

v. 2.0

**Information Technology
Telecommunications & Systems
Document**



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MetroInx Information & Information Technology


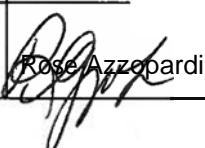
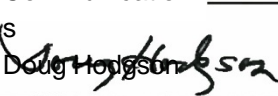

IT TELECOMMUNICATION & SYSTEMS DOC

1 REVISION HISTORY

Version Number	Date Issued	Author	Date Approved
0.1	6/27/2011	Brandon Scott / IT Net. Eng.	N/A
Notes: Original Document Creation and Draft			
1.0	9/22/2011	Brandon Scott / IT Net. Eng.	
Notes: Completion of first draft. Issued for review and comment by stakeholders.			
1.1	3/8/2012	Brandon Scott / IT Net Eng	
Notes: Updated from comments received from meeting held 09/28/2011 with Tony Norman, Jay Gill, Brandon Scott and Alex von Tiesenhausen.			
1.2	11/20/2011	Brandon Scott / IT Net Eng	
Notes: Updated and included drawings for rack elevations			
1.3	11/23/2011	Brandon Scott / IT Net Eng	
Notes: Updated Section References			
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Notes: Updated based on comments received during meeting held November 24 th 2011 with PMPS – Constantin U, Bhavana N, Michael J., Chris J., Robert S., Jay G., Edison R.			
1.5	1/14/2012	Brandon Scott / IT Net Eng	
Notes: Some verbiage modifications and addition of Rack Elevation Drawings			
1.6	2/29/2012	Brandon Scott / IT Net Eng	
Notes: Adjusted Fibre Specifications and Added Wireless Access Point Standards. Added Ticket Booth PC Standard.			
1.7	3/8/2012	Brandon Scott / IT Net Eng	
Notes: Submitted For Approval			
1.8	3/13/2012	Brandon Scott / IT Net Eng	
Notes: Included Fuel Management Infrastructure			
2.0	5/22/2012	Brandon Scott / IT Net Eng	
Notes: Review of all aspects and inclusion of received comments from stakeholders. Final version for approval.			

2 APPROVAL

This version of the Information Technology Telecommunications & Systems Document has been reviewed and approved by the following Managers and Director of the Metrolinx I&IT Department. Future versions and changes to this document are subject to subsequent review & approval processes.

Mgr. Network Engineering	Mgr. Network Operations	Mgr. Electronics & Communication	Director Information Technology
			
Alex von Tiesenhausen	Rose Azzopardi	Doug Hodgson	Robert Power

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3.1 COMMUNICATIONS SPECIALIST'S TECHNICAL QUALIFICATIONS

The communications specialist assigned by the Consultant to monitor the construction of telecommunications and electronic systems must be a Registered Communications Distribution Designer (RCDD) and shall be either a Licensed Professional Engineer (P.Eng.) or a Certified Engineering Technologist (C.E.T.). The telecommunications specialist must be experienced in the design and construction of building services and be able to carry out construction supervision in an efficient and professional manner.

3.2 STATION READINESS FOR SYSTEMS INSTALLATION

Consultant's Communications Specialist shall provide thirty (30) business days' notice to Metrolinx Information Technology Group and to the systems vendor/installer, of the planned readiness of the station for system installation.

No telecommunications or electronic systems shall be installed until the Consultant has:

- Certified the completion of the station telecommunications room.
- Verified that the Bell Canada Trunk Line has been installed and ready for use.
- Verified that all power outlets have been inspected and approved for use.
- Verified that all work and finishes have been completed in the vicinity of the system installation
- Verified that any changes or deviations to the telecommunications infrastructure that took place during construction have been identified, documented and communicated to Metrolinx' Information technology group.

3.3 PROTECTION OF EXISTING COMMUNICATIONS INFRASTRUCTURE

During construction it is the consultant's responsibility to ensure all electronic and communications devices in and around the construction areas are protected. This may include hoarding, relocating, or possible temporary trailers / kiosk to house electronic and communications equipment. All aspects of this protection are to be identified during design where it is known that impact to systems could be a possibility. All protection is to be reviewed with the Information Technology department prior to implementation to ensure its suitability.

Conditions where protection is identified during construction must be communicated to the Metrolinx Information & Information Technology department before commencing work in the area.

All Communications System Outages require a minimum of 4 weeks' notice and must be performed outside of scheduled service hours. This may include weekend or night work and must be coordinated with Metrolinx and the Metrolinx I&IT department.

3.4 COMMISSIONING AND ACCEPTANCE

All communications systems are required to be commissioned and tested. In addition to the Metrolinx DRM requirements for testing and commissioning the Metrolinx I&IT department must be present for the commissioning of any communications systems. This includes but is not limited to CCTV, Network & Bell Services, PA Systems, Ticket Vending and Service Counter systems, Access Control and Security systems, Fuel Management systems and others listed in this document.

3.5 QUALIFICATIONS OF THE QUALIFIED COMMUNICATIONS CABLING INSTALLER (QCCI)

The Consultant shall ensure that the communications cabling installer is experienced in his/her trade. The ideal qualifications of the qualified communications cabling installer (QCCI) could be: a licensed electrician with communications or electronics specialization and/or a licensed electrician with BICSI registration as Installer Level. However, the “licensed electrician” requirement may be waived if the installer demonstrates superior communications and electronics cabling knowledge or other trade specific certifications relating to cable installation. The qualified communications cabling installer is referred to as QCCI throughout this document.

3.6 SITE CLEAN-UP

A full cleaning of the communications room is required prior to systems installations. Upon completion of the cleaning and preparation of systems installations this room must be kept in a clean and tidy fashion. Regular inspection and cleaning is required to protect the equipment during installation. This includes regular vacuuming for dust and debris, maintaining air circulation filtration to ensure dust is not circulated, and general cleanliness of the area including removal of packaging materials, and cable debris.

These spaces are not to be used for tool or other storage during the systems installation nor are these spaces to be used for machining or work other than systems installation. This includes threading pipes, bending conduits, general fitting of any other material.

Final cleaning shall follow Metrolinx Close-Out Specifications as per contract documents. In addition to the standard close-out procedure cleaning, the Consultant shall ensure that the cleaning of the systems equipment, such as CCTV racks, P.A. racks, etc., is carried out by a qualified technician.

4 TELECOMMUNICATION ROOM REQUIREMENTS

4.1 LOCATING TELECOMMUNICATIONS ROOMS

Limitations in cable distances for end devices such as Digital Signage, Presto, Parking Counters and others reduces the distance of a permanent link length of no more than 90m. Where facilities are being built which have significant renovation or increase in size, the distribution of telecommunications rooms should be evaluated. Some of these facilities include but are not limited to; parking garages, operational facilities, stations, Rail and Bus Maintenance facilities. Telecommunications rooms should be placed to ensure that these buildings have complete coverage within the 90m length. This distance limitation is based on the total cable path length and not a radius from the telecommunications rooms.

The location of the telecommunications rooms are to be approved by the Metrolinx I&IT department at the 25% design phase. Please reference Metrolinx DRM for guidelines on communication room locations.

4.2 CO-LOCATION WITHIN FACILITIES

In situations where co-location of telecommunications spaces is required or proposed, coordination between groups is necessary. Factors determining co-location between organizations include current working agreements between organizations, sensitivity of equipment intended to be co-located and physical space issues. In situations where co-location is approved all Metrolinx cabinets must be locked

at all times. Space for future cages or complete fire partitioning is to be considered or installed based on the agreements between organizations.

Colocation will only be considered if shared with other telecommunications equipment. Sharing this space with other groups or purposes is not permitted as per Metrolinx DRM i.e. Janitorial, Storage or others.

In cases where co-location is not permitted or used and the two groups are to use separate telecommunications rooms each room shall share a single wall. Accommodation for interconnectivity of these rooms is to be considered. A single common overhead tray should be considered between rooms.

All communication Rooms are to be sized based on the following requirements and are to be sized in adherence to the Metrolinx DRM. These rooms are to only house systems outlined within this document. Any systems which are not described in this document are not to be housed in the telecommunications rooms. This includes Fire annunciation panels, fuel management systems, SCADA, and others. In some cases these systems may be housed in these telecommunications rooms but require approval from Metrolinx and the room size must be increased to accommodate these systems without impacting space for Metrolinx equipment.

4.3 STATION TELECOMMUNICATIONS ROOM

Each Station Facility (Rail or Bus) is to have a communications room within the station building (where possible). Refer to the DRM for requirements of Main Telecommunications Rooms (Stations). This room should allow for 4 Full Height Racks or Cabinets.

4.4 PARKING GARAGE TELECOMMUNICATIONS ROOM

A Telecommunications room is required in all parking garages. This room may become the "Main" telecommunications room for the campus, or a sub-telecommunications room based on current and planned site conditions etc. In either case these rooms are to meet Metrolinx DRM Standards for primary telecommunications rooms in parking garages. These spaces are to allow for 5 Full Height Racks to be installed with the required clearances outlined in the DRM.

Subsequent rooms should be strategically placed to allow reach of all devices within a 90 meter cable distance. Location preference should be given to areas of high passenger flow. For example closer to elevator lobbies, egress areas to pedestrian bridges and other locations where passengers may congregate. These areas will have a higher concentration of network devices.

These rooms should be placed in vertical alignment where possible. This is to allow for a straight cable path between rooms for backbone cabling. A detail drawing showing room interconnectivity and route is required at the time of design.

4.5 OFFICE BUILDINGS / OPERATIONAL FACILITIES / BUS MAINTENANCE FACILITIES

In buildings which have a concentration of employees or large open warehouse type facilities, the need for sub telecommunications rooms is increased.

There should be no location within a branch facility or office that is not within 90m of a telecommunications room. This distance limitation is based on conduit path distance or entire cable length distance and not a 90m radius from the telecommunications room.

These facilities require a primary telecommunications room on the ground floor and are to adhere to the DRM for telecommunications room standards. The following facility types have varying minimum telecommunications room sizes:

Class A Bus and Rail Maintenance Facilities:	Space for 6 Racks
Class B Bus Facilities:	Space for 5 Racks
Class C Bus Facilities:	Space for 4 Racks

4.6 SUB-TELECOMMUNICATIONS ROOMS

Sub telecommunications rooms are to have the same treatments, but are smaller in size (See DRM for sizing). This includes UPS Electrical distribution, HVAC and all fire separation requirements as well. These are best to be located on every floor in a vertical column allowing for conduit or sleeves to be run in a straight path. All of these rooms require conduit paths back to the MTR (Main Telecommunication Room).

4.7 WALL MOUNT TELECOMMUNICATIONS CABINETS

In areas where only network switch equipment is required a wall mount cabinet with the following features may be used for a network wiring hub location. These are not permitted to be installed in hazardous locations (i.e. fuel delivery, bus maintenance areas, and other areas where hazardous goods or activities may impact this equipment.) This equipment must be installed in areas that are easily accessible and must maintain at least 1.3 meters clearance from any point of the cabinet. It is preferred to have this located within an enclosed room for protection – however in areas where it is in an open space and there is a possibility of moving vehicles i.e busses, elevating devices or hand trucks for material movement bollards must be installed to protect the 1.3m perimeter. It is also not to be installed below 1200mm from the finished floor, or above 2200mm from the finished floor.

See Section 4.8 - Communication Room Racks

4.8 COMMUNICATION ROOM RACKS

4.8.1 STATION AND PARKING GARAGE MAIN TELECOMMUNICATIONS RACKS

Each station MCR (Main Telecommunications Room) is to be fitted with the following racks and equipment.

- Network / Presto Divided Rack
- CCTV
- PA
- Parking Counting (Parking Garages Only)
- Future

All rack frames and accessories are to be Middle Atlantic WMRK Series and are to conform to the following specifications.

- Overall dimensions shall be 2034H x 650W x 1124D
- All racks are to include 70% vented locking front door
- All racks are to include split 79% vented locking rear doors
- All racks are to include locking, removable side panels
- All racks are to be grounded to the telecommunications room grounding bus-bar
- All racks are to be ganged together for stability

4.8.1.1 NETWORK / PRESTO RACK

The network / presto rack is also to include a 21 RU Security front and rear door for the lower half (See rack elevation drawings). This is to protect Presto equipment from tampering. This is also to include a full depth shelf installed directly in-line with the top of the security door to provide further separation and protection.

The network rack front rails are to be set back from the front of the rack by 120mm for proper cable bend radius with the door closed.

All Metrolinx equipment is to be installed above the middle shelf. This includes Bell Networking Equipment.

POWER REQUIREMENTS

This rack is to include one APC Automatic Transfer Switch, and is to be APC Model AP7752 or approved equivalent. This is to be installed in the uppermost rack unit of the network / presto rack and connected to the NEMA L5-20R outlets on the overhead tray.

4.8.1.2 CCTV RACK

This rack is to include two (2) APC Power Distribution Units and is to be model AP7830 or approved equivalent. These are both to be connected to the NEMA L5-20R receptacles on the overhead tray. These are to be installed in the rear section of the rack and are to be secured according to the manufacturer's instructions. See Section 7.1.10 - CCTV Rack Elevation

POWER REQUIREMENTS

This rack is to include two (2) APC Power Distribution Units and is to be model AP7830 or approved equivalent. These are both to be connected to the NEMA L5-20R receptacles on the overhead tray. These are to be installed in the rear section of the rack and are to be secured according to the manufacturer's installation instructions.

4.8.1.3 PA RACK

PA Rack power distribution is provided by the current Metrolinx PA provider. This rack is only to be installed if required and PA services are to be served from this telecommunications room.

4.8.1.4 OTHER RACKS

Other racks are used as necessary to house telecommunications equipment for new systems in our telecommunications room. These racks are only to be used with the approval of Metrolinx I&IT department and will be specified at the time of design.

POWER REQUIREMENTS

All other racks will be powered and installed as required. Requirements will be given at the time of design if the facility requires this rack. Power infrastructure for telecommunications rooms racks are to be included at the time of construction regardless of this rack being installed.

4.8.1.5 PARKING SPACE COUNTING SYSTEM RACK

These racks, where required are to be Middle Atlantic WMRK Series but must meet the requirements of the Parking Counting System.

POWER REQUIREMENTS

Power bars and power requirements for these racks will be specified at the time of design.

4.8.2 BRANCH OFFICE TELECOMMUNICATIONS RACKS

4.8.2.1 NETWORK RACK

Each communications room at these facilities shall include a minimum of 1 of the following racks. Where the telecommunications rack serves more than 250 Network outlets, a second network rack meeting the same specifications as below is to be integrated with the first.

- Cabling rack shall be Panduit NFR84 or approved equivalent and meet below specifications.
- Cable management rack shall be constructed of steel and capable of mounting as 19" or 23" EIA rack.
- The vertical channels shall have side and front pass through holes.
- The vertical channels shall have slots that can accommodate plastic d-rings, plastic bend radius fingers and spools to provide vertical cable management.
- The rear of the channel shall have an unequal flange design that allows access to cables inside the channel.
- The top of the rack shall have integral waterfalls that feed to the front and center of the vertical channels.
- The rack shall include steel, full length, 8" hinged doors.
- Rack construction method shall ensure an electrically bonded structure for ease of grounding.
- The rack shall be fastened directly to the floor.
- The rack shall include Vertical cable management bend radius fingers.

POWER REQUIREMENTS

This rack is to include one APC Automatic Transfer Switch, and is to be APC Model AP7752 or approved equal. This is to be installed in the uppermost rack unit of the network rack and secured as per manufacturers installation instructions. This is to be connected to two NEMA L5-20R receptacles on the overhead tray.

4.8.2.2 CORPORATE SYSTEMS RACK

These cabinets are to house VOIP Telephony server systems and PBX equipment, corporate servers, and other corporate system equipment.

This rack is to include one HP AZ870A - HP TFT7600 G2 KVM Console Rack mount Keyboard Monitor.

This rack is to include one HP AF620A - HP 1x1Ex8 KVM IP Console Switch G2 with Virtual Media

CAC Software. See Section 4.9 - Rack Elevation Drawings for layout of equipment

POWER REQUIREMENTS

Each rack is to include two (2) APC AP8865 power distribution units. These are to be installed as per the manufacturer's instructions and secured within the rear section of the rack. These are to be connected to the NEMA L21-30R outlets on the overhead tray

4.8.2.3 CCTV RACK (WHERE REQUIRED)

This rack is to be the same as the station CCTV Racks. See Section 4.8.1.2 - CCTV Rack

4.8.3 SUB TELECOMMUNICATIONS RACKS

All rack frames and accessories are to be Middle Atlantic WMRK Series and are to conform to the following specifications.

- Overall dimensions shall be 2034H x 605W x 1124D
- All racks are to include 70% vented front door
- All racks are to include split 79% vented rear doors
- All racks are to include locking, removable side panels
- All racks are to be grounded to the telecommunications room grounding bus-bar
- All racks are to be ganged together for stability

4.8.3.1 NETWORK / PRESTO RACK

The network and Presto rack is to be outfitted the same as a Primary Telecommunications Room Network / Presto Rack. This rack is to be installed in all cases when a sub-telecommunications room is being built.

See Presto Standards Documentation and Metrolinx DRM for presto rack details. See Section 4.8.1.1

Network / Presto Rack for rack specifications and details.

4.8.3.2 CCTV RACK

The CCTV Rack is to be outfitted the same as the Main Telecommunications Room CCTV Rack. This is not to be installed should there be no CCTV equipment in this room at the time of construction.

See Section 4.8.1.2 - CCTV Rack

4.8.4 WALL MOUNT CABINETS

Wall mount cabinets are to be Middle Atlantic wall type enclosures. These are to include the following features and components:

- Tool-Free Quick-Mount™ system allows for easy, one-person mounting of the center section to the back pan on the jobsite
- 24" or 30" useable depths
- Welded construction to provide a minimum 300 lb. weight capacity
- Abundant built-in cable lacing points in interior
- ½", ¾", 1", 1 ½", 2" and 3" electrical knockouts and 5/8" UHF/VHF antenna knockouts on top & bottom, easily removable for cable pass-through
- 12 ½" x 12 ½" laser knockout opening in the back pan for electrical pull-box
- Standard adjustable front 11-gauge 10-32 threaded rack rail with marked rack space increments to speed equipment mounting

- Center section hinges for left or right opening accessories
- 2" knockouts, 4" knockouts for Wire mold® 4000 Series raceways, and knockouts for UCP series universal connector panels on side.
- Front Mounted Minimum-Clearance Latch saves valuable wall space by allowing wall racks to be placed side-by-side, in a corner, or wherever side clearance is an issue.

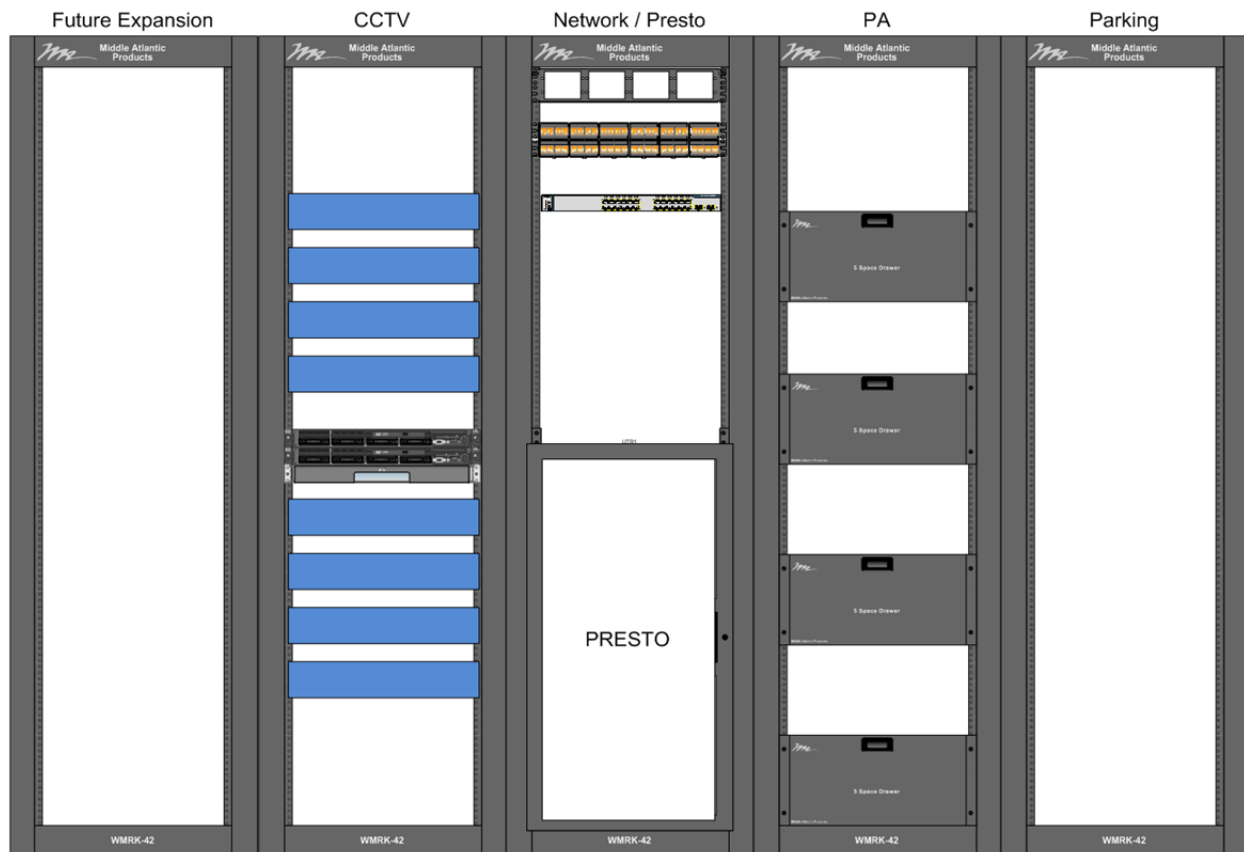
These racks are to be installed with the front rails set back from the inside of the cabinet by 120mm. This is to allow proper cable bend radius requirements when the cabinet door is closed.

POWER REQUIREMENTS

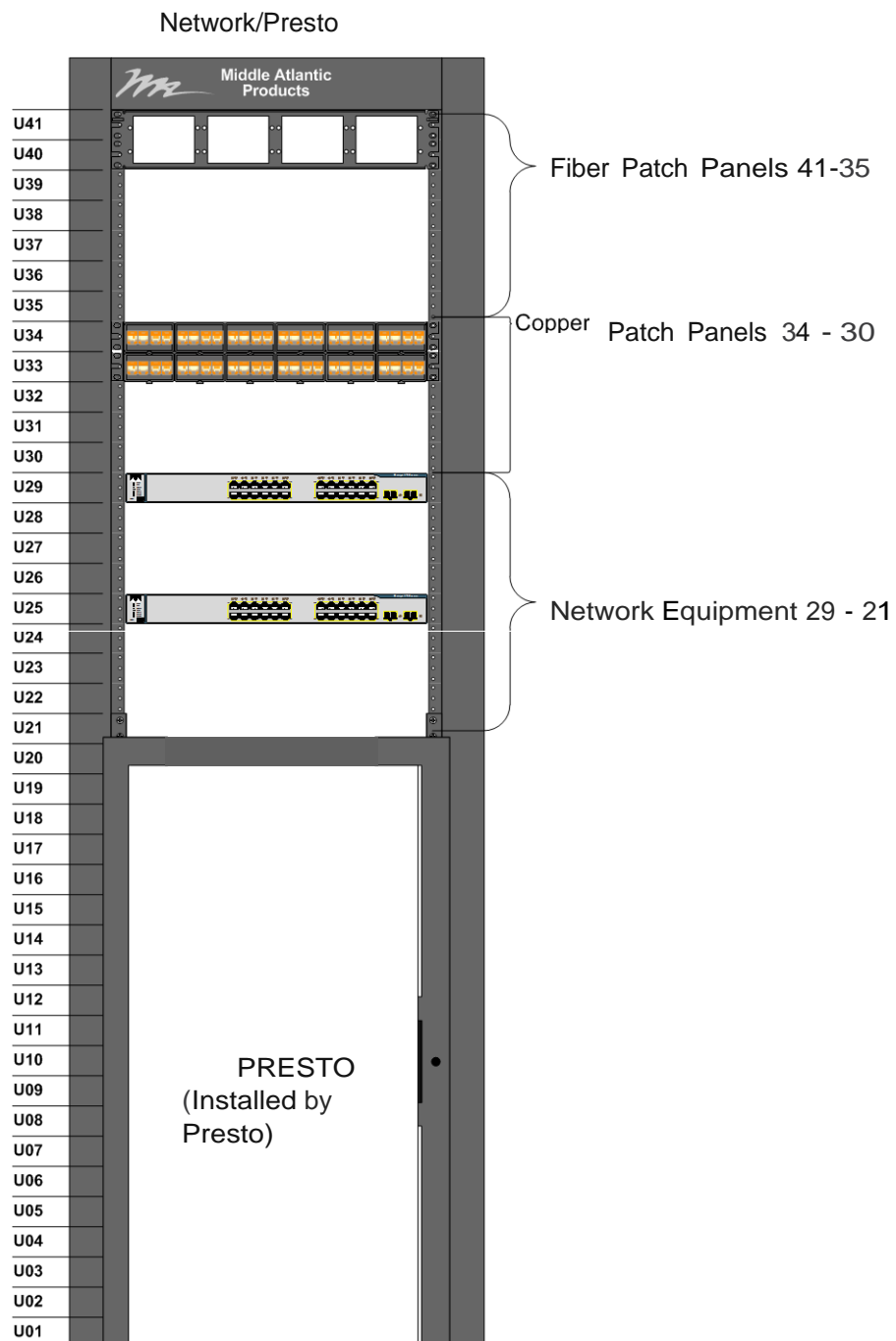
This rack is to include one APC Automatic Transfer Switch, and is to be APC Model AP7752 or approved equivalent. This is to be installed in the uppermost rack unit of the network / presto rack and connected to the NEMA L5-20R outlets on the overhead tray.

4.9 RACK ELEVATION DRAWINGS

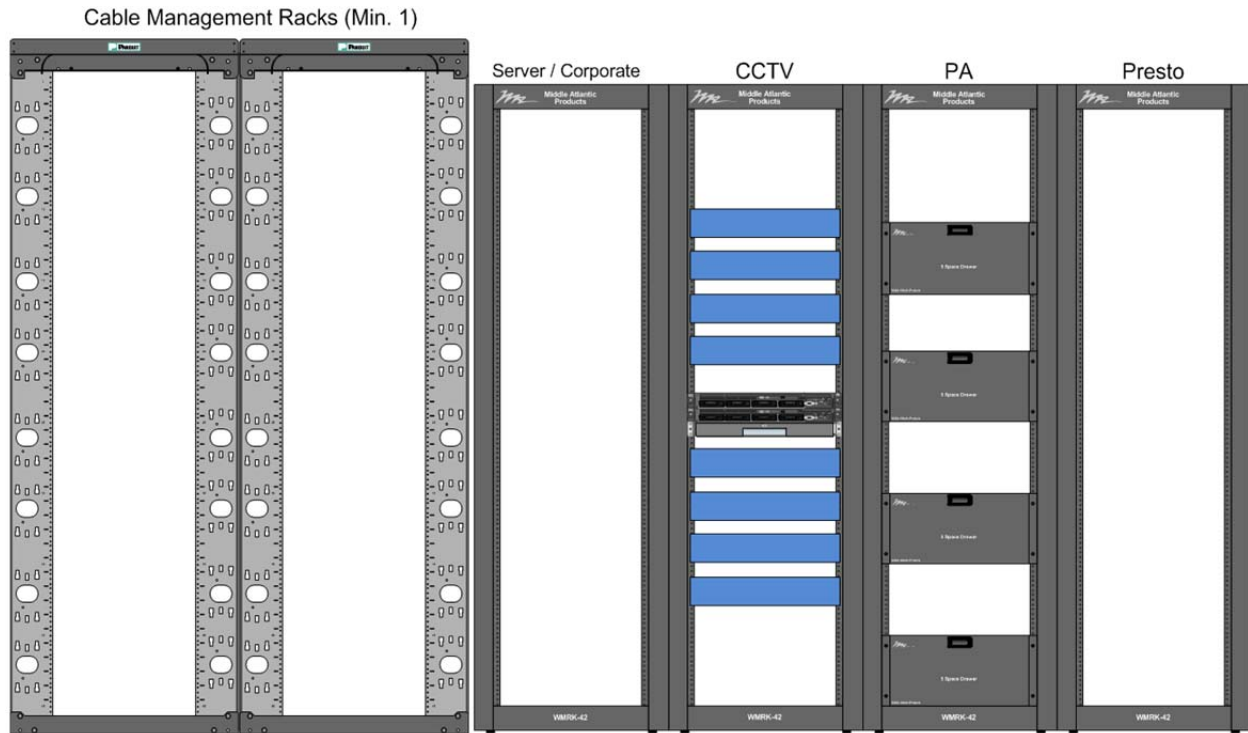
The below Drawing shows the preferred layout of racks in Station and Parking Garage Communication Rooms:



4.9.1 NETWORK/PRESTO RACK ELEVATION



4.9.2 OPERATIONAL SUPPORT BUILDING RACK ELEVATIONS



4.10 TELECOMMUNICATIONS ROOM INTERCONNECTIVITY

At station facilities where multiple telecommunications rooms are built, it is required that the following interconnectivity be implemented.

4.10.1 CONDUIT REQUIREMENTS

All new telecommunications rooms within a facility require 9 total 2" conduits for telecommunications systems. See Metrolinx DRM for conduit specifications. These conduits are for the following systems:

- Network Fibre (CCTV, IP Network, Digital Signage, VOIP Telephony, PA, Access Control & Security)
- Telephone Backbone
- PA
- Fare Systems (Presto)
- Chubb Security
- Spare
- Spare
- Spare

See Section 5.1 - Cabling Requirements for details on telecommunications room fibre and copper backbone cabling.

4.11 BELL DEMARCATION REQUIREMENTS

Each facility requires a Bell Demarcation point for telecommunications. Station Facilities and Rail Layover Facilities require a minimum of a 50pr Bell Copper Demarcation, and a Fibre Demarcation point. These demarks are to be terminated in the MTR (Main Telecommunications Room) on the wall surface. Any branch office, Bus Maintenance facility (Excluding Class C Bus Storage Facilities), or Rail Maintenance Facilities require a 100pr Copper Demarcation and a Fibre Demarcation point.

All circuits for telecommunications will be ordered by the Metrolinx I&IT Department. These circuits are required for operation of a facility, and require extensive lead times. It is advised that at least 3 months' notice prior to opening of a Station or other facility be given to the Metrolinx I&IT Department for coordination of these circuits and to ensure service is available for operations.

The electrical Site Plan shall clearly identify the location of the Bell duct banks and demark locations. Details pertaining to size and layout of the duct bank are also to be included.

The project consultant is responsible for coordinating with Bell Canada the installation of the demarcation point.

In cases where relocation of the Bell Demark service is required it is preferred to have the demarcation duplicated in both locations to allow the Metrolinx I&IT Department the flexibility in migrating each individual circuit from one demarcation point to the other.

5 CABLING STANDARDS

This section replaces the "Metrolinx Communications Wiring Guide" and supersedes any information within.

5.1 CABLING REQUIREMENTS

5.1.1 FIBRE CABLING REQUIREMENTS

All cabling between telecommunications rooms, between buildings and along roadway or rail corridors is considered to be 'Back-Bone' cabling. Size, type and number of strands / pairs vary between locations and are to be verified by Metrolinx Network Engineering Department at the time of design.

5.1.1.1 FIBER BACKBONE CABLING

All fibre back-bone cabling is to be a dedicated fibre cable between the MCR and the sub-telecommunications room or other locations. Our minimum number of strands of a backbone cable is to be no less than 24 strands. See Cabling Specifications for details on the cable construction.

Each Telecommunications Room is to be connected with a 24 Strand fibre. The type of fibre depends on its installation location and length of run.

- Where cables are to be installed within a single building structure and are less than 500m Multimode Fibre is to be used.
- Where cable length is above 500m Single Mode Fibre is to be installed.
- Where cables are linking multiple buildings together, or is an outdoor type cable it is to be Single Mode Fibre regardless of link distance.

See Specification for Single and Multimode Fibre specifications in Cabling Standards.

5.1.1.2 TELECOMMUNICATIONS ROOM FIBER PROTECTION REQUIREMENTS

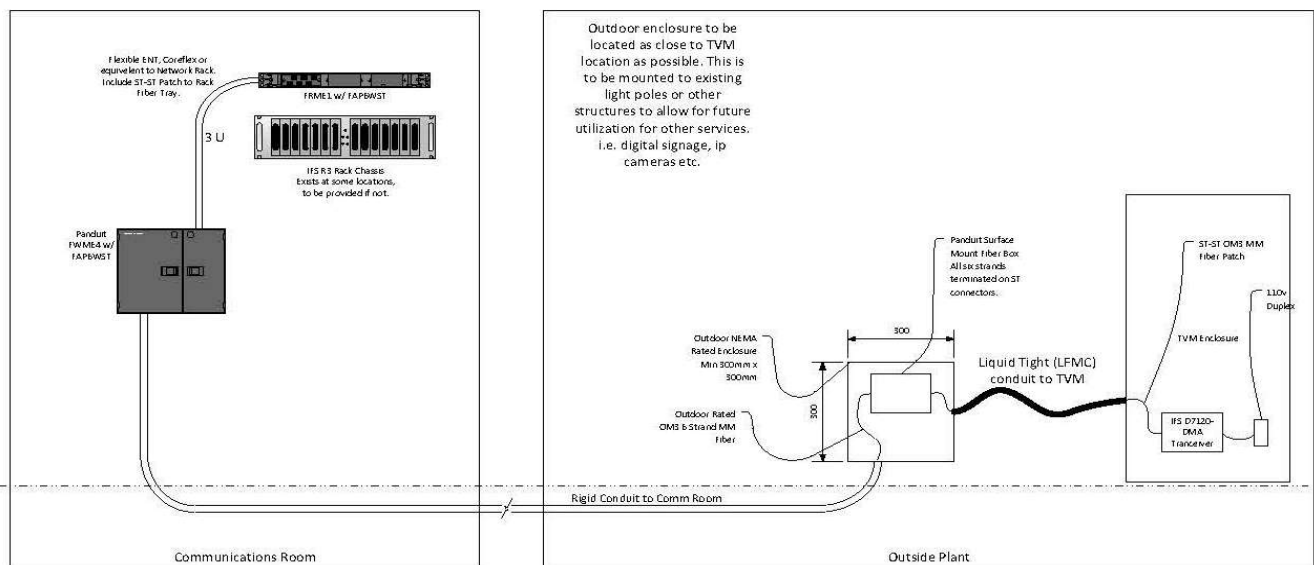
All fibre cabling within the telecommunications room is to be enclosed in orange corrugated flexible HDPE type conduit. Each end of the conduit must terminate directly on the wall mount termination enclosure. It must also terminate on the fibre enclosure within the network rack. All effort to utilize the overhead tray system is a must. The flexible conduit must be secured to the tray every 1m maximum using nylon cable ties and may not crush or deflect the flexible conduit in any way.

5.1.1.3 FIBRE CABLE CONSOLIDATION

In locations where multiple smaller strand fibre cables amalgamate at one location or junction box, these may be spliced onto a single larger fibre cable to ease conduit congestion, installation difficulties and future troubleshooting. This is only to be used for field devices and is not permitted for back-bone cabling. All strands must be spliced and extended to the destination telecommunications room. **These are to be permanent fusion splices – no exceptions.**

5.1.1.4 HORIZONTAL FIBER CABLING

This is to be used for all field terminated fibre devices where a fibre transceiver or other end device is to be installed. This includes TVMs, Digital Signage, IP Cameras, Wireless Access Points and other devices which are beyond 90m from the nearest telecommunications room. The field end of these cables is to be terminated with LC Type Connectors. All horizontal fibre cabling is to be terminated on the telecommunications room backboard (Wall) using LC Type Connectors. These are to be extended to the network rack fibre patch panel. All strands terminated on the backboard are to be extended to the patch panel. All rack patch Panel terminations are to be of LC Type Connectors. See below diagram for an example:



5.1.2 COPPER CABLING REQUIREMENTS

5.1.2.1 COPPER BACKBONE CABLING

This type of cabling is to be used only for communications structured cabling where more than 4 pairs are required. This is not to be used for runs to the desk or end devices. CAT-5e Telephone Backbone cable is to be used for backbones. A minimum of 25 pairs is required between all telecommunications rooms. In some cases 50 Pair or multiple 25 pair cables will be specified as needed.

Each Telecommunications room is to be connected with a 25 Pair (50 Conductor) CAT-5e Cable. See Cabling Standards for details on termination and cable type.

5.1.2.2 COPPER HORIZONTAL CABLING REQUIREMENTS

CABLING TO THE DESK / CUBICLE

Each desk requires two CAT-6 data cables. These are to support both voice and data. Some situations require additional network outlets and will be identified during the design phase. All horizontal network / voice cables are to be blue in colour.

CABLING TO THE SERVICE COUNTER

Each service booth selling position is to have a minimum of eight (8) Category-6 data / voice outlets. These are to be terminated using Category-6 RJ-45 outlets with dust guards or caps. All of these outlets are to be mounted in a patch panel type frame which is mounted below the millwork. These patch panels are to be equivalent to Panduit CWPP12WBL and include the following features:

- Release snap feature on faceplate allows simple front access for termination and accessibility to installed modules
- Accept Modules for UTP, fibre optic, and audio/video, which snap in and out for easy moves, adds, and changes
- Mount directly onto wall
- Modular design for easy cabling revisions
- Have 12 Module Spaces
- Be no more than 9.5" x 2.5" x 1.75" in size.
- Mount directly to wall or millwork surfaces

These are to be located in a convenient location to reach all networked and phone devices within the service position.

All of these cables are to be direct home run cables to the nearest telecommunications room. These are to be terminated on a flat RJ-45 patch panel. (See Patch Panel Specifications for Station Telecommunications Rooms).

COPPER CABLING TO OUTDOOR FIELD DEVICES

Outdoor devices requiring Ethernet or IP connectivity are to have an outdoor rated NEMA Enclosure / junction box large enough to terminate four RJ-45 jacks on a surface mount jack field. The minimum number of cables to be run to these junction boxes is two (2). However all conduits are to be able to accommodate 6 cables to these boxes. These cables are to be terminated within the junction box / enclosure. A suitable patch cable is to be run from the junction box to the end device at the time of installation. These junction boxes or enclosures are to be mounted within 6m of the end device. These are

to be sized large enough to accept up to three field conduits and the permanent link conduit to the telecommunications room.

5.2 CABLING SPECIFICATIONS

5.2.1 FIBER CABLE SPECIFICATIONS

The below specifications are to be followed when using fibre cable at Metrolinx Facilities.

5.2.1.1 SINGLE MODE

All locations which require outdoor fibre between telecommunications rooms are to use Single Mode outdoor rated cable. (See below specification). This is also to be used where the permanent link length between telecommunications rooms exceeds 500m.

Installed cable shall be 9/125micron core/cladding, OS2 single-mode, and graded index glass fibre. All materials in the cable are to be dielectric. Metrolinx IT Network Engineering must clear the fibre type before installation.

SINGLE MODE PERFORMANCE

Installed fibre must meet or exceed the following performance specifications.

Fibre cable types	Wavelength (nm)	Max. Attn. (dB/Km)
Singlemode, Inside	1,310	.75
	1,550	.75
Singlemode, Outside	1,310	0.34
	1,550	0.22

CABLE CONSTRUCTION

Riser or plenum rated cable shall be used for all interior installations. Installed cable shall meet or exceed the following specifications:

RISER OR PLENUM (INSIDE CABLE)

- Riser cable shall be used for all interior installations and shall meet the following specifications:
- Tight buffered 900 um, mechanical strippable Teflon.
- EIA/TIA -598 color coding for fibre optic cable.
- Aramid yarn strength member, capable of supporting a short-term tensile load of 400 lb. without stretching.
- Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
- Capable of a minimum crush resistance of 850 lb./in.

OUTDOOR CABLE

- Outside cable shall be used for all applications where cable is to be run in underground conduits or duct banks. Outside cable may not be used for interior applications and shall meet the following specifications:
- Buffer tube, 250 um, acrylate.
- EIA/TIA -598 color coding for fibre optic cable.
- Flooded core
- Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
- Capable of a minimum crush resistance of 850 lb./in.
- All outdoor fibre must be installed in conduits. No direct buried cable will be accepted.

5.2.1.2 MULTI-MODE FIBER CABLE SPECIFICATION

All locations where the sub telecommunications rooms are within the same building structure and the permanent link length between telecommunications rooms does not exceed 500m, Multimode fibre is preferred. (See specification below).

Installed cable shall be OM3 50/125micron core/cladding, enhanced grade, multimode, and graded index glass fibre. All materials in the cable shall be dielectric. This is the preferred fibre type for fibre runs inside the buildings in Metrolinx premises. Metrolinx IT Network Engineering must clear the fibre type before installation.

PERFORMANCE

Installed fibre must meet or exceed the following performance specifications.

Wavelength (nm)	Max. Attn.(dB/Km)	Min. Bandwidth (Mhz*Km)
850	3.0	1500
1,300	1.0	500

INDOOR PLENUM / RISER CABLE

Plenum rated cable shall be used for all interior installations. Installed cable shall meet or exceed the following specifications:

- Tight buffered 900 um, mechanical strippable Teflon (for plenum applications).
- EIA/TIA -598 color coding for fibre optic cable.
- Aramid yarn strength member, capable of supporting a short-term tensile load of 400 lb. without stretching.
- Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
- Capable of a minimum crush resistance of 850 lb./in.

OUTDOOR CABLE

Outside cable shall be used for all applications where cable is to be run in underground conduits or outside of the immediate building. Outside cable may not be used for interior applications and shall meet the following specifications:

- Buffer tube, 250 um, acrylate.
- EIA/TIA-598 color coding for fibre optic cable.
- Flooded core
- Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
- Capable of a minimum crush resistance of 850 lb./in.

5.2.2 FIBER PATCH CABLES

All fibre patch cables will be Panduit Opti-Core® 10gig 50/125 or 9/125 as required. All patch cables must be approved by Metrolinx IT Network Engineering department. All fibre patch cables must conform to industry standard colour identification for single, multi, and 10GbE requirements.

5.2.3 FIBER TERMINATION

All backbone and field fibre cables are to be terminated within a wall type enclosure. This is to be sized according to the number of strands being terminated, and is to allow for 50% future expansion. All strands of each cable are to be terminated on the wall enclosure using LC type connectors. A minimum of 3 meters of slack cable is to be left within the wall termination enclosure.

All strands are to be extended from the wall enclosure to the Network Rack enclosure using LC type terminations at the rack patch panel. These are to be enclosed in Core Flex or other protective flexible ENT conduit orange in colour. This conduit is to terminate at the wall fibre enclosure and is to terminate within the network rack fibre enclosure patch panel tray.

5.2.4 FIBRE CABLE INSTALLATION & TESTING

Prior to Installation:

It is required that each strand of fibre in a cable be tested with an OTDR for length and transmission anomalies while on the reel before installation.

After Installation and Termination:

- All single mode and multi-mode fibre strands shall be tested end-to-end for bi-directional attenuation, 850 nm/1300 nm for multimode and 1310 nm/1550 nm for single-mode fibres. Tests should be conducted in compliance with EIA/TIA-526-14 or OFSTP 14, Method B, according to the manufacturer's instructions for the test set being utilized.
- Tests must ensure that the measured link loss for each strand does not exceed the "worst case" allowable loss defined as the sum of the connector loss (based on the number of mated connector pairs at the EIA/TIA-568 B maximum allowable loss of 0.75 dB per mated pair) and the optical loss (based on the performance standard above)
- After termination, each fibre shall be tested with an ODTR for length, transmission anomalies, and end-to- end attenuation. Results are to be recorded and supplied to Metrolinx IT Network Engineering in the form of hard-copy printouts or photographs of screen traces.
- After termination and bulkhead mounting, each terminated fibre is to be tested for end-to-end loss with a power meter/light source. As above, results are to be recorded and supplied to Metrolinx IT Network Engineering.
- The maximum allowable attenuation for any splice or termination is 0.3 dB
- The contractor shall review all end faces of field terminated connectors with a fibre inspection scope following the final polish. Connector end faces with hackles, scratches, cracks, chips and or surface

pitting shall be rejected and re-polished or replaced if re-polishing will not remove the end face surface defects. The recommended minimum viewing magnifications for connector ends are 100X for multimode fibre and 200X for single-mode fibre.

5.2.5 CAT 5E BACKBONE CABLE SPECIFICATION

All voice and data runs greater than 4 pair is to be of Category 5e Plenum type cable. This is used for all building to building voice / data circuits where cable lengths allow and all demarcation points to customer equipment connections. All cables installed in underground conduits or duct banks must be of buried service quality.

- Minimum of 25 pair cables are to be installed unless otherwise stated.
- Must be 24 AWG bare copper wire insulated with FEP 9 (plenum)
- Must support 10 Base-T, 100 Base-TX, 1000 Base-T. Verified to TIA/EIA 568 Cat5e backbone cable sum power performance.
- Maximum installation tension 25 LB
- Minimum bend radius 175mm
- Must be terminated at both ends onto Northern Telecom BIX Punch down terminal strip or equivalent unless otherwise stated.
- Terminal strips are to be installed no lower than 48" above the finished floor, or higher than 84" above the finished floor

5.2.6 HORIZONTAL CATEGORY 6 CABLE SPECIFICATION

All horizontal data cables are to be Category 6 type and adhere to the following conditions.

- All cables being installed will be fully terminated at both ends unless otherwise specified.
- Patch panel terminations will meet or exceed the TIA/EIA T568a Category 6 cable installation standards.
- End devices will be fully terminated to T568-A standards on modular wall face plates or surface mount boxes as specified by Metrolinx.
- All cable runs will conform to TIA/EIA Category 6 Installation specifications and guidelines.
- Cable bundles will not exceed more than 25 cables and be secured with either Velcro type cable ties.
- All cables will be secured to all available cable raceways and under floor trays with Velcro type ties.

5.2.6.1 WALL JACK COLOUR STANDARDS

Use	Colour
Data / Corporate Network	Blue
Telephone	Blue
Radio Data / Communication	Orange

5.2.6.2 PATCH CABLE COLOUR STANDARDS

All patch cables being provided must be Panduit TX6 Plus Category 6 cables. Cable lengths will be of reasonable length allowing for proper cable routing needed for a tidy and organized installation. Cables of excess or inadequate cables will be rejected by Metrolinx.

Use	Colour
Data / Corporate Network PC / Printers / Telephone Sets	Blue
Corporate Servers	Red
Switch / Router Crossovers and Normal	Yellow
iLO / KVM / Management	Purple / Indigo

5.3 NETWORK PATCH PANEL SPECIFICATIONS (TELECOMMUNICATIONS ROOM)

These patch panels are to be included as necessary, and are to be minimum of 24 port type. Some locations require angled patch panels, where others require flat type patch panels. See details below.

5.3.1 STATION NETWORK RACK COPPER PATCH PANEL

All patch panels at station buildings are to be of flat type. These patch panels are to be installed as per the rack elevation drawings. No new patch panels are to be installed until the previous patch panel has been fully used.

These patch panels are to be equivalent to Panduit CPP24FMWBL and have the following features.

- Rear mounted faceplates allow modules to be flush with front of patch panel
- Accept Modules for UTP, fibre optic, and audio/video, which snap in and out for easy moves, adds, and changes
- Pre-printed numbers above each port for easy identification
- White write-on areas for port and/or panel identification
- Mount to standard EIA 19" racks or 23" racks with optional extender brackets
- Have minimum 24 spaces available for modules
- Must be flat patch panel

If a patch panel currently exists which is not of this specification, new inserts matching the existing patch panel must be used. All new subsequent patch panels are to meet above specifications.

5.3.2 OFFICE BUILDINGS / BRANCH OFFICES / BUS OR RAIL MAINTENANCE FACILITIES COPPER PATCH PANEL

All Branch facilities where a network cable rack is installed is to use the angular type patch panels and is to be of the same brand and model of the existing patch panels onsite. No new patch panels are to be installed until the previous patch panel has been fully used.

- These patch panels are to be equivalent to Panduit CPPLA48WBL and have the following features.
- Rear mounted faceplates allow modules to be flush with front of patch panel
- Accept Modules for UTP, fibre optic, and audio/video, which snap in and out for easy moves, adds, and changes
- Pre-printed numbers above each port for easy identification
- White write-on areas for port and/or panel identification
- Mount to standard EIA 19" racks or 23" racks with optional extender brackets
- Have minimum 48 spaces available for modules
- Must be angular patch panel

5.3.3 FIBRE PATCH PANEL SPECIFICATIONS

All facilities where fibre patch panels are installed within rack enclosures must have the following specifications.

- Panduit Model FRME2U or approved equivalent
- Mount to standard 19" or 23" EIA rack or cabinet
- Hold QuickNet™ or Opticom® Fibre Adapter Panels (FAPs) and Opticom® Fibre Optic Splice Modules
- Front and rear access on all models via durable moulded-hinge doors
- Integral bend radius control and cable management for fibre patch cords
- Multiple trunk cable entry locations
- Include fibre optic cable routing kit (grommets, cable ties, saddle clips, strain relief bracket, and ID/caution labels) for various cable management solutions

6 LABELLING STANDARDS

All of Metrolinx Cabling is to be labeled according to the ANSI/TIA/EIA 606A - Administration Standard for Telecommunications Infrastructure.

All cables are to be labeled and recorded as per the 'CLASS III' requirements under the 606A standard.

6.1 TELECOMMUNICATIONS ROOM / RACK NAMING AND SIGNAGE

Each communications room is to be named, and signed as a Telecommunications Room. Each Site is to have one MCR (Main Telecommunications Room) and subsequent rooms being labeled with the following syntax.

<BUILDING>-<FLOOR #><SPACE>-

<RACK> Building Variables:

- ST - Station
- PG - Parking Garage
- PF – Platform
- OB - Outside Building (aka Bunker, Kiosk etc)

Facilities with only one building may omit this field.

Floors:

- B9-B1 - Sub Grade Floors
- 1 - 99 - Above Grade Floors

n.b. Floor identification numbers are to include only the floor number the room is located on, and not the floors it serves.

Spaces:

- MTR - Main Telecommunications Room
- TR - Telecommunications Room (Any other space designated as a communications room which is not the primary.)
- TC - Telecommunications Closet (Typically located in the Service Counter area.)

Racks:

Racks at Station Facilities are to be labelled by their use. For example the following rack names are acceptable in station facilities. Should there be multiple cabinets or racks for a single system in the same room – i.e. two CCTV racks, each rack name is to include an index number CCTV1, CCTV2.

- CCTV CCTV Cabinets
- NET Network Cabinets
- PA Public Address
- FARE Presto Rack
- PARK Parking Systems

Racks in facilities such as datacenters and branch offices are to be labelled by row and number. All rows will have an alpha character to identify the row with an index number for each rack. The syntax is to be <ROW>:<RACK>

This allows all cables to be labeled accordingly.
See labelling standard below.

6.2 HORIZONTAL CABLE LABELS

A horizontal link is defined as the cabling between and including the communications outlet/connector and the horizontal cross-connect termination hardware. It was often referred to as the workstation cabling, horizontal cabling or user drop. This includes all other types of end devices such as Cameras, Digital Signage and other field devices as well. The Horizontal Link Identifier shall be formatted as fs-an, where:

fs = TS Identifier

a = one or two alpha characters uniquely identifying a single patch panel, a group of patch panels with sequentially numbered ports, an IDC termination block, or a group of IDC termination blocks, serving as part of the horizontal cross-connect

n = two to four numeric characters designating the port on a patch panel, or the section of an IDC termination block on which a four-pair horizontal cable is terminated in the TS Identifiers shall be placed in the CR, on the patch panel or wiring block. Each end of the cable shall be labeled within 12 inches from the ends, and in the work area each individual connector shall be labeled as well.

6.3 INTRA-BUILDING BACKBONE CABLE

Cables that run within one TS or extend between two or more TS's within a building are called intra-building backbone cables.

A unique backbone cable identifier shall be assigned to each backbone cable between two TS's in one building and it shall have a format of fs1/fs2-n, where:

fs1 = CR identifier for the space containing the termination of one end of the backbone cable

fs2 = CR identifier for the space containing the termination of the other end of the backbone cable

n = one or two alpha-numeric characters identifying a single cable with one end terminated in the CR designated fs1 and the other end terminated in the CR designated fs2

In this format, the CR with the lesser alpha-numeric identifier shall be listed first. All intra-building backbone cable identifiers in a single infrastructure should have the same format where possible. The backbone cable identifier shall be marked on each end of the backbone cable within 300 mm (12 in) of the end of the cable jacket.

6.4 INTER-BUILDING BACKBONE CABLE

Cables that run from a CR in one building and extend to two or more CR's in another building are called inter-building backbone cables. A unique inter-building backbone cable identifier shall be assigned to each backbone cable connecting CR's in different buildings, and it shall have the format [b1-fs1]/[b2-fs2]-n, where:

b1-fs1 = building identifier and TS identifier for the TS in which one end of the backbone cable is terminated

b2-fs2 = building identifier and TS identifier for the TS in which the other end of the backbone cable is terminated
n = one or two alpha-numeric characters identifying a single cable with one end terminated in the CR designated b1fs1 and the other end terminated in the CR designated b2fs2
In this format, the building with the lesser alpha-numeric identifier shall be listed first. All inter-building backbone cable identifiers in a single infrastructure should have the same format where possible. The inter-building backbone cable identifier shall be marked on each end of the backbone cable within 300 mm (12 in) of the end of the cable jacket.

6.5 BACKBONE CABLE DOCUMENTATION AND RECORDS

A copy of all backbone cable records shall be left in each of the TRs where the cable terminates. This is to be located nearest the cabling / network rack and is to be placed in a self-adhesive plastic envelope. A copy shall also be provided to Metrolinx Network Engineering Department for our records. This is to be included with the testing and certification records of the installed cable. (See Installation Testing and Certification)

Cable: PG-01MCR/PG-03TR-01

Total Cable Length: 330m

Number of Strands / Pairs:6

Cable Type: 50/125uM Multimode Fibre

Installation Date: January 12, 2011

	Device Connected / Circuit #			Device Connected / Circuit #
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.01			.04	
.02			.05	
.03			.06	

7 SYSTEM DESCRIPTION AND DETAILS

7.1 CCTV

Each head end system shall include, but not be limited to, the following:

- HP Server Console and KVM if required
- HP DL320 Server (Used for Indigo Vision Windows NVR)
- Indigo Vision NVR License Dongle
- Indigo Vision VB 9000 Series Encoder Hardware
- Cisco 2960G Series Switch

In addition to the head end system, monitoring at our Station facility service counter is required. Each monitoring system shall include, but not be limited to the following:

- Current model monitoring PC (See attached BOM for details)
- 32" or 24" LCD monitor / panel wall or ceiling mounted depending on local requirements

7.1.1 EQUIPMENT INSTALLATION

No equipment shall be installed in the CCTV rack unless directly related to CCTV. This equipment will also be installed in the rack in designated rack units, and may not overlap into other rack units.

7.1.2 RACK CONSOLE

The rack console is to use the 23rd Rack Unit from the base of the rack. The KVM is to be installed in the same RU on the rear of the console. See installation instructions for details on mounting these in the same RU.

7.1.3 SWITCH GEAR

The Cisco switch shall be configured by the IT Network Engineering team. Two weeks' notice prior to installation is to be given to the Metrolinx IT Network engineering department for configuration of this equipment.

The Cisco switch, if required is to be installed at the uppermost RU of the rack, with the network ports facing the rear of the rack. This is to be installed by the CCTV Installation Vendor. This switch is to be uplinked to the Metrolinx corporate router to the designated port. This is to be done under the supervision (either onsite, or remotely) of a Metrolinx IT Network Engineering specialist.

7.1.4 NVR SERVER

Each NVR is to be installed directly above the console, and placed without spacing in between. In cases where multiple NVRs are required, the second NVR will be installed directly above the previous, again with zero spacing between. All manufacturer supplied rails are to be used.

Both ports of the NVR server are to be plugged into the Cisco switch on ports 1 and 2. The second NVR are to be plugged into ports 3 and 4. This permits redundant paths to each server.

7.1.5 RECORDING SOFTWARE

Each NVR is to be configured to record every camera 24 hours per day for duration of 3 days unless otherwise approved by Metrolinx.

7.1.6 INDIGO VISION CHASSIS

Each indigo vision chassis will be installed at least two RU from the top of the last NVR with a rack mount fan unit directly below. Each subsequent Indigo chassis is to leave three RU above the previous, and another fan installed between. See Section 7.1.10 CCTV Rack Elevation

Each Encoder card is to be configured to Metrolinx instruction. This will be provided at the time of installation.

7.1.7 MONITORING PC

Each site which requires a monitoring PC is to be a small form factor desktop PC. These requirements will be provided in the attached BOM for CCTV, and the current model outlined within.

Each station monitor is to be a screen of 32" in size. The location of the screen is to be determined by Station Operations at the time of design. These screens are to be wall mounted, and include all hardware required for the installation.

7.1.7.1 32" LCD MONITORS

Mandatory Specifications:

Screen Size	32" Diagonal LCD
Physical Aspect Ratio	16:9
Viewable Aspect Ratios	4:3, 16:9
Input 1	1 Composite (BNC or RCA)
Input 2	HDMI
Input 3	1 RGB (D-Sub) and 1 DVI
Menu Language	English and French
VESA Mount	200mm x 200mm
Power Input	120 vAC 50/60Hz
Bezel Colour	Black or Silver

Minimum Requirements:

Resolution	1366 x 768
Brightness (cd/m ²)	500
Contrast Ratio	4,000:1
Minimum Response Time	8ms
Minimum Viewing Angle	178° Horizontal & Vertical
Display Colours	16.7 Million
Min. Speaker Output	10 Watt Total
Weight Limit	75 Lbs
Physical Maximum External Dimension	810(W) x 515(H) x 120(D) mm

7.1.8 STATION SERVICE COUNTER OR OTHER MOUNTED CCTV SCREEN LOCATIONS

Each screen is to be mounted within the service area where each attendant may see the screen without strain, or discomfort. At the same time the screens are to be kept in a position that does not allow the public to see the contents of the screen. An approved location should be agreed upon at the time of design by Station Operations and Information Technology, Occupational Health & Safety and System Safety

7.1.9 SERVICE AREA / MONITORING PC

Each pc must be installed within close proximity of the service attendants and the monitor.

Each service area / monitoring PC must be connected to the network switch in the telecommunications room and port designated by Metrolinx.

The service area PC must be configured with Metrolinx provided user accounts and specifications. This will be provided at the time of installation.

A network outlet and two duplex receptacles are required for the monitoring PC.

7.1.10 CCTV RACK ELEVATION

Metrolinx CCTV Rack Layout

Friday, March 05,
2010

Cabinet Front



FAN

FAN

FAN

FAN

FAN

SewndNVR FirstNVR
HP Console

FAN

FAN

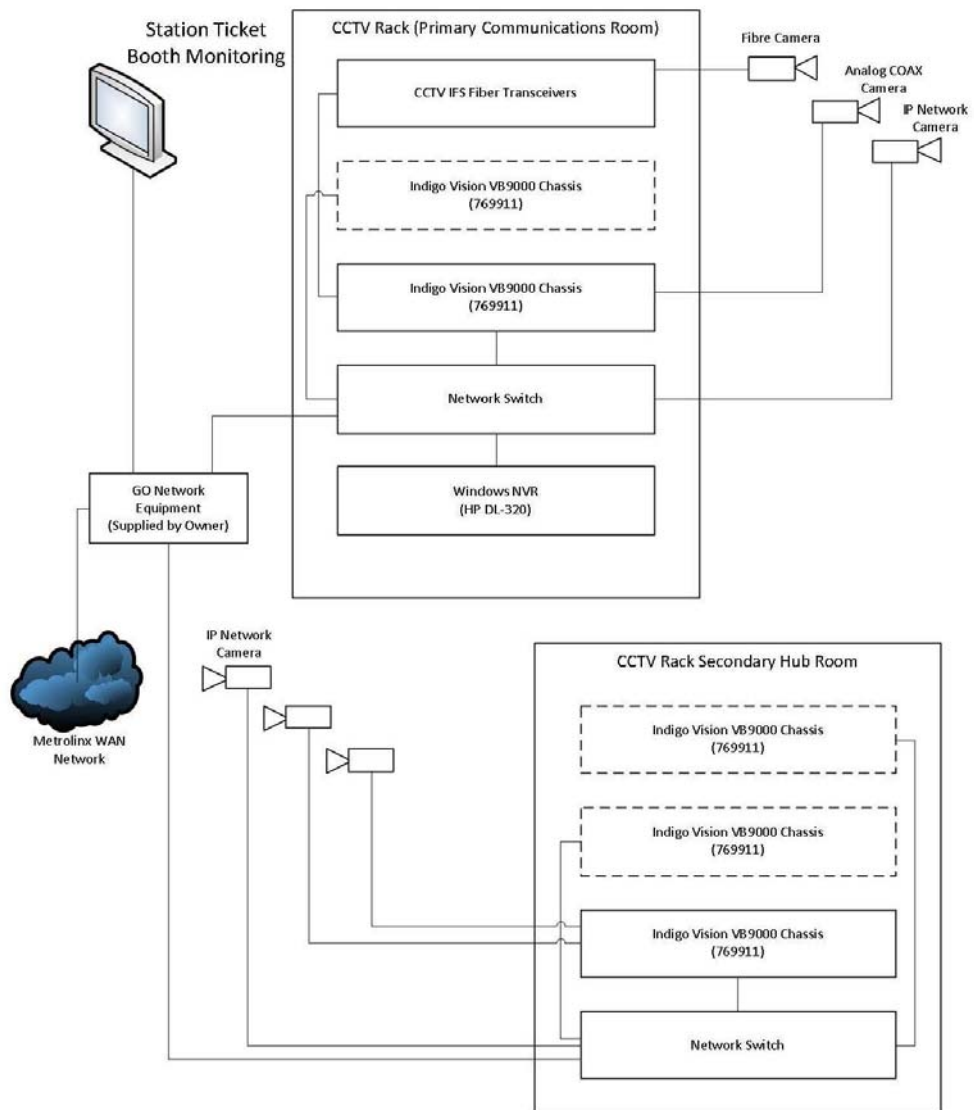
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7.1.11 EXAMPLE SINGLE LINE DIAGRAM



7.1.12 CAMERA CONNECTIVITY AND CONTROL

Each camera connected to the Indigo Vision system must be visible from the corporate network. Working with an IT Representative, each camera will be tested for PTZ control and image quality using the Indigo Vision Client Application

Metrolinx requires two weeks' notice prior to the anticipated completion of the CCTV system to verify and test all camera connectivity and control. Contact the IT Network Engineering department to schedule testing of this system.

7.1.13 REPORTING

Upon completion of the CCTV installation, a complete list in Excel format is to be submitted to the IT Department with the following details for each camera:

- Make
- Model
- Serial Number
- PTZ Protocol Settings
- IP Address
- Description of Location
- Date of Installation (For warranty Purposes)

7.2 TELEPHONE NETWORK

7.2.1 STATION PHONE

The function of the station telephone is to provide voice communication capability between the station attendant and other Metrolinx staff.

Station telephones are PSTN commercial line telephones located in the service counter. These phones are supplied and installed by Metrolinx. Phone Lines will be ordered by Metrolinx IT department. The phone sets must be cabled to the service counter cabling jacks. Locations are defined by the service counter standard in the DRM.

7.2.2 STATION RED-PHONE

The function of the red phone is to provide voice communication capability between the station attendant and the Metrolinx' Rail Operations Control Center GTCC at Union Station as well as to provide connection to the local PA system for emergency announcements. The signalling integration of the Red Phone with the PA system is included in the PA system.

This telephone set is on a separate 2 wire line connected through a 4 wire circuit to the GTCC. The Red Phone line is ordered by Metrolinx IT. The Red Phone should be cabled to the service counter jacks.

7.2.3 PAY PHONES

7.2.3.1 PAY PHONE - STATION

The function of the pay phone-station is to provide telephone service for the use of the passengers.

This telephone is on a regular PSTN circuit and is typically located in a convenient area for passenger access. Usually each station has one internal pay phone and one external pay phone; however, at larger stations the number of pay phones is increased. The telephone is supplied and installed by Bell Canada. The conduit from the telecommunications room to the payphones is to be designed by the Consultant.

At the 25% design stage the Consultant shall request Metrolinx to provide the number and locations of pay phones. Metrolinx will contact Bell Canada to identify the number of pay phones Bell Canada is to provide. Metrolinx Station Operations will select the pay phone locations. The Consultant shall ensure that the appropriate sub-trades provide the telecommunications conduit, pay phone footing and power. The footing template will be provided by Metrolinx. Cable and connections are to be provided by Bell Canada.

7.2.3.2 PAY PHONE - PLATFORM

The function of the pay phone-station is to provide telephone service for the use of the passengers.

These telephones are on regular PSTN circuit and are located near the mini-platform in a well-lit location on each platform. Locations are to be provided by the site specific design Consultant and approved by Metrolinx. The telephone is supplied and installed by Bell Canada. The conduit from the telecommunications room to payphones is to adhere to DRM for communication conduit standards. The footing template will be provided by Metrolinx.

7.2.4 ELEVATOR PHONE & ELEVATOR LOBBY INTERCOM

The function of the elevator phone is to provide voice communication capability for elevator passengers. It is used for elevator emergencies and passenger safety. When activated; emergency calls are placed directly to the Metrolinx' Security Company.

Elevator Phones must meet all of the requirements of the TSSA and other codes and regulations relating to elevator telecommunications.

Elevator Lobby Phones when activated; phones are calls are placed directly to the Metrolinx System Safety Dispatch Office located at the Wolfedale Facility.

7.2.4.1 NETWORK CONNECTIVITY

All security systems require connectivity from the main alarm panel onto the Metrolinx IP Network. Exact location of this system is to be coordinated through the security system provider. At each main panel location two network outlets are required and are to be cabled back to the nearest telecommunications room network rack. These cables are not to be more than 90m in length.

7.3 FARE HANDLING EQUIPMENT

Fare handling equipment refers to POS, TVM, STC and STI equipment and does not include Presto.

7.3.1 POS DEVICES

Each POS or Moneris devices require a network outlet. These devices are to use the outlets provided in the service counter cabling. (See "Cabling to the service counter").

7.3.2 TVM EQUIPMENT

7.3.2.1 POWER REQUIREMENTS

The TVM is powered by 120V 60 Hz. The incoming cable has 3 wires of 4 mm² (AWG 10) diameter. The main specifications are:

- Hot, Neutral and Ground (Black, White and Green/Yellow),
- Useful length at the pipe outlet = **2000 mm** / 78.7402 inch, Circuit Breaker (out of the machine) 30A bipolar*.
- Maximum power consumption: 24A with 120V,
- Earth cable will be connected to the TVM cabinet using a bolt and nut, Standard ESA
- Earth resistance: 10 Ohms maximum; test each machine with respect to a reliable reference after wiring.

*: Bipolar is recommended by PARKEON, but unipolar is accepted in regards to the Canadian electrical network

7.3.2.2 NETWORK CONNECTIVITY

Each TVM requires a network outlet within the TVM. Conduits for power and telecommunications are to be included in the design and construction. Installation of the cabling is to be done prior to the arrival of the TVM, and should be coordinated with the TVM installer. Connectivity of this device is to be done by Metrolinx IT department.

7.4 PUBLIC ADDRESS SYSTEMS

The function of the system is to provide local and remote announcement capabilities of timely information to passengers, of track changes, delays, cancellations, safety, etc.

The system comprises zone speakers, amplifiers and control equipment, and input devices, such as, but not limited to, operator console microphone, noise cancelling microphone and red phone telephone input. The amplifiers and control equipment are installed into the PA Cabinet.

7.4.1 POWER REQUIREMENTS

Refer to the rack requirements for power needs for the PA system cabinet.

7.4.2 NETWORK CONNECTIVITY

Each PA system cabinet requires a minimum of Six (6) network outlets. These network outlets are to be cabled back to the nearest telecommunications room network rack patch panel (Typically same room) and terminated as per the copper horizontal cabling standard.

7.5 WIRELESS (WI-FI) ACCESS POINTS

In all cases any facility which requires wireless access points must have a proposed wireless access point layout at the time of design. This is to be reviewed by the Metrolinx IT department prior to finalizing any construction design documents. This is intended only to be an estimated layout based on the specifications and are subject to change based on a final site survey prior to installation.

All sites must have a final site survey completed prior to the installation of the access points. The result of this site survey is to be reviewed by Metrolinx IT for approval prior to final installation.

The final connection of these devices at the communication room end is to be completed by Metrolinx IT Personnel. The required head end equipment and switch hardware will be provided by Metrolinx.

7.5.1 WIRELESS ACCESS COVERAGE

7.5.1.1 OFFICE WIRELESS COVERAGE

In all office spaces at any facility (Rail, Bus, Office, and Maintenance areas) must have a minimum coverage of all meeting areas. Some office spaces may require full coverage of the entire office floor areas with priority given to Meeting, Lobby, and hoteling locations. These are to be determined at the time of design.

7.5.1.2 BUS STORAGE AND MAINTENANCE FACILITIES

Wireless access points are to be installed in all GO Bus Storage and Maintenance facilities. These are to provide complete coverage of all areas of the facility. This is to allow communication with the vehicle to transfer data to/from onboard fleet vehicle systems. This is in addition to any Presto wireless systems being implemented. Wireless VOIP handsets and other wireless devices will also use this system.

7.5.1.3 RAIL MAINTENANCE & LAYOVER FACILITIES

Coverage of rail fleet vehicles is required. Due to the size and nature of where these vehicles are stored, it will require outdoor wireless access points either canopy mounted or pole mounted to provide coverage to at least the middle of the rail consist (Coach 5 Accessibility Coach), the locomotive and the cab car. This too is intended to provide data transfer to / from the rail fleet vehicles when stored. This is to be included at Rail Layovers, Rail Maintenance, and all Rail Wayside power locations.

Rail Maintenance Facilities require full coverage of wireless access points for VOIP handsets and other wireless enabled devices. This includes all maintenance, office, mechanical and other areas.

7.5.2 ACCESS POINT HARDWARE

7.5.2.1 INDOOR OFFICE WIRELESS ACCESS POINTS

These access points are to be Cisco Model 3600i. These access points are to be used in office areas with suspended ceiling architecture. See below for mounting, cabling and other details for installation.

7.5.2.2 INDOOR OPEN CEILING WIRELESS ACCESS POINTS

These access points are to be Cisco Model 3600e. These access points are to be used in indoor storage and warehouse facilities but not in areas which are harsh in nature (e.g. close proximity to hazardous materials, or vehicle washing facilities). See Outdoor Wireless access points below for these environments.

7.5.2.3 OUTDOOR WIRELESS ACCESS POINTS

These access points are to be Cisco Model 1552E. These access points are to be used in outdoor areas, or are in harsh indoor environments (e.g. close proximity to hazardous materials, or vehicle washing facilities).

7.5.3 NETWORK CABLING TO WIRELESS ACCESS POINTS

All Wireless Access Points require a single Category 6 Cable to each location and may not exceed the 90m CAT-6 standard cable length. All cables must conform to Metrolinx CAT-6 standards for horizontal cabling and adhere to all ANSI/TIA standards. These cables are to be run to the nearest Hub Room or Communication Room in the facility.

7.5.3.1 INDOOR OFFICE WIRELESS ACCESS POINTS

In office locations with open plenum ceiling tile environments, a single CAT-6 cable is required to each location and may be run free air using “J” hooks in the open ceiling. Cables at the access points may be terminated directly with an RJ-45 male connector and do not require a separate open female jack. These cables must terminate directly to a patch panel in the nearest telecommunications room and be labeled at both ends according to our labeling standards outlined in this document.

7.5.3.2 INDOOR OPEN CEILING WIRELESS ACCESS POINTS

These access points in areas which do not have a standard office ceiling tile environment and are either an open web joist or flat drywall or concrete type ceiling or other similar environments require conduit directly to the access points. The CAT-6 cable must run within this conduit. See - Wireless Access Point Mounting Details for more information.

7.5.3.3 OUTDOOR WALL, OR POLE MOUNT ACCESS POINT CABLING

See above open ceiling cabling requirements.

7.5.3.4 OUTDOOR WIRELESS ACCESS POINT POWER REQUIREMENTS

In some cases these access points will require additional power. In such cases installation of additional NEMA enclosures are required. These must be sized large enough to house a duplex receptacle, fibre termination jacks, and fibre transceiver hardware. These enclosures must be a minimum of 300mm x 300mm x 150mm.

7.5.4 ACCESS POINT INSTALLATION

All access points must be installed in accordance with the manufacturer’s instructions and follow the below guidelines.

7.5.4.1 INDOOR OFFICE WIRELESS ACCESS POINTS

These access points are to be installed in the ceiling tile and not be clipped directly to the “T-Bar” support system. This is to provide the lowest possible visible impact to the office ceiling.

7.5.4.2 OPEN CEILING OR WAREHOUSE INSTALLATIONS

All access points located outside of standard open suspended ceiling tile environments must have conduit installed directly to a standard electrical box fitting the mounting bracket for the supplied Wireless Access

Point. These access points are mounted directly to the electrical / telecommunications junction box face similar to that of an electrical fixture. All data cabling must be run through this conduit and to the access point. A minimum of 300mm of slack cable must be left within the junction box after termination to allow for easy replacement, and re- termination if necessary. All junction boxes must be mounted in a secure fashion and must support the full weight of the specified access point. Junction box locations must be coordinated with the final site survey for the facility.

7.5.4.3 OUTDOOR WIRELESS ACCESS POINTS

These access points must be installed as per the manufacturer's instructions and must be fastened securely to prevent theft or damage to the equipment. These may be pole, wall or ceiling mounted based on the final wireless survey instructions. The appropriate hardware for the installation is to be included.

7.6 NETWORK GPS CLOCKS

Network clock locations shall be indicated in the electrical drawings and is to include location of the below network and power outlets for review by Metrolinx.

7.6.1 NETWORK CONNECTIVITY

Each of these devices requires a minimum of one network outlet. These network outlets are to be cabled back to the nearest telecommunications room network rack and terminated as per the copper horizontal cabling standard.

7.6.2 POWER REQUIREMENTS

Each of these device locations require a single 20amp duplex receptacle

7.7 TIME KEEPING / PUNCH CLOCKS

Each location of a time keeping or punch type requires the following. The location of the time clocks is determined by the project stakeholders at the time of design.

7.7.1 NETWORK CONNECTIVITY

Each of these devices requires a minimum of one network outlet. These network outlets are to be cabled back to the nearest telecommunications room network rack and terminated as per the copper horizontal cabling standard.

7.7.2 POWER REQUIREMENTS

Each of these device locations requires a single 20amp duplex receptacle. These do not need to be connected to UPS / Emergency power and do not require a dedicated outlet. See Metrolinx DRM for electrical outlet specifications.

7.8 DIGITAL SIGNAGE

Each digital signage location shown on the electrical drawings must include data and electrical outlet locations as well as any enclosures or other infrastructure associated with these signs.

7.8.1 NETWORK CONNECTIVITY

Each of these devices requires a minimum of one network outlet. These network outlets are to be cabled back to the nearest telecommunications room network rack and terminated as per the copper horizontal cabling standard.

7.8.2 POWER REQUIREMENTS

Each of these device locations requires a dedicated single 20amp duplex receptacle for indoor locations. Outdoor locations require sizing based on external enclosure and screen power draws. All outdoor outlets must be GFI Type receptacle which may be reset at the NEMA enