Region of Waterloo
Stage 1 Light Rail Transit Project

Design and Construction Performance Output Specifications
Article 20
Fire Life Safety

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ARTICLE 20 FIRE LIFE SAFETY

20.1 General

(a) Scope

(i) This criteria covers fire protection requirements for surface transit systems including right of ways, LRT Stops, vehicle maintenance and storage areas; and for life safety from fire in LRT Stops, vehicles, and outdoor vehicle maintenance and storage areas. Transit LRT Stops shall pertain to LRT Stops accommodating only passengers and employees of the fixed trackway transit systems and incidental occupancies in the LRT Stops. This standard establishes minimum requirements for each of the identified subsystems.

(ii) Nothing in this standard is intended to prevent or discourage the use of new methods, materials, or devices. Project Co shall submit technical data to the authority having jurisdiction to demonstrate the new method, material, or device meets or exceeds the requirements of this Standard with respect to fire/life safety.

(iii) Safeguards during construction is outside the scope of this document.

(b) Purpose

(i) The purpose of this Section is to establish the minimum requirements for safety from fire and its related hazards.

(c) Characteristics of Fire Safety

(i) Fire safety on a fixed trackway transit system is achieved through a composite of facility design, operating equipment, hardware, procedures, and software subsystems integrated for the protection of life and property from the effects of fire. The level of fire safety desired for the whole system shall be achieved by integrating the required levels for each subsystem.

(d) Application

(i) These criteria shall apply to the Region of Waterloo Stage 1 Light Rail Transit System.

(ii) Any changes and/or revisions to the FLS Criteria shall not affect the design, construction, operations and maintenance of the System past final design unless deemed necessary for public safety by the FLSC.

(e) Abbreviations and Definitions

(i) The following is a list of abbreviations used within this Article:

AODA	Accessibility for Ontarians with Disabilities Act
AHJ	Authority Having Jurisdiction
ANSI	American National Standard Institute
ASTM	American Society of Testing and Materials

BLS	Blue Light Station
CSS	Central Supervising Station
CCF	Central Control Facility
CTS	Cable Transmission Subsystem
DTS	Data Transmission Subsystem
EPP	Emergency Preparedness Program/Plan
ETS	Emergency Trip Station
FACP	Fire Alarm Control Panel
FD	Fire Department
FLS	Fire/Life Safety
FLSC	Fire/Life Safety Committee
HVAC	Heating, Ventilating, and Air Conditioning
ICP	Incident Command Post
IEEE	Institute of Electrical and Electronics Engineers
NFPA	National Fire Protection Association
OESC	Ontario Electrical Safety Code
OBC	Ontario Building Code
PA	Public Address
Region	Region of Waterloo
TPSS	Traction Power Substation
UL	Underwriters' Laboratories

(ii) The following is a list of definitions and associated abbreviations used within this Article. Other definitions can be obtained from NFPA 130 and then OBC.

A. Ancillary Area/Ancillary Space - The non-public areas or spaces on the LRT Stop platforms usually used to house or contain operating, maintenance, or support equipment and functions.

B. Approved - acceptable to the "authority having jurisdiction."

C. Authority - The agency legally established and authorized to construct and operate a fixed trackway transit system.

D. Authority Having Jurisdiction (AHJ) - The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, and installation or a procedure. Note: The phrase "authority having jurisdiction" is used in a broad manner since jurisdictions and "approval" agencies vary as do their responsibilities. Where public safety is primary, the "authority having jurisdiction" may be a Federal, Provincial, Regional, local, and/or individual such as a fire chief, fire marshal, chief of fire prevention bureau, building official, or others having statutory authority. In many circumstances the property owner or his designated agent, such as the Fire/life Safety Committee (FLSC), assumes the role of the "authority having jurisdiction".

E. Blue Light Station (BLS) - A location along the trackway indicated by a blue light, where emergency service or Project Co. authorized personnel may communicate with the CCF and disconnects traction power by use of an Emergency Trip Switch (ETS).

F. Central Control Facility (CCF) - The operations center where Project Co controls and coordinates the systemwide movement of passengers and trains and maintains communication with its supervisory and operating personnel, and with participating agencies, when required. The CCF shall meet the requirements of an Operations Control Center defined in NFPA 130.

G. Communications - Radio, telephone, and messenger services throughout the System and particularly at the CCF.

H. Elevated Structure - All structures not otherwise defined as surface or underground structures.

I. Emergency Preparedness Program (EPP) - A plan developed by Project Co with the cooperation of all participating agencies detailing specific actions required by all those who responding during an emergency.

J. Emergency Trip Switch (ETS) - A device by which traction power may be removed from a designated segment of the trackway by authorized personnel. The device shall provide local mechanical lockout capability which preclude restoration of power until the mechanical lockout has been reset. The ETS is an integral part of a BLS.

K. Fire/Life Safety Committee (FLSC) - Established to facilitate the interchange of information, make evaluations and recommendations, and promulgate Fire/Life Safety Criteria. Permanent members include a representative of Project Co,

Region, City of Kitchener, and City of Waterloo and local EMS, fire departments and police.

L. Fixed Trackway Transit System (System) - An electrified transportation system utilizing a fixed trackway consisting of and operating on Right-of-Way for the mass movement of passengers within a metropolitan area and consisting of its fixed trackways, transit vehicles and other rolling stock, power system, buildings, maintenance facilities, LRT Stops, transit vehicle yard, and other stationary and movable apparatus, equipment, appurtenances, and structures.

M. Transit Vehicle (Car, LRV or Vehicle) - An electrically propelled passenger-carrying rail vehicle characterized by high acceleration and braking rates for frequent starts and stops, and fast passenger loading and unloading.

N. Trackway – The transit line contained within Right-of-Way fences, inside or outside of curbs and/or shoulders, cut or fills slopes, ditches, channels, waterways, and including all appertaining structures (traction power substations, communications and signaling buildings, incoming electrical service buildings, etc.)

O. Incident Commander - The person in command at the scene of an emergency providing supervision and coordination of all personnel, equipment and resources.

P. Incident Command Post - The location selected during an emergency, by the person in command, for controlling and coordinating the emergency operation.

Q. Incidental occupancies in LRT Stops - Refers to the use of the LRT Stop by others who are neither transit system employees nor passengers.

R. Labeled - Equipment and/or materials to which has been attached a label, symbol or other identifying mark of an organization acceptable to the “authority having jurisdiction” and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment and/or materials and by whose labeling the manufacturer indicates compliance with appropriate Codes and Standards and/or performance in a specified manner.

S. Listed - Equipment and/or materials included in a list published by an organization acceptable to the “authority having jurisdiction” and concerned with product evaluation, that maintains periodic inspection of production of listed equipment and/or materials and whose listing states either the equipment and/or material meets or exceeds the appropriate Codes and Standards and/or has been tested and found suitable for use in a specified manner. NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The “authority having jurisdiction” should utilize the system employed by the listing organization to identify a listed product.

T. Noncombustible - A material, in the form used and under the conditions anticipated, will not aid combustion or add appreciable heat to an ambient fire. Materials tested in accordance with ASTM E136, Standard Test Method for

Behavior of Materials in a Vertical Tube Furnace at 750ºC, and conforming to the criteria contained therein.

U. Point of Safety - An enclosed fire exit leading to a public way or safe location outside the structure, or at-grade point beyond any enclosing structure, or other area that affords adequate protection for passengers.

V. Power Station - A public electric utility plant for generating and supplying electrical energy to the rail system.

W. Traction Power Substation (TPSS) - A fixed facility within the rail system identified by an exterior blue light where electrical equipment is located for the specific purpose of receiving, converting, and/or transforming incoming alternating current (AC) to direct current (DC) for distribution of generated electrical energy to the rail system.

X. LRT Stop - A place designated for the purpose of loading and unloading passengers, including patron service areas and ancillary spaces.

Y. LRT Stop Platform - The area of a LRT Stop used primarily for loading and unloading transit vehicle passengers.

Z. System - See "Fixed Trackway Transit System."

AA. Trainway - The portion of the trackway in which the transit vehicles operate.

(f) Compliance

(i) The prime responsibility for implementation of the FLS Criteria lies with Project Co.

(ii) The Fire/Life Safety Committee (FLSC) shall be be formed by Project Co.

(ii) When the Authority Having Jurisdiction (AHJ) is not specifically identified, the FLSC shall be the AHJ.

(iii) The review process shall include and enable all Federal, Provincial, Regional, local and participating Emergency Medical Service (EMS), fire departments and/or police to exercise their responsibility and input into the FLS Criteria.

(iv) The Region and FLSC shall be advised when any deviation from FLS Criteria occurs in any design, specification, procedure and/or aspect of construction, operations and maintenance.

(g) Revision

(i) Revisions to the FLS Criteria shall be made periodically following review and recommendations of the FLSC via the established Document Control Procedure.

(ii) Project Co shall present to the Region and FLSC suggested revisions to the FLS Criteria, if changes in the System results in changing the conditions, assumptions or data upon which the original FLS Criteria were based.

(h) Codes and Standards

(i) The Fire Life Safety design shall comply with applicable governing local, provisional, and national codes. Additionally, the design shall comply with the latest edition of NFPA

130, Fixed Trackway Transit Systems and Passenger Rail Systems. If there are any conflicts, the OBC prevails for clarity unless explicitly specified.

(ii) All applicable Codes and Standards, including but not limited to, the following:

A. American National Standards Institute, Inc. (ANSI)

B. Accessibility for Ontarians with Disabilities Act (AODA)

C. American Society for Testing and Materials (ASTM)

D. Institute of Electrical and Electronic Engineers (IEEE) 383

E. Institute of Electrical and Electronic Engineers (IEEE) 484

F. Insulated Cable Engineers Assoc. (ICEA) S-19-81, with Amendment FR-1

G. National Building Code (NBC)

H. NFPA 110, Standard for Emergency and Standby Power Systems

I. NFPA 110A and NFPA 111, Standard on Stored Electrical Energy Emergency and Standby Power Systems

J. NFPA 130, Fixed Trackway Transit Systems and Passenger Rail Systems

K. Ontario Building Code (OBC)

L. Ontario Electrical Safety Code (OESC)

M. Ontario Ministry of Transportation (MTO)

N. Other NFPA National Fire Codes (as applicable)

O. All Federal, Provincial, Region, and local Codes, Laws, Ordinances, Standards, Statutes, etc. dealing with fire/life safety referred to the FLSC for adjudication.

P. Underwriters Laboratories, Inc. (UL) 44 and 83

Q. CAN-CSA B651-12 Accessibility.

R. CAN-CSA Z462 Workplace Electrical Safety

20.2 LRT Stop Facilities

(a) General

(i) Application

A. The LRT Stops will be at-grade LRT vehicle loading/unloading areas composed of open air shelters and platforms.

B. Project Co is responsible to design LRT Stops to be *an open air shelter (per OBC) and a shelter stop*, as defined in the annex A of NFPA 130. If this requirement cannot be met, Project Co. shall design the LRT Stops to meet the requirements for an open or enclosed station in NFPA 130.

LRT Stops shall conform to the requirements of the codes (including ordinances and Zoning By-Laws), regulations (including general rules and safety orders), and standards listed herein

C. This Article shall also be applicable to appurtenant facilities including traction power substations, gap-tie stations, train control and communication rooms, communication and signaling rooms, incoming electric service rooms or vaults, and emergency/standby generator rooms or enclosures along the trackway which adjoin LRT Stops.

(ii) Occupancy

A. The primary purpose of a LRT Stop is its use by transit patrons who normally stay in a LRT Stop structure for a period of time no longer than necessary to wait for and enter a departing transit vehicle, or to exit the LRT Stop after arriving on an incoming transit vehicle. In its entirety, it essentially functions to access and egress to transit vehicles. When contiguous commercial occupancies are in common with the LRT Stop, or where the LRT Stop is integrated into a building of non-transit occupancy, special considerations will be necessary beyond this section, and AHJ approval will be required.

B. A LRT Stop is also for the use of employees whose work assignments require their presence in the LRT Stop and/or platform or other structure or facility.

C. The LRT Stop public occupancy shall consist of all areas in which patrons may be allowed to enter, and shall include the full length of LRT Stop platform, stairways, ramps, and passageways required for emergency egress.

D. The LRT Stop ancillary occupancy shall consist of all spaces other than LRT Stop public occupancies.

(iii) Codes and Standards

A. The design of LRT Stops and/or platforms, their appurtenances and all other structures shall conform to the Access for Ontarians with Disabilities Act (AODA), and the more stringent of Federal Provincial, Region and local Code, Laws, Ordinances, rules, Regulations, Standards, and/or Statutes, etc except as specifically set forth in this section.

B. Where more than one adopted/applicable Code, Standard, or criterion is applicable, the most restrictive shall govern.

C. Unless specifically stated in applicable local regulations or ordinances, each Code and Standard shall be the latest edition or issue and the most recent revision, amendment, or supplement in effect at the date of completion of final design.

(b) Electrical Requirements

(i) Electrical equipment and wiring materials and installations within LRT Stops shall conform to the requirements of OESC and, other than for traction power, shall satisfy the following requirements:

A. Materials manufactured for use as conduits, raceways, ducts, boxes, cabinets, equipment enclosures, and their surface finish materials shall meet the OESC requirements.

B. All conductors shall be insulated. Ground wires may be bare. All thicknesses of insulation and all thicknesses of jackets shall conform to OESC.

C. Insulation shall conform to the OESC and be moisture and heat-resistant types, carrying temperature ratings corresponding to the conditions of application and in no case lower than 90°C.

D. Wire and cable construction used in operating vital train signal circuits and power circuits to lights, etc., shall pass the flame-propagating criteria of IEEE and have a minimum short circuit time of five minutes in the flame test of IEEE. Single conductor wires shall also meet the requirements of ICEA S-19-81. Such tests shall be performed with the wire and/or cables protected as they will be when installed.

E. All conductors, except radio antennas, shall be enclosed in their entirety in armour sheaths, conduits, or enclosed raceways, boxes and cabinets, except in traction power substations, auxiliary power substations, electrical equipment rooms, train control rooms, or communications rooms. Conductors shall not be installed exposed or surface-mounted in air plenums which may carry air at the elevated temperatures accompanying fire-emergency conditions.

F. Switches, electrical outlets, and lighting fixtures installed in areas where batteries are installed/ charged shall conform to OESC and/or more restrictive Federal, Provincial, Region and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc. for the type of construction.

G. Traction Power and Electrical Wiring and Cable – Shall comply with the applicable requirements of this Article and in accordance with the Contract.

(c) Means of Egress

(i) Occupancy and Occupant Load

A. If required, the occupant load for a transit LRT Stop shall be based on OBC.

(ii) Special Conditions and Design Considerations

A. Special consideration shall be given to LRT Stops servicing areas where events occur that establish occupant loads not included in normal passenger loads. These would include such areas as civic centers, sports complexes, and convention centers.

B. During special events, Project Co should implement measures to control access to the platform and/or the LRT Stop to a platform net area occupancy equivalent to a Level of Service C or better per person.

(iii) Number and Capacity of Exits

A. Exit capacities shall be calculated on the width at the clear and narrowest point.

B. There shall be sufficient means of egress to evacuate the LRT Stop occupant load from the platforms.

C. The LRT Stop shall also be designed to permit evacuation from the most remote point on the platform to a point of safety.

D. No point of the LRT Stop platform(s) shall be more than the more restrictive NFPA and Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc. from a point of safety.

E. In addition to the exits to obtain compliance means of ingress shall be provided from each trackway to the platform.

F. Stairs, landings and ramps shall conform to requirements of the OBC and CAN-CSA B651-12 Accessibility.

G. Vertical circulation elements shall be comprised of stairs and ramps

(d) Fire Protection

(i) Fire Sprinkler Systems

A. Sprinkler system is not required for LRT Stops.

B. Graphics identifying fire protection system zone locations will be provided in each valve room.

(ii) Standpipe and Fire Hydrants

A. If not already existent, a fire hydrant of the type approved by the local authority having jurisdiction shall be provided at each of the following locations:

1 Adjacent to a LRT Stop on an appropriate street corner.

2 Within 90 m of each location where the light rail guideway crosses over a traveled way or access road

B. An approved fire standpipe system shall be provided in passenger rail system trainways where physical factors prevent or impede access to the water supply or fire apparatus, where required by the authority having jurisdiction.

(iii) Emergency Access to LRT Stops

A. Access to LRT Stop and emergency egress locations shall meet the access route location requires of OBC section 3.2.5.5 and 3.2.5.6.

20.3 Trackway Facilities

(a) General

(i) Application

A. The trackway shall be considered “at-grade” where track is placed on grade without supporting structure or roof;

(b) Definitions

(i) Trackway Traction Power and Facility Wiring

A. Traction power elements associated with the trackway include overhead contact conductor and its appurtenances, and special warning and identification devices.

(ii) Overhead Traction Power

A. Overhead traction power conductor systems shall comply with project agreement and meet the following requirements:

1. Non-conducting material shall be used to isolate the overhead catenary from any grounded structure.

2. The requirement to disconnect traction power at Blue Light Stations shall be permitted by an approved alternative means.

(iii) Traction Power Isolation from the Utility

A. Isolation means shall be provided outside the traction power substation to enable the removal of the high voltage from the transit equipment.

(c) Signage

A. Warning signs shall be posted on entrances to the trackway (e.g., LRT Stop platforms, portals), on fences or barriers adjacent to the entrance, and at other locations where unauthorized, non-operating Project Co. employees may attempt to enter the trackway. The warning sign shall clearly state the hazard in letters, size, and colors as required by OBC, OESC, AODA, and Federal, Provincial, Region and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc. for the type of construction.

(d) At-Grade Trackways

(i) Construction Materials

A. If facilities such as train signaling equipment, communications equipment, or battery power supplies are incorporated into a traction power substation structure, occupancy separations shall be provided with the more restrictive Federal, Provincial, Region and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc. for the type of construction.

B. Traction Power and Electrical Wiring and Cable

1. Comply with the applicable requirements contain herein and with the more restrictive Federal, Provincial, Region and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc. for the type of construction.

(ii) Emergency Access

A. If security fences are provided, access gates shall be provided with the appropriate locking and controls. Access shall be provided in accordance with NFPA 130.

B. All gates shall have sufficient width for the safe entry and exit from the Right-of-Way for its intended purpose, maintenance and operation, and be of the hinged or sliding type.

C. Graphics shall be provided on, or adjacent to, each gate to identify the geographic location, track section, and traction power feeder zone. Warning signs, identifying the appropriate hazards, shall also be posted on the access to the fences and barriers.

D. Access to the trackway for emergency response personnel shall be provided where conditions such as landscaping, structures, or contiguous private property ownership hinder access. Special provisions will be provided as necessary.

E. Within the Right-of-Way, the maintenance vehicle access areas shall be suitable for use by emergency vehicles.

F. The system shall incorporate means for passengers to evacuate a train at any point along the trackway and reach a safe area.

G. The means of egress within the trainway shall be provided with an unobstructed clear width per NPFA 130 requirements.

H. Center walkways shall provide a minimum clear width. However, in no case shall appurtenances (catenary poles, light standards, manholes, pull boxes, etc.) reduce the to less than the minimum clear width.

(iv) Fire Protection Systems

A. Protective Signaling System - Smoke detection shall be provided in all ancillary rooms including TPSSs, C/S buildings, incoming electrical vaults, electrical rooms, elevator machine rooms and trash rooms.

B. Automatic Sprinkler System - Automatic sprinkler systems may be required in TPSSs, C/S buildings when located near adjacent buildings, railroads, freeway, freeway underpass, etc. Project Co shall determine whether Automatic Sprinkler Systems shall be incorporated to meet the more restrictive applicable Federal, Provincial, Region and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc. for the type of construction.

C. Automatic Sprinkler System - Automatic sprinkler systems shall be provided in all ancillary rooms.

D. An approved fire standpipe system shall be provided in passenger rail system trainways where physical factors prevent or impede access to the water supply or fire apparatus, where required by the authority having jurisdiction.

(v) Storage and/or Tail Track Areas

A. Storage and tail tracks, other than in the main yard and maintenance facility, shall provide a minimum spacing between the centerline of adjacent tracks for their safe operation and maintenance. Trains stored on the same track shall be separated by a minimum distance consider safe in accordance with the Contract provisions.

20.4 Vehicle Yard and Maintenance Facilities

(a) General

(i) Vehicle yard and maintenance facilities occupancies shall include any and/or all of the following: the vehicle maintenance facility, vehicle storage yards, yard train control and communication facilities, yard control tower, maintenance of way facility, component repair facility, operations personnel facility, gap tie station, traction power substations,

blowdown facility, paint shop, vehicle car wash facility, test track, test building, and occupancies ancillary to these facilities.

(ii) The vehicle yard and maintenance facility occupants are employees and/or contractors whose work assignment requires their presence in these facilities.

(iii) Facilities, such as the blowdown facility, car wash facility, and test building shall be given appropriate classification when contained in a separate structure. Where these facilities are integrated within major facilities, the classification will usually be that of the major facility.

(iv) Applicable OBC, NFPA 130 and NFPA 220 shall be incorporated into these facilities.

(b) Yard Facilities

(i) Fire Protection Water Supply and Distribution

A. An adequate, reliable water supply shall be provided for fire protection, including a sufficient number of properly located hydrants. These provisions shall comply with the OBC. Fire pumps, if required, shall be installed in accordance with NFPA 20.

(ii) Emergency Access/Egress

A. Emergency access approved by the FLSC shall be provided to system structures, trackway facilities, yards, and outside storage areas in accordance with appropriate local ordinances.

B. Access to any structure shall be from public streets or transit access roads.

C. Access to the inside perimeter of the vehicle yard and maintenance facility area, including yards, shall be by transit access roads.

D. Transit Access roads shall be a minimum all-weather paved width to accommodate the expected equipment, emergencies, events, incidents, snow removal, maintenance, operation, safety, etc. and widened at all turnouts for the expecting usage including emergency vehicles where pumping and/or aerial apparatus is expected to operate.

E. Minimum vertical clearance shall be four and one-half meters (4.5m) in height. Dead ends shall be no greater than required by Code and/or Standard with cul-de-sac or "T" turnaround provisions and the expected emergencies, usage, maintenance and operation. Transit access road pavement design shall provide for an all-weather hard surface roadway for all loading conditions.

F. Yard tracks shall allow a minimum clearance between the sides of adjacent transit vehicles. Prime consideration shall be given to providing a clear exit path to evacuate personnel in an emergency.

(iii) Fire Extinguisher

A. Portable fire extinguisher shall be provided, suitably housed and spaced in accordance with the more restrictive NFPA and Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc. the more restrictive local ordinances.

(iv) Alarm and Communication Systems

A. Blue Light Stations (BLS) shall be provided as follows:

1. Outside each wall where vehicles enter and leave building vehicle maintenance areas;

2. At ends of storage track arrays;

3. At trackways near normal and emergency entrances to the yard including test track areas; and

4. Throughout the maintenance yard and train storage areas to limit the travel distance to a BLS

B. The requirement to disconnect traction power shall be permitted by an approved alternative means.

(v) Oil Filled Transformers

A. Oil Filled Transformers shall conform to the following requirements:

1. Separation distances between oil-filled transformers and other structures shall be as shown in Exhibit 20.4-1.

2. Drainage for oil-filled transformers shall be provided under the transformers by means of a gravel-filled enclosure that includes a trench drain of sufficient capacity to hold 100% of the oil contents of the largest transformer. As an alternative, the transformers shall be located on a concrete slab, sloped away from the transformers and adjacent structures and toward a collection area. The collection area shall have sufficient capacity to hold 100% of the oil contents of the largest transformer.

3. The design capacity and containment shall consider the use of water and/or chemicals used during an incident or failure.

4. The use of less flammable transformer fluids may reduce or eliminate exposure protection requirements. Less flammable transformer fluids shall be UL listed or FM approved with a fire point of at least 300°C(572°F), and the convective and radiative heat release rates shall be known.

(c) Structures

(i) Structural Facilities

A. Structures shall conform to new Type I non-combustible fire-resistant material. Full automatic sprinkler protection shall be provided, where required.

1. A yard control facility for yard operations, if utilized, shall be constructed and separated in accordance with the CCF facility requirements.

2. Fire separations shall be provided and maintained to separate occupancies as required by the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

3. Emergency exiting for maintenance facilities shall be in accordance with the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

4. Emergency Lighting - Emergency lighting shall be provided for all exits within the maintenance facilities, in accordance with the more restrictive OESC, NFPA and Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

(ii) Drainage Systems

A. Where there is a potential for fire and/or explosion, drainage systems shall use non-combustible piping. Where piping is not enclosed, as direct a routing as possible to a safe outside location shall be provided per all applicable Codes

1. Oil separators, grease and sand traps shall be installed on all floor drainage systems which service the maintenance and vehicle storage areas to provide for the extraction of oil, grease, sand and other substances harmful or hazardous to the structure and/or public drainage systems. Where areas are protected by sprinkler systems, a bypass shall be provided around the separator and grease traps. Separators and grease traps shall be of approved design and of sufficient capacity to meet the level of waste discharged from the areas. The separator storage capacity shall be of sufficient size to retain all the sludge between cleanings.

2. Periodic maintenance checks, cleaning, flushing, obstruction removal, etc. shall be conducted on all drains, oil separators and grease traps to perform as designed. Any flammable liquids, greases, contaminated debris, etc. shall be removed to an area approved for disposal.

(iii) Floors

A. The surface of the grade floor of storage and/or maintenance areas shall be of non-combustible slip-resistant material.

(iv) Roofs

A. Roof deck coverings shall be tested in accordance with the more restrictive of NFPA 256, Class A or B, and Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc., and be UL listed.

(v) Electrical Requirements

A. The installation of electric wiring for structure light and power, and the installation of all electrical devices not supplying traction power shall be in accordance with the more restrictive of OESC; the ANSI; NFPA; and applicable Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

B. Traction power equipment shall meet the following requirements:

1. Overhead Conductors – Non-conducting material shall be used as a runway on which to mount overhead feed trolley wires. Overhead trolley power installations shall have a minimum height as required to keep a separation

of three and one-half meters (3.5 metres) for isolation of the power lines from shop and storage activity. Vehicle roof top activity shall provide portable cord connectors with insulated plugs and similar safety features.

2. Emergency Power Shutoff - All traction power circuits shall have emergency power shutoff devices or means in accessible locations.

(vi) Maintenance Pit Areas

A. Where flammable/combustible liquids and/or hazardous materials are used in pit areas and associated below floor level areas, such areas shall be designed to meet the more restrictive of Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc., OESC provisions and NFPA requirements.

B. Walls, floors, and piers shall be of reinforced concrete.

C. Pits shall have at a minimum of at least 2 exits. Steps shall be non-combustible fire-resistive and constructed with no free space underneath.

(vii) Overhead Cranes

A. Overhead cranes installed in the maintenance area shall adhere to the standard for cranes, and monorails as required by OESC and the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

(viii) Ventilation

A. In all pit areas where undercar maintenance generate vapors of a combustible nature (e.g., blowdowns of transit vehicles), a positive mechanical exhaust ventilation system shall be provided capable of ten air changes per hour or 1 cfm/ft2 of pit floor area, whichever is greater, during normal operation and designed to discharge to the outside atmosphere.

B. When a mechanical ventilating system is employed in a shop maintenance area, the ventilating system shall be designed and installed in accordance with NFPA 90A. When a blower and exhaust system are installed for vapor removal; the systems shall be designed and installed in accordance with NFPA 91.

C. Battery charge areas shall be ventilated to the outside atmosphere to maintain the maximum hydrogen/air mixture generated during charging below the lower explosive limits. In addition, mechanical ventilation systems shall be installed in accordance with NFPA 91, Blowers and Exhaust Systems, as required. Battery exhaust ventilation system shall be provided with electrical power and air-flow interlocks; to prevent the operation of the battery charger if the ventilation fan motor is not energized; and/or the air velocity in the exhaust duct is less than the designed velocity. The entire electrical system shall be in accordance with OESC and NFPA.

D. Large building open areas will require a means for smoke and heat venting.

E. Permanent draft stops in sprinklered buildings shall be installed in structures having a height of over 7.62 metres (25') to top of roof trusses. Draft stops shall

be constructed of rigidly supported non-combustible fire-resistive material. (Comply with the more restrictive of NFPA 204 and Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.)

(d) Fire Protection Systems

(i) Sprinkler Systems

A. Sprinkler systems shall be installed in all areas of enclosed structures required by NFPA 13 and the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

B. Electronic maintenance and control areas shall have an automatic sprinkler system or other approved special extinguishing system in accordance with NFPA and local standards, dealing with fire/life safety, which are referred to the FLSC for adjudication.

C. Train signalling and communication rooms shall be protected with a clean agent fire extinguishing system per NFPA 2001.

Sprinkler systems for storage areas where racks, shelves or other storage devices shall comply with NFPA 231, NFPA 231C and the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc., as appropriate.

(ii) Protective Signalling Systems

A. Automatic Fire Detection Systems conforming to NFPA 72 shall be installed in traction power rooms and train control rooms in each facility structure except where normally charged automatic sprinklers are installed or where required for control of ventilation equipment.

B. Water flow alarm and section control valve supervision shall be provided for automatic sprinkler connections. Fire pumps shall be supervised in accordance with NFPA 20.

C. The fire alarm system shall provide means to supervise and trip special extinguishing systems and to control ventilation equipment per the appropriate NFPA standards and the more restrictive of Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

D. A fire alarm control panel shall be provided in each principal building or building group and include a fire management panel provided near the point of emergency access to each principal building or building group consisting of an annunciator panel from the associated fire alarm control panel.

E. The fire alarm system shall be electrically supervised and operated on low voltage with local source stand-by power (Reference: NFPA 72). The fire alarm system shall alarm at each separated principal facility of alarm origin and at a central supervising station.

F. A supervised public address system, zoned by building, shall be used for fire alarm annunciation in principal maintenance facilities buildings. Small separated buildings may be included in the zone of a nearby principal building. Emergency

messages shall be preceded by an audible tone. Audible fire alarms shall be provided to alert personnel throughout the yard and outside storage areas.

(iii) Standpipe Systems

A. A Class III wet standpipe (including fire hoses) shall be provided in all areas of major repair, service, and inspection shops. The standpipe shall comply with NPFA 14 and Division B Sentence 3.2.5.15(1) of the OBC in accordance with the OFC.

B. The spacing of standpipes in large open areas of the vehicle maintenance facility shall require special design consideration to obtain hose stream access around, under and within vehicles.

(iv) Portable Fire Extinguishers

A. Portable fire extinguishers shall be provided in accordance with NFPA 10 and OBC.

(e) Operations and Maintenance

(i) Vehicle Placement

A. Transit vehicles shall be placed to allow the minimum clearance acceptable for the safety and maintenance of all personnel for any vehicles placed parallel and between any two uncoupled vehicles. A clear exit path to evacuate personnel from the structure in an emergency shall be maintained in accordance with the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc

(ii) Vehicle Maintenance

A. Vehicle electrical systems, including battery circuits, shall be de-energized except in those cases where an energized circuit is necessary to accomplish the required maintenance.

B. Transit vehicle batteries shall be disconnected or removed during maintenance operations which require the de-energizing of all electrical circuits.

1. Exception: Batteries need not be disconnected or removed when the vehicle is equipped with a battery cutout switch which fully isolates the battery and is physically located immediately adjacent to the battery.

2. When moving batteries, including removal and replacement, precautions shall be taken to prevent short circuits which may result in fires or explosions.

3. Batteries shall be charged at a rate (amperage and length of charge) that will not produce a dangerous concentration of hydrogen or excessive heat. In addition, the following safety practices shall be followed:

I. Access to battery rooms shall be limited to authorized personnel only.

II. Smoking shall be prohibited and open flames, sparks, arcs and other sources of ignition shall be kept away from the immediate vicinity of

batteries which are being charged. Appropriate warning signs shall be prominently displayed.

III. Precautions shall be observed while working near battery terminals. Wrenches and other hand tools shall be used carefully to avoid short circuits.

IV. Brushes used to clean batteries shall have neither a metal frame nor wire bristles.

(iii) Painting/Cleaning/Paint Removal

A. In selecting materials for cleaning and paint removal purposes, non-flammable materials shall be specified whenever possible. The use of flammable or combustible cleaning agents shall be in accordance with NFPA 30 and the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

B. Painting and/or cleaning shall be performed at a location chosen providing ventilation, ease of cleanup and convenience.

C. Where major cleaning, painting and paint removal operations are being conducted, no concurrent potentially hazardous operations shall be conducted within 15.24 metres (50') of the area being worked on. Operation and facilities shall conform to NFPA 30 and 33 and local codes.

D. The use of heat lamps to accelerate the drying of painted surfaces shall be prohibited unless used as part of an approved drying booth or enclosure in accordance with NFPA 33 and local codes.

E. When cleaning or paint removal agents are applied through spray nozzles under pressure, the nozzle shall be of the self-closing type so that, when the hand of the operator is removed, the nozzle will automatically close.

F. For touch-up operations, any ignition sources within the areas being worked shall be eliminated; such areas shall be maintained hazard free during the work period.

(iv) Storage of Painting/Cleaning Liquids

A. Storage of painting/cleaning liquids shall be in accordance with the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

(v) Welding

A. All welding operations performed on component transit vehicle parts on the transit vehicle shall be in accordance with NFPA 50, 51, and 51B and more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

B. Welding shall not be done in an area which contains fuel, other flammable, combustible liquids, or vapors. No other work shall be permitted within a fifteen meter (15m) radius of the location of any gas shielded arc welding operation,

unless vented and enclosed in an approved manner to prohibit flammable and combustible vapors from entering the work area.

C. Welding equipment shall have no electrical components other than flexible lead cables within the applicable distance to the floor in accordance with the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

D. Only qualified welders, trained in the techniques and familiar with the hazards involved, shall be permitted to do this work.

(vi) Industrial Trucks

A. Industrial trucks shall mean fork trucks, tractors, platform lift trucks and other specialized industrial trucks, their operation, and usage in accordance with NFPA 505, ANSI B.56.1 Safety Standard for Low-Lift and High-Lift Trucks

(vii) Fuel Handling

A. The storage and handling of liquefied petroleum gas (LP-Gas) shall be in accordance with the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

B. The storage and handling of liquid fuels (gasoline and diesel) shall be in accordance with the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

(viii) Service Stations

A. Service station facilities for road or hi-rail vehicles shall conform to the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

(ix) Other Requirements

A. Provision shall be made for the removal of all flammable/combustible liquids and greases to an area approved for disposal or storage.

B. Pits and subfloor work areas shall be kept clean. Smoking shall be prohibited in pits and subfloor maintenance areas.

Exhibit 20.4-1
OIL-FILLED TRANSFORMER
SEPARATION REQUIREMENTS

Structure Type	Distance (meters)	
	<100 MVa	=>100 MVa
Non-System Structures of Wood Construction	30	30
Passenger LRT Stop and Shelter Stop Public Areas	15	23
Transformers and Structures o Noncombustible Construction	8	15

C. When separation distances cannot be maintained by applicable code, one of the following mitigating measures shall be provided:

1. Water spray protection, meeting the requirements of NFPA 15, for transformers and wire glass in all openings of non-combustible construction when located within eight meters (8m) of transformers of less than 100 MVa capacity or within fifteen meters (15m) of transformers of 100 MVa or greater capacity.

2. Three-sided masonry (2 hour) enclosure with non-combustible fire-resistive roof materials for each transformer of less than 100 MVa capacity within eight meters (8m) of exposed non-combustible walls and for larger capacity transformer within fifteen meters (15m) of non-combustible fire-resistive walls.

20.5 System Fire/Life Safety Procedures

(a) Emergency Procedures Objective

(i) Project Co shall anticipate and plan for emergency situations through development of emergency procedures. These procedures shall be contained in an Emergency Preparedness Program (EPP).

(ii) Emergency Procedures shall meet the requirements of NFPA 130, Chapter 9.

(b) Emergencies

(i) Types of Emergencies

A. As a minimum the following types of emergencies shall be addressed in the EPP:

1. Fire and/or smoke on a train or any other part of the System.

2. Fire and/or smoke adjoining or adjacent to the System that threatens the system or disrupts service.

3. Collision and/or derailment involving one or more cars

4. Loss of electric power resulting in a stalled train(s) and/or loss of illumination.

5. Evacuation of passengers from a train under adverse conditions.

6. Panic of passengers.

7. Disabled and/or stalled trains under adverse conditions.

8. Serious flooding.

9. Structural collapse and/or threat of imminent collapse that threatens the System.

10. Seepage of flammable, toxic or irritating products into System.

11. Serious vandalism or other criminal acts.

12. Emergency medical attention required by passengers.

13. Extreme weather conditions causing disruption of service.
14. Gas in a underpass .
15. Gas in a LRT Stop ancillary room.
16. Derailment of any CN railroad freight, GO and/or Via.
17. Grand River Transit emergency.

(c) Emergency Preparedness Program (EPP)

(i) The EPP shall, include but not be limited to, the following:

A. Date adopted, reviewed and revised.

B. Statements of policy, purpose, scope and definitions.

C. Identification of participating agencies, top officials, and signatures of executives signing for each agency.

D. Safety procedures during emergency operations.

E. Purpose and operation of the Operation Control Center in an emergency.

F. Detailed locations, requirements, purpose, and operation of Command Posts and/or Auxiliary Command Posts.

G. The requirements, purpose, and operation of radio and telephone communications at the Operation Control Center, at all LRT Stops and access points to facilities, and intermediate points throughout the System.

H. Emergency procedures for postulated incidents with identification of agency in command.

I. Up to date maps and As-Built Plans, data, MSDS, etc. of complex areas of the System such as CCF, under passes, and graphics at LRT Stops.

J. Any additional information and data, deemed necessary by FLSC.

(ii) Project Co shall develop three levels of incident related procedure plans designed to provide an appropriate level of action based on the degree of emergency. The emergency plans shall address regional major disaster conditions which may affect other areas besides the system; systemwide major incidents which will affect systemwide operations; and emergencies, such as small fires or passenger illnesses, which will not affect the systemwide operations and may or may not affect individual train operation.

(d) Participating Agencies

(i) Participating agencies shall be summoned by Project Co to, coordinate, cooperate, and assist, depending upon the nature of an emergency and include:

A. Region of Waterloo

B. City of Kitchener

C. City of Waterloo

D. Fire departments.

E. Emergency medical service.

F. Police departments.

G. Utility companies: communication, gas, electricity, telephone, water.

H. Public works: bridges, streets, and storm sewers.

I. Building department.

J. Coroner's Office.

K. CN and other railroads

(e) Central Control Facility (CCF)

(i) Project Co shall staff CCF for the operation, supervision and maintenance of the System.

(ii) Standards of Operation

A. The CCF shall be staffed by trained, qualified personnel, utilize the essential apparatus and equipment to communicate with, supervise, and coordinate all personnel and trains operating in the System, and movement of passengers in trains, Right-of-Way, and LRT Stops.

B. CCF personnel shall be thoroughly conversant with the Emergency Preparedness Program and trained to employ it effectively, whenever required.

(iii) Emergency Communication Procedures

A. Procedures shall be developed for CCF to communicate rapidly with participating agencies, such as EMS, fire and police, utilizing direct telephone lines used for emergencies involving the system.

B. Details shall be developed defining equipment availability and procedures for recording radio and telephone communications during an emergency.

C. Should the CCF be out of service or unable to fully execute its functions, the following capabilities shall remain:

1. Train operations shall continue, although in a degraded state, if necessary;

(iv) Protection from Fire

A. Procedures shall be developed to maintain CCF operations in the event of fire or other emergency in adjoining or adjacent structures.

B. Procedures shall be developed to minimize detection and extinguishment times for any fire in the CCF by effective utilization of fire detection, protection, and extinguishing equipment.

(f) Liaison

(i) Emergency Liaison Personnel

A. An up-to-date listing of all emergency liaison personnel from participating agencies shall be maintained by Project Co and be part of the EPP.

B. The listing shall include the full name, title, agency, business telephone number(s), and home telephone number of the liaison person and alternate.

C. The list shall be reviewed and confirmed at least once every 3 months to ensure ability to contact the liaison person without delay.

(g) Incident Command Post (ICP)

(i) During an emergency on the System, an Incident Command Post (ICP) shall be established by the person in command for the supervision and coordination of all personnel, equipment and resources at the scene of the emergency.

(ii) Appointment of Supervising Party - The EPP shall clearly delineate the operating authority organization or participating agency in command and the individuals within each organization responsible for supervision, correction, or alleviation of the emergency.

(iii) Appointment of Liaison Person - Participating agencies should assign a liaison person to the ICP, when appropriate.

(iv) Location of Incident Command Post - The ICP shall be at a site convenient for responding personnel, easily identifiable, suitable for supervising, coordinating and communicating with participating agencies, as requested by the incident commander.

(vi) Communication Between Agencies - The most effective use shall be made of specified radio channels and telephones to communicate with participating agencies operating at an emergency.

(h) Removing and Restoring Traction Power

(i) The EPP shall have a clearly defined procedure for removing and restoring traction power.

A. Prior to any Project Co. staff, participating agency, and /or Third Party personnel operating on the trackway, consideration shall be given to the removal of traction power. Verification procedures for removal shall be established.

B. When traction power is removed by activation of an emergency traction power disconnect switch (ETS), CCF shall be contacted by telephone and/or radio to give the full name, title, affiliation, i.e. Project Co. staff, agency, Third Party, etc., and reason for removal by person responsible.

C. When shutdown of traction power is no longer required by Project Co, participating agency, and/or Third Party; control of such power shall be returned to Project Co. Procedures for transfer of such control shall be established.

D. During an emergency, Project Co and participating agency(s) personnel shall be carefully supervised so only the minimum number of essential persons operate on the trackway.

20.6 Communications

(a) General

(i) Comprehensive and dependable communications shall be essential for a serviceable and efficient operated fixed trackway transit system during emergencies.

(b) CCF Communications

(i) To provide the fundamental emergency coordination for all rail transit facilities the CCF shall be equipped to:

A. Receive, log, and annunciate fire alarm, trouble alarm and supervisory alarm;

B. Receive, record, and log emergency telephone messages;

C. Have direct multi-channel radio communication with rail vehicles

D. Have access to appropriate fire and emergency organization radio channels;

E. Have direct line telephone communication with each fire jurisdiction dispatch facility;

F. Have the capability to use the LRT Stop public address system to advise and direct patron response to emergencies;

G Have capability for emergency removal of traction power.

(ii) An area for fire department operations shall be provided at the CCF, as required, and approved by the FLSC. The area, as approved, shall provide the local fire department access to the following information:

A. Emergency telephone and public address system displays;

B. Selected fire department radio channels (reception only);

C. Fire detection and alarm system annunciator displays;

D. Sprinkler valve and water flow detector displays;

E. Standby power controls and status indicators;

F. Ventilation and air handling status indicator and controls;

G. A FD transceiver station.

(iii) Yard Control Facility

A. The yard control facility shall provide emergency coordination for all transit facilities within the vehicle yard and maintenance facility.

B. The control facility shall be arranged to function as a CSS for the yard and maintenance facility in conformance with appropriate standards.

C. The control facility shall be equipped to perform functions as required for CCF, except for the LRT Stop related facilities requirements.

D. Two-way voice communication shall be provided between CCF and the control tower for coordination of emergency operations within the transit system.

(c) Emergency Functions Requiring Communication

(i) Alarm and Notification

A. Alarm and notification communication facilities shall be provided to advise of an emergency condition for the following interface situations:

B. Communications between CCF and the following:

1. Patrons in LRT Stops and on vehicles;
2. LRT Stop agents, where utilized;
3. Train operators;
4. Other transit personnel (operations/maintenance);
5. Emergency response agencies (fire, police, medical, etc.).

C. Communications between LRT Stop agents, where utilized, and the following:

1. Patrons in LRT Stops;
2. Transit system law enforcement;
3. Other Transit personnel (maintenance, operations, etc.);

D. Communications between train operators and the following:

1. Vehicle passengers;

E. Local police and fire departments to CCF.

F. Automated fire detection alarm and control equipment to CCF (or yard control tower).

(ii) Emergency power removal and train stopping requirements shall be met through alarm and/or notification to CCF. Where potential hazards require immediate action, on-site traction power removal devices (ETS) shall be provided.

(iii) Patron evacuation capability shall be provided in passenger LRT Stops including operation of appropriate LRT Stop facilities and providing patron instructions.

(iv) Tactical communication shall be provided for each responding organization to provide operations control at the site of an emergency.

A. A communication subsystem shall be provided for responding transit personnel dedicated exclusively to this purpose during times of emergency.

B. Any transit system facility, in which fire department radio communications do not function, shall be provided with repeater or other equipment necessary to meet the local fire department requirements.

C. The dispatching communications for public emergency organizations shall be their own equipment.

(d) Telephones

(i) General

A. The System shall have a telephone network (transit central office exchange) or fixed telephone lines and instruments capable of communication with all LRT Stops, structures, offices, power stations and substations, control towers, ancillary rooms and spaces, (not normally used by patrons).

Exhibit 20.6-1
DIRECT EMERGENCY VOICE COMMUNICATIONS MATRIX

Response From/To	Central Control Facility	Vehicle Operator	Patrons On Trains	In LRT Stops	Emergency Response Organization	On-Duty Transit Personnel
LRT Stops	X					
Patrons on Trains	X	X				
Patrons in LRT Stops	X					
Vehicle Operator	X		X	X		
Central Control Facility		X		X	X	X
On Duty Transit Personnel	X					X
Emergency Response Organization	X					

(e) Blue Light Stations (BLS)

(i) The requirement to disconnect traction power along the trainway shall be permitted by an approved alternative means.

Activation of the ETS at any BLS shall trip the traction power feeder breakers for all tracks in the power zone covered by the BLS. The device shall provide local mechanical lockout capability to preclude restoration of power until the mechanical lockout is reset. CCF shall have the ability to selectively restore power to any power zone in which the ETS has been activated.

(ii) An emergency telephone shall provide communication to CCF. This phone is intended for fire or other emergency uses.

(iii) Blue Light Stations shall be provided at the following locations:

A. At ends of storage track arrays.

B. Throughout the maintenance yard and train storage areas to limit the travel distance to a BLS.

C. Outside each wall where vehicles enter and leave building vehicle maintenance areas.

D. Traction power substations;

E. Other locations, as required.

F. BLS shall be installed at designated access locations.

(iv) Adjacent to each BLS, graphic information shall be provided which identifies the location of the LRT Stop and the distance to an exit in each direction.

(f) Radio Subsystem

(i) The radio system shall operate on FCC authorized radio channels in accordance with specified functions (maintenance, security, operations, etc.) and shall be compliant with Industry Canada Standard. Radio transmissions from radios operating from any location in the transit system shall be received and re-transmitted via repeater(s)/amplifier(s) to all other locations in the transit system. Centralized radio dispatching shall be the primary mode of operation and be located at the CCF for transit radio channels. Public safety channels shall be repeated at the designated radio system repeater location. See Schedule 15-2 Article 10 for the detail specification and strategy for Radio.

(ii) At least one separate 2-way voice communications RF channel shall be provided within the radio subsystems of the transit system for use in emergency conditions.

(iii) Two-way radio voice communications from non-transit police and fire emergency personnel shall operate using their own portable equipment from all locations in the transit system. The transit radio system shall have its own dedicated frequency channels from the radio system for fire and police departments. Repeater/amplifier facilities for local police and fire departments shall be provided by the Region throughout the transit system.

(iv) At least one radio communications link from CCF facility shall be maintained with the most appropriate public emergency frequency.

(v) A minimum of two channels of radio communications shall be provided for line security force use.

(vi) Project Co shall be provided and coordinate with Region and the local fire departments underground communications for eight (8) radio channels in accordance with the agreements reached. Other fire and police departments shall be provided with their own underground radio communication capability as required by the FLSC.

(g) Public Address System

(i) Trains and LRT Stops shall have a public address system for communicating with patrons and employees.

(ii) CCF shall have the capability of using the public address system to make announcements on trains and throughout LRT Stops.

(iii) Train operators shall have the capability of making announcements throughout their trains on the vehicle public address system. During interruptions of train service or delays for any reason, the patrons and employees shall be kept informed by means of the public address system.

(iv) At times of emergency, the public address system shall be used effectively to communicate to patrons, employees, and emergency personnel.

(h) Fire Subsystem

(i) The fire subsystem shall consist of the following:

A. Automatic fire detection, alarm and supervision;

B. Fixed extinguishment equipment actuation, alarm and supervision;

C. Public address system, when required by OBC.

(ii) Water flow alarm and valve supervision shall be provided at CCF/FACP for automatic sprinkler and combined automatic sprinkler/standpipe systems.

(iii) The fire alarm system shall provide means to supervise and trip special extinguishing systems and to control ventilation systems in accordance with applicable standards.

(iv) The fire subsystem shall be electrically supervised and provided with UPS standby power. The system shall be multi-zoned and capable of using interchangeable combination rate of rise/fixed temperature, smoke, and fixed temperature detectors.

(v) The fire alarms, trouble alarms, and supervisory alarms shall be transmitted to CCF via the DTS or separate multiplex system.

(i) Subsystem for Inter-Facility Transmission

(i) Cable Transmission Subsystem - Transmission of emergency communications between CCF and passenger LRT Stops, or the vehicle yard and maintenance facility, may be by the Cable Transmission Subsystem (CTS).

A. Emergency communication subsystems transmitted via CTS voice channels include radio signals from satellite receivers, repeaters, emergency telephones, public address, and direct line telephones. The Data Transmission Subsystem (DTS) may be provided consisting of terminals converting data, serial transmissions via the CTS and reconversion to parallel output data.

B. The requirements for fire alarm signal transmissions from the FACP to the Master Fire Alarm Panel are in Schedule 15-2 Article 10.

C. The cable transmission subsystem shall be arranged so a single loss-producing incident (internal or external to the subsystem) does not result in a loss of transmission capability from the CCF facility to locations preceding the location of the incident.

20.7 Central Control Facility (CCF)

(a) General

(i) The CCF shall meet the NFPA 130 requirements for an Operations Control Center. The CCF is a controlled space for offices, equipment, and supporting facilities to be used by those persons responsible for train control, communications, and fire and security management. CCF is the portion of the facility used for data processing, status reporting, and transit system control, and excludes ancillary spaces and supporting facilities.

(b) Basic Construction

(i) Central Control Facility - The CCF shall comply with NFPA 130 or OBC, whichever is more stringent.

(c) Building Services and Utilities

(i) Light and Power

A. Electrical equipment and wiring materials and installations shall conform to the requirements of OESC, and satisfy the criteria requirements for applicable local code.

B. Emergency lighting shall be provided for all means of egress from and throughout the entire CCF area.

C. A separate on-site emergency power system shall be provided for the CCF facility such that loss of normal electrical power will not impair any critical CCF functions, and shall meet OESC.

(ii) Heating, Ventilating, and Air-conditioning Systems (HVAC)

A. CCF HVAC systems shall be physically and operationally separated from HVAC systems serving any other area.

B. Redundant fans and/or air conditioning units shall be provided to serve the CCF.

C. Emergency smoke removal capability shall be provided for the CCF. Systems shall be arranged for exhausting with 100% outside air make up. Two full-capacity outside air intakes shall be provided, arranged so as to not be subject to the same source of contamination. A minimum of 6 air changes per hour shall be provided.

(iii) Personnel Facilities

A. The CCF shall contain all personnel facilities necessary so on-duty operating personnel are continuously available.

(d) Fire Protection, Alarm, and Communications

(i) Fire Alarm System

A. A fire alarm system complying with the requirements of the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc and NFPA 72 shall be provided for protection throughout the CCF building.

B. The fire alarm shall sound an evacuation signal which can be heard throughout the CCF building. To facilitate selective evacuation from larger facilities so that transit system control functions can be maintained to the greatest possible extent, a public address system shall be provided and supervised by the fire alarm system in accordance with NFPA 72 and the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

C. Water-flow alarm and control valve and fire pump supervision shall be provided for all automatic sprinkler systems.

D. The fire alarm system shall provide means to supervise and actuate special extinguishing systems and, where required, to control the ventilation system.

E. The fire alarm system shall be electrically supervised and equipped with battery standby power. The CCF fire alarm system shall be multi-zoned and capable of using carbon monoxide, smoke detectors, and combination rate-of-rise/fixed temperature detectors.

F. The fire alarms, trouble alarms, and supervisory alarms shall be annunciated in CCF in accordance with NFPA 72 and the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc.

G. The CCF fire alarm system shall be separated from any fire alarm system in any other occupancy or building, except that remote alarm annunciation from this system may be provided at locations outside CCF approved by the Region and local fire authority.

H. If located within a building having other occupancies, the CCF shall be provided with at least one summary alarm for fire or evacuation notification initiated from any part of the building.

I. As the central supervising station, CCF shall:

1. Receive and annunciate fire alarm, trouble alarm, and supervisory alarm for all portions of the transit system, except the maintenance facility may have an independent system;

2. Have direct dedicated telephone communications with each fire jurisdiction dispatch facility serving any portion of the transit system;

3. Perform those additional functions, as required, in other Sections of these criteria;

4. Contain dedicated area for fire department liaison.

(ii) Automatic Fire Detection

A. Products of combustion detectors, other than heat detectors, shall be installed in all areas of the CCF, in accordance with NFPA 72 on the basis of twenty square meters ($20m^2$) per detector except in HVAC systems. HVAC systems detectors shall be installed in accordance with NFPA 90A.

B. Products of combustion detectors, other than heat detectors, shall be installed throughout the CCF area to activate the pre-action sprinkler or other approved special extinguishing systems.

1. Detectors shall be installed in all rooms and under-floor spaces protected by a pre-action sprinkler or approved special extinguishing system;

2. The detectors shall be cross-zoned so activation of 2 zones in any single protected area is necessary for operation of the fire suppression system;

3. The activation of a single detector or manual operation of the special extinguishing system shall provide a pre-discharge alarm signal and

appropriate activation of auxiliary devices including release of hold-open devices on doors to ancillary rooms and control of ventilation systems.

(iii) Fire Extinguisher

A. Portable fire extinguishers of the type and size specified shall be installed throughout the CCF as required in accordance with NFPA 10.

B. Suitable UL approved portable fire extinguisher shall be installed in areas protected by special extinguishing systems.

(iv) Standpipe Systems and Automatic Sprinklers.

A. Standpipes and automatic sprinklers, as required, by the Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc and local codes shall be installed in the CCF building.

(v) Special Extinguishing Systems

A. Pre-action automatic sprinkler systems or other approved clean agent fire extinguishing system protection shall be provided for underfloor areas of equipment rooms and operations rooms. A separate system shall be provided for each room or area.

B. Approved clean agent fire extinguishing system extinguishing system protection shall also be provided for other areas containing critical communications, telephone, and train control equipment and systems.

C. Pre-action and clean agent fire extinguishing systems shall be installed in accordance with NFPA and the more restrictive Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc and/or local fire department requirements.

20.8 Inspection, Maintenance, and Training

(a) Inspection, Maintenance

(i) Functions

A. Project Co shall develop a program of testing and inspection of the fire/life safety related equipment; and an operational and maintenance program to ensure the functionality of all fire/life safety-related equipment.

(ii) Testing and Inspection Program

A. The testing and/or inspection program shall be in accordance with applicable Sections of the following documents and requirements of the FLSC:

1. NFPA 10, Portable Fire Extinguisher;

2. NFPA 13, Sprinkler Systems, Installation of;

3. NFPA 14, Standpipe and Hose Systems;

4. NFPA 70, National Electrical Code (Article 760);

5. NFPA 72, Protective Signaling Systems;

B. Project Co shall develop a fire/life safety equipment testing and/or inspection program, and include agreements and procedures to conduct the testing and inspection at regular intervals as prescribed by the appropriate codes. The program shall include testing and inspection requirements and record-keeping procedures to substantiate and document the program.

(iii) Maintenance Program

A. The fire/life safety equipment maintenance programs shall be subject to maintenance and testing as contained in the more restrictive and applicable Federal, Provincial, Region, and local Codes, Laws, Ordinances, rules, Regulations, Standards, Statutes, etc., and local fire codes. It shall include, but not be limited to:

1. Manual or portable fire suppression equipment.
2. Fire alarms and detection systems.
3. Automatic fire suppression systems.
4. Auxiliary fire service equipment.
5. Emergency communications systems.
6. Emergency lighting.

(b) Training

(i) Employee Training Programs

A. Project Co shall establish the training programs and coordinate the fire/life safety services interfaces to educate and/or familiarize employees with the transit system's fire/life safety equipment, operations, and emergency procedures.

B. Project Co shall also develop and implement an CCF operator training program on all CCF functions to be performed during emergencies anywhere within the transit system. FLSC and SCRT shall review and approved, as required, prior to implementation.

(ii) Public Emergency Personnel Training Program

A. Project Co shall develop and implement a comprehensive joint training and indoctrination program for emergency personnel which will include, but not be limited to, the following:

1. Transit vehicle indoctrination.

   Collision and/or derailment involving one or more cars

2. Incidents involving the Traction Electrification System

   Emergency access facilities

3. Communications procedures and facilities.
4. Facilities indoctrination.
5. System fire control and alarm systems.

6. Yard and shop indoctrination.
7. Arrangements for fire equipment tests.
8. Emergency medical aid procedures and policies.
9. Identification of personnel authorized to make decisions in emergencies.
10. Emergency procedures plan(s).

B. Project Co. shall train emergency personnel once per year, unless otherwise approved by the FLSC. If yearly training is cancelled, Project Co. shall provide the necessary documentation and training supplies for existing emergency personnel to be retrained and initiate new employees. The documentation and training supplies shall be reviewed by the FLSC.

C. Training shall be updated to match the latest procedures.

(c) Exercises, Drills, and Critiques

(i) Exercises, Drills, and Critiques - Exercises and drills shall be conducted at least twice per year to prepare Project Co and participating agency personnel for emergencies. Critiques shall be held after the exercises and drills. Project Co shall update procedures as necessary.