METROLINX

Rail Maintenance & Storage Facilities Standard

MX-RMF-STD-001

Revision 00
Date: October 2023

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Preface

This is the first edition of the Rail Maintenance and Storage Facilities Standard (RM&SF STD). It outlines the design principles and minimum design and performance requirements that need to be followed during the planning and design of GO Rail Maintenance and Storage Facilities.

This standard is directed at various stakeholders, with an interest in the planning and design of GO Rail Maintenance and Storage Facilities, like Rail Fleet Maintenance, Rail Facility Assets, Rail Operations, Capital Projects Group, Sponsor Office, Facilities Architecture & Engineering, consultants, and contractors.

The Rail Maintenance and Storage Facilities Standard is available for external users to download via the Metrolinx public download site at http://www.gosite.ca/engineering_public/.

Suggestions for revision or improvements including a description of the proposed change along with information on the background of the application and any other useful rationale or justification can be sent to Maintenance Facilities Assurance, Attention: Manager of Maintenance Facilities Assurance. The Director of Facilities Architecture & Engineering ultimately authorizes the changes. Proposals for revisions or improvements shall include your name, company affiliation (if applicable), e-mail address, and phone number.

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1.1 Document Scope and General Requirements

1.1.1 Scope

1.1.1.1 The purpose of Rail Maintenance and Storage Facilities Standard (RM&SF STD) is to define design principles and minimum design and functional performance requirements for GO Rail Maintenance and Storage Facilities and shall be used in conjunction with the governing laws, codes and regulations, Metrolinx Standards, and industry best practices.

1.1.1.2 Rail Maintenance and Storage Facilities Standard (RM&SF STD) is a supplemental Standard to the GO Design Requirements Manual (DRM) and should be complied with in conjunction with GO DRM.

1.1.2 General Requirements

1.1.2.1 The Contracted Party shall:

a) Provide Works that support Metrolinx health and safety requirements;

b) Provide rolling stock storage, maintenance and repairs operational effectiveness and flexibility in compliance with Lean 5S design principles;

c) Support Metrolinx rail storage and maintenance facility assets' reliability and maintainability (RAM) targets;

d) Provide ergonomics obligations as part of the workspaces, tools, and equipment design;

e) Provide future expansion as necessary to meet up to 50% fleet growth;

f) Provide compatibility to existing building systems, operational and maintenance equipment; and

g) Provide external architectural consistency throughout Metrolinx Rail Maintenance and Storage Facilities.

2 Abbreviations, Definitions, References, Codes, and Standards

2.1 Abbreviations

Table 1: Abbreviations

Abbreviation	Definition
AAR	Association of American Railroads
ANSI	American National Standards Institute
AODA	Accessibility for Ontarians with Disabilities Act
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASTM	American Society for Testing and Materials
AWBIS	Automatic Wheel and Brake Inspection System
BAS	Building Automation System
CCTV	Closed Circuit Television
CN	Canadian National Railway
CNC	Computer Numerical Control
CP	Canadian Pacific Railway
CROR	Canadian Rail Operating Rules
CSA	Canadian Standards Association
DEF	Diesel Exhaust Fluid
DMU	Diesel Multiple Unit
DRM	Design Requirements Manual
DSL	Digital Subscriber Line
DTL	Direct to Locomotive
EDI	Electro-De-Ionization
EMS	Energy Management Systems
ePTFE	Expanded Polytetrafluoroethylene
ETLc	Electrical Testing Labs certification
FLSA	French Language Services Act
FMS	Fuel Management System

HDPE	High-Density Polyethylene
HEP	Head End Power
HVAC	Heating, Ventilation and Air Conditioning
ISO	Information Technology International Organization for Standardization
IT	Information Technology
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
MCC	Motor Control Centre
MRE	Manual for Railway Engineering
MTO	Ministry of Transportation of Ontario
MTO GDM	Ministry of Transportation of Ontario Geometric Design Manual
NEMA	National Electrical Manufacturers Association
OAT	Outside Air Temperature
OBC	Ontario Building Code
OD	Outside Diameter
OEM	Original Equipment Manufacturer
OFC	Ontario Fire Code
OHSA	Ontario Occupational Health and Safety Act
OPS	Ontario Provincial Standards
OPSD	Ontario Provincial Standard Drawings
OTM	Ontario Traffic Manual
OWS	Oil Water Separators
PA	Public Address
PLC	Programmable Logic Controller
PVC	Polyvinyl Chloride
RMF	Rail Maintenance Facilities
RM&SF STD	Rail Maintenance & Storage Facilities Standard
RPM	Revolutions per Minute
RSO	Revised Statutes of Ontario
SCADA	Supervisory Control and Data Acquisition
TAC	Transportation Association of Canada
TSSA	Technical Standards and Safety Authority

ULC	Underwriters Laboratories of Canada
UPS	Uninterruptable Power Supply
VFD	Variable Frequency Drive
WPEMS	Wayside Power Energy Management System

2.2 Definitions

Table 2: Definitions

Term	Definition
Arc Flash Hazard	A dangerous condition associated with the possible release of energy caused by an electric arc.
Arc Flash Boundary	When an arc flash hazard exists, an approach limit at a distance from a prospective arc source within which a person could receive a second-degree burn if an electrical arc flash were to occur. **Note:** A second-degree burn is possible by an exposure of unprotected skin to an electric arc flash above the incident-energy level of 5 J/cm^2 (1.2 cal/cm^2).
Consist	A set of railroad vehicles forming a complete train.
Contracted Party	Means the party responsible for the performance of the Work of the project assignment and under contract or agreement with Metrolinx (e.g., Contractor, Designer, Design-Builder, Designer of Record, Project Co, Technical Advisor, or Developer).
CROR Rule 26	Canadian Rail Operating Rules, Rule 26 Blue Signal Protection
CROR Rule 104.5	Canadian Rail Operating Rules, Rule 104.5 Derails
DuroVac	An industrial central vacuum systems manufacturer's name.
DVR15-300	Central vacuum system DuroVac Platform type, Model DVR15-300.
Fuel Dispensing System	Set of equipment allowing fuel transfer from the fuel storage tanks to a locomotive fuel tank.
Fuel Unloading System	Set of equipment allowing fuel transfer from a fuel tanker to the fuel storage tanks.
GO Transit service area	The area comprised of the geographic areas of jurisdiction of the upper-tier municipalities of Dufferin, Durham, Halton, Niagara, Peel, Peterborough, Simcoe, Waterloo, Wellington, and York; and the single-tier municipalities of Barrie, Guelph, Hamilton, Kawartha Lakes, Peterborough, and Toronto. O. Reg.189/09, s. 1.
Interval trending log with delta	An interval trend log with delta checks the monitored value at each interval and records the new value if it differs from the previously recorded value by more than the delta. Delta is the difference between the current variable value and the last log value.

L12CL	353m long train consisting of 2 locomotives, 11 passenger cars and one cab car.
Metrolinx	This means Metrolinx, a non-share capital corporation, continued under the Metrolinx Act, S.O. 2006, c.16 and a Crown Agency in accordance with the Crown Agency Act, R.S.O. 1990, c.48 and includes all operating divisions.
Metrolinx Corridor Maintenance	Means the division within Metrolinx that is accountable for the maintenance of the Metrolinx rail corridors.
Metrolinx Security Office	Means the division within Metrolinx that is accountable for the security of the Metrolinx assets.
Metrolinx Security Vendor of record	Metrolinx Security Vendor of Record is a provider of fire safety and security solutions for businesses and organizations nationwide.
Metrolinx Standards	GO DRM, Metrolinx Standard Drawings, Specifications, Standards and Metrolinx Environmental Management System.
Rail Layover Facility	A rail facility where trains are stationed when not in use.
Rail Maintenance Facility	A rail facility where the locomotives and coaches are maintained, repaired, and serviced.
Service Road	A road between two adjacent tracks or a track and a fence.
Sand Silo and Sand Pod	Structures for storing sand.
Service support vehicles	Utility vehicles, tractor-trailers, trucks.
Wayside Power System (WPS)	WPS provides electrical power to trains during layover periods when the locomotive is not in operation. It supplies the energy required for heating, air conditioning, lighting, and other auxiliary functions of train systems during the layover period.

2.3 Existing Governing Laws, Regulations, Codes, and Standards

2.3.1 Design Guidelines

2.3.1.1 The RM&SF STD does not absolve the Contracted Party from current regulations and codes or professional duty of care.

2.3.2 Precedence

2.3.2.1 The design shall be in accordance with all rules, regulations, by-laws and the requirements and interpretations of all authorities having jurisdiction, with the most stringent of standards taking precedence.

2.3.2.2 In case of discrepancies between RM&SF STD and selected by Contracted Party standard or regulation, the Contracted Party shall provide justification in writing why they picked a specific standard or regulation before proceeding with the Design.

2.3.2.3 In no instance shall the Contracted Party reduce the standard established by any of the codes and standards referred to herein.

2.3.2.4 The Contracted Party shall be responsible for ensuring adherence to all applicable codes and attaining all approvals required by Authorities Having Jurisdiction.

2.3.3 Reference documents:

a) Association of American Railroads (AAR) Manuals of Standards and Recommended Practices;

b) American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering (MRE);

c) AREMA Manual for Signals;

d) American National Standards Institute (ANSI);

e) American Society for Testing and Materials (ASTM);

f) Canadian Electrical Code C22.3, C22;

g) Canada Labour Code Part;

h) CAN/CGA B149.2, Propane Installation Code;

i) Canadian National Railway Engineering Track Standards;

j) Metrolinx Standards;

k) ISO 8573-1:2001;

l) MTO's Manual of Uniform Traffic Control Devices;

m) National Fire Protection Association (NFPA)780;

n) Metrolinx Climate Adaptation Strategy;

o) 2015-2020 Metrolinx Five-Year Strategy;

p) Ontario Building Code, with all related Supplements and Amendments;

q) Ontario Boilers and Pressure Vessels Act;

r) Ontario Fire Code;

s) Ontario Electrical Safety Code;

t) Ontario Liquid Fuels Handling Code;

u) Ontario Provincial Standards (OPS).

v) Ontario Ministry of Transportation (MTO) Geometric Design Standards for Ontario Highways (GDM);

w) Transportation Association of Canada (TAC) Standards;

x) MTO Ontario Highway Bridge Design Code;

y) TAC 1999 – HSU Truck Dimensions and Turning Limitations; and

z) Transport Canada TC-E-10.

2.3.4 Units

2.3.4.1 The Contracted Party shall use the International System of Units (SI).

2.3.4.2 Where Imperial Units are shown, the Contracted Party shall, in addition show the converted SI Units.

3 Site Selection Assessment

3.1 Site Access

3.1.1 Road Access

3.1.1.1 The Contracted Party shall provide a Rail Maintenance Facility and Rail Layover Facility with at least one access road tied into the existing Municipal Road.

3.1.1.2 Facility access roads shall have the following:

a) Gate entry queue length of 25.0 m on both sides of the gate; and

b) Unobstructed visibility in all directions at the junction with Municipal Road.

3.1.1.3 Access roads shall include provision for track wayside appliances.

3.1.1.4 Designated fire access routes shall be provided and shall meet OBC and local fire department requirements.

3.1.2 Rail Access

3.1.2.1 The Contracted Party shall provide secure controlled access, including entry and exiting protocols.

3.1.2.2 The Contracted Party shall comply with the Metrolinx Rail Corridor Access Process for access onto Metrolinx territory.

3.1.2.3 The Contracted Party shall provide site analysis, including the following:

a) Define legal boundaries; and

b) Identify setbacks, existing easement, and right-of-way (e.g., along the mainline corridor).

3.2 Pre-existing Conditions

3.2.1 Zoning

3.2.1.1 Contracted Party shall ensure the following:

a) Site selection preference shall be given to areas which are currently zoned for commercial/industrial land use;

b) Proximity to existing rail facilities shall also be taken into consideration;

c) The availability of existing municipal services (i.e., water, sanitary sewers, gas, and hydro) is preferable and shall take priority when identifying locations for future rail maintenance and rail storage facilities; and

d) Value for Money Analysis shall be taken into consideration when determining the viability of a site.

3.2.2 Vegetation and Trees

3.2.2.1 Where existing landforms or vegetation are to be preserved, Contracted Party shall apply appropriate protection and construction controls.

3.2.2.2 The Contracted Party shall comply with the following requirements related to protection measures:

a) Local conservation authority.

b) Local municipal standards; and

c) Ontario Provincial Standards (OPS).

3.2.2.3 Where tree removal is required, Contracted party shall comply with Metrolinx Vegetation Guideline.

3.2.3 Grading

3.2.3.1 Contracted Party shall design grading to avoid more than 8% slopes.

3.2.3.2 Grading shall be integrated with surrounding landforms to provide slope stabilization and positive flows to the drainage system.

3.3 Landscaping

3.3.1 Landscaping Standards and Codes

3.3.1.1 All landscape design and implementation shall be governed by the current edition of the following standards and codes, as applicable:

a) Ontario Building Code;

b) The Tree Act R.S.O. 1970;

c) Landscape Canada: "Metric Guide Specifications for Nursery Stock;"

d) Metrolinx Vegetation Guideline; and

e) Canadian Nursery Trades Association "Guide Specifications for Nursery Stock."

3.3.2 Landscaping Mitigations

3.3.2.1 For the vegetation compensation details, see Metrolinx Vegetation Guideline.

3.3.2.2 Landscaping shall also assist and reinforce site uses and circulation patterns to provide shade, windbreaking and snow drift reduction.

3.4 Train Length Information

Table 3. Rolling Stock Length

Rolling Stock Description	Length (In metres)	Length (In feet)
Coach or Legacy Cab Car	25.908	85
CEM Cab Car	26.893	88
Locomotive: MP40 or Tier 4 AC Traction	20.720	68
Locomotive: F59	17.729	58

Table 4. Train Length

Maximum Length of 2 Locomotive (2L) + 12 Car Train	
Configuration	2 MP40 + 11 Coaches + 1 CEM Cab Car
Length	353.321 m (1159.189 ft)

4 Rail Layover Facilities

4.1 Rail Layover Drainage

4.1.1 Major and Minor Flows

4.1.1.1 Minor flows, up to a 10-year return, shall be carried by the storm sewer and/or ditch systems.

4.1.1.2 Major flows, in excess of a 10-year return, shall flow overland.

4.1.1.3 Temporary storage of stormwater shall not be permitted on any tracks.

4.1.1.4 Any culverts which convey major flows beneath a mainline track shall be designed for a 100-year return with a 25% addition to the peak flow.

4.1.1.5 Flow shall be in conformance with American Railway Engineering and Maintenance of-Way Association (AREMA) Guidelines.

4.1.2 Overland Flows

4.1.2.1 Overland storm flows shall be directed away from tracks and track switches.

4.1.2.2 Overland flows shall not be directed into the railway track ballast.

4.1.2.3 Flows shall not be directed over track flangeways along at-grade crossings.

4.1.2.4 Flows shall be directed away from railway switches.

4.1.3 Storm Sewers and Storm Structures

4.1.3.1 All piping which crosses beneath tracks shall be designed in accordance with Transport Canada TC-E-10 and shall be designed to support railway loading. For definitions of railway loading, refer to AREMA.

4.1.3.2 In all cases, designs shall comply with AREMA.

4.1.3.3 Manholes and catch basins shall not be placed between the rails of any track.

4.1.3.4 Manholes and catch basins which are adjacent to tracks shall be placed at such an offset so that they do not interfere with the railway ties and ballast shoulder.

4.1.3.5 Accordingly, the outermost edge of any drainage structure shall not be closer than 1.8 m from the centerline of any adjacent track.

4.2 Rail Layover Roads

4.2.1 Design Requirements

4.2.1.1 Roads shall be designed to meet the following standards:

a) Transportation Association of Canada (TAC) Standards;

b) Local Municipal Standards;

c) Ontario Provincial Standards (OPS);

d) Ontario Ministry of Transportation (MTO) Geometric Design Standards for Ontario Highways (GDM); and

e) Ontario Building Code (OBC) Fire Access Route Criteria.

4.2.1.2 Roads and crossings shall not have visibility less than 50 m.

4.2.1.3 For sites without permanent fueling capabilities, the roadway shall be designed to provide access for fueling trucks to the locomotives.

4.2.1.4 Fuel delivery designated access, roadway, transloading and turnaround area layout and dimensions shall comply with TAC 1999 – HSU Truck dimensions and turning limitations.

4.2.1.5 Designated fire truck routes and turnaround space shall be designed and constructed to accommodate the weight and dimensions of fire trucks used by the local municipality.

4.2.1.6 Adequate clearances shall be provided for maintenance vehicles and equipment such as snow-clearing equipment.

4.2.1.7 Adequate clearances shall be provided for service vehicles temporarily parked to service utilities (such as gas metering stations).

4.2.1.8 Parked vehicles shall not block the flow of traffic in and out of the Metrolinx rail service centers.

4.2.1.9 Guardrails shall be provided where access roads and parking lots are adjacent to more than 8% slopes or ditches.

4.2.1.10 Track and signals equipment such as Snow Clearing Devices or switch stands that are directly adjacent to the road shall be protected by concrete-filled hazard yellow bollards to prevent equipment damage.

4.2.2 Main Road

4.2.2.1 A minimum one-way main road shall be provided for the entire length of the Rail Layover Facility for service vehicles.

4.2.2.2 The one-way main road width shall be 3.7 m.

4.2.2.3 Where site permits, a minimum of two, one-way main roads, full length, on each side of the rail layover facility shall be provided.

4.2.2.4 The two-way main road width shall be 7.0 m.

4.2.2.5 Main roads shall be terminated with a T-intersection to facilitate vehicle turnaround.

4.2.2.6 All main roads and pavement requirements shall be designed for heavy-duty traffic grade (e.g., emergency response vehicles, fuelling trucks, material and equipment

delivery trucks) to receive heavy-duty grade pavement and rated for 30 t vehicles.

4.2.2.7 Roads which will be used for fueling shall be made of reinforced concrete. Refer to Figure 1 for a typical main road cross-section.

4.2.3 Service Road

4.2.3.1 A service road shall be rated for 5 t vehicles.

4.2.3.2 Service roads designated for emergency vehicles, and fuel or vacuum trucks traffic shall be rated for 30 t vehicles.

4.2.3.3 Service road shall be terminated with a T-intersection to facilitate vehicle turnaround.

4.2.3.4 Service road widths are as follows:

a) For a one-way service road, the distance between a fence and the center of a track shall be 5.52 m.

b) For a one-way service road, the distance between the center of the tracks shall be 7.35 m.

c) One-way service road with light poles, shallow drainage ditch, or wayside stations, the distance between the center of the tracks shall be 8.55 m.

d) For a two-way service road, the distance between the center of the tracks shall be 9.75 m.

e) For a two-way service road with light poles or shallow drainage ditch or wayside station/s, the distance between the center of the tracks shall be 10.05 m.

4.2.3.5 To calculate the width of a service road with Overhead Contact System poles, refer to the Metrolinx Electrification Standards.

4.2.3.6 Refer to Figure 1 for a Typical Service Road Cross-section.

Figure 1: Typical Road Cross-section

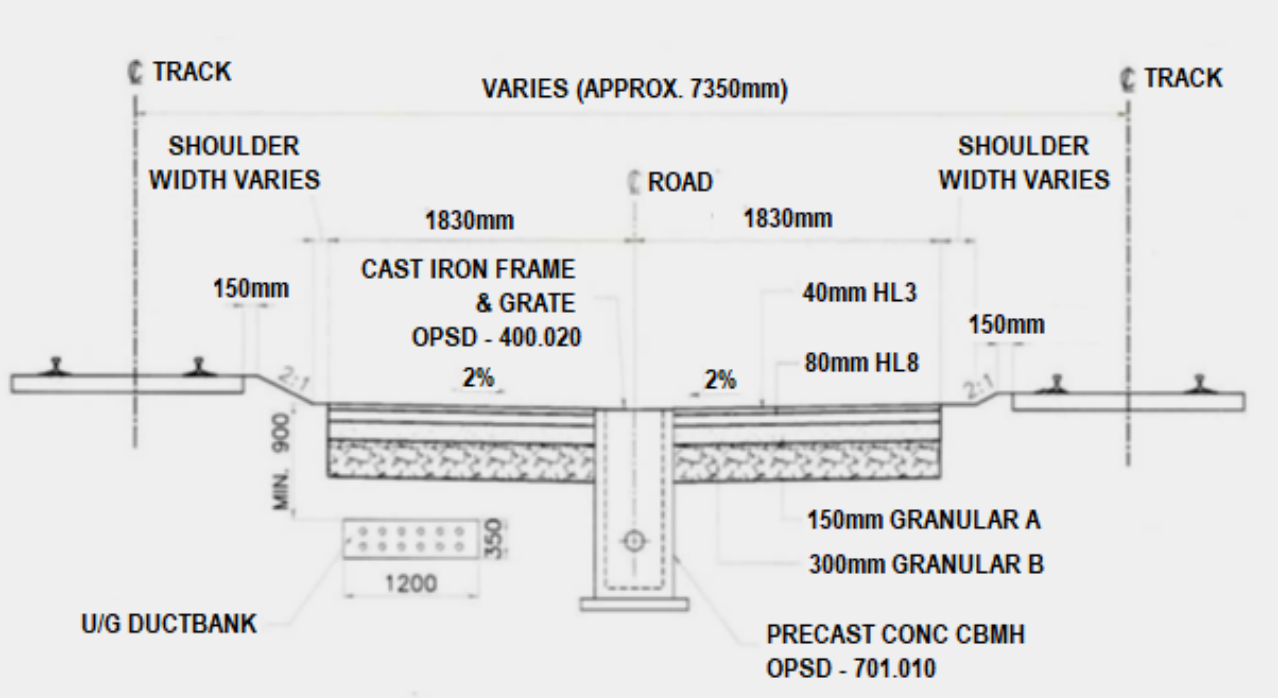

Figure 1: Typical Road cross section

4.3 Rail Layover Parking Lots

4.3.1 Parking Lot Design Requirements

4.3.1.1 Parking layouts shall respond to property size and site geometry.

4.3.1.2 Barrier-free accessible parking stalls shall be provided close to the staff quarters.

4.3.1.3 An accessible pathway with curb cuts shall be provided from the accessible parking spaces.

4.3.1.4 The number of available, accessible parking stalls shall conform to local municipal standards.

4.4 Rail Layover Walkways

4.4.1 Walkways Design Requirements

4.4.1.1 All walkways shall be constructed of a granular base, overlaid with an asphalt surface.

4.4.1.2 The minimum distance between a fence and the center of the rolling stock parking track shall be 3.5 m.

4.4.1.3 Exterior ramps, stairway, doorway areas and a 1 m wide perimeter area around

Wayside Power Stations shall be provided with a thermostat-controlled electric resistance snow melting system embedded below the traffic or walkway surface.

4.5 Site Lighting and Lightning Protection

4.5.1 Site Lighting

4.5.1.1 All Yard/Layover lighting shall have built-in apparatus for light fixtures lowering to the ground level for service, inspection, and repairs.

4.5.2 Lightning Protection

4.5.2.1 In consultation with Metrolinx, the application of both lightning detection systems and lightning protection systems shall be designed and installed in accordance with the National Fire Protection Association (NFPA)780 Standard for the Installation of Lightning Protection Systems and CSA B72 - Installation Code for Lightning Protection Systems.

4.6 Power Distribution Equipment

4.6.1 Service Requirements

4.6.1.1 The contracted Party shall contract the local Supply Authority to supply utility services for a site.

4.6.1.2 Services to the electrical substation high voltage switchgear shall be underground.

4.6.1.3 Underground utility feeders shall have 100% redundancy.

4.6.1.4 The service shall be sized to accommodate current and future known loads plus 50%, 1000 A minimum, 347/600 V service.

4.6.2 Rail Facilities and Layovers Voltages and Capacities

4.6.2.1 Voltages and capacities shall be based on consultation with Metrolinx as it pertains to the specific project at hand.

4.6.3 Grounding Systems

4.6.3.1 The grounding system shall conform to requirements of the latest edition of the Ontario Electrical Safety Code and Canadian Electrical Code C22.3, C22.2, and meet the approval of the inspection department of the authority having jurisdiction.

4.6.3.2 Grounding systems shall be a complete, permanent, continuous grounding system including, electrodes, conductors, connectors, and accessories.

4.6.3.3 Inspection boxes and covers shall be provided for ground electrodes.

4.6.3.4 Rubber matting shall be provided as floor covering in high-voltage indoor areas around apparatuses, fuse boxes, switchgear, control panels and heavy machinery to insulate workers.

4.6.4 Back-up Power Requirements

4.6.4.1 All Yard/Layover buildings, lighting and equipment except wayside power shall have a backup power generation system.

4.6.4.2 Back-up power generation system shall have a generator with a resistive load bank set at 100% of the generator nameplate KVA rating for maintenance under-load runs and an Automatic Transfer Switch.

a) Generator shall be able to run 48 h on full load without refuelling; and

b) 50 KVA or more generators shall be located on the ground level.

4.6.4.3 UPS for the wayside power safety loop shall have a 48-hour battery back-up as a minimum.

4.7 Train Wayside Power

4.7.1 Wayside Power System

4.7.1.1 Each in-service train shall have its own wayside power station during layover.

4.7.1.2 Wayside power station shall be located within 5 m of the parked train point of connection.

4.7.1.3 Electrical power supplied to the train shall be 575 V ±5%, 3-Phase at 60 Hz.

4.7.1.4 Electrical power supplied to the Diesel Multiple Unit (DMU) shall be 480 V ±5% 3-Phase at 60 Hz.

4.7.1.5 Wayside power station shall have as a minimum:

a) The electrical cabinet, receiving power from the facility sub-station;

b) The control panels allow the verification of the integrity of the wayside power trainline control safety loop and to turn the power on and off.

c) Receptacles to connect power cables and storage for these power cables.

d) Wayside cabinets shall have heating to maintain a temperature above 0 °C, and adequate inside cabinet and outside cabinet lighting.

e) Wayside cables support the jib crane; and

f) Concrete-filled hazard yellow bollards to protect wayside stations from potential damage caused by moving vehicles. Bollards' location shall comply with pathway clearances outlined in the Rail Layover Roads section.

4.7.1.6 The electrical power for each wayside station shall be supplied from a remote motor control center (motor control center located in the electrical substation).

4.7.1.7 The wayside power station shall be located so that it can be connected to the train either from the locomotive end or the cab car end.

4.7.1.8 It shall only be possible to supply power to the train when:

a) The locomotive head end power is not supplying power to the train;

b) All power cables between coaches are connected, the safety control loop is closed; and

c) The Wayside station located next to the track should have its control panel and all doors facing the adjacent service road.

4.7.2 Wayside Power Energy Management System (WPEMS)

4.7.2.1 The rolling stock is equipped with temperature control that has regular and energy-saving setback settings. The rolling stock Energy Saving Mode can be enabled or disabled by WPEMS during layover through a plugin connection.

4.7.2.2 The WPEMS functionality shall include:

a) Monitor Outside Air Temperature (OAT);

b) Adjust pre-service warming and cooling time based on OAT;

c) Avoid energy consumption spikes during pre-service warming and cooling;

d) Monitor and analyze each wayside station load to avoid wayside feeder breaker and main breaker overload tripping by enabling/disabling energy-saving mode;

e) Information management, including monitoring, archiving, and trending of voltage, current and power consumption for each wayside station, OAT, fuses, main and feeder breakers status, direct current (DC) power status; and

f) Communicate and exchange information with WPEMS Server located at Willowbrook Rail Maintenance Facility (Willowbrook) in accordance with Metrolinx I&IT Communication requirements.

4.8 Security Measures

4.8.1 Fencing and Gates

4.8.1.1 For perimeter fences adjacent to a track, a minimum distance of 3.8 m shall be provided between the adjacent Layover track center and fence line.

4.8.1.2 For exterior electrical and mechanical equipment yards such as substation yards containing high voltage transformers and emergency backup generators, fencing shall be topped with barbed wires which angle outward (i.e., away from the yard). Any use of barbed wire along perimeter fencing shall ensure the barbed wire resides within Metrolinx property lines and shall comply with local Municipal guidelines.

4.8.1.3 Based on property line information, easements onto neighbouring properties (e.g., Local Municipalities, CN, and CP) may be required to completely secure the perimeter and restrict public access.

4.8.1.4 Pedestrian gates shall be turnstile.

4.8.1.5 Trainman gates shall have an electrical contact relay provision and Metrolinx Security Vendor of record proximity card reader and PIN pad.

4.8.1.6 "Often" used gates are assumed to be opened and closed at least 20 to 30 times per day or approximately 10,000 cycles per year. Any entry point identified as used "often" (including the entry points with less than 20 cycles per day) shall utilize fully automated gate systems. This method will enhance public safety and Metrolinx assets security.

4.8.1.7 Vehicular access gate openings shall have a minimum clear drive-through opening of 4.5 m wide for unidirectional traffic.

4.8.1.8 A 6.0 m opening for bi-directional traffic shall be provided if site physical limitations permit.

4.8.1.9 Ramp slopes shall be re-graded to yield a maximum slope of 8%. A slope of 6% is ideal and shall be attempted where physically and economically feasible.

4.8.1.10 A minimum overhead clearance of 4.5 m shall be provided.

4.8.1.11 The minimum gate entry queue length shall be 25.0 m to allow for full-length flatbed delivery trucks plus the gooseneck gate control pedestals.

4.8.1.12 Gate opening time shall not exceed 6.0 seconds.

4.8.1.13 Automated gates shall have a manual override.

4.8.1.14 The opening direction of automatic swing gates shall be in such a manner that the flow of vehicle traffic is not impeded.

4.8.2 Access Control and Intrusion Detection

4.8.2.1 All gates shall be lockable and only accessible by train crews, maintenance crews and other personnel authorized by Metrolinx.

4.8.2.2 All gates that require electrical operation shall have local and remote capabilities (addressing access control, CCTV, intercom, data, and power requirements).

a) CCTV shall be by Fixed type cameras at all controlled entry points.

4.8.2.3 Facilities that require a security gate to gain entry shall include an access control system, two-way communication to Metrolinx Security Office and CCTV monitoring of the gate.

4.8.3 Surveillance Systems

4.8.3.1 The following areas shall have Closed-Circuit Television (CCTV) coverage:

a) Entrance and exit gates;

b) Along and between parked trains;

c) Entrance to all buildings;

d) Outdoor high voltage substations;

e) Entrance to staff quarters;

f) Communications room/cabinet;

g) Wayside power stations, if not covered by CCTV cameras located at ends of consist;

h) Entire length of consist, this will need one CCTV camera at each end looking in;

i) Inside vestibule and exit of entry/exit doors;

j) Entire fenced perimeter 100% via fixed cameras, with a minimum of one strategically located PTZ to assist with live event coverage; and

k) Waste management areas.

4.9 Locomotive Layover and Servicing Area

4.9.1 General

4.9.1.1 The locomotive end of each layover/servicing track shall have wayside power, compressed air, water service and spill containment.

Note: *See the Spill Containment paragraph for details.*

4.9.1.2 Metrolinx will inform the Contracted Party if fixed locomotive fueling and sanding installations are required.

4.9.2 Locomotive wayside power station shall be designed in accordance with the Train Wayside Power section.

4.9.3 Locomotive Sanding

4.9.3.1 Locomotive sanding systems shall consist of a diluted phase conveyance system shall be designed to transport dry sand of a density of 1600 kg/m^3 (100 lb/ ft^3) with a mesh size of 0.425 mm, and the diluted phase pneumatic conveying system shall be capable of conveying sand at an hourly average conveying rate of 600 kg (1320 lb) per hour.

4.9.3.2 Locomotive sanding systems shall consist of a diluted phase conveyance system comprised of the following:

a) One storage silo;

b) One silo loading blower;

c) Two silo pod systems;

d) Two transporters;

e) Sand stations consist of two reservoirs and one sand station blower

f) One air compressor;

g) Control modules, instrumentation, and controls; and

h) Sand conveying lines and piping.

4.9.3.3 Sanding System noise level shall be in compliance with AREMA requirements and NPC-300 Noise Standard.

4.9.4 Sand Delivery Equipment

4.9.4.1 The sanding system shall have a sand delivery truck unloading station in compliance with AREMA MRE.

4.9.5 Sand measuring and recording systems.

4.9.5.1 The measuring of sand available in the storage silo shall be done by a volumetric method (level of sand in the silo) or by weight measurement (load cells on silo structural supports). Analog sand volume measurement is preferable.

4.9.5.2 A system monitoring the sand level in the silo shall be provided.

4.9.5.3 The sand monitoring system shall include a display of the sand level and alarms indicating a full and empty silo. That information shall be displayed at the sand delivery station.

4.9.6 Sand Storage Facility Capacity

4.9.6.1 The sand is stored in a silo. The size of the silo depends on the sand consumption at each location. The AREMA recommends a silo with a capacity representing two weeks of consumption plus the capacity of the delivery vehicle if delivery is made by truck.

4.9.7 Sand Storage Facility Replenishment Considerations

4.9.7.1 For truck delivery, the area around the silo shall provide enough space for sand delivery trucks to get in and out safely, preferably without backing out.

4.9.8 Sand Distribution System

4.9.8.1 The diluted phase pneumatic conveying system shall be capable of conveying sand at an hourly average conveying rate of 600 kg (1320 lb) per hour.

4.9.8.2 The silo shall convey sand to two silo pod systems by gravity.

4.9.8.3 The diluted phase pneumatic conveying system shall then convey sand in batch

mode to all sanding stations.

4.9.8.4 Above-ground sand conveying lines (all components should be of stainless steel and have interior ceramics coating) should be considered.

4.9.8.5 A Programable Logic Controller (PLC) shall monitor the sand level at every station and sequence sand deliveries.

4.9.8.6 Pods shall work in tandem, and any of the pods shall be able to supply sand to any sanding station.

4.9.8.7 A blower at each sanding station shall convey sand from the station reservoirs to the locomotive through a hose and nozzle system.

4.9.8.8 Where practical, each sanding station shall have additional gravity sand loading capability from the station's sand hopper to the locomotive tank.

4.9.8.9 Sanding stations shall be equipped with platforms at each end and on both sides of the locomotives to allow the operator to safely reach (or access) the locomotive sand box filler traps.

4.9.8.10 Each sand station pod should have a minimum capacity of 1 m^3.

4.9.9 Sanding system PLC and Supervisory Control and Data Acquisition (SCADA) requirements

4.9.9.1 Sanding system PLC should have a minimum of 15-inch touch screen.

4.9.9.2 Metrolinx requires that:

a) Sanding system PLC shall be integrated with existing BAS/SCADA system or have its own SCADA; and

b) Stand-alone sanding SCADA system shall be accessible over Metrolinx intranet.

4.9.9.3 Sanding System BAS/SCADA User Graphical Interface shall provide the following minimum required information:

a) Distribution system, compressor, air blower status and logs;

b) System compressed air pressure value and logs;

c) All valves' status and logs;

d) Main silo fill cycle Start/Finish time sand volume/weight delivered;

e) Main silo and hoppers' current sand levels and logs in analog format;

f) Each hopper fill cycle Start/Finish time, sand volume/weight delivered; and

g) Optional - each locomotive ID, fill cycle Start/Finish time, sand volume/weight delivered).

4.9.9.4 Above-ground sand conveying lines (all components should be of stainless steel and shall have interior ceramics coating) shall be considered.

4.9.9.5 All trend logs shall be available in table and graphical formats.

4.9.9.6 All trend logs intervals and delta shall be user-adjustable.

4.9.9.7 All equipment graphical representation images, status screens, and flow diagram design shall be approved by Metrolinx.

4.9.9.8 All active alarms and warnings information shall be saved by Sanding System SCADA and should be available in table format.

4.9.9.9 Each alarm and warning record shall have its ID#, activation date and time, status (is it active now) and link to troubleshooting information.

4.9.9.10 The Sanding System PLC touch screen should provide the same equipment status information as SCADA.

4.9.9.11 PLC trending logs shall keep 48-hour worth of data.

4.9.9.12 Screens with interactive troubleshooting/diagnostic information and PLC inputs & outputs status shall be available.

4.9.10 Sand Spill Prevention

4.9.10.1 The sanding system shall monitor the timing and amount of sand delivered to each sand hopper to prevent sand spills due to equipment malfunction.

4.9.10.2 Each sand hopper shall have an analog sand weight measuring sensor.

4.9.10.3 Sand system PLC shall compare sand delivery time vs. sand amount/weight delivered and generate a warning or stop sand delivery to the hopper if it takes too long to fill the hopper or if the hopper is filled too often for a given period.

4.9.11 Sand Spill Containment

4.9.11.1 A grit chamber shall be installed on the drain system at the sanding facility.

4.9.11.2 Dust produced by silica sand can be harmful if inhaled by employees. The system shall be designed to minimize the dust produced during sand transfer by capturing dust at the source and by applying proper air filtration.

4.9.12 Locations and Accessibility to Locomotives

4.9.12.1 All locations equipped with fixed sanding and fuelling, facilities shall be integrated into a service station concept.

4.9.13 Fixed Fuelling System

4.9.13.1 The fixed fueling system shall have the following equipment installed as a minimum:

a) The fuel storage tanks.

b) An unloading pad for tank trucks fuel deliveries.

c) A fuel distribution system to deliver fuel from the storage tanks to locomotives, see paragraphs Minimum required locomotive fuel stations equipment and Fuel Management System (FMS) for more details.

d) Where a fuel dispensing station for emergency use only is required for Metrolinx bus fleet, the bus emergency fueling station shall be provided in accordance with Metrolinx Bus Operations Instructions.

e) An electrical room;

f) A control room;

g) Leak detection system;

h) Spill containment system; and

i) The pump house. The pump house shall have a combination of fuel pumps, motorized valves and other equipment that would allow to:

1) Unload fuel from tank trucks; and

2) Deliver fuel to locomotives.

4.9.13.2 Fixed fueling system characteristics will vary by location. The contracted Party shall provide a consistent approach to the following elements of the system:

a) Fuel storage capacity;

b) Pump capacity;

c) Size of piping; and

d) The number of fueling points adapted to the number of locomotives serviced at each location.

4.9.14 Fuel Storage Tanks

4.9.14.1 The Contracted Party shall provide above-ground fuel storage tanks. However, underground reservoirs can be provided on Metrolinx instruction.

4.9.14.2 Above-ground fuel storage tanks shall be equipped with heating system. The heating system shall keep diesel fuel temperature above -15 °C before it is pumped through the pump house filters.

4.9.14.3 The Contracted Party shall provide concrete diking capable of holding 100% of the total tanks capacity of above-ground reservoirs.

4.9.14.4 Contracted Party shall provide double-walled underground tanks equipped with a leak detection system between the inner and outer walls.

4.9.14.5 Contracted Party shall ensure the following:

a) Above-ground and underground fuel storage tanks are constructed and inspected as per TSSA regulations;

b) Diked areas have a pit for collecting stormwater;

c) Pit drains have a valve with a physical lock-out mechanism;

d) Stormwater from the pit is drained into OGS;

e) Fuel storage tanks' leak detection system is integrated with the tank level monitoring system and generates an alarm when a leak is detected; and

f) The total tank capacity shall be enough to provide a 7-day safety stock.

4.9.15 Fuel Unloading to Storage Tanks

4.9.15.1 Contracted Party shall ensure that the Fuel Unloading System has the following capabilities:

a) Fuel delivery to site storage tanks can be done by semi-trailer tankers with a capacity of 50,000 l and by B-train, consisting of a tractor pulling two tank trailers in tandem.

b) Transfer from the tank truck to site storage shall be achieved through a hose and piping system, two alternating pumps, an air eliminator and a metering system.

c) Each pump shall maintain at least 1000 l/min fuel flow rate.

d) The unloading pad is also used for fueling buses in emergency situations and unloading Diesel Exhaust Fluid (DEF) from tank trucks to a storage tank.

e) The unloading pad is designed to collect any fuel or urea spilled from the truck during the transfer operation and fuel and urea spilled during the bus fuelling operation.

f) Spills are directed to a fuel storage tank catch basin and to an oil/water separator.

4.9.16 Fuel Delivery to Locomotives

4.9.16.1 The Contracted Party shall ensure that the Fuel Dispensing System:

a) Pumps fuel from storage tanks to locomotives using double-walled piping, equipped with leak detection equipment.

b) Dispensed fuel volume is measured after passing through an air eliminator.

c) Three alternating pumps are used for locomotive fueling.

d) Optimal fuel delivery system pressure is maintained during locomotive fueling.

e) Optimal fuel delivery system pressure and emergency shut-off pressure are determined during fueling system design.

4.9.16.2 Based on demand, the fuel system PLC shall control the number of working fuel dispensing pumps and their speed to maintain optimal pressure.

4.9.16.3 The Pump house pressure relief valve shall be set above optimal system pressure and below emergency shut-off pressure.

4.9.16.4 PLC shall automatically shut off all fuel dispensing pumps if fuel delivery system pressure stays at or above the Emergency Shutoff Pressure level for 2 seconds or longer.

4.9.16.5 The contracted Party shall provide the following minimum set of requirements for locomotive fuel station equipment:

a) Interactive user terminal;

b) Emergency shear valve;

c) The emergency stop button is easily accessible to the operator to shut-off the pump in case of an emergency;

d) Two fuel line isolation valves;

e) Automatic fire suppression system;

f) Pressure relief equipment with slop tank;

g) Slop tank capacity shall be 1000 l minimum;

h) The fuel level in the slop tank shall be monitored by the fuel system PLC and by the fuel station slop tank control panel;

i) Fuel system PLC and the slop tank control panel shall generate:

1) Slop tank 50% full warning; and

2) Slop tank 90% full alarm.

j) Spill containment system; and

k) Adjustable fuel flow in a range from 600 l/min to 1000 l/min.

4.9.16.6 Contracted Party shall ensure that:

a) Fuel is delivered to locomotives through articulated pipes and hoses supporting a nozzle that mechanically locks to an adaptor on the locomotive fuel tank during the fueling operation;

b) Snyder fuel nozzles or approved by Metrolinx equivalent are used;

c) To prevent accidental fuel spillage, fuelling nozzles are equipped with pressure-sensing automatic shut-off features; and

d) Per site requirements and restrictions, fueling hoses are supplied with hose reels or fuel cranes for ease of use and organization.

4.9.17 Fuel Management System (FMS)

4.9.17.1 A Fuel Management System (FMS) provides integrated features, functions, and services to:

a) Measure the quantity of fuel delivered to site storage;

b) Measure the quantity of fuel delivered to each vehicle;

c) Control fuel system pressure. See Section 4.10.16 for more details;

d) Make fuel reconciliation reports between stock takes, fuel deliveries and issues;

e) Calculate the volume differential between the actual temperature and a reference temperature of 15 °C;

f) Forecast the fuel reordering point; and

g) Communicate and exchange information with the Central Fuel management System located at Willowbrook.

4.9.17.2 Each transaction shall receive a unique identification number and date/time tagged and identifiable to the person initiating the transaction (employee number, swipe card).

4.9.17.3 The transaction shall be identified to the locomotive or DMU number, Employee ID and the fuel dispensing station ID.

4.9.17.4 Fuel Management System shall be included based on consultation with Metrolinx as it pertains to the specific project at hand.

4.9.17.5 Fuel Management System controls, and data logging should be integrated with BAS based on Metrolinx recommendations.

4.9.17.6 Communicate and exchange information with the Central Fuel management System located at Willowbrook.

4.9.18 Piping

4.9.18.1 The Contracted Party shall ensure all buried piping, or any other elements of the Fuel Oil System shall be designed and constructed in accordance with Metrolinx Specification 231113 – Fuel Oil System.

4.9.18.2 The Contracted Party shall provide a leak detection system using probes installed between the inner and outer pipe walls shall be provided.

4.9.18.3 The Contracted Party shall ensure that the buried outer metal pipe shall have cathodic protection in accordance with ISO 15589-1:2015 Petroleum, petrochemical and natural gas industries – Cathodic protection of pipeline systems or equivalent anticorrosion protection.

4.9.19 Urea Diesel Exhaust Fluid (DEF) System

4.9.19.1 The Contracted Party shall provide a urea DEF system with the following equipment installed as a minimum:

a) Urea storage tanks.

b) An unloading station for tank truck deliveries.

c) A distribution system to deliver urea from the storage tanks to locomotives.

d) Where a DEF dispensing station for emergency use by Metrolinx bus fleet is required, the station shall be designed and constructed in accordance with Metrolinx Bus Operations Instructions.

4.9.19.2 Contracted Party shall provide pumps that shall be required to:

a) Unload urea from tank trucks.

b) Deliver urea to locomotives; and

c) Deliver urea to busses for emergencies.

4.9.20 Urea Storage Tanks

4.9.20.1 The Contracted Party shall provide above-ground fuel storage tanks. However, underground reservoirs can be provided on Metrolinx instruction.

4.9.20.2 For above-ground reservoirs, the Contracted Party shall provide concrete diking capable of holding 100% of the total tanks capacity or 110% of any singular tank, whichever is greater.

4.9.20.3 Contracted Party shall ensure the following:

a) Diked areas shall have pit for collecting stormwater;

b) The pit drain shall have a valve with a physical lock-out mechanism; and

c) Stormwater from the pit shall be drained into OGS.

4.9.20.4 The Contracted Party shall provide underground tanks that shall be double-walled and equipped with a leak detection system between the inner and outer walls.

4.9.21 Urea Unloading to Storage Tanks

4.9.21.1 The preferred method for DEF delivery to the site storage tank is by tank trucks. Transfer from tank truck to site storage is achieved through a hose and piping system, pumps, and metering system.

4.9.21.2 A station shall be provided at the DEF unloading pad to unload urea.

4.9.22 Urea Delivery to Locomotives

4.9.22.1 Contracted Party shall provide a station at the DEF unloading pad to unload urea from tank tracks.

4.9.22.2 Contracted Party shall ensure that the transfer from the tank truck to site storage is achieved through a hose and piping system, pumps, and metering system.

4.9.22.3 Contracted Party shall ensure a hose reel, retractable hose, nozzle system, and metering system are used for DEF delivery to locomotives.

4.9.23 Urea Piping

4.9.23.1 Contracted Party shall ensure the following:

a) Urea piping and hoses system is equipped with pressure relief equipment;

b) All piping transporting urea is heat traced.

c) All buried piping transporting urea is double-walled.

d) Leakage detection system using probes installed between the inner and outer pipe walls is provided.

e) Buried outer metal pipe should have cathodic protection or equivalent anticorrosion protection.

4.9.24 Spill Containment System

4.9.24.1 Spill protection shall consist of a combination of drip trays (structural concrete slab or prefabricated), drainage network, oil-water separators and oil stop valves.

4.9.24.2 Piping, hoses, and pumps shall be mounted on concrete slabs, sloped toward a drain connected to the oil-water separator system.

4.9.24.3 In addition to the spill protection systems listed above, secondary means of containment shall be installed in the form of an underground liner made of Bentonite clay or High-Density Polyethylene (HDPE). These secondary containment systems protect the surrounding soils and waterways from any oil that is not captured by the drip trays and non-permeable concrete pads surrounding the drip tray area.

4.9.25 Drip Trays

4.9.25.1 Drip tray design shall include reinforced concrete structural slabs and stainless steel or Fibreglass Reinforced Plastic (FRP) pans incorporating curbs and end dams.

4.9.25.2 The key function of the drip trays is to capture all fluids which drip from a locomotive body and running gear. All working platforms adjacent to fueling operations shall be designed to drain into drip trays.

4.9.25.3 Thus, concrete slabs supporting locomotive fuel dispensing equipment next to a drip tray shall be sloped so that any accidental releases will drain into drip trays, or any spray of fluids beyond the horizontal extent of the drip tray is more likely to be captured.

4.9.25.4 The drip trays shall have integral grating systems which create a level, non-slip surface and may be required to allow for structural loading depending on the site-specific requirements.

4.9.25.5 The drip trays, adjacent roads and walkways shall form a uniform, integral safe working area free of slip and trip hazards.

4.9.26 Oil Water Separator (OWS)

4.9.26.1 OWS shall be used to separate/remove hydrocarbon fluids and settle out any

contaminated grit that is washed off with rainfall and snowmelt runoff from drip trays. There are two broad levels of treatment that shall be used in combination, flotation, and coalescence:

a) Flotation is based upon the lower density of most hydrocarbon fluids than water. Flotation separation usually serves as well to settle out coarse particulate that is heavier than water.

b) Coalescing separators are based upon a high surface-area media within a laminar flow of the contaminated water. Fine oil droplets are attracted to the surfaces, where they coalesce, and form oil droplets, which then can detach from the surfaces and be removed by flotation.

4.9.27 OWS hydrocarbon level monitoring equipment

4.9.27.1 OWS-s shall have analog hydrocarbon level monitoring equipment/panel capable of generating an 'OIL DETECTED' (5 to 20 mm of hydrocarbon) warning, 'HIGH OIL LEVEL' (>20 mm of hydrocarbon) alarm, 'PANEL/PROBE SELF-CHECK FAIL' alarm.

4.9.27.2 Hydrocarbon level monitoring panel shall have an adjustable timer for sensor and panel self-check.

4.9.27.3 Hydrocarbon sensors that require cleaning and soaking in a special solution after exposure to hydrocarbon fluids shall not be used.

4.9.27.4 OWS hydrocarbon level monitoring panel shall be able to send alarms and warnings through Metrolinx Security Vendor of record to appropriate maintenance personnel.

4.9.28 Oil Stop Valves

4.9.28.1 Oil Stop Valves are the last line of defence and shall be used to contain and prevent catastrophic, large-volume spills from entering waterways or stormwater management systems.

4.9.28.2 The motorized Oil Stop Valve shall be installed before OWS and controlled by the OWS control panel or fuel system PLC.

4.9.28.3 Gravity Operation Oil Stop Valve shall be installed after OWS.

4.9.29 Direct to Locomotive (DTL) fueling

4.9.29.1 For the Layovers with DTL service or with potential DTL service, the Contracted Party shall provide a system that has designated fueling locations with concrete pad for fuelling trucks and a spill containment system, see paragraphs Spill containment system, Drip trays, Oil Water Separators (OWS), OWS hydrocarbon level monitoring equipment and Oil stop valves for spill containment system design details.

4.9.30 Self-Contained Compressed Air Supply and Distribution System

4.9.30.1 Contracted Party shall provide a compressed air system for the layover facility supplies compressed air for train air brakes comprising of:

a) Two single-stage, air-cooled, oil-injected rotary screw compressors;

b) Each compressor shall be capable of supplying 336 m^3/h at 1,000 kPa; and

c) Drive motors, starter, oil system, oil cooler, check valve, air cooled aftercooler, oil separator, integrated twin tower desiccant air dryer, pre-filter, after filter, oil/water separator, automatic condensate drain and electronic regulating control system.

4.9.30.2 Contracted Party shall ensure a self-contained compressed air supply system in compliance with the following requirements:

a) Shall supply up to six L12CL train consists.

b) Compressed air shall be at 900-960 kPa (130 to 140 psi) required for the train air brake system.

c) Air for train air brakes shall conform to ISO 8573-1:2001 Class 2.2.1. Industrial Grade Air.

d) Train brakes compressed air pressure, and dew point shall be monitored at the trains' compressed air connection points and logged by BAS/SCADA.

e) All underground and exterior compressed air pipe and fittings shall be 316 stainless steel, ASTM A269.

f) All isolation valves shall be self-venting.

g) Compressed air station shall have a compressed air pressure gage, venting valve and compressed air dew point indicator.

h) Operator shall vent compressed air until the dew point pilot light indicates compressed air can be applied to the consist.

i) The compressed air system shall be in its own prefabricated building.

j) The building shall be weather-resistant and installed on a concrete pad.

4.9.30.3 Contracted Party shall ensure compressed air system building in compliance with the following requirements:

a) Designed to National Electrical Manufacturers Association (NEMA) Type 3R, 4 or 4X standards and respect the Ontario Building Code requirements.

b) Insulated, heated, ventilated, and air-conditioned.

c) Equipped with a CO2 fire suppression system.

d) Equipped with lighting and an emergency lighting system.

e) The building shall be supplied with a service electrical panel board and a separate panel board for the compressors and other power equipment.

f) The air piping shall be of stainless steel conform with ASTM A778, type 316L.

g) All hoses shall be Technical Standards and Safety Authority (TSSA) certified, flexible, heavy-duty, reinforced, equipped with swivel coupling to connect to supply piping, and sized to suit pipe size.

4.9.31 Locomotive Water Hydrant

4.9.31.1 Contracted Party shall ensure the following:

a) Locomotive water hydrant is a non-freeze ZURN Z1396 Yard Hydrant or equivalent;

b) Locomotive water hydrant hose connection is 762 mm above-ground and has a valve and hose fitting at the end for an 18 mm hose;

c) Locomotive water hydrant shall have a 25 mm PVC or copper supply pipe with thermostat-controlled heat trace for the vertical portion of the hydrant and pipe below ground;

d) The hose connection shall be located inside a heated stainless-steel cabinet with a locking hinged door and with enough space inside the cabinet to store a 10 m long 18 mm water hose;

e) Locomotive water cabinet shall be protected with bollards.

4.10 Coach Layover and Servicing Area

4.10.1 General

4.10.1.1 Coach layover and servicing area requirements shall follow Metrolinx requirements defined during the design process.

4.10.1.2 Contracted Party shall provide systems to ensure the following cleaning and maintenance activities are performed in a coach layover facility to include as a minimum:

a) Toilet cleaning;

b) Interior litter pick-up;

c) Interior floor wet mopping;

d) Windows interior on an as-required basis;

e) Stanchion and table cleaning, interior on as required basis; and

f) Interior and exterior graffiti removal;

g) Light bulb replacement;

h) Brake pad replacement;

i) Replenishment of company literature;

j) Updating advertising materials; and

k) Unscheduled repairs.

4.10.2 Toilet System Servicing

4.10.2.1 Contracted Party shall provide systems to ensure the following activities can be performed in a coach layover facility for toilet system servicing as a minimum:

a) Emptying of holding tanks.

b) Replenishment of toilet chemicals and water; and

c) Intermediate holding and subsequent transport to an interim holding facility, until collection by a third party.

4.10.3 Unscheduled repairs

4.10.3.1 Contracted Party shall provide systems to ensure the following minor unscheduled repairs can be performed in the layover facility, including:

a) Individual window replacement.

b) Heating Ventilation and Air Conditioning repairs.

c) Brake pad replacement.

d) Door actuator replacement.

e) Door seals replacement; and

f) Inter-car brake hoses and 600 v cables replacement.

4.10.3.2 Other support services, facilities, and equipment shall be included based on consultation with Metrolinx as it pertains to the specific project at hand.

4.10.4 Accessibility to rollingstock

4.10.4.1 Between each track, there shall be a service road at the full length of the layover tracks to permit access by service support vehicles as well as emergency response vehicles.

4.10.4.2 Access shall be provided by means of raised platforms to enter locomotives and clean windshields, as well as service the locomotive.

4.10.4.3 Similarly, access to coach windows at both levels shall be provided by portable work platforms for window cleaning and replacement as needed.

4.10.4.4 Access shall be provided to below deck running equipment to inspect wheels and brake pads, as well as service batteries, brake valves and so forth.

4.10.5 Train Storage

4.10.5.1 A layover shall accommodate 353 m long L12CL consists.

4.10.5.2 The Contracted Party shall seek direction from Metrolinx on the overall storage capacity on a site-by-site basis.

4.10.6 Spares and Consumables Storage

4.10.6.1 Storage rooms shall be accessible from the exterior for delivery vehicles to allow regular replenishing of supplies.

4.10.6.2 Storage rooms shall be located adjacent to the main office with an interior door connection, unless otherwise directed.

4.10.6.3 Interior storage size shall be at least 3 m (10 ft) x 4.5 m (15 ft) with a 2.5 m (8 ft) high roll-up door and a regular pedestrian door.

4.10.6.4 Floors for material storage areas shall be exposed concrete painted finish.

4.10.6.5 The location and number of 120 V AC receptacles in the storage room shall be determined by Metrolinx.

4.10.7 Rail yard track maintenance equipment, track, and signals materials

4.10.7.1 A small indoor storage area for storage of perishable items and small power equipment shall be provided. See the Track & Signals Maintenance Facilities paragraph for more details.

4.10.7.2 Storage of rail yard track and/or signals maintenance equipment and track materials shall be based on consultation with Metrolinx as it pertains to the specific project at hand.

4.10.8 Waste management - chemical toilet effluent tank

4.10.8.1 The layover facility shall have an interim buried holding tank with a minimum capacity of 20,000 l, to temporarily store the contents of emptied toilet holding tanks from the train, until such time as a licensed hauler can take the effluent away for further processing.

4.10.8.2 Chemical Toilet Effluent underground tank requirements shall be:

a) A fibreglass tank suitable for chemical toilet effluent storage, double-walled with leak detection interstitial space monitoring device.

b) A tank shall be installed in accordance with Original Equipment Manufacturer (OEM) instructions.

c) A tank submittal, buoyancy calculations and strap sizing shall be stamped by a professional engineer licensed in the Province of Ontario.

d) Minimum allowed distance from the closest structures and rail tracks shall be calculated as per OEM instructions.

e) Leak testing shall be completed after the tank is installed to confirm the tank is not leaking and performs to the manufacturer's requirements.

f) A tank shall only be installed by a tank specialist contractor, not a general contractor. A manufacturer-certified inspector or installer shall oversee the installation and post-install testing.

g) An underground Tank Traffic installation shall be done as per OEM instructions.

h) An underground Tank: No Traffic installation shall be done as per OEM instructions; bollards shall be installed around the tank's perimeter.

i) Surface concrete pad shall be poured on top of the tank to protect the tank, in accordance with the tank's OEM instructions.

j) A concrete pad's highest point should be at the center of the pad to move stormwater away from the tank.

k) An underground tank shall have an access manhole hatch for entry inside the containment tank no less than 76 cm in diameter, a fibreglass ladder, accommodations for intake and controls, vents, and connection devices compatible with sewage haul collection and disposal.

l) An underground tank ground-level access cover shall be no less than 1 m by 1 m and shall have below surface hinges, compression spring lifting mechanism, open position locks and closed position locks.

m) An underground Chemical Toilet Effluent Tank's level monitoring control panel should be installed in the Sanitary Building. The tank's leak detection device shall be monitored by the Tank Level Monitoring panel. Metrolinx shall have all required means and rights to the program-level monitoring control system.

n) A control panel shall have the following:

1) Display the tank's current level information.

2) Tank level monitoring probe. The probe shall be non-contact (ultrasonic, for example), accessible from outside of the tank for service, inspections and replacement and shall have analogue output.

3) Float switch installed at tank's 90% Full level. The float switch shall be accessible and replaceable from outside of the tank.

4) Adjustable by End User Tank High-Level Warning trigger point (value between 50% and 70%). It shall activate the warning pilot light and screen warning message.

5) Tank 90% Full audio alarm with silencing option and flushing beacon light.

6) At least one tank level analogue output for Metrolinx Security Vendor of record panel connection.

7) At least one Tank 50% - 70% Full warning N.O./N.C. set of contacts for Metrolinx Security Vendor of record panel connection.

8) At least one Tank 90% Full alarm N.O./N.C. set of contacts for Metrolinx Security Vendor of record panel connection.

9) At least one Tank Leak is Detected alarm N.O./N.C. set of contacts for Metrolinx Security Vendor of record panel connection.

10) All control panel warnings and alarms shall be logged by local BAS.

11) Panel shall be made of stainless still and have a NEMA 4X rating.

o) Metrolinx Security Vendor of record panel should generate corresponding notifications to Metrolinx stakeholders.

4.10.9 Waste Management - Sanitary Effluent Tank

4.10.9.1 The layover facility shall have a buried sanitary effluent holding tank with a minimum capacity of 20,000 l, if city service is not available.

4.10.9.2 Sanitary Effluent Underground Tank Requirements shall be:

a) A fibreglass tank suitable for sanitary effluent storage, double-walled with leak detection interstitial space monitoring device.

Note: *See paragraph Chemical Toilet Effluent underground tank requirements for the Sanitary effluent underground tank requirements*.

4.10.10 Waste Management - Waste Oil

4.10.10.1 Waste oil shall be stored in the above-ground waste oil storage tank.

4.10.10.2 Underground reservoirs can be used in areas where space is limited or where aesthetic considerations preclude using above-ground reservoirs.

4.10.10.3 For the ground reservoir, concrete diking capable of holding 110% of the total tank capacity shall be provided.

4.10.10.4 Underground tank shall be double-walled and equipped with a leak detection system between the inner and outer walls.

4.10.11 Recyclable Materials

4.10.11.1 A waste disposal building, or compound shall provide accommodation for recyclable materials.

4.10.11.2 Details on parts and quantities to be recycled shall be obtained through consultation with Metrolinx.

4.10.12 Hazardous Materials Disposal

4.10.12.1 The waste streams that generate hazardous materials include such items as oily rags, used aerosol cans, empty solvent cans, batteries, used tires, brake hoses and so forth. Space allocation within the Waste Disposal Building shall be provided for these items.

4.10.13 Bin and container storage

4.10.13.1 Details on types and quantities to be accommodated shall be obtained through consultation with Metrolinx.

4.10.14 Snow storage, removal, and disposal

4.10.14.1 The designated sites within the layover facility shall be allocated to store snow removed from the layover track area, main road, and local service road network.

4.10.14.2 Each of these snow storage sites shall have a snow melting system with a thermostat and a catch basin within the site connected to the runoff drainage system described in Section 4.1.

4.11 Layover Buildings

4.11.1 Staff and Maintenance Building

4.11.1.1 The staff and maintenance building for layover sites shall contain the following amenities as a minimum:

a) Male and Female locker rooms;

b) Lunchroom (also used as meeting room);

c) Male and Female washrooms;

d) Eyewash Stations and Drinking Fountains. See GO DRM for more details;

e) Offices;

f) Storage garage (layover vehicles, lifts, supplies, water for the crew);

g) Room or garage for facility and plant services and for maintenance needs;

h) Communications and server room; and

i) Data and phone service.

4.11.1.2 Layover buildings shall have energy-saving BAS and be designed in accordance with Metrolinx Sustainable Design Standard.

4.11.1.3 Metrolinx Rail Operations determines the size of the facility (i.e., the number of trains being stored), which determines the size and functions within the staff quarters building.

4.11.1.4 Where space is limited, it is possible to combine the lunchroom and conference room together.

4.11.1.5 The components of the building program for staff quarters shall be designed to be user-friendly, with access for service and maintenance.

4.11.1.6 Staff and maintenance buildings' interior design requirements:

a) Floors for the material storage area shall be exposed concrete painted epoxy finish;

b) Floors for all other rooms shall be porcelain tile with 100 mm high base tile.

c) Interior walls that back onto exterior walls shall be concrete blocks with a latex eggshell enamel painted finish.

d) Office walls in drywall shall be latex enamel painted.

e) Ceiling at the material storage area shall be exposed; and

f) Ceilings for all other rooms shall be 610 mm x 1219 mm (2 ft x 4 ft typ.) or 2 ft x 2 ft T-bar ceiling. Offices shall be sized per Metrolinx corporate standards, which require a desk and fixed shelving.

4.11.1.7 The offices shall be equipped with phone lines and Digital Subscriber Line (DSL) data lines.

4.11.1.8 The offices and storage garage shall have the ability to be locked separately from the rest of the facility.

4.11.1.9 The communications room (or closet) shall be provided within the staff quarters building.

4.11.1.10 There shall be no higher than 208 V rated equipment in the communications room.

4.11.1.11 The communications room shall require card access and have CCTV monitoring.

4.11.1.12 The materials storage area shall have the ability to be locked separately from the rest of the facility.

4.11.1.13 Washroom facilities shall be provided, and these can be shared with crews and other staff.

4.11.1.14 The janitor's room shall include enough space for a "slop sink" and cleaning supplies.

4.11.1.15 It is preferable to have a rail equipment office and a rail equipment storage garage adjacent to one another. They shall include furniture and shelving, which should not be shared with crews or other departments.

4.11.1.16 The rail equipment office and rail equipment storage garage shall have a separate entry that can be locked off from the rest of the building.

4.11.1.17 Storage garage shall have drive-through capability with overhead roll-up door located at each end of the building.

4.11.1.18 An override crew-key, granting access to the main door lockset of the staff quarters building shall be provided.

4.11.1.19 The current edition of the Accessibility for Ontarians with Disabilities Act (AODA) shall be fully implemented throughout the facility; all building areas shall be designed accordingly.

4.11.2 Sanitary Building

4.11.2.1 Sanitary building shall have drive-through capability with overhead roll-up door located at each end of the building.

4.11.2.2 Sanitary building is used for toilet chemical containers/tanks, DEF tanks, 'Honey Wagon,' tractor and cleaning supplies storage. It shall be a minimum of 13m x 9.5m in dimension. For Chemical Toilet Effluent underground tank requirements, see the corresponding paragraph.

4.11.2.3 Sanitary building shall be equipped with the following:

a) Air quality control and ventilation.

b) Air quality control monitors CO and NO2 levels, generates visual (beacon light) and sound alarms and starts the building ventilation system.

c) Eyewash and shower station.

d) Building drain that is connected to the underground sanitary tank.

e) Fittings for discharging 'Honey Wagon' substance into underground sanitary tank; and.

f) Mop and slop sinks.

4.11.3 Storage Building

4.11.3.1 The Storage Building shall be a minimum of 13 m x 7 m.

4.11.3.2 The Storage building shall have a cement epoxy coated floor, heating, lighting, and ventilation systems, a 10 m^2 storage area with an overhead roll-up panel door for cleaning supplies, an area with an overhead roll-up panel door for areal lift parking, supplies, tools, equipment, and materials storage.

4.11.4 Electrical Substation

Note: *See the Substation Building section and GO DRM for electrical substation design requirements.*

4.11.5 Roof Fall Protection

4.11.5.1 All buildings 3 m or higher with serviceable equipment on the roof shall have adequate roof perimeter protection–parapet, and guardrails.

4.11.5.2 Protection-parapet and Guardrails shall be designed and installed to provide a barrier preventing a worker from falling from the edge of a surface.

4.11.5.3 The location and position of serviceable equipment shall have adequate clearance from the roof edge (min. 3.0 m).

5 Rail Maintenance Facilities

5.1 Drainage

Note: *See Rail Layover Drainage section and subsections for drainage requirements.*

5.2 Roads

Note: *See Rail Layover Roads section and subsections for road requirements.*

5.3 Parking Lots

Note: *See Rail Layover Parking Lots section and subsections for parking lot requirements.*

5.4 Walkways

Note: *See Rail Layover Walkways section and subsections for walkway requirements.*

5.5 Crossings

Note: *See Rail Layover Crossings section and subsections for crossing requirements.*

5.6 Power Distribution Equipment

Note: *Refer to GO DRM Electrical Technical Requirements for power distribution equipment requirements.*

5.7 Site Lighting and Lightning Protection

Note: *Refer to GO DRM, DS-05 Sustainable Design Standard and Metrolinx Specification 265000 – Lighting and Controls for general and task lighting requirements and lightning protection requirements.*

5.8 Security Measures

Note: *See Security Measures section for security measures requirements.*

5.9 Rollingstock Maintenance Center – Integral Facilities

5.9.1 Progressive Maintenance Bay for Indoor Maintenance - Size and Capacity

5.9.1.1 The Progressive maintenance bay shall be at least 364 m long to accommodate an L12CL (2 locomotives, 11 coaches and 1 cab car) train. See Section 3.4 for train length details. Metrolinx will provide site-specific requirements.

5.9.2 Accessibility to Rolling Stock

5.9.2.1 Provisions shall be made to provide full-length coach and locomotive access to the sides, roof and below-deck equipment and underneath, via recessed pits.

5.9.2.2 Access to locomotives' doors and coaches' doors shall not be obstructed by platform-level structures and installations.

5.9.2.3 At least a 1 m wide strip along the platform edge shall be free of any installations to provide unobstructed and safe movement of service carts along the pit.

5.9.2.4 Additional hi-rail battery-powered safety platforms shall be provided to service locomotive nose equipment (such as windshield wipers and headlights).

5.9.2.5 An overhead fall protection system shall be provided over the entire length of tracks and configured so that it will not hinder the movement of the overhead crane.

5.9.3 Progressive Maintenance Bay Materials Handling

5.9.3.1 Provisions shall be made to provide full-length overhead bridge cranes with 1 t to 3 t loading capacity to facilitate the replacement of coach roof-mounted equipment.

5.9.3.2 Forklift truck access shall also be provided along all maintenance platforms.

5.9.4 Progressive Maintenance Bay Janitorial Stations

5.9.4.1 Provisions shall be made to provide a janitorial station at every coach position along the maintenance bay.

5.9.4.2 The janitorial station shall have, as a minimum, a floor-level slop or mop sink with a hot and cold domestic water supply and a high-stability (24-hour) Aqueous Ozone Cleaning System.

5.9.5 Progressive maintenance bay building support services

5.9.5.1 Provisions shall be made to provide at least two de-ionized water stations per maintenance bay.

5.9.5.2 Typical service stations for each coach shall include retractable hoses with shutoff valves and quick-connect fittings for potable water, compressed air, de-icing/hot water, and toilet chemicals.

5.9.5.3 The hose reels requirements shall be:

a) Compressed air rewind motor with a fingertip control valve with integral back pressure relief;

b) Hose rollers and hose stop;

c) Adjustable steel strap lined with brake pad material; and

d) Toilet chemical hose reel components and fittings are made of stainless steel.

5.9.5.4 The Consultant and Contractor shall seek guidance from Metrolinx concerning additional hose reels and hose requirements.

5.9.6 Progressive Maintenance Bay Compressed Air Supply and Distribution

5.9.6.1 The air compressors shall be capable of producing enough volume of air to meet the needs of the facility.

5.9.6.2 Compressed air at 900- 960 kPa (130-140 psi) is required for the train air brake systems and at 700-760 kPa (100-110 psi) for shop equipment and tools.

5.9.6.3 Progressive maintenance bay compressed air system requirements:

a) Air for train air brakes shall conform to ISO 8573-1:2001 Class 2.2.1 Industrial Grade Air;

b) Air used strictly within the shops shall conform to ISO 8573-1:2001 Class 2.3.2 Industrial Grade Air;

c) Train brakes compressed air pressure, and dew point shall be monitored at the trains' compressed air connection points and logged by BAS/SCADA;

d) All underground and exterior compressed air pipe and fittings shall be 316 stainless steel, ASTM A269; and

e) All isolation valves shall be self-venting.

5.9.6.4 Provisions shall be made to provide train air brakes and shop equipment compressed air distribution and supply outlets at each coach and locomotive position within the maintenance bay pits and shop equipment compressed air supply outlets at every second coach along the maintenance bay platforms.

5.9.6.5 Compressed air station for brakes shall have a compressed air pressure gauge, venting valve and compressed air dew point indicator.

5.9.6.6 Operator shall vent compressed air until the dew point pilot light indicates compressed air can be applied to the consist.

5.9.6.7 Noise levels immediately outside the air compressor enclosure shall not exceed 65 dBA.

Note: *Additional guidance and requirements are found in the AREMA MRE.*

5.9.7 Progressive Maintenance Bay De-Icing System

5.9.7.1 A hot water de-icing system shall be used to cut ice from the coaches and locomotives undercarriage.

5.9.7.2 The Consultant or Contractor shall seek guidance from Metrolinx concerning de-icing system water pressure and temperature range, required supplied volume and station layout on PM platforms.

5.9.8 Progressive Maintenance Bay Exhaust Fume Extraction System

5.9.8.1 An exhaust fume extraction system shall be provided in accordance with the Ontario Occupational Health and Safety Act, the Environmental Protection Act of Ontario, Ontario Regulation 419/05, the American Conference of Governmental Industrial Hygienists entitled Industrial Ventilation, the ANSI Standard ANSI Z9.2

Fundamentals Governing the Design and Operation of Local Exhaust Systems and the AREMA MRE.

5.9.8.2 Air quality shall be monitored and logged by BAS. The exhaust fume extraction system shall be controlled by BAS and should start automatically if higher than normal CO and NO2 levels are detected.

5.9.8.3 Operators shall be able to start the exhaust fume extraction system in manual mode and keep it running for an adjustable period.

5.9.8.4 Progressive maintenance bay exhaust fume extraction system sequence of operation

a) The operation shall be dictated by the following limits:

Table 5: CO Threshold Alarms/Limits

CO Threshold Alarms /Limits	(PPM)
Upper Limit Alarm	100
Start Ventilation	40
Low Limit Alarm	25

Table 6: NO2 Threshold Alarms/Limits

NO_2 Threshold Alarms /Limits	(PPM)
Upper Limit Alarm	3
Start Ventilation	1
Low Limit Alarm	0.75

b) Exhaust fans assigned to the area with CO and/or NO2 levels reaching the "Start ventilation" threshold shall start operation until CO and NO2 level drops below the "Low limit alarm" threshold for at least 10 min. An alarm shall be generated by the BAS and sent to the Operator workstations (OWS) if the upper limit threshold is reached.

5.9.9 Progressive maintenance bay welding receptacles

5.9.9.1 The welding receptacles 600 V, 60 A, 3 pole, 4 wire-configuration shall be with the following features:

a) Fusible mechanical interlock;

b) Industrial specification grade - nonconductive, watertight, corrosion and impact resistant;

c) Hinged access door with windows allows clear viewing of blown-fuse LED indicators and provides fast, easy access to fuse pullers; and

d) Pass & Seymour catalogue number PS460MIR5W (Series II – North American) or approved equal.

5.9.10 Progressive maintenance bay wayside power

5.9.10.1 Provisions shall be made to have wayside power for the consist with a wayside station (a wayside station consists of wayside power, compressed air, and water supplies) positioned preferably at each locomotive location or, if not practical, at each cab-car location.

5.9.10.2 See Rail Layover Facilities, and Train Wayside power section for wayside power requirements.

5.9.10.3 The wayside power system shall be designed as per GO Transit engineering wayside power drawings.

5.9.11 Wayside Power Energy Management System (WPEMS)

Note: *See Wayside Power Energy Management System (WPEMS) section for WPEMS details.*

5.9.12 Progressive maintenance bay central vacuum system for locomotive

5.9.12.1 Provisions shall be made to provide a wet/dry central vacuum system and connection point at the locomotive.

5.9.13 Progressive maintenance bay industrial central vacuum system

5.9.13.1 The system unit shall be a DuroVac Platform type, Model DVR15-300 or equivalent, approved by Metrolinx.

5.9.13.2 DuroVac DVR vacuum producer shall be an FPZ, high performance, regenerative type, Model K09-MS; and this exhauster shall be driven with a 15 Hp TEFC 575 V-3-60 premium efficiency motor and shall generate 13.3 m^3 (470 ft^3) and 67 kPa (10.3 in Hg) vacuum continuously and consist of:

a) High-quality cast aluminum housing and impeller;

b) Silencers on the inlet and exhaust to operate below NC70 or 79 dBA;

c) Automatic vacuum relief; and

d) 0-30 in Hg vacuum gauge.

5.9.13.3 Inline filter shall protect the vacuum producer differential pressure gauge. The entire unit shall be mounted on an extra heavy-duty frame and shall feature the following:

a) Filter separator with 5.7 m2 (61.6 ft2) of filter area, grounded, with an efficiency of 99.9% at 0.5 microns;

b) Effective manual filter shaker assembly;

Note: *The filter sub-system shall be designed so that the filters do not need to be shaken clean until the storage canister is filled, even with super-fine powders.*

c) Large service access door;

d) Integrated 102 L (27.0-gal) material storage canister;

e) Vacuum equalizer to allow lining of the canister with garbage bags (bags by others);

f) Heavy-duty steel structural frame, central vacuum type; and

g) Fabricated of heavy plate steel, designed to withstand 40 kPa (18 in Hg).

5.9.13.4 Controls and instrumentation shall include:

a) Across-the-line starter for the 11.2 kW (15 Hp) vacuum producer motor, 575 V AC- 3 phase - 60 Hz;

b) Locking rotary disconnect with circuit breakers;

c) 575V/120 V AC 1 phase - 60 Hz control voltage transformer;

d) Green system run light;

e) Green system Start pushbutton;

f) Red system Stop pushbutton; and

g) One panel upgrade, Start-Stop dry contacts, 120V ULC / CSA / ETLc labelled.

5.9.13.5 The starter and control panel for each system shall be NEMA 4.

5.9.13.6 Accessories, adapters, and controls shall be included with each DVR15-300:

a) Vacuum Equalization Kit;

b) Adapter, Inlet Flange, 4 in x 3.5 in OD, C.S. Black;

c) Top Hat Separator to be non-ferrous, galvanized or 316SS material;

d) Lined 30 gal open Top Steel Drum w/steel dolly. Drum to be non-ferrous, galvanized or 316SS material;

e) Vacuum equalizer drum kit; and

f) Starter and control panel, dry contacts & remote station.

5.9.13.7 The vacuum shall be connected to a monitoring system which sends the status of the suction point to the main vacuum station and shows the status of the train suction

point on its location.

5.9.13.8 The vacuum system shall include a SCADA-based telemetry system, or similar remote-control system, which shall incorporate local control, alarm, and logging system.

5.9.14 Progressive Maintenance Bay Central Toilet Servicing Systems

5.9.14.1 Provisions shall be made to provide a toilet chemical dispensing system and both vacuum and gravity toilet waste drainage removal distribution system and connection outlet at each coach and locomotive position along the maintenance bay.

5.9.15 Progressive Maintenance Bay Central Toilet Chemical Dispensing Systems

5.9.15.1 For the toilet chemical dispensing system, two distribution systems shall be provided: one for the coaches, connected to above ground solution tank and downstream mixing tank, and the other one for the locomotives.

5.9.15.2 All stainless-steel storage tanks, piping, valves, fittings, joints, and hoses shall be free of leaks while operating at a maximum rated operating pressure of the delivery system and during pressure testing.

5.9.15.3 All components shall be rated for maximum operating pressure of the toilet chemicals delivery system.

5.9.15.4 Each tank shall include a real-time tank level monitoring system including high- and low-level sensors, outdoor high-level visual/audio alarms and overfill prevention devices to prevent filling the tanks beyond 90% capacity shall be provided.

5.9.15.5 A low-level sensor adjusted to 10% of tank capacity and to send a “low fluid” signal to the mixing tank to the main controller shall be provided.

5.9.15.6 Both toilet chemical systems shall include a minimum of two Programmable Logic Controller (PLC) controlled pumps working in ‘On demand’ mode with a user-adjustable System Stop timer.

5.9.15.7 Toilet chemical distribution Start/Stop pushbutton stations shall be installed near each toilet chemical hose reel.

5.9.15.8 Toilet chemical pumps shall be sized to provide the following minimum acceptable flow rates per dispenser:

a) 0.38 L/s for coach toilet chemicals; and

b) 0.63 L/s for locomotive toilet chemicals.

5.9.15.9 Toilet chemical tanks and pumps shall be installed in the toilet chemical storage room equipped with spill containment, adequate heat recovery ventilation and heating.

5.9.16 Progressive maintenance bay traction motor gear oil and locomotive compressor lubricant servicing systems

5.9.16.1 A traction motor gear lubricant distribution system shall have the following equipment installed as a minimum:

a) A distribution point, consisting of a nozzle, hose and retractable hose reel located at each spot at locomotive inspection pit level;

b) Traction motor gear oil drums with dispensing pumps and spill containment platforms located in designated floor spaces in shops nearest to the locomotive;

c) The locomotive air compressor lubricant drums with dispensing pumps and spill containment platforms are located in designated floor spaces in shops nearest to the locomotive;

d) Oil pumps are sized to provide the following minimum acceptable flow rates per dispenser:

1) 0.063 L/s for Traction Motor Oil; and

2) 0.063 L/s for Locomotive Air Compressor Oil.

5.9.17 Progressive maintenance bay central locomotive supplies servicing system

5.9.17.1 Provisions shall be made to provide Locomotive services (oil, water, de-ionized water, locomotive and head End Power (HEP) lubricating oil, locomotive engine coolant, and HEP antifreeze supply and distribution systems at each locomotive position along the maintenance bay, accessible from the lower platform.

5.9.17.2 The Contracted Party, as required by the contract, shall consult with Metrolinx concerning specific design requirements.

5.9.17.3 Locomotive lubricating oil, HEP lubricating oil and antifreeze distribution systems shall have:

a) A distribution point, consisting of a dripless distribution nozzle, hose, and reel at each spot;

b) A distribution system comprising pumps and piping;

c) Underground fibreglass, double wall oil storage tanks built to Underwriter Laboratories of Canada (ULC) listed specification, ULC-S655 and conform to Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products;

d) Real-time tank level monitoring system including high- and low-level sensors, outdoor high-level visual/audio alarms and overfill prevention devices to prevent filling the tanks beyond 90% capacity: and

e) Two PLC-controlled pumps, working in 'On demand' mode with a user-adjustable system stop timer. Distribution Start/Stop pushbutton stations should be installed near each corresponding hose reel.

5.9.17.4 The Contracted Party shall confirm with Metrolinx the requirement for separate

engine lubricating oil storage and distribution systems for other types of engines (head-end power or DMUs), based on fleet assignment and volumes of lubricant used.

5.9.17.5 The lube oil and antifreeze pumps shall be sized to provide the following minimum acceptable flow rates per dispenser:

a) 0.63 L/s for Main Engine Lubricant; and

b) 0.38 L/s for common HEP and Tier 4 Engine lubricant/antifreeze.

5.9.18 Progressive Maintenance Bay Roll-up Doors

5.9.18.1 Progressive maintenance bay roll-up doors shall be equipped with air curtains. ***Note:*** *see GO DRM par. Air Curtain for design details*

5.9.18.2 Progressive maintenance bay roll-up door opening shall be a minimum of 6100 mm high and 4500 mm wide.

5.9.18.3 Progressive maintenance bay roll-up door control panel shall be installed on the interior wall, 1.5m above the ground, within 1m from the roll-up door's frame and shall have:

a) OPEN, CLOSE and EMERGENCY STOP buttons.

b) Door PLC status screen with the following minimum required information:

1) Status: In Service or Maintenance Required;

2) Diagnostics page;

3) Alarms and warning page; and

4) Open/Close cycles statistics.

c) Automatic Closing ON/OFF switch with Automatic Closing is ON pilot light.

5.9.18.4 Progressive maintenance bay roll-up Doors Automatic Closing Sequence of Operation shall follow the requirements below:

a) Doors Automatic Closing Operation shall be controlled by BAS;

b) BAS shall enable Automatic Closing when Outside Air Temperature is below the adjustable point,12 °C should be set as a default value;

c) After the overhead door is opened, it shall stay open for an initial 15 minutes;

d) At the end of the initial 15 minutes, if a train or some other object or person passes through the door line or a motion near the door is detected, the closing cycle shall be delayed by an additional 5 min.

e) Safety measures before closing the door:

1) Two minutes (adjustable value) before the door closing green and red lights on both sides of the door will start flashing;

2) 30 sec. (adjustable value) before door closure lights on both sides of the overhead door will turn red;

3) Alarm horn will be ON for 30 seconds (adjustable value) before door closure, and it will stay ON during door closedown;

4) Motion sensors are installed on both sides of the overhead door to detect approaching objects or people from both directions;

5) If, during the last 5 minutes of the countdown, the door line is crossed or motion sensors detect some motion within 5m of the door - the countdown will be interrupted, and the door will stay open until there is no more movement, plus an extra 5 min.

5.9.19 Accessibility to Locomotives

5.9.19.1 A locomotive maintenance shop shall provide accessibility features to support the following functions:

a) Platforms capable of supporting locomotive equipment and parts (e.g., turbochargers, power assemblies), maximum allowed load capacity for each platform and platform section shall be explicitly outlined by the platform entry points;

b) Battery-powered high-rail safety platforms for servicing locomotive nose equipment (such as windshield wipers and headlights); and

c) Overhead fall protection system above all locomotive spots that have roof-level platforms.

5.9.19.2 The suggested overhead fall protection system shall be retractable and shall be out of the way when the overhead crane is required.

5.9.20 Locomotive Maintenance Shop Materials Handling

5.9.20.1 A locomotive maintenance shop shall provide material handling features to support the following functions for forklift accessibility to mid and lower-level platforms and areal lifts for mid-level platforms.

5.9.20.2 Platform load capacity shall be based on a list of equipment to be used and materials to be stored on each platform provided by Metrolinx.

5.9.20.3 The maximum allowed load capacity for each platform and platform section shall be explicitly outlined by the platform entry point/s.

5.9.20.4 Floor space shall be provided to store shop tools.

5.9.20.5 A lockable room and cabinets shall be provided to store some of the tools.

5.9.21 Locomotive Maintenance Shop Traction Motor Case Degreasing/ Cleaning Equipment

5.9.21.1 Traction motor gear case cleaning equipment shall have the following equipment installed as a minimum:

a) A container to recover the traction motor gear oil when disassembling gear cases; and

b) A high-pressure spray washer equipped with a fully enclosed cabinet and a water heating system.

5.9.21.2 It shall be capable of cleaning at least two complete gear cases simultaneously using an aqueous alkaline solution.

5.9.21.3 The wash cycle shall include separate cleaning and rinsing stages.

5.9.22 Locomotive Maintenance Shop Parts Washing System

5.9.22.1 Parts degreasing and cleaning capabilities shall be provided.

5.9.22.2 For that purpose, a high-pressure spray-washer equipped with a fully enclosed cabinet and a water heating system shall be used.

5.9.22.3 The washing operation shall consist of a cleaning stage, using a hot aqueous alkaline solution, and a rinsing stage, using fresh water.

5.9.23 Locomotive Maintenance Shop Synchronized Jack Lifting System

5.9.23.1 Jacking equipment that will allow raising locomotives from the trucks shall be provided.

5.9.23.2 For that purpose, portable jacks synchronized by sets of four shall be used.

5.9.23.3 Jacks shall be positioned at the lifting pad at each corner of the locomotive.

5.9.23.4 Jacks lifting capacity shall be adapted to the weight of the vehicle.

5.9.23.5 The shop floor shall be reinforced at jacking locations.

5.9.23.6 Areas where jacking is allowed shall be clearly marked on the floor.

5.9.24 Locomotive Maintenance Shop Supplies

5.9.24.1 Supplies outlets shall be grouped in “islands” to facilitate their access on a shop floor.

5.9.25 Locomotive Maintenance Shop Main Engine Coolant and Head End Power (HEP) Engine Antifreeze

5.9.25.1 The shop shall be equipped with a centralized engine coolant mixing, storage, reclamation, and distribution system that shall have the following equipment installed as a minimum:

a) An outlet to supply fresh engine coolant and a drainpipe to drain used engine coolant at each locomotive spot;

b) A collection system to return used engine coolant from each spot to the central storage system;

c) A distribution system to supply fresh engine coolant from the storage tank to each spot; and

d) A centralized treatment system that shall comprise:

1) Separate storage tanks for used and fresh engine coolant;

2) A storage tank for the cooling water treatment;

3) A filtering system for the used engine coolant; and

4) A monitoring and mixing system, allowing for replenishment of the water treatment of the used engine coolant before transferring it to the fresh engine coolant tank.

5.9.25.2 The system shall be designed to suit the specific requirements of each maintenance facility.

Note: *See 'Locomotive lubricating oil, HEP lubricating oil and antifreeze distribution systems shall have' paragraph for HEP engine antifreeze distribution system requirements.*

5.9.26 Locomotive Maintenance Shop Engine Lubricating Oil

Note: *See 'Locomotive lubricating oil, HEP lubricating oil and antifreeze distribution systems shall have' paragraph for main and HEP engine lubrication oil distribution system requirements.*

5.9.26.1 A used engine oil collection system shall have the following equipment installed as a minimum:

a) Drains located at each spot in the shop;

b) A collection system comprising all pumps, sumps, and collector pipes; and

c) Underground fibreglass, double wall oil storage tanks built to ULC listed specification, ULC-S655 and conform to Protected Underground Tank Assemblies for Flammable and Combustible Liquids.

5.9.26.2 Tank level shall be monitored by BAS/SCADA.

5.9.26.3 BAS shall generate a 70% (adjustable value) full warning message and should stop used engine oil pumping when the tank level is above 90%, the tank is 90% full visual, and an audible alarm should be generated.

5.9.26.4 Personnel shall be able to see the alarm strobe light and hear the buzzer.

5.9.27 Locomotive Maintenance Shop Traction Motor Gear Lubricant

Note: *See 'Locomotive lubricating oil, HEP lubricating oil and antifreeze distribution systems shall have' paragraph for traction motor gear lubricant distribution system requirements.*

5.9.28 Locomotive Maintenance Shop Toilet Servicing

5.9.28.1 Locomotive toilet servicing stations shall be provided in the area of the entrance to the shop with a minimum of one station per track so toilets can be serviced before the locomotive is released from the shop.

5.9.28.2 This toilet servicing system shall be a stand-alone installation or integrated with the system provided at the progressive maintenance bays.

Note: *See Progressive maintenance bay central toilet servicing systems section for further details.*

5.9.28.3 Locomotive toilet servicing stations shall have the following equipment installed as a minimum:

a) A dumping station for toilet effluent; and

b) A filling station to replenish the toilet with water and chemicals.

5.9.29 Locomotive Maintenance Shop Battery Charging and Servicing

5.9.29.1 Provisions shall be made to provide locomotive battery charging capabilities at each locomotive servicing spot.

5.9.29.2 Metrolinx will provide the locomotive battery charging station requirements.

5.9.30 Locomotive Maintenance Shop Building Supports Services

Note: *See Progressive maintenance bay building support services section for Building Support Services requirements.*

5.9.30.1 Metrolinx will provide details on each building support service station's required configuration and location.

5.9.31 Flammable and nonflammable liquid underground storage tanks requirements shall be a fibreglass tank suitable for storage identified by Metrolinx liquid, double-walled with leak detection interstitial space monitoring device.

Note: *See the Chemical Toilet Effluent underground tank requirements paragraph for the rest of the underground tank requirements*.

5.9.32 Locomotive Maintenance Shop Domestic Water Supply and Distribution

5.9.32.1 Provisions shall be made for a domestic water distribution system with back-flow prevention and a water supply outlet at each locomotive maintenance spot in the facility.

Note: *See the Building Support Services section for more details.*

5.9.33 Locomotive Maintenance Shop Compressed Air Supply and Distribution

5.9.33.1 Provisions shall be made for a compressed air distribution system and compressed

air supply outlet at each locomotive maintenance spot in the facility.

Note: *For additional compressed air supply and distribution requirements, see Self-Contained Compressed Air Supply and Distribution System section and the AREMA MRE.*

5.9.34 Locomotive Maintenance Shop Exhaust Fume Extraction System

5.9.34.1 An exhaust fume extraction system shall be provided in accordance with the Ontario Occupational Health and Safety Act, the Environmental Protection Act of Ontario, Ontario Regulation 419/05, the American Conference of Governmental Industrial Hygienists entitled Industrial Ventilation, the ANSI Standard ANSI Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems and the AREMA MRE.

Note: *See Section Progressive maintenance bay exhaust fume extraction system for further details.*

5.9.35 Locomotive Maintenance Shop Welding Receptacles

Note: *See Welding Receptacles section for welding receptacles requirements and installation details.*

5.9.36 Locomotive maintenance Shop Wayside Power Supply

5.9.36.1 Provisions shall be made for a wayside power connection at each locomotive maintenance spot in the facility.

5.9.36.2 See Rail Layover Facilities, Train Wayside Power section for wayside power requirements.

5.9.37 Locomotive Maintenance Shop Bogie Drop Table

5.9.37.1 A bogie drop table shall be installed in the locomotive heavy maintenance shop.

5.9.37.2 It shall allow removing and replacing a complete bogie from a locomotive without lifting the vehicle.

5.9.37.3 In addition, it shall allow the removal and replacement of a single axle and fuel tank.

5.9.37.4 The bogie drop table shall allow the removal and application of the longest bogie in Metrolinx service that will receive maintenance at that facility.

5.9.37.5 Once locked in place, the bridge shall be capable of supporting half the weight of the heaviest vehicle.

5.9.37.6 The table shall allow for the removal of the bogie, fuel tank or wheelset/traction motor combo from the rolling stock and for its transfer to the adjacent release track.

5.9.37.7 When in a locked position, the bridge shall allow for the circulation of the heaviest vehicle that will receive maintenance on the drop table track.

5.9.37.8 The transfer table shall transport the bridge supporting the wheelset or the combo removed from the vehicle through a covered pit that extends between the work track and the adjacent release track.

5.9.37.9 The release area on the release track shall be equipped with a bascule top covering the opening in the absence of the bridge.

5.9.38 Locomotive Maintenance Shop Single Axle Drop Table

5.9.38.1 In addition to the bogie drop table, Metrolinx may request the installation of a single axle drop table in the locomotive shop.

5.9.38.2 The single axle drop table shall allow for the replacement of single wheelset/traction motor assemblies (combos) on locomotives and of single wheelsets on coach cars.

5.9.38.3 The table shall allow for the removal of the wheelset or combo from the rolling stock and for its transfer to the adjacent release track.

5.9.38.4 The table shall be dimensioned for wheelset/traction motor combos.

5.9.38.5 When in a locked position, the bridge shall allow for the circulation of the heaviest vehicle that will receive maintenance on the drop table track.

5.9.38.6 The transfer table shall transport the bridge supporting the wheelset or the combo removed from the vehicle through a covered pit that extends between the work track and the adjacent release track.

5.9.38.7 The release area on the release track shall be equipped with a bascule top covering the opening in the absence of the bridge.

5.9.39 The Locomotive Maintenance Shop Shall have Roll-up Doors with Air Curtains.

Note: *See Section Progressive maintenance bay roll-up doors and Metrolinx Specification 233345 – Air Curtains for design details.*

5.9.40 Coach Maintenance Shop Size and Capacity

5.9.40.1 Metrolinx will provide site-specific size and capacity requirements.

5.9.41 Coach Maintenance Shop Accessibility to Rollingstock

5.9.41.1 Provisions shall be made to provide full-length access to the sides, roof and below-deck equipment.

5.9.41.2 Coach roof access safety platform shall be designed and constructed to provide safe working conditions at heights as per OHSA requirements.

5.9.41.3 Metrolinx will provide guidance on the quantity and location of coach roof access safety platforms.

5.9.41.4 Based on Metrolinx request, an overhead fall protection system shall be provided over the entire Metrolinx specified length of tracks and configured so that it will not hinder the movement of the overhead crane.

5.9.42 Coach Maintenance Shop Materials Handling

5.9.42.1 Provisions shall be made to provide material handling support to the coach maintenance shop.

5.9.42.2 These include but are not limited to forklift accessibility to mid and lower-level

platforms.

Note: *See Overhead Cranes section for coach shop overhead cranes minimum capacity requirements.*

5.9.42.3 Metrolinx will provide further site-specific details.

5.9.43 Coach maintenance shop tools and equipment - bogie drop table

5.9.43.1 A bogie drop table shall be installed in the coach heavy maintenance shop.

5.9.43.2 It shall allow removing and replacing a complete bogie from a coach car without lifting the vehicle.

5.9.43.3 In addition, it shall allow the removal and replacement of a single axle.

5.9.43.4 Metrolinx will provide guidance if removing DMU fuel tank capabilities will be required.

5.9.43.5 The operation of the bogie drop table is to allow for the removal and application of the longest bogie equipping the fleet of vehicles that will receive maintenance at that facility.

5.9.43.6 Once locked in place, the bridge shall be capable of supporting half the weight of the heaviest vehicle.

5.9.43.7 When in a locked position, the bridge shall allow for the circulation of the heaviest vehicle that will receive maintenance on the drop table track.

5.9.43.8 The transfer table will transport the bridge supporting the wheelset or the combo removed from the vehicle through a covered pit that extends between the work track and the adjacent release track.

5.9.43.9 The release area on the release track shall be equipped with a bascule top covering the opening in the absence of the bridge.

5.9.44 Coach Maintenance Shop Car Hoist with the Body Support System

5.9.44.1 The car hoist with body support system shall meet the following requirements:

a) All components of the lift equipment shall be below or flush with the floor when it is not in use;

b) The car hoist shall:

1) Have a capacity of 60 t (60 000 kg);

2) Be designed to handle one coach, complete with the wheel sets in place;

3) Lift and lower the load at a speed of approximately 1.5 m per minute.

4) Raise and hold a car with both bogies at any height within the lift's range of travel;

5) Raise and hold a car and disconnected bogies separately at any height

within the lift's range of travel;

6) Allow unobstructed use of floor area when hoists and supports are in the retracted position; and

7) Operate safely and effectively beneath cranes.

5.9.44.2 The car hoist with body support system shall meet the following requirements: Openings in the floor for the hoist equipment shall be closed by steel plates, identical to the pit cover plates, filling the gap left by the hoist cantilever arms to permit uninterrupted travel over the floor at all operating heights. There shall be no opening greater than 9 mm at rest position.

5.9.44.3 With the hoisting equipment in the full down position, the hoist area shall be completely free of obstructions to the movement of the rubber-tired forklift operating in the area with a 7,200 kg full load weight distribution on front wheels.

5.9.44.4 Any unprotected accessible temporary floor openings greater than approximately 50 mm wide occurring during the use of the lifting systems shall be protected by hinged steel plates rated to the movement of the rubber-tired forklift operating in the area with 7200 kg full load weight distribution on front wheels.

5.9.45 Coach Maintenance Shop Synchronized Jack Lifting System

5.9.45.1 Jacking equipment that will allow raising coaches from the trucks shall be provided.

5.9.45.2 Portable jacks, synchronized by sets of four, shall be used.

5.9.45.3 Jacks shall be positioned at a lifting pad at each corner of the coach car.

5.9.45.4 Jacks shall be adapted to the weight of the vehicle but will have a lifting capacity of 15 t (15 000 kg) each.

5.9.45.5 Lifting capacity shall be sufficient to allow pulling the trucks away from the coach car.

5.9.45.6 The shop floor shall be reinforced at jacking locations; areas where jacking is allowed, shall be clearly marked on the floor.

5.9.46 Coach Maintenance Shop In-Floor Lifting System

5.9.46.1 The lifting system-bogie shall meet the following characteristics:

a) All components of the lift equipment shall be below or flush with the floor when it is not in use;

b) The lifts shall:

1) Have a capacity of 8 t (8000 kg);

2) Be designed to handle one coach truck each, complete with the wheel sets in place.

3) Lift and lower the load at a speed of approximately 1.52 m per minute.

4) Be positioned to lift the truck/bogie at the manufacturer's designated

lift/support locations.

5) Raise and hold a truck/bogie at any height within the lift's range of travel.

6) Provide vertical travel of not less than 1500 mm above the finished floor.

7) Allow unobstructed use of floor area when hoists and supports are in the retracted position.

8) Operate safely and effectively beneath cranes.

9) Be designed with maximum lifted height variations of 25 mm from side to side, and end-to-end, as measured at the extremities of the lifting cradle.

10) The system shall not require licensing or periodic relicensing (Industry Canada license-exempt).

c) Protection for any part of the screw jack housings protruding below other parts of the lift structure, in heavy plastic High-Density Polyethylene or an equivalent approved by Metrolinx;

d) Openings in the floor for the hoist equipment shall be closed by steel plates, identical to the pit cover plates, filling the gap left by the hoist cantilever arms to permit uninterrupted travel over the floor at all operating heights. There shall be no opening greater than 9 mm at rest position;

e) With the hoist equipment in the full down position, a hoist area is completely free of obstructions to the movement of the heaviest rubber-tired vehicles operating in the area, equivalent to a Toyota 8FBCU32 forklift.

f) Any unprotected accessible temporary floor openings greater than approximately 50 mm wide occurring during the use of the lifting systems shall be protected by hinged steel plates rated to the movement of the heaviest rubber-tired vehicle physically maneuvering in that area: Toyota 8FBCU32.

5.9.47 Coach Maintenance Shop Toilet Servicing, Supply, and Extraction Equipment

5.9.47.1 Provisions shall be made to provide coach toilet servicing stations (dumping waste holding tank and charging toilet chemical and water systems) located in an area near the entrance to the shop for each track so that toilet systems can be serviced when the coach is released from the shop.

5.9.48 Coach Maintenance Shop Battery Charging and Servicing

5.9.48.1 Provisions shall be made to provide coach battery charging system at each coach maintenance spot in the coach maintenance facility.

Note: *See Battery Water paragraph for battery water supply requirements.*

5.9.49 Coach Maintenance Shop Building Support Services - Domestic Water Supply and Distribution

5.9.49.1 Provisions shall be made for a domestic water distribution system with back-flow prevention and water supply outlet accessible at each coach maintenance spot in the coach maintenance facility.

5.9.50 Coach Maintenance Shop Compressed Air Supply and Distribution

5.9.50.1 Provisions shall be made for a train air brake and shop equipment compressed air distribution systems and air supply outlets accessible at each coach maintenance spot in the coach maintenance facility within the maintenance bay pits and shop equipment compressed air supply outlets at every second coach along the maintenance bay platforms.

Notes:

1) *See Progressive Maintenance Bay Compressed Air Supply and Distribution section for more compressed air systems details.*
2) *For additional compressed air supply and distribution requirements, refer to the AREMA MRE.*

5.9.51 Coach Maintenance Shop Melting Snow and Ice Draining

5.9.51.1 Provisions shall be made to design and install a melting snow/ice draining system on both sides of rolling stock parking areas.

5.9.52 Coach Maintenance Shop Exhaust Fume Extraction System

5.9.52.1 An exhaust fume extraction system shall be provided in accordance with the Ontario Occupational Health and Safety Act, the Environmental Protection Act of Ontario, Ontario Regulation 419/05, the American Conference of Governmental Industrial Hygienists entitled Industrial Ventilation, the ANSI Standard ANSI Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems and the AREMA MRE.

Note: See Section Progressive Maintenance Shop exhaust fume extraction system for further details.

5.9.53 Coach maintenance shop welding receptacles

Note: *See Progressive maintenance bay welding receptacles section for welding receptacles requirements and installation details.*

5.9.54 Coach maintenance shop wayside power supply

5.9.54.1 A wayside power station shall be located at each coach maintenance spot.

5.9.54.2 See Rail Layover Facilities, Train wayside power section for wayside power requirements.

5.9.54.3 The wayside power system shall be designed as per GO Transit electrical engineering standard drawings.

5.9.55 Coach maintenance shop supervisors and equipment officers' offices.

5.9.55.1 The office shall be Access for Ontarians with Disabilities Act (AODA) compliant. Metrolinx will provide the required office location and size.

5.9.56 Coach maintenance shop shall have roll-up doors with air curtains.

Note: *See Section Progressive maintenance bay roll-up doors and Metrolinx Specification 233345 – Air Curtains for design details.*

5.9.57 Facility Maintenance Shop and Storage

5.9.57.1 The facility maintenance shop and ancillary storage area shall be co-resident with the major facilities. The purpose of this shop is to support the maintenance and upkeep of the facility, its services, and its systems.

5.9.58 Facility Maintenance Shop and Storage Size and Capacity

5.9.58.1 Metrolinx will provide site-specific requirements.

5.9.59 Facility Maintenance Shop Tools and Equipment

5.9.59.1 There shall be provisions for a drill press, metal cutting saw, hydraulic press, grinders, sheet metal bending press, overhead or jib crane, stationary welding equipment, and any specialized equipment needed to inspect, service, and maintain the facilities' services and equipment.

5.9.59.2 Metrolinx will provide site-specific requirements.

5.9.59.3 Inspection, servicing, and maintenance services that are contracted out to third parties do not require support services from this shop.

5.9.60 Facility Maintenance Shop Building Support Services - Compressed Air Supply and Distribution

5.9.60.1 Provision shall be made for a compressed air supply and distribution system for this shop. For additional compressed air supply and distribution requirements, refer to the AREMA MRE.

5.9.61 Facility Maintenance Shop Welding Receptacles

5.9.61.1 Provision shall be made for welding receptacles to support the welding equipment identified in Section 5.9.58.

Note: *See Progressive maintenance bay welding receptacles section for welding receptacles requirements and installation details.*

5.9.62 Facility Maintenance Shop Materials Handling Equipment Recharging Station

5.9.62.1 There shall be provision for charging materials handling equipment such as powered pallet dollies, forklifts and so forth. Metrolinx will provide site-specific requirements.

5.9.63 Facility Maintenance Shop-Powered Floor Cleaners Support

5.9.63.1 There shall be provision for dumping, charging, and refilling of powered, self-

propelled floor cleaners. Metrolinx will provide site-specific requirements.

5.9.64 Facility Maintenance Shop Fume Extraction System

5.9.64.1 An exhaust fume extraction system shall be provided in accordance with the Ontario Occupational Health and Safety Act, the Environmental Protection Act of Ontario, Ontario Regulation 419/05, the American Conference of Governmental Industrial Hygienists entitled Industrial Ventilation, the ANSI Standard ANSI Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems and the AREMA MRE.

5.10 Rolling Stock Maintenance Center Facilities

5.10.1 Wheel Shop

5.10.1.1 The wheel shop shall be equipped with an overhead crane of a minimum capacity of 20 t (20 000 kg) covering the whole area of the wheel shop.

5.10.1.2 There shall be a storage capacity for at least thirty-wheel sets on storage tracks inside the Wheel Shop.

a) Unintended wheelset movement prevention devices shall be provided.

5.10.1.3 The wheel shop shall have roll-up doors with air curtains.

Note: *See Section Progressive maintenance bay roll-up doors and Metrolinx Specification 233345 – Air Curtains for design details.*

5.10.1.4 A Closed-Circuit Television (CCTV) system allowing monitoring of wheel shop operation from a remote area shall be provided. For CCTV camera placement considerations, refer to the GO DRM section CCTV Camera Placement and section Mini-Hub Rooms.

5.10.2 Wheel Shop In-Floor Wheel Lathe

5.10.2.1 The wheel lathe shall be a tandem machine, capable of machining simultaneously two sets of wheels on the same bogie.

5.10.2.2 It shall be capable of machining coach cars or locomotive wheelsets, with those wheelsets mounted under the vehicle or off the vehicle.

5.10.2.3 The wheel lathe shall be a Computer Numerical Control (CNC) machine, equipped with a wheel profile measuring system.

5.10.2.4 A chip-cutting device shall be included to break the long swerves produced during wheel reprofiling.

5.10.2.5 The chips shall be evacuated in a container located outside of the in-floor lathe pit, using a conveyor or a vacuum system.

5.10.2.6 An air extraction system shall allow for the evacuation of smoke and fumes produced by the machining process.

5.10.2.7 The lathe shall be capable of optimizing the wheel contour by minimizing the

amount of metal removed.

5.10.2.8 The lathe shall be capable of recording the wheel contour before and after the reprofiling process and to communicate this information to a separate maintenance management system.

5.10.2.9 The lathe shall be capable of machining axle mounted brake disks.

5.10.2.10 The wheel reprofiling cycle shall not exceed one hour when only the wheels are reprofiled and 1.5 hours if the wheels and disks are machined.

5.10.2.11 Tolerances of the reprofiling process shall meet the requirements contained in volumes G and GII of the Association of American Railroads (AAR) Manuals of Standards and Recommended Practices.

5.10.2.12 Both wheels on an axle shall be turned simultaneously and maintain limits in accordance with standards outlined in the AAR Manual of Standards and Recommended Practices.

5.10.2.13 Stairs shall be provided to access the in-floor lathe pit.

5.10.2.14 In-floor wheel lathe pit light level in all working areas shall be no less than 75 fc (750 LUX) with a colour temperature of 4000 K.

5.10.2.15 Connections for phone and data communication shall be provided in the pit.

5.10.3 Wheel Shop Pre-Wheel-Cutting De-icing

5.10.3.1 There shall be provisions made for the design of rolling stock undercarriage de-icing areas with required draining on both sides before and after the In-Floor Wheel Lathe.

5.10.4 Wheel Shop Battery-Powered Shunter

5.10.4.1 A battery-powered shunter capable of moving an L12L trainset shall be provided.

5.10.4.2 A battery-powered high-rail shunter capable of moving a L6 trainset shall be provided.

5.10.4.3 The shunter shall allow for accurate positioning of the vehicles on the drop table and the in-floor wheel lathe.

5.10.5 Wheel Shop Support Systems - Waste Metal Removal

5.10.5.1 Waste metal removal systems shall be provided for the in-floor and above-floor wheel lathes.

5.10.6 Wheel Shop Exhaust Fume Extraction System

5.10.6.1 An exhaust fume extraction system shall be provided in accordance with the Ontario Occupational Health and Safety Act, the Environmental Protection Act of Ontario, Ontario Regulation 419/05, the American Conference of Governmental Industrial Hygienists entitled Industrial Ventilation, the ANSI Standard ANSI Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems and the AREMA MRE.

5.10.7 Wheel Shop Compressed Air System

5.10.7.1 Compressed air system requirements shall be based on wheel lathe OEM requirements.

5.10.8 Wheel Shop Material Storage

5.10.8.1 Floor space shall be provided in the shop for material that is in the process of being assembled or disassembled.

5.10.8.2 Storage space shall be provided for:

a) 30 coach wheelsets; and

b) 10 and locomotive wheelsets with traction motors.

5.10.9 Wheel Shop Overhead Crane

5.10.9.1 An overhead crane with a minimum capacity of 10 t (10,000 kg) - covering the entire wheel shop floor area shall be provided.

5.10.9.2 The overhead crane shall be equipped with one wheel and one traction motor lifting jigs.

5.10.10 Wheel Shop Single Axle Drop Table

5.10.10.1 The single axle drop table shall be located in the Wheel Shop.

5.10.10.2 It shall allow for the replacement of single wheelsets on coach cars and of single wheelset/traction motor assemblies (combos) on locomotives.

5.10.10.3 The table shall allow for the removal of the wheelset or combo from the rolling stock and for its transfer to the adjacent release track.

5.10.10.4 The table shall be dimensioned for wheelset/traction motor combos.

5.10.10.5 When in a locked position, the bridge shall allow for the circulation of the heaviest vehicle that will receive maintenance on the drop table track.

5.10.10.6 The transfer table shall transport the bridge supporting the wheelset or the combo removed from the vehicle through a covered pit that extends between the work track and the adjacent release track.

5.10.10.7 The release area on the release track shall be equipped with a bascule top covering the opening in the absence of the bridge.

5.10.11 Locomotive Test Cell

5.10.11.1 A locomotive test cell shall be provided in a separate building.

5.10.11.2 It shall offer the characteristics described in the following sections.

5.10.12 Locomotive test cell capacity and overall dimensions

5.10.12.1 The locomotive test cell shall be in an enclosed building and provide space for one locomotive.

5.10.12.2 In addition, sufficient space shall be provided for the test equipment, tools and materials required for the tests, a control room, and facilities for employees.

5.10.13 Locomotive Test Cell Access to Locomotive

5.10.13.1 The locomotive test cell shall be designed with a pit and platforms to provide easy access to all areas of the locomotive.

5.10.13.2 A wide pit shall provide access to the locomotive running gear.

5.10.13.3 Platforms shall be located at the side sill level and at the roof level.

5.10.14 Locomotive test cell acoustical consideration - surrounding exterior

5.10.14.1 The building shall be soundproofed to prevent disturbance to the neighbourhood.

5.10.15 Locomotive Test Cell Control Room

5.10.15.1 A soundproofed control room shall be provided to monitor all tests and to provide technicians with an area free of exhaust fumes and excessive noise levels.

5.10.16 Locomotive test cell offices and staff quarters

5.10.16.1 Offices and areas reserved for employees shall also be soundproofed and properly ventilated.

5.10.17 Locomotive test cell building support services

5.10.17.1 Fume hoods and exhaust fans shall be provided to exhaust the main engine combustion gases.

5.10.17.2 The exhaust system shall be designed to minimize noise propagation outside the building.

5.10.18 Locomotive test cell testing, diagnostic and instrumentation equipment

5.10.18.1 The facility shall be equipped with all the instrumentation required to perform electrical and mechanical tests on the locomotive.

5.10.19 Locomotive Test Cell Load Box

5.10.19.1 A load box, to dissipate all the energy produced by the HEP generator under full load, shall be provided.

5.10.20 Locomotive Test Cell Locomotive Battery Charging

5.10.20.1 A locomotive battery charging system shall be provided.

5.10.20.2 Metrolinx will provide locomotive battery charging system requirements.

5.10.21 Locomotive Test Cell Spill Containment and Abatement

5.10.21.1 The drain system shall be designed in such a way that any spill of engine coolant, fuel or lubricating oil can be contained and recuperated.

5.10.22 Paint Shop

5.10.22.1 A complete paint shop capable of receiving coaches and locomotives and offering the characteristics described hereafter shall be provided.

5.10.23 Paint Shop Size and Capacity

5.10.23.1 The paint shop shall be subdivided into two distinct areas, one for paint preparation and one for paint application.

5.10.23.2 Both areas, the paint preparation and paint application areas, shall accommodate the largest locomotive or passenger coach owned by Metrolinx, augmented by a minimum of 3 m of workspace on all sides of the vehicle.

5.10.23.3 The building design shall reflect that the vehicle could be raised on jacks to permit access to preparing and painting underfloor equipment and panels, etc.

5.10.23.4 The paint shop shall be designed to allow working on two vehicles simultaneously.

Note: *For paint shop size and capacity requirements, refer to AREMA MRE and the Ontario Building Code (OBC).*

5.10.24 Rolling Stock access in Paint Shop

5.10.24.1 The paint shop shall be designed to provide easy access to the entire exterior area of coaches and locomotives and shall consist of the following elements as a minimum:

a) Wall-mounted movable platforms.

b) Side floor structure capability to support locomotive jack equipment; and

c) Jack system to raise locomotives/coaches from trucks (mobile or permanent equipment).

5.10.24.2 Each spot shall be sized to receive the longest vehicles of the fleet.

5.10.24.3 Height clearance shall be sufficient for locomotives and bi-level cars and for the jacking of these vehicles.

Note: *For additional rolling stock access requirements, refer to the AREMA MRE.*

5.10.25 Paint Preparation and Sandblasting Shop

5.10.25.1 The paint preparation shop shall be adapted to receive one locomotive or one coach car.

5.10.25.2 It shall allow jacking the vehicle off the trucks.

5.10.25.3 The area shall be equipped for cleaning the vehicle and for stripping the paint using the sandblasting process.

5.10.25.4 A dedicated sandblasting room as part of the paint preparation shop shall be designed to mitigate health and safety hazards during the rolling stock sandblasting process.

5.10.25.5 Sandblasting room requirements:

a) Shall be properly sealed;

b) Shall have adequate ventilation and filtration system;

Note: *See Paint shop air circulation system and Dust and fume extraction sections for more details.*

c) Shall have an auto-balancing air circulation system, which will properly pressurize a sandblasting room and shall be designed to automatically keep the booth pressure between 0 and 0.2 kPa below atmospheric pressure during operation;

d) A sandblasting room air pressure shall be measured in the center of the room and at a similar distance from intake air filters and exhaust air filters;

e) Shall have air quality control equipment that would indicate when it is safe for personnel to enter the Sandblasting room without using breathing apparatus; and

f) Remotely controlled sandblasting equipment should be considered.

Note: *See required PPE for manual sandblasting in OHSA.*

5.10.26 Paint Shop Paint Application System

5.10.26.1 The paint room shall be dimensioned to receive one locomotive or one coach and provide a minimum of 3 m space around the vehicle.

5.10.26.2 There shall be provisions to allow jacking a vehicle off its trucks.

5.10.26.3 The room shall be equipped with doors at each end, separating it from the rest of the building.

5.10.26.4 It shall be equipped with height-adjustable, air-operated platforms attached to the walls.

5.10.27 Paint Shop Air Circulation System

5.10.27.1 The paint shop shall have an auto-balancing air circulation system, which will properly pressurize a booth and shall be designed to automatically keep the booth pressure between 0 to 0.2 kPa above atmospheric pressure.

5.10.27.2 A paint shop inside air pressure shall be measured in the center of the paint shop and at a similar distance from intake air filters and exhaust air filters.

5.10.27.3 Metrolinx prefers a down draft configuration for incoming air.

5.10.28 Paint Shop Dust and Fume Extraction

5.10.28.1 An exhaust fume extraction system shall be provided in accordance with the Ontario Occupational Health and Safety Act, the Environmental Protection Act of Ontario, Ontario Regulation 419/05, the American Conference of Governmental Industrial Hygienists entitled Industrial Ventilation, the ANSI Standard ANSI Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems and the AREMA MRE.

Note: *See also the Emission Controls section.*

5.10.28.2 Metrolinx utilizes polyurethane coatings containing isocyanates. Therefore, provisions shall be made for the use of air-supplied (from outside the paint booth) protective respiratory devices for employees.

5.10.29 Paint Shop Lighting

5.10.29.1 The lighting shall conform to the Illuminating Engineering Society requirements.

5.10.29.2 The paint booth area shall have vertically oriented wall lights to create a shadow-free environment, perfect for colour matching and precise application of paint.

5.10.30 Paint Shop Emission Controls

5.10.30.1 Emission controls shall be provided in accordance with the Ontario Occupational Health and Safety Act, the Environmental Protection Act of Ontario, Ontario Regulation 419/05, the American Conference of Governmental Industrial Hygienists entitled Industrial Ventilation and, in the ANSI Standard ANSI Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems.

5.10.31 Paint Shop Spill Containment and Abatement

5.10.31.1 Storage cabinets and storage racks equipped with retention tanks shall be used for the storage and handling of paints and solvents.

5.10.31.2 Special containers shall be provided for the storage of residue paint, solvents and isocyanate paints in accordance with the Ontario Occupational Health and Safety Act, the Environmental Protection Act of Ontario, Ontario Regulation 419/05, and the Threshold Limit Values (TLVs®) for Chemical Substances and Physical Agents & Biological Exposure Indices (BEIs®) by the American Conference of Governmental Industrial Hygienists.

5.10.32 Paint Shop Paint Storage Room

5.10.32.1 A separate room shall be provided for paint storage and paint preparation.

5.10.32.2 This room shall also have the paint pumping and mixing systems.

5.10.33 Heating Ventilation and Air Conditioning (HVAC) repair shop

5.10.33.1 An HVAC Repair Shop shall be provided within a major coach maintenance facility and a progressive maintenance facility.

5.10.34 HVAC Repair Shop Size and Capacity

5.10.34.1 A minimum of 185 m^2 (2000 ft^2) of floor space shall be provided to perform cleaning, stripping, assembly, and testing.

5.10.35 HVAC Repair Shop Building Support Services

5.10.35.1 Power outlets shall be provided to power and test HVAC units, and a wash bay with supporting equipment and any additional support services to comply with The Federal Halocarbon.

5.10.35.2 Metrolinx will provide details about HVAC units to be serviced and their power supply requirements.

5.10.36 HVAC Repair Shop Material Handling

5.10.36.1 The HVAC shop shall be forklift accessible.

5.10.36.2 In addition, a 5 t overhead crane shall be provided to relocate and load HVAC components.

5.10.37 Train Wash Facility

5.10.37.1 The contracted Party shall provide a train wash facility with the following features as a minimum:

a) The train wash shall be in a separate auxiliary building;

b) The system shall be suitable for operation even when the ambient temperature reaches minus 5 °C;

c) There shall be a control office for an overview of wash operations;

d) The system shall be automatic;

e) Train wash equipment shall be capable of cleaning the exterior nose, sides and roof of the coaches, sides and nose of locomotives and sides, nose, and roof of DMU cars;

f) Train wash equipment shall be capable of cleaning the undercarriage of locomotives, coaches and DMU cars;

g) A mixing and storage area for wash supplies and chemicals shall be provided;

h) Wastewater management system (e.g., sewers, separators, and piping);

i) The system shall be designed for water recycling and rainwater collection;

j) A ventilation system for evacuation of locomotive exhaust and the fumes produced by the washing operation; and

k) Washroom for employees.

5.10.37.2 Bi-directional requirements and run-around tracks shall be determined on a per-site basis.

5.10.37.3 All electrical and communication equipment shall be rated for outdoor use with a temperature range from – 40 °C to 40 °C.

5.10.38 Train Wash Facility Size and Capacity

5.10.38.1 The train washing facility shall be located and sized to permit the washing of an L12L consisting of approximately 354 m in length without obstructing train traffic on adjoining tracks or exceeding the capacity of supply and runoff capture catchment and recycling tanks within the consistent wash facility.

5.10.38.2 Train wash facility shall be able to perform at least nine consecutive L12L consistent full washing cycles in three hours. Train speed through the wash bay is 2 km/hr.

5.10.38.3 The building housing the washing facility shall be at least 75 m long. The length of the building shall be adapted to the requirements of the selected washing system.

5.10.38.4 The train wash facility shall be equipped with an emergency eyewash and shower station.

5.10.38.5 A room adjacent to the washing track shall be planned to house the pumping and mixing systems.

5.10.39 Train Wash Facility Washing Equipment

5.10.39.1 Concrete track slabs with acid-resistant treatment shall be provided for the full length of the washing area with a minimum 9.14 m (30 ft) treated approach slab.

5.10.39.2 The rails shall be sufficiently elevated to allow the various cleaning/rinse agents to freely pass under.

5.10.39.3 All track fastenings shall be corrosive resistant.

5.10.39.4 The entire floor shall be properly sloped, curbed, and drained to provide for proper waste collection.

5.10.39.5 All concrete surfaces shall be coated with acid and alkaline-resisting material to preclude severe deterioration, as well as coated with a non-slip surface.

5.10.39.6 The building structure may be precast or poured but shall be made of acid and alkaline-resisting concrete.

5.10.39.7 The exterior of the building shall be constructed using pole construction with plastic sheathing or a standard steel prefabricated building, provided the exterior panels are of a fibreglass plastic material or factory pre-coated with long-life synthetic enamel.

5.10.39.8 An acid-resisting coating shall be field-applied to the structural frame and any other exposed steel.

5.10.39.9 All fasteners shall be stainless steel.

5.10.39.10 Piping shall be acid and alkaline-resisting Polyvinyl Chloride (PVC).

5.10.39.11 For long spans and pressure requirements, fibreglass pipe shall be used and properly supported.

5.10.39.12 A holding tank shall be provided below floor level to recover the rinse water.

5.10.40 Train Wash Facility Chemical Mixing Equipment

5.10.40.1 There are several acid/alkaline cleaning agent combinations on the market that are satisfactory and approved for use by Metrolinx.

5.10.40.2 The type selected would depend on availability, frequency of washing, and adaptability to be neutralized into an acceptable waste material for final treatment

and disposal.

Note: *For additional chemical mixing equipment requirements, refer to the AREMA MRE.*

5.10.41 Train Wash Facility Wastewater Treatment and Recycling System

5.10.41.1 The wastewater treatment and recycling system shall have an auto shutoff valve that would stop wastewater discharge into the local municipality if:

a) Wastewater pH level is outside of the allowed range; and

b) Hydrocarbon volume above pre-set value is detected in the wastewater holding tank.

5.10.41.2 The cost of a recycling plant with necessary filters and equipment shall be evaluated against the type of chemical used, the availability of water and the availability of a waste disposal system.

5.10.41.3 The final rinse shall be recycled easily for pre-wash, acid or alkaline wash, and chemical rinse requires more treatment depending on the final pH result.

5.10.41.4 Final liquid and solid waste disposal shall be kept in a holding sump with a pipeline to the acceptable treatment plant.

5.10.42 Train Wash Facility Exhaust Fume Extraction System

5.10.42.1 An exhaust fume extraction system shall be provided in accordance with the Ontario Occupational Health and Safety Act, the Environmental Protection Act of Ontario, Ontario Regulation 419/05, the American Conference of Governmental Industrial Hygienists entitled Industrial Ventilation, the ANSI Standard ANSI Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems and the AREMA MRE.

Note: *See Par. Progressive maintenance bay exhaust fume extraction system for more details.*

5.10.43 Train Wash Facility Control Room

5.10.43.1 The contracted Party shall provide a control room allowing monitoring the consistent washing operation and located at the upper level of the building.

5.10.43.2 Air for heating and ventilation of the room shall be supplied from outside of the building.

5.10.44 Locomotive Wash Facility Size and Capacity

5.10.44.1 The locomotive wash facility shall be in a stand-alone building with the capacity to accommodate two locomotives.

5.10.44.2 The locomotive wash facility shall be equipped with an emergency eyewash and shower station.

5.10.44.3 The track in the building shall be at least 53 m long and be a run-through facility.

5.10.45 Locomotive wash facility accessibility to rolling stock

5.10.45.1 Accessibility to the roof, sides, and deck equipment shall be provided by a combination of roof, midlevel and ground-level platforms and underfloor pits.

5.10.46 Locomotive wash facility washing equipment

5.10.46.1 Metrolinx will provide guidance on the required number and location of power wash stations within the locomotive wash.

5.10.46.2 The exterior of locomotives shall be washed regularly with the coach cars in the train wash facility. However, locomotives sometimes need additional exterior cleaning to remove soot and grease, and interior cleaning of the engine and other car body compartments. A locomotive interior cleaning process:

a) The interior cleaning shall be performed using a manual high-pressure spray washer, with a locomotive stopped;

b) An alkaline cleaning solution shall be applied first as a mist or preferably as foam; and

c) A locomotive then shall be rinsed using high-pressure, hot water.

5.10.46.3 Locomotive wash shall be equipped with concrete track slabs with acid-resistant treatment shall be provided for the full length of the washing area with a minimum 9.14 m (30 ft) treated approach slab.

5.10.46.4 The rails shall be sufficiently elevated to allow the various cleaning/rinse agents to freely pass under.

5.10.46.5 All track fastenings shall be corrosive resistant.

5.10.46.6 The entire floor shall be properly sloped, curbed, and drained to provide for proper waste collection.

5.10.46.7 All concrete surfaces shall be coated with acid and alkaline-resisting material to preclude severe deterioration, as well as coated with a non-slip surface.

5.10.46.8 The floor shall be free of obstacles to allow for the circulation of mobile scissor lift platforms on each side of the locomotive.

5.10.46.9 The building structure shall be made of acid and alkaline-resisting materials or properly protected against corrosion caused by acids or alkalis.

5.10.46.10 A separate room shall be provided for the heating/pump-in equipment and for the storage of cleaners in bulk tanks.

5.10.46.11 All fasteners shall be 316 stainless steel.

5.10.46.12 Piping shall be acid and alkaline-resisting PVC plastic.

5.10.46.13 For long spans, fibreglass pipes shall be used and properly supported.

5.10.46.14 A water pumping and heating system shall be provided to supply 10 to 30 L/min of water per station at a pressure of 80 to 160 Bars (1160 to 2320 psi) and at a

temperature of 50 to 70 °C for rinsing.

5.10.47 Locomotive Wash Facility Chemical Mixing Equipment

5.10.47.1 There are several acid or alkaline cleaning agent combinations on the market that are satisfactory. The type selected shall depend on availability, frequency of washing, and adaptability to be neutralized into an acceptable waste material for final treatment and disposal.

Note: *For additional chemical mixing equipment requirements, refer to the AREMA MRE.*

5.10.48 Locomotive wash facility waste-water treatment and recycling system

5.10.48.1 Formulation of any equipment or materials used in the wash, where there is a risk of leaching to the wastewater system, shall not contain substances that are regulated in the local sewer-use bylaw.

5.10.48.2 The wastewater treatment system(s) shall be designed to meet the jurisdictional requirements of the receiving municipality or waterbody.

5.10.48.3 The wastewater treatment and recycling system shall have an auto shutoff valve that would stop waste-water discharge into the local municipality if:

a) Waste-water pH level is outside of the allowed range.

b) Hydrocarbon volume above pre-set value is detected in the wastewater holding tank.

5.10.48.4 The cost of a recycling plant with necessary filters and equipment shall be evaluated against the type of chemical used, the availability of water and the availability of a waste disposal system.

5.10.48.5 The final rinse shall be recycled for pre-wash, acid or alkaline wash, and chemical rinse requires more treatment depending on the final pH result.

5.10.48.6 Treatment of final liquid and solid waste prior to discharge shall be required.

5.10.49 Locomotive wash facility exhaust fume extraction system

5.10.49.1 An exhaust fume extraction system shall be provided in accordance with the Ontario Occupational Health and Safety Act, the Environmental Protection Act of Ontario, Ontario Regulation 419/05, the American Conference of Governmental Industrial Hygienists entitled Industrial Ventilation, the ANSI Standard ANSI Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems and the AREMA MRE.

Note: *See progressive maintenance bay exhaust fume extraction system paragraph for more details.*

5.10.50 Locomotive Wash Control Room

5.10.50.1 There shall be a room to control and operate the necessary pumps, mixing, and treatment equipment located next to the washing equipment room.

5.10.51 Locomotive Wash Staff Facilities and Welfare

5.10.51.1 Change locker rooms for two to four personnel shall be provided, as well as one unisex washroom.

Note: *For additional architectural features, see Architectural Section.*

5.11 Embedded Mechanical Equipment

5.11.1 Overhead Cranes

5.11.1.1 Minimum requirements for overhead cranes for the maintenance facilities are listed in Table 7.

Table 7. Overhead Cranes

Shop Type	Minimum Load Capacity (t) (t = 1000 kg)
Locomotive Heavy Maintenance Shop	60 and 10
Locomotive Light Maintenance Shop	10 and 3
Coach Heavy Maintenance Shop	10
Coach Light Maintenance Shop	3
HVAC Overhaul and Repair Shop	3
Progressive Maintenance Bays	3
Wheel Shop	20
Material Management and Stores	10
Railstock Welding Shop	Metrolinx Direction

5.11.2 Vehicle Jacking Capabilities

5.11.2.1 Jacking capabilities to lift the car-body of vehicles off the bogies shall be required at the locomotive heavy maintenance shop and at the coach heavy maintenance shop.

5.11.2.2 This jacking capability shall be provided either by in-floor jacks or by portable jacks. Jacks' capacity shall be adapted to the weight of the vehicle.

5.11.2.3 Jacks shall be synchronized by sets of four to provide an even lifting of the vehicle.

5.11.2.4 If portable jacks are used, the floor shall be reinforced at jacking locations.

5.11.2.5 Areas where jacking is allowed, shall be clearly identified.

5.12 Water Supply Systems

5.12.1 Fire Suppression

5.12.1.1 Fire suppression shall be designed to meet the requirements of the OBC.

5.12.1.2 For locations not accessible to municipal fire mains, a water reservoir and supporting ancillaries shall be provided in accordance with the requirements of the authority having jurisdiction.

5.12.2 Battery Water

5.12.2.1 Electro-de-ionization (EDI) Systems shall be installed to remove ions from aqueous streams up to 18.2 MΩ/cm for use in locomotive, coach, and material handling batteries.

5.12.3 Wastewater Treatment Plant

5.12.3.1 All process water (excluding stormwater and sanitary effluent) generated on the site shall be directed to a wastewater treatment plant for processing.

a) All chemical containers used in the wastewater treatment process shall be equipped with drainage holding tanks to prevent a chemical spill.

5.12.3.2 Contaminants contained in the process water consist of hydrocarbons and alkaline and acid cleaners used for washing rolling stock and for the cleaning of components and shop facilities.

5.12.3.3 The water decontamination shall be a combination of chemical and physical treatments adapted to remove or neutralize the contaminants found in the effluent as follows:

a) Wastewater shall be treated to ensure compliance with criteria for municipal sewage;

b) Wastewater treatment shall be part of a centralized facility wastewater system;

c) Wastewater system shall be integrated with the BAS;

d) The BAS shall record wastewater system status, condition, and alarms; and

e) Discharge of effluent to the sewer shall be controlled to prevent the release of product outside of receiving municipal authority's sewage parameters.

5.13 Fall Protection

5.13.1 Roof Fall Protection

5.13.1.1 All buildings 3 m high or higher with serviceable equipment on the roof shall have

adequate roof perimeter protection–parapet, and guardrails.

5.13.1.2 Protection-parapet and guardrails shall be designed and installed to provide a barrier preventing a worker from falling from the edge of a surface and in accordance with the Ontario Ministry of Labor Working at Heights Guideline.

5.13.1.3 The location and position of serviceable equipment shall have adequate clearance from the roof edge (minimum 3.0 m).

5.13.2 Open Pits and Platforms Fall Protection

5.13.2.1 All open pits and above-ground platforms with 3 m or more fall hazards shall have guardrails designed and installed to provide a barrier preventing a worker from falling from the edge of a surface.

5.13.2.2 Any above-ground platform where employees are expected to perform work on top of equipment should be provided with removable guard rails that are easy and lightweight to move and safe to store when not in use.

5.13.2.3 All above-ground platforms with 3 m or more fall hazards shall have engineered overhead fall protection systems for employee use when working on top of the equipment. See Metrolinx Working at Heights Operations Standard, MXSD-OHSE-L2-STD-3007, for the details.

6 Staff Facilities

6.1 Staff Quarters

6.1.1 Staff Quarters Requirements

6.1.1.1 The building program shall be determined by the number of train crews and other staff who work out of the building.

6.1.1.2 Metrolinx will identify the number of train crew that the building is to accommodate.

6.1.1.3 The Contracted Party shall work with Metrolinx to assess the program and location to establish the best building type for the location.

6.1.2 Crew Building

6.1.2.1 Staff quarters for main sites shall contain the following amenities as a minimum:

a) Administration, reporting and dispatch area with office space;

b) Computer, server, and communications room;

c) Separate Metrolinx and Contractor administrative offices and support (Minimum 25 staff);

d) Recreation and amenities area (lounge, recreation room, quiet room, etc.);

e) Meeting and training rooms;

f) File and document storage rooms;

g) First aid room;

h) Male and female washrooms and shower facilities;

i) Fitness room with typical gym cardio and weight training equipment;

j) Janitor room with High stability (24-hour) Aqueous Ozone Cleaning System;

k) Linen rooms – clean and dirty;

l) Male and female locker rooms and change rooms;

m) Bedrooms – fatigue management;

n) Kitchen and lunchroom;

o) Lost and found room; and

p) Data and phone service.

6.1.2.2 Crew building shall have energy saving Building Automation System (BAS).

Note: *See Metrolinx Specification 250510 – BAS Performance for details.*

6.1.3 Layover buildings

***Note**: See the Layover Buildings section for the details.*

6.2 Guard Houses

6.2.1 Architectural Requirements

***Note**: For architectural features, see Architectural Section.*

6.3 Track and Signals Maintenance Facilities

6.3.1 Size, access, interior and exterior materials laydown equipment

***Note:** For guidance and general requirements, refer to AREMA MRE.*

6.3.1.1 Space and access shall be provided for:

a) Outdoor storage area for track maintenance material storage (e.g., rails, ties, etc.);

b) Outdoor parking for track maintenance vehicles;

c) Salt shed structure;

d) Accessibility by rail car to receive rail stock deliveries;

e) Garage with overhead door for tool and parts storage, including lock-up; and

f) Garage with overhead door for an equipment storage system for track materials (i.e., spikes, tie-plates, bolts, etc.).

6.3.2 Welding Equipment

6.3.2.1 Stationary welding stations and portable welding equipment shall be provided.

***Note:** For additional welding equipment requirements, refer to the AREMA MRE.*

6.3.2.2 Metrolinx will provide site-specific requirements.

6.3.3 Fabrication Shop Equipment

6.3.3.1 Shop equipment shall be provided for track maintenance fabrication.

***Note:** For additional fabrication shop equipment requirements, refer to the AREMA MRE.*

6.3.3.2 Metrolinx will provide site-specific requirements.

6.3.4 Equipment and Parts Washing Facilities

6.3.4.1 Cleaning and stripping areas (e.g., wash bay and equipment) shall be provided.

***Note:** For additional equipment and parts washing facilities requirements, refer to the AREMA MRE.*

6.3.4.2 Metrolinx will provide site-specific requirements.

6.3.5 Tools Storage

6.3.5.1 A tools storage area shall be provided.

Note: *For tool storage requirements, refer to the AREMA MRE.*

6.3.5.2 Metrolinx will provide site-specific requirements.

6.3.6 Railyard Track Maintenance Equipment Storage Rail-Bound Equipment

6.3.6.1 Storage tracks adjacent to the facility and repair spots inside the facility shall be provided.

6.3.6.2 Metrolinx will provide site-specific requirements for the storage capacity.

6.3.7 Hi-Rail Equipment

6.3.7.1 Storage tracks adjacent to the facility and repair spots inside the facility shall be provided.

6.3.7.2 Metrolinx will provide site-specific requirements for capacity and wayside layover requirements.

6.3.8 Road-Based Equipment

6.3.8.1 Space to park road-based vehicles adjacent to the facility and repair spots inside the facility shall be provided.

6.3.8.2 Metrolinx will provide site-specific requirements for capacity and wayside layover requirements.

6.3.9 Track Maintenance Building Support services - Compressed Air Supply and Distribution

6.3.9.1 A compressed air supply and distribution system shall be provided.

6.3.9.2 The compressed air system used strictly within the shop shall conform to ISO 8573-1:2001 Class 2.3.2. Industrial Grade Air.

Note: For additional compressed air supply and distribution requirements, refer to the AREMA MRE.

6.3.10 Fume Extraction System

6.3.10.1 A fume extraction system shall be provided in accordance with the Ontario Occupational Health and Safety Act and AREMA MRE.

6.4 Visitor Reception

6.4.1 Overview

Note: *See the General Criteria section for general guidelines.*

6.4.2 Applicable Code Classifications

6.4.2.1 All necessary references to the applicable Codes and Acts are included in the construction documents.

6.4.3 Visitor Reception and Waiting Area

6.4.3.1 Metrolinx will provide site-specific requirements for visitor reception and waiting areas.

7 Signage

7.1 General Criteria

7.1.1 Metrolinx Signage

7.1.1.1 The Contracted Party shall coordinate with Metrolinx signage department during the preliminary design stages of a project to familiarize themselves with the Metrolinx information and guidance system, define signage requirements, location, and mounting criteria, and define the scope of sign-related work.

7.1.1.2 Signage design shall comply with requirements defined in the Metrolinx signage standards.

7.1.1.3 Metrolinx signage standards have been developed based on criteria and rules related to industry best practices, compliance with corporate branding, and governing bodies such as, but not limited to:

a) FLSA (French Language Services Act);

b) AODA (Accessibility of Ontario Disabilities Act);

c) OTM (Ontario Traffic Manual); and

d) OBC (Ontario Building Code).

7.1.1.4 Metrolinx's static signage program is based on operational requirements, customer care and industry best practices.

7.1.1.5 It is intended that all Metrolinx signage plans be developed with these basic principles plus that they be easy, have appropriate corporate colours and contrast, defined French Language treatment, minimal text, maximum use of icons and are caring to the environment.

7.1.1.6 Signage shall be in accordance with the following documents:

a) Metrolinx Sign Implementation Manual – GO Transit Edition.

b) "Manual of Uniform Traffic Control Devices," as published for the Ministry of Transportation in the Province of Ontario. (Most recent version); and

c) Any local municipal guidelines.

8 Automated Support Systems

8.1 Yard Management, Blue Flag Protection

8.1.1 Yard Management Requirements

8.1.1.1 The yard train movement, location and status management system shall be in

accordance with Metrolinx instructions during the design process.

8.1.1.2 In general, the yard management system shall:

a) Use a convenient, user-friendly web-based interface;

b) Provide worker "blue flag" and "derail" protection on each track with a standup blue flag; when the derail is applied, the blue flag shall be forced into the upright position;

c) Provide convenient access for staff to activate protection throughout the facility and yard using proximity card-type technology;

d) Display the location of personnel based on where they have activated their protection;

e) Record all aspects of the facility and yard protection system;

f) Provide a complete overview of the facility and yard on any authorized user's computer workstation;

g) Track and graphically display location and status of all rolling stock in the yard and facility; and

h) Provide system interlocking to improve safety by preventing unauthorized train movements (for example, a derail will not disengage until all workers have "logged off" the equipment located on the track protected by the derail).

8.2 Automatic Wheel and Brake Inspection System (AWBIS)

8.2.1 Automatic Wheel and Brake Inspection System Requirements

8.2.1.1 Contracted Party shall ensure that:

a) Any new systems are fully compatible with the current AWBIS;

b) New AWBIS automatically inspects the wheels and brakes on the vehicles, analyzes the results and provides reporting to wheel shop staff to aid in the planning of work, identifying trends and predicting wheel work requirements; and

c) New AWBIS is a wayside system and is located on a section of track, allowing a train's speed to be sufficient to obtain reliable and repeatable data.

8.2.1.2 The Contracted Party shall ensure that the new AWBIS system is able to perform the following functions as a minimum:

a) Automatically identify and inspect all vehicles in the Metrolinx rail fleet.

b) Conduct inspections without human intervention 24-hours per day, 365 days a year.

c) Measure the following wheel parameters:

1) Wheel profile.

2) Flange height.

3) Flange width (thickness).

4) Flange angle.

5) Rim and tread thickness.

6) Tread width.

7) Hollow tread.

8) Taper wear.

9) Wheel diameter.

10) Back-to-back gauge; and

11) Roundness.

d) Measure the following brake parameters:

1) Tread brake shoe thickness;

2) Disc brake pad thickness;

3) Disc thickness;

4) Asymmetrical wear; and

5) Missing hardware detection, e.g., brake shoes and other brake components.

e) Correlate all measurements with individual vehicles and locations;

f) Collect and archive all measurement data;

g) Conduct an analysis of the collected data to determine component wear rates;

h) Compare against limits for maximum allowable wear;

i) Flag unusually high or low wear rates;

j) Flag potential component failures and out-of-tolerance or condemning conditions;

k) Identify wear and failure trends;

l) Predict replacement or re-profiling requirements;

m) Generate reports on measured parameters on a per-vehicle or fleet basis with user-selectable fields;

n) Generate an automated email notification to key personnel when any measured parameters approach wear limits;

o) Generate an automated alarm notification in the form of an email when measured parameters fall below minimum standards or safety limits;

p) Interface with the Metrolinx maintenance management system Maximo;

q) Allow data to be uploaded to an Excel spreadsheet for manual analysis;

r) Perform internal self-test, diagnostic and health monitoring activities; and

s) Report health to the Contractor and/or Metrolinx and generate an email alarm notification in case of System failure.

8.2.1.3 A bungalow shall be provided next to the AWBIS equipment to house electronics and control systems (e.g., heat, A/C, and data connection to a network server).

8.3 Security, Access Control and Building Alarms

8.3.1 Security and Access Control System Requirements

8.3.1.1 Security and access control system requirements shall be in accordance with Metrolinx instructions throughout the design process.

8.4 Energy Management Systems (EMS)

8.4.1 EMS Requirements

8.4.1.1 The contracted Party shall provide an EMS in accordance with the following integrated features as a minimum:

a) Control of all ventilation, heating, and HVAC systems;

b) Control of the lighting system;

c) Operator information, alarm management and control functions;

d) Facility-wide information and control access;

e) Information management, including monitoring, transmission, archiving, trending, retrieval, and reporting functions;

f) HMI/SCADA system with Graphical User Interface and with diagnostic, monitoring and reporting functions;

g) Offsite monitoring and management access through Metrolinx Intranet;

h) Energy management, including lighting control;

i) Standard applications for terminal HVAC systems;

j) Indoor Air Quality monitoring and control;

k) Direct communication with and access to energy-related information provided by the power monitoring system; and

l) Where possible, apply hydronic space heating or ground-source or air-source heat-pump technology to reduce Green House Gas emissions.

8.4.1.2 For some of its rail maintenance facilities, Metrolinx has adopted a native BAC net-based Energy Management System (EMS). Incorporation of an EMS system, or elements thereof, shall be based on consultation with Metrolinx as it pertains to the specific project at hand.

8.4.1.3 Lighting levels may be lowered below minimum lighting levels recommended by the industry or adopted by GO Transit, as outlined in the GO DRM, especially when an area is not occupied.

8.4.1.4 Light levels shall always be adequate to support occupancy work.

8.4.1.5 Light levels shall allow for minimum safety and security requirements and be sufficient for the operation of CCTV cameras, wherever applicable.

9 Accessibility

9.1 Guidelines

9.1.1 Accessibility for Ontarians with Disabilities Act

9.1.1.1 Accessibility for Ontarians with Disabilities Act (AODA) most current edition shall be fully implemented whenever applicable, and all applicable building areas shall be designed accordingly.

10 Sustainable Design

10.1 Leadership in Sustainability

10.1.1 The Contracted Party shall comply with Metrolinx Standards for sustainable design obligations.

11 Architectural

11.1 General Criteria

11.1.1 Design Requirements

11.1.1.1 All buildings shall be designed in accordance with the Ontario Building Code, and all equipment and fixtures shall be CSA-approved.

11.1.1.2 Facilities buildings shall be designed to complement surrounding residential, commercial, and industrial communities.

11.1.1.3 Facilities buildings located in non-residential areas shall be designed with materials and forms to suit the special characteristics of their sites.

11.1.1.4 The optimum design solution shall demonstrate the architectural integration of all building elements, including structural, mechanical, electrical, communications, easier access, and barrier-free routes where applicable.

11.1.1.5 Joint development of a site, where applicable, shall be planned to maintain the facilities buildings' functions as priorities, even while integrating the Metrolinx facilities into the development.

11.1.1.6 Maximum use of daylight shall be utilized by incorporating clerestories, skylights, and windows into the design of the buildings.

11.1.1.7 Where possible, street furniture shall back against a building wall as opposed to being freestanding obstructions to sight lines.

11.1.1.8 Bicycle racks shall be located for visibility from the entrance areas and circulation routes.

11.1.1.9 All building materials and finishes shall be durable and require minimal maintenance.

11.1.1.10 Overhead structures shall not result in an ice or snow accumulation passenger and staff safety problem, or in bird-nesting or interference with bird migrations.

11.1.1.11 Construction and maintenance of facilities buildings shall be compatible with Metrolinx's pavement structures, or the scope of work, particularly tenant work, shall include pavement reconstruction accordingly at tenant cost to suit heavy-duty vehicles.

11.1.2 Exterior ramps, stairway, doorway areas and a 1m wide perimeter area around Wayside Power Stations shall be provided with a thermostat-controlled hydronic or electric resistance snow melting system embedded below the traffic or walkway surface.

11.2 Train Layover Facilities

11.2.1 Overview

11.2.1.1 Rail layover facilities are constructed for the purpose of parking trains during off hours. During that evening time period, minor maintenance and cleaning activities are performed. Trains are connected to electrical power to provide lighting and heat them during the winter months, and to cool them during the summer months. In most cases, facilities buildings are combined with staff and administrative office buildings.

11.2.1.2 Visible elements of Metrolinx facilities shall respond to individual sites with either unusual inherent qualities or notable contextual features.

11.2.1.3 Metrolinx facilities shall be consistent in terms of functional planning principles, functional components (e.g., power distribution system to each train consist, security access via gated perimeter, staff quarters, etc.), structural systems, materials, and lighting.

11.2.1.4 Standardization of Metrolinx facilities design shall not be applied so rigidly as to preclude architectural responses to special site characteristics such as:

a) Heritage features of surrounding neighbourhoods;

b) Significant natural features, identity, or image;

c) Surrounding high-density development; and

d) Potential integration with multi-use buildings on the same site.

11.2.1.5 Facilities shall be flexible and respond to changes generated either from within the system or external to it, with minimal disruption of ongoing system operations.

11.2.1.6 While site potential should always be maximized, there may be instances whereby the design and construction shall factor and protect for the addition of future successive layover tracks to be built over time and potentially under different Contracts.

11.2.1.7 In contrast, the design of new fixed facilities such as substations and staff quarters buildings shall be thought of as permanent structures since the removal of these would generally not be cost-beneficial and further cause significant operational disruptions.

11.2.1.8 Designs may also need to consider and allow for future expansions to existing facilities to accommodate growth.

11.2.1.9 Designs and construction staging shall cause the least disruption to facility and railway operations.

11.2.1.10 The planning and design of Metrolinx facilities shall take into consideration the potential for joint development by encouraging the integration of other facilities run by other railway operators.

11.2.1.11 The likelihood and nature of development in the immediate vicinity of individual rail service center sites shall be identified prior to the design of each facility to ensure that integration into any development is consistent with Metrolinx' s present and future needs.

11.2.1.12 Architectural facilities usually utilize steel structures with building envelope composed of precast concrete insulated panels, aluminum composite or steel insulated panels and metal cladding and curtainwall.

11.2.2 Applicable code classifications

11.2.2.1 Building Classification shall be F2 as per OBC Section 3.2.2.68, sprinklered, non-combustible construction.

11.3 Maintenance Facilities

11.3.1 Applicable Code Classifications

11.3.1.1 Building classification shall be either Group F, Div. 2 as per OBC Section 3.2.2.68, sprinklered, non-combustible construction or Group D as per OBC Section 3.2.2.55, non-sprinklered (either combustible or non-combustible construction depending on the building).

11.3.1.2 Natural light for shop lighting is highly recommended and should be applied as much as possible in illumination design.

11.3.2 Maintenance Centers

11.3.2.1 Maintenance centers shall include supervisor and support offices.

11.3.3 Maintenance Shops

11.3.3.1 Maintenance shops shall include supervisor and support offices.

11.3.4 Control Room for Locomotive Test Cell

11.3.4.1 Soundproofed control room with staff workstations shall include air quality controls during engine testing.

11.3.5 Storage Facilities

11.3.5.1 Storage facilities shall include at least one workstation.

11.3.6 Janitor Rooms

11.3.6.1 The janitor's Room shall have a slop sink, hot water tank and metal storage shelving.

11.4 Railway Operating Facilities

11.4.1 Applicable Code Classifications

11.4.1.1 Building classification is Group D as per OBC Section 3.2.2.55, non-sprinklered, either combustible or non-combustible construction.

11.4.2 Guard and Security Offices

11.4.2.1 Guard and security offices shall be designed to have room for two people and contain the following as a minimum:

a) Regular office area with workstations;

b) Locker room;

c) Network to central security monitor systems; and

d) Access to communications systems and equipment.

11.4.2.2 Accessibility for Ontarians with Disabilities Act (AODA) most current edition shall be fully implemented throughout the facility, and all building areas shall be designed accordingly.

11.5 Building Support Services

11.5.1 Substation Building

11.5.1.1 Substation building shall accommodate switchgear and motor control equipment.

11.5.1.2 A separate communications room shall be included in the above footprint area. The communications room is accessed from the exterior and is air conditioned separately from the main electrical room.

11.5.1.3 Substation layouts shall be designed to house and maintain the electrical equipment associated with the Metrolinx rail service centers (e.g., switchgear cabinets, MCCs).

11.5.1.4 The substation shall be located as close as possible to the wayside cabinets to minimize underground cable lengths.

11.5.1.5 Typical components housed within the substation shall contain the following integrated features as a minimum:

a) Programmable heat and cool thermostat dedicated for roof top unit.

b) Ventilation ducting exhaust thru high fixed louvers with frame and blades of aluminum alloy.

c) Fixed louver and frame completed with bird screen.

d) Motorized damper with interlock with exhaust fan and reverse acting thermostat.

e) Air filter replaceable type.

f) Unit heaters complete with disconnect switch and wall brackets, mounted at elevated level above floor. This shall provide heating source for operator's comfort within building.

g) Adjustable thermostat with lockable cover wall mounted 1500 mm above floor (ventilation controlled).

h) Wall exhaust fan complete with wall mount housing, gravity damper, weather hood, and motor guard.

i) Thermostat and summer fan switch mounted 1500 mm above floor (unit heater controlled) set point 18°C (65°F).

j) Packaged electric cooling and heating unit complete with roof curb, filters, programmable heat/cool thermostat, disconnect switch, low ambient controls, economizer with fresh air set at 71 l/s (150 ft3/min).

k) Hydrogen monitors complete with sensor hi/low alarm, low voltage output relay to fan starter in UPS room.

l) Main and wayside breakers remote control panel with breakers status display or pilot lights.

m) Cabinet fan complete with vibration isolators, starter, disconnect switch and intake air grille; and

n) Automatic back draft damper.

11.5.1.6 Substation building shall be insulated, heated, and cooled where required.

11.5.1.7 There shall be no windows.

11.5.1.8 There shall be no pits around substation building, as cables shall run directly up into the switchgear.

11.5.1.9 Switchgear shall have a remote panel to keep workers outside of the Arc Flash Boundary.

11.5.1.10 Arc Flash Labels shall comply with Metrolinx Standards.

11.5.1.11 Lighting shall be provided for high-voltage areas, but fixtures shall be kept out of the high-voltage compound.

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