plan (SSP) will be prepared by Project Co and submitted to the Region not later than one hundred twenty (120) calendar days after the commencement of Phase 2.
  - (iii) The System Security Plan (SSP) must be developed and maintained as a separate document and may not be part of the Project Co's System Safety Program Plan (SSPP).
  - (iv) The Region may prohibit Project Co from publicly disclosing the System Security Plan (SSP).
  - (v) Security Committee (SC)
    - A. The SSP will be approved by a Security Committee (SC) based on an analysis of the security of the LRT System with an emphasis on user and employee security. The Committee shall also be concerned with the SSP addressing both the security of facilities and systems in the following areas:
      1. Evaluate potential crime and vandalism based on patterns experienced.
      2. Develop LRT System user security philosophy, guidelines and practices.
      3. Control LRT System operations from a security standpoint.
      4. Determine procedures for surveillance and communication within the LRT System.
      5. Establish interfaces with Grand River Transit Security operations, law enforcement agencies, and define the LRT System organizational elements, with their functions and responsibilities, for continued interface and coordination with the law enforcement agencies.
      6. Organize a public and media/community relations program to promote a positive attitude toward the LRT System.
      7. Assure Project Co properly coordinates security at fixed facility and vehicles.
      8. Define a training program for CCF staff to prepare them for handling security situations safely and expeditiously and in the best interests of the LRT System users.
      9. Periodically review security problems encountered and, when resolved, include corrective measures in operating procedures and/or design features.

B. Security Committee Organization

- (1.) The Security Committee will be composed of representatives from Project Co, the Region of Waterloo and appropriate law enforcement agencies. Project Co involvement shall continue for the duration of the Project Agreement.

C. Security Program Policies

- (1.) The following guidance is presented to aid the Security Committee in achieving its goal:
  - I. The LRT System, including stations, trackway, electrical power substations, and OMSF shall be designed and constructed to assure a high perception, as well as a real level, of user, employee, and fixed facility security.
  - II. This security shall be accomplished with a minimum of manpower by utilizing automatic electronic surveillance and communication means.
  - III. Primary LRT System surveillance of public LRT transit spaces (i.e. stops and trains) shall be performed from the GRT Transit Security Control Centre by the Region of Waterloo. Region personnel shall be responsible to fare enforcement and will be vested with the appropriate powers to do so.
  - IV. Project Co employees involved in security matters shall have access to CCTV security feeds at all LRT properties under surveillance, but will primarily be responsible for the surveillance and management of the OMSF, trackway, and power substations assets. Roving facility and asset security personnel shall be provided by Project Co.

D. Region Responsibilities

1. The Region shall be responsible for forming the Security Committee and monitoring the System Security Program. Responsibilities of the Security Committee shall include developing security philosophy, guidelines and practices, and monitoring, reviewing and evaluating facilities and surveillance and communication systems through participation in design reviews to ensure the effective and timely implementation of the Security Committee's program.

E. Project Co Responsibilities

1. Project Co shall be responsible for establishing a security program and preparing a System Security Plan (SSP). As part of this SSP, Project Co shall be responsible for the following:
  - I. Active participation of its organization, its Subcontractors and consultants in Security Committee meetings and documentation of the meeting minutes thereof. Active participation entails familiarity

- with transit industry security practices as related to the LRT System to enable effective and practical recommendations and critiques.
- II. Development and documentation of standard security operating rules and procedures consistent with the Security Committee's guidelines for application when the LRT System goes into revenue service.
  - III. Development and documentation of field operations phase procedures consistent with the Security Committee's guidelines.
  - IV. Implementation of Security Committee's guidelines in the detailed design of the surveillance and communication systems.
  - V. Preparation of progress and status reports.
- F. Third Party Coordination
- 1. Project Co and the Security Committee shall coordinate with the Region, City of Kitchener, City of Waterloo, Grand River Transit Security, and Third Party Utilities, as necessary. Each will be active participants in the Security Committee. Their participation will include input regarding the crime and vandalism problems relatable to the systems equipment, stations, trackway, substations, and OMSF and judgments on planning and design of these facilities to reduce the security risks.
- G. Security Plan Schedule
- 1. Activities comprising the Security Plan shall be scheduled to coordinate with the overall operation schedule and Project Co shall consider and address security issues vehicles and facilities.
- H. Program Audits
- 1. The Region reserves the right to conduct independent audits of Project Co's program to determine compliance with security considerations.
- I. Progress and Status Reports
- 1. Project Co shall report on security activity in its Monthly Progress Reports.
- J. Access Management and Control Plan
- 1. Project Co shall provide an Access Management and Control Plan which will be directed towards controlling access to restricted areas, both during the System's pre-revenue testing and training as well as revenue service. Project Co shall submit the Access Management and Control Plan to the Region for approval within one hundred twenty (120) calendar days after the commencement of Phase 1. This plan shall contain at a minimum the following:
    - I. A preliminary breakdown of the LRT System equipment and areas requiring secured access.
    - II. The structure for organizing the types and numbers of access-controlled locks to be used in the LRT System.

- III. Recommendations for access hardware, techniques, materials, special codes, etc.
  - IV. The methodology to enforce standardized access across all subcontractors to Project Co, material suppliers, vendors, maintenance, cleaning services, etc. at all tiers.
  - V. A control system for monitoring and controlling the issuance, and mastering of keys, cards, and other such access devices.
  - VI. A plan for changing locks, cards, etc., at the completion of field construction and testing.
2. Upon approval of the Access Management and Control Plan, Project Co shall maintain the lock, card, etc., control system, providing monthly reports of locks, cards and other devices issued to the Region for review and comment.
  3. Project Co shall also provide the necessary equipment to produce additional cards, keys, etc., as required. The maintenance information and special training for this equipment shall also be provided.
- K Wayside Intrusion Detection
1. In locations along the LRT corridor where there is a likelihood for vehicles and materials from the wayside intruding into the rail Right-of-Way and posing a hazard to train operations, an analysis shall be performed during Phase 1 in order to determine if a Wayside Intrusion Detection (WID) system shall be implemented for the LRT System. The analysis shall be submitted to the Region. The primary location for a WID is along the Huron Spur, however, the design and installation of a WID system is not part of the base scope of the Project Agreement.