Transit Oriented Communities

Reference Concept Design- Mechanical Engineering- Cosburn

Contract RFS-2019-NAFC-110

PO 214244

HDR Project 10206938

Ontario Line Technical Advisor

TORONTO, ONTARIO

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Key Stakeholders Consulted

Date	Name	Role	Organization

Quality and Revision Information

Rev	Date	Originator	Checker	Approver	Description
A	October 21, 2022	Timothy Wong	Anas Alhadidi	M. Pearce	First Draft for IO Review
	Signatures	T.W.	A.A.	M.P.	

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Abbreviations

ACH – Air Change per Hour

Civil Project Co – Design, Build and Finance contractor responsible for North civil works

CO – Carbon Monoxide

CO2 – Carbon Dioxide

ERV – Energy Recovery Ventilator

FAHU – Fresh Air Handling Units

IO – Infrastructure Ontario

MMCL – Mott MacDonald Canada Limited

NO – Nitric Oxide

OA – Outdoor Air

OBC – Ontario Building Code

PIV – Position Indicating Valve

OLTA – Ontario Line Technical Advisor

RCD – Reference Concept Design

RSSOM – Rolling Stock, Systems, Operation and Maintenance

SLS – Serviceability Limit State

SM – Square Meter

SF – Square Foot

SWM – Storm Water Management

TOC – Transit Oriented Community

ULC – Underwriters Laboratories of Canada

VAV – Variable Air Volume

VFD – Variable Frequencey Drive

1 Introduction

1.1 Background

The Ontario Line rapid transit project being delivered by Infrastructure Ontario and Metrolinx will be a 15.6-kilometre stand-alone rapid transit line connecting the Ontario Science Centre to Exhibition/Ontario Place through the Toronto downtown core. Fifteen stations are proposed, with numerous connections to the city's broader transit network. The project also intends to develop Transit Oriented Communities (TOCs) at selected stations to enhance communities along the length of the transit line.

In developing the TOC strategy, the Cosburn site was identified as an opportunity area for development and a TOC was advanced at this location.

The sites for Cosburn TOC are located at South TOC: 1002-1028 Pape Ave, 103-109 Cosburn Ave and North TOC: 1030-1052 Pape Ave. To construct the rail infrastructure Civil Project Co will demolish the existing buildings and build the new OL Cosburn station. The station entrance will occupy part of the footprint of the North TOC building. The station emergency egress building will occupy part of the footprint of the South TOC building. The TOC is projected to fill the remaining length of each site.

The TOC was designed as a mixed-use development, allocating most of the floor area for residential use, with the ground level allocated to mostly retail space.

1.2 Purpose and Limitation of Document

This document presents the basis of design for the reference concept design developed for the Cosburn TOC development. It is intended to be part of the Disclosed Data (in the data room) to provide Proponents with context to the development of the RCD. The reference concept designs for the TOCs represent an approximate 10% level of design development. As such, this report provides only key engineering parameters required for the concept design. A number of areas will require future consideration, and these are noted through the report.

The report describes the station interfaces, design criteria and design approach for the TOC mechanical design.

This memo is not intended to dictate how to design and construct the project or relieve the developer of design responsibility. Moreover, the document is not prescriptive and does not limit or prevent the TOC Developer from adapting the design to suit the future TOC. Instead, this document intends to be informative and outline the design data used to develop the reference design and presents a potential design option for this location.

1.3 Referenced Documents

This memo is intended to be read in conjunction with the following key documents:

- Station -TOC Interface Drawings (MMCL)
- TOC architecture reference concept design (SvN)
- TOC structural reference concept design (MMCL)
- Station architecture reference concept designs (HDR)

- Electrical concept design memo
- Geotechnical concept design memo
- Constructability memo (MMCL and HDR)
- Available existing building record drawings from City of Toronto

2 Design Responsibilities

Division of responsibilities related to the general design of the TOC Development:

Infrastructure Ontario

Infrastructure Ontario (IO) is the client and leads the development of the TOCs associated with the Ontario Line subway project.

Civil Project Co

Civil Project Co identifies the joint venture selected by Metrolinx to design and build the Railway Civil Infrastructure for the North Ontario Line segment.

Rolling Stock, Systems, Operation and Maintenance Project Co

Rolling Stock, Systems, Operation and Maintenance (RSSOM) Project Co identifies the joint venture selected by Metrolinx to design, build, operate, and maintain the Ontario Line Infrastructure for 30 years following substantial completion of the works.

City of Toronto

The City of Toronto is a key stakeholder in the Ontario Line project and will grant planning approvals for the development of the TOC.

TOC Developer

The TOC Developer will be responsible for developing and constructing the TOC building in accordance with the latest editions of revisions of applicable codes and standards, City of Toronto guidelines and the constraints identified in the Developer Agreement.

3 Site Overview

3.1 Site Information

Site Name: Cosburn

Location: The TOC will be located on the northwest and southwest blocks of the intersection of Pape Avenue and Cosburn Avenue.

TOC Address: North site: 1030-1052 Pape Ave
South site: 1002-1028 Pape Ave, 103-109 Cosburn Ave

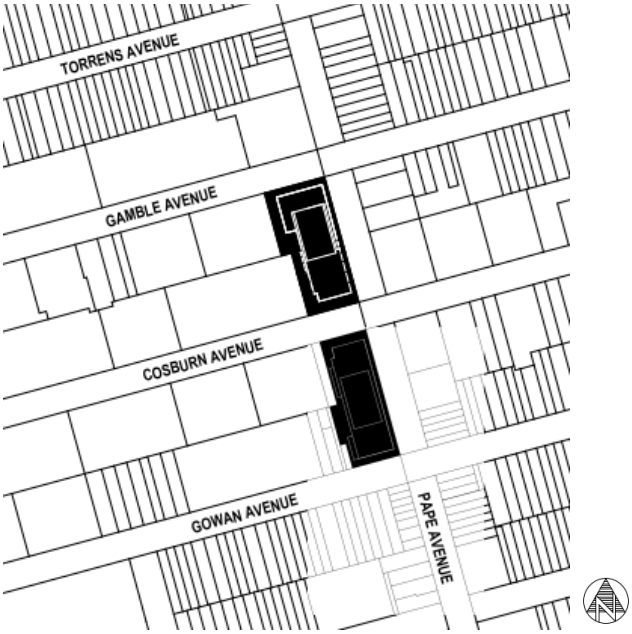

Figure 3-1. Site Location Plan

4 Design Criteria

4.1 General

Mechanical systems will be in accordance with latest versions of applicable codes and standards including, but not limited to:

1. Requirements of Authorities Having Jurisdiction (local building department requirements, local fire department requirements, local by-laws including, but not limited to, Toronto Green Standard)
2. National:
   a. Canadian / American Air Balance Council (CAABC)
   b. Canadian Standards Association (CSA)
   c. Model National Energy Code for Buildings (MNECB)
3. International:
   a. Air Conditioning and Refrigeration Institute (ARI)
   b. American National Standards Institute (ANSI)
   c. American Standard for Testing and Materials (ASTM)

d. American Society of Mechanical Engineers (ASME)
e. American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)
f. American Society of Plumbing Engineers (ASPE)
g. Natural Gas Utilization Code
h. National Fire Protection Association (NFPA)
i. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

4. Ontario:
   a. Ontario Building Code (OBC)
   b. Ontario Fire Code (OFC)
   c. Ontario Electrical Safety Code

4.2 HVAC

4.2.1 Outdoor Design Conditions

The sizing of mechanical systems should be based on the outdoor air conditions shown in the following table:

	Dry Bulb °C (°F)	Wet Bulb °C (°F)	Design Temperature
Cooling Toronto	31.0 (87.8)	23.0(73.4)	OBC 2.5%
Heating Toronto	-20.0 (-4.0)	-	OBC 1%

Table 4-1. Outdoor Design Conditions

4.2.2 Ventilation for Acceptable Indoor Air

Ventilation to meet acceptable indoor air quality should be in accordance with ASHRAE Standard 62.1 and the OBC.

Specific minimum outdoor air (OA) ventilation rates are identified in the following table and are equal to the sum of a per person rate and per SM (SF) rate:

Area	L/s (CFM) Per Person	L/s- SM (CFM/SF)	Minimum OA-ACH	Comment
Residential Suites (Condo)	2.5 (5)	0.3 (0.06)	0.35	See Note 1
Residential Suites (Hotel)	2.5 (5)	0.3 (0.06)	-	See Note 1
Office / General Commerce	2.5 (5)	0.3 (0.06)	-	-
Retail	2.5 (5)	0.3 (0.06)	-	-
Multi-purpose / Amenity	2.5 (5)	0.3 (0.06)	-	-
Note 1: Localized fan coil unit will provide the ventilation requirement for the suites to offset the stack effect.				

Table 4-2. Ventilation for Acceptable Indoor Air

4.2.3 Indoor Design Conditions

1. The indoor space conditions will be in accordance with the following table:

Area	Summer		Winter	
	Temperature ºC	Relative Humidity	Temperature ºC	Relative Humidity
Residential Suites, Office, Multi-purpose	23.5 +/- 2 ºC	40%-60%	21.5 +/- 2 ºC	30%-60%
Mech / Elec Plant room	27 +/- 2 ºC	Not monitored	20 +/- 2 ºC	Not monitored
• Note 1: No direct space humidity control will be provided, although the necessary cooling will provide dehumidification to maintain the internal humidity levels in the range of 30 to 60% relative humidity, although they may occasionally move above or below this range.				

Table 4-3. Indoor Design Conditions

2. Non-standard indoor design conditions to be determined during programming stage.
3. During the programming stage, internal loads for the equipment provided for each space will be reviewed in order to establish required cooling.

4.2.4 Air Filtration Design

1. The following air filtration levels are proposed for the new HVAC air handling systems indicated:
   a. Supply air systems (Pre Filters): MERV 7
   b. Supply air systems (Final Filters): MERV 13
2. Station's exhaust placed within the TOC development will comply with minimum separation required from operable windows and other fresh air intake as per applicable code requirements.
3. Station's exhaust (environmental discharges) placed within the TOC development will comply with requirements of Authorities Having Jurisdiction (in Ontario, under the Ministry of the Environment).

4.2.5 Noise Design Criteria

1. All mechanical systems and components will be designed and installed with attention to reducing sound and vibration levels to meet space noise criteria and provide a space that is comfortable, acoustically, for the occupants. All mechanical equipment generating exterior noise to adjacent buildings are to comply with the noise criteria as outlined in MECP NPC-300.
2. Noise levels due to mechanical equipment, ductwork, grilles, registers, terminal devices, and diffusers will be designed not to exceed the recommended ASHRAE limit listed below for the areas indicated:

Area	NC (low)
Office	30
Office Open Plan	40
Suites	30
Multi-purpose / Amenity	30
Lobby / Circulation	35
Mech / Elec Room	NC 65 mechanical / 40 electrical
Property Line	45

Table 4-4. Noise Design Criteria

3. The identified noise criteria resulting from the operation of mechanical systems assumes a finished room with all the final architectural finishes (e.g. ceilings and floor finishes) and furniture in place.
4. The acoustic performance of the project including mechanical systems will be reviewed by the acoustical consultant.

4.2.6 Thermal Analysis

Systems will be designed to offset gains from infiltration, solar, envelope, occupants, lighting and small power loads.
At this preliminary stage, the cooling and heating loads estimates were developed using high-level “rule-of-thumb” methods complemented with preliminary computer-based load simulation. In this method, the area of the building spaces is multiplied by a cooling / heating intensity factor.

The following cooling / heating load intensity factors were used:

- Cooling load intensity assumed for residential: 60 w/sqm (20 BTUH / sq-ft)
- Cooling load intensity assumed for offices / retail: 95 w/sqm (30 BTUH / sq-ft)
- Heating load intensity assumed for residential and offices / retail: 173.5 w/sqm (55 BTUH / sq-ft)

A diversity factor of 0.95 was applied to determine the required cooling / heating plant capacity. Diversity factors are applied to account for load shift based on time of day, space type, solar exposure and building thermal performance.

A thermal load analysis will be carried out at later design stages using either IES or other recognized computation procedures referenced in ASHRAE.

4.3 Fire Protection

4.3.1 General

- The Fire Protection System will conform to the applicable codes, standards and requirements listed in Section 4.

4.3.2 Sprinkler

1. A wet pipe, hydraulically sized sprinkler system will be installed for the building. Sprinkler design will be to NFPA 13.
2. Sprinkler heads will be:
   a. Upright brass type where no ceiling exists.
   b. Concealed type where ceilings occur.
   c. Provided with guards in exposed areas where heads are susceptible to damage.
   d. Sidewall or concealed in suites.
3. All piping 65mm (2-1/2 inch) and larger will be schedule 40 with Victaulic fittings.
4. All piping 50mm (2 inch) and smaller will be screwed.
5. Dry system piping will be galvanized.
6. The following sprinkler zones and coverage is anticipated:

Area	Type	Hazard	Remarks
• Offices and Multi-Purpose	• Wet	• Light	• -
• Gymnasium	• Wet	• Ordinary GR 1	• Guards on heads
• Exterior Canopies	• Dry	• Light	• Galvanized piping
• Mechanical Rooms, Storage Rooms	• Wet	• Ordinary GR 1	• -

Table 4-5. Sprinkler System

7. All supervised valves will have end switches.
8. Main Data / IT rooms will be equipped with pre-action sprinkler systems that required two fault occurrences to occur before sprinkler system will be activated.
9. Window sprinkler systems will be provided for any rated glazing. Window sprinkler zone demand will be added to the building sprinkler demand requirement.
10. Retail and/or tenant areas will be provided with upright sprinklers on a “grid” pattern to meet occupancy requirements. Tenant will do any modifications necessary to suit the architectural design of the fit-out. Any retail with cooking applications will be provided by a chemical suppression system by the tenant.

4.4 Plumbing

4.4.1 General

1. The Plumbing System will conform to the listed codes and standards in Section 4.
2. All exterior site services including external cisterns will be provided under the “Site Works” division or “Civil” contract.
3. Above floor storm drains, sanitary drains and vents, 65mm (2-1/2 inch) and larger will be cast iron.
4. Buried storm / sanitary piping within the building will be PVC.
5. Domestic water piping will be copper type L.
6. Domestic water within suites will be distributed from a common suite manifold, through the slab with PEX piping to the fixtures. All PEX piping within the slabs will be complete with conduit to permit removal and future replacement.

7. Valves will be Crane or equal of type and construction to suit service and working pressures

5 Description of TOC Design

5.1 General

Mechanical systems will be designed and installed to maximize usable space within the building while maintaining optimum service clearances for maintenance and repair.

5.2 Notable Sustainable Design Features

The mechanical concept design incorporates energy conservation and sustainable design measures to reduce the building's operating costs, lower the environmental impact and improve the quality of the indoor environment. Provisions are made to meet the requirement of Toronto Green Standard V4 Tier 3. Some of the measures incorporated or to be considered are as follows:

1. Water usage
   a. Low flow fixtures will be using throughout to minimize water usage. Refer to the plumbing section for details.
2. Heat recovery
   a. Make up air systems for the office and residential developments will use heat recovery wheels to reclaim energy from general exhaust and sanitary systems.
3. Equipment considerations
   a. All mechanical cooling equipment will be CFC and HCFC free.
   b. All new supply fans will be selected to operate at a static efficiency of 60% or greater.
   c. Condensing boilers will be used for heating water. Condensing boilers can have operating efficiencies over 90%.
   d. Low temperature heating systems will be employed to improved condensing boiler efficiency.
   e. Ultra-high efficiency motors will be specified throughout.
   f. Variable frequency drives will be used on pumping and fan systems to save considerable energy in part load conditions as described in the HVAC Systems section.
4. Indoor air quality
   a. Ventilation systems will meet the requirements of ASHRAE 62.1.
5. Indoor air quality will meet ASHRAE 55.

5.3 HVAC

5.3.1 Cooling Strategy and Load Summary

The two main cooling systems considered at this stage for the spatial planning exercise are the following:

1. A central air-cooled chiller plant located on the roof with distribution pumps and piping system.
2. A central water-cooled chiller plant located in the basement mechanical plant room with distribution pumps and roof mounted cooling towers.

The following table summarizes the cooling load estimates for each development, the cooling system, chiller sizes and approximate required footprint area:

Station	Site	Building / Block	Cooling Load (Tons)	Chiller Type & Arrangement	Chiller Size (Tons)	Required Open Space for Chillers (m^2)
Cosburn	North TOC	Residential Tower	500	Air Cooled Chiller 2 x duty	2 x 250	160
Cosburn	South TOC	Residential Tower	500	Air Cooled Chiller 2 x duty	2 x 250	200

Table 5-1. Cooling Load Summary

5.3.2 Heating Strategy and Load Summary

The proposed central boiler plant consists of ultra-high efficiency, condensing, gas-fired, forced draft boilers located either on the roof or in the basement mechanical plant rooms with distribution pumps and piping system.

The heating plant will be sized to serve:

1. Perimeter envelope losses.
2. Building air handling unit heating coils.
3. Vertical fan coil units heating coils.
4. Reheat, if required.

The following table summarizes the heating load estimates for each development, the boiler sizes and approximate required footprint area:

Station	Site	Building / Block	Heating Load (MBH)	Boiler Type & Arrangement	Boiler Output (MBH)	Required Open Space for Mechanical Room with Boilers & AHUs etc (m^2)
Cosburn	North TOC	Residential Tower	16,200	Gas-fired Heating Boilers 4 x duty	4 x 4,050	200
Cosburn	South TOC	Residential Tower	16,000	Gas-fired Heating Boilers 4 x duty	4 x 4,000	200

Table 5-2. Heating Load Summary

5.3.3 Ventilation and Air Conditioning

1. Residential Areas:
   a. A central roof mounted Fresh Air Handling Units (FAHU) will be provided to supply fresh air at each floor for corridor pressurization purposes and for general amenities and retail areas to achieve ASHRAE ventilation requirements. The FAHU will provide filtered, tempered and dehumidified outside air, the FAHU will typically incorporate inlet motorized dampers, panel and bag filters, thermal heat recovery wheels, cooling and heating coils with supply and extract fans.
   b. All apartments will be provided with high-rise, floor mounted integrated vertical fan coil system that includes an energy recovery ventilator (ERV).
   c. The primary bathroom exhaust for each apartment will be collected and ducted via an enthalpy recovery ventilator (ERV) to the perimeter via exhaust louver. Outdoor air will be ducted from perimeter intake louver to the ERV within the vertical fan coil unit.
   d. Kitchen range exhaust will be individually ducted to the perimeter and exhausted.
   e. Laundry exhaust will be individually ducted to the perimeter and exhausted complete with booster fan and lint trap. A current sensing relay will be provided to start / stop the exhaust fan.
   f. Any retail areas will be provided with chilled / heating water pipework connections for future use by the tenants while fresh air is supplied centrally from the main FAHU, fresh air duct will be capped within the space for tenant distribution.

2. Life safety ventilation system:
   a. An independent code review will confirm the life and safety ventilation (pressurization, venting and smoke control) requirements for high rise development.
   b. At this stage, it is considered that pressurisation will be provided to the following areas to provide a smoke free escape route in the event of a fire:
   c. Fire fighting stair via multi-injection points pressurization system.
   d. At this early stage, the mechanical design input was limited to space proof the shafts required to accommodate the ducts required for stairs / corridor pressurization and smoke control if needed.

5.3.4 Cooling / Heating Hydronic Distribution System

1. Distribution pumps will be duplex, lead / lag systems (two pumps sized at 100% of the peak design circulation rate) to provide redundancy during times of service.

2. Variable flow distribution systems will utilize variable frequency drives (VFD) on the distribution pumps and two-way control valves at the terminal devices. Minimum system flow rates will be maintained either by including three-way control valves at a sufficient number of terminal devices or by installing a two-way (bypass) control valve across the supply and return mains modulated by a differential pressure controller.

5.4 Fire Protection

5.4.1 Standpipe Systems

1. At this stage, it is considered that the buildings require a fire standpipe system complete with fire hose cabinets equipped with 38mm (1-1/2 inch) hose reels and 65mm (2-1/2 inch) hose connections. An independent code review will confirm this at a later date.
2. In lieu of fire hose cabinets in the tower, hose valves / landing valves located in exit stairs will be provided.
3. Vertical standpipe piping will be enclosed in 2-hour fire rated enclosure. Where accepted by local authority having jurisdiction (e.g. Ontario), vertical standpipe does not require a fire rating provided it is located within a stairwell or service area having 2-hour fire separate from the remainder of the floor.

5.4.2 Sprinkler and Standpipe Water Services

1. A ULC listed sprinkler / standpipe pump will boost incoming service water to the required pressure level for fire protection.
2. Fire pumps will be complete with jockey pump, bypass, and test header piped to a street location. Emergency power will be provided for fire pumps.
3. Fire department Siamese connection will be provided for the sprinkler and standpipe system and will be located near the main fire department entrance and at a distance not to exceed 45m (150 feet) from a fire hydrant. There will be an additional Siamese connection provided on the secondary street to meet NFPA 20 requirements for high rise buildings.
4. Risers will be complete with 75mm (3 inch) as minimum drain risers to permit testing of pressure reducing devices, flow switches and annunciation.
5. At this early stage, the mechanical design input was limited to:
   a. Validate the pipe connection size and review civils' utilities plan and calculations.
   b. Space proof fire pump room location.
   c. Space proof shaft for fire protection risers.

5.4.3 Portable Fire Extinguishers

1. General areas including offices will be covered by multipurpose dry chemical extinguishers (Type ABC).
2. Mechanical rooms, electrical rooms and similar spaces will be provided with CO2 fire extinguishers (Type BC).

5.5 Plumbing

5.5.1 Storm Water Systems

1. A complete system of roof storm drainage and storm drainage piping will be provided.
2. The “Civil” consultant will prepare the storm water management (SWM) approach for the site, which determines the retention storm cistern requirement.
3. Green roof storm management system will be further developed with the architects and green roof specialist.
4. At this early stage, the mechanical design input was limited to space proofing the shafts required to accommodate the stormwater leaders within the high-rise developments.

5.5.2 Sanitary Systems

1. A complete system of plumbing fixtures and sanitary drainage and vent piping will be provided.
2. New above grade drains will be collected and drained by gravity to site sanitary sewers. Drains below the municipal services invert elevations will be collected in sump pits complete with duplex submersible pumps. Pits will be pumped into the gravity drainage piping. Sump pumps will be on emergency power (if available).
3. At this early stage, the mechanical design input was limited to validating the main sanitary pipe connection size and reviewing utilities plan and calculations done by the Civil team.

5.5.3 Plumbing Fixtures

1. Water use will be minimised by selecting plumbing fixtures that use lower water flows than conventional fixtures. The maximum permitted flow rates by fixture type will comply with OBC requirements.

5.5.4 Domestic Cold Water

1. Domestic water service will be brought into the building for domestic water use and for fire services. The domestic water and fire services will be isolated from the municipal water supply by approved backflow prevention devices.
2. A domestic cold water booster system will be provided to maintain a minimum pressure of a minimum of 25psi water pressure at the most remote system point. Booster system will consist of duplex set of pumps and equipped with variable speed drives. The domestic cold water booster system will be on emergency power. Pressure Regulating Valves should be provided at branch pipes feeding areas that are close to the booster pumps set to regulate the feed pressure.
3. A replaceable bladder expansion tank suitable for domestic cold water will be installed on the highest point of the domestic cold water system to reduce potential of water hammer and pump cycling on low load.
4. At this early stage, the mechanical design input was limited to space proofing the shafts required to accommodate the risers within the high-rise developments and reviewing utilities plan and calculations done by the Civil team.

5.5.5 Domestic Hot Water

1. Hot water services will be of two types:

a. Local water heating to offices in office floors using either electrical or gas fired water heaters.
b. Central water heating to residential areas by gas fired water heaters.

2. A replaceable bladder expansion tank suitable for domestic hot water will be installed on the domestic hot water system to accommodate thermal expansion. A thermal / pressure relief valve will be installed to accommodate thermal expansion.
3. A recirculation loop and recirculation pump will maintain flow in the domestic hot water system to maintain hot water at the fixtures at all times.
4. At this early stage, the mechanical design input was limited to space proofing the location required for central water heaters in mechanical plant rooms.

5.5.6 Natural Gas

1. Natural gas will be distributed to boiler rooms as required. All gas piping will be schedule 40. Piping 64mm (2-1/2 inch) and larger will be welded. All gas piping will be painted yellow in its entirety including concealed areas.
2. At this early stage, the mechanical design input was limited to space proof the shafts required to accommodate the risers within the high-rise developments and to review / validate Civils' utilities plan and calculations.
3. Current design consideration is based on using gas powered generators with gas system as follows:
   a. High pressure risers 34.5kPa (5psig) will serve the mechanical penthouse. Natural gas service for emergency generators will be piped independently from the incoming service connection (downstream of the meter) to the generator.
   b. A supervised, Position Indicating Valve (PIV) will be installed at the incoming gas station with contact that will initiate a trouble alarm condition at the generator control panel or fire alarm panel when the valve is closed.
   c. Dedicated emergency generator gas supply will be in a fire rated shaft with minimum vent opening of 25mm (1 inch) as per CSA B149.1 at the top and bottom of the shaft. The vented shaft will be fire rated to match the floor slab rating. Any horizontal dedicated generator gas pipe will be fire rated to match the floor slab rating.
   d. In accordance with CSA-B149.1-15 item 6.18, there will be a supervised isolation valve at the generator.
   e. Any isolation valves between the incoming gas service and the generator will be supervised (monitored open-closed) at the fire alarm.

6 Station and TOC Interfaces

6.1 Mechanical Interfaces

6.1.1 HVAC

The HVAC systems of the TOC will be separated from the station with separate utility supplies. However, fresh air intakes or operable windows in the TOC will need to have sufficient separation from smoke, station ventilation and tunnel ventilation exhausts from the station. The separation distance should be in accordance with ASHRAE requirements.

6.1.2 Fire Protection

Fire protection systems including standpipes, sprinklers and fire extinguishers for the TOC and station will be separated, although the fire detection systems will be integrated (refer to the electrical reference concept design memo).

6.1.3 Plumbing

All plumbing systems for the TOC and station will be separated with separate utility supplies. As the TOC covers the full footprint of the station head house, the stormwater drainage system for the TOC roof will drain to the TOC drainage network. The storm water load from the TOC building façade will be considered in the storm water calculation of the station house as they drain towards the utility network by gravity.

The reference concept design for the TOC is provided with a raised floor system at the TOC and station interface where any drainage system at that TOC/ station interface level will run within the raised floor and downward towards the TOC part of the site for drainage discharge. This arrangement will ensure delineation of drainage pipework between the station and TOC contract works.

6.2 Construction Constraints

The Cosburn TOC is located in a medium density Toronto neighbourhood, bordered by one major arterial road: Pape Ave and one minor arterial road: Cosburn Ave. Major equipment delivery route, replacement access route and pipework connection to civil network should minimize the impacts toward the roads and the operation of the station.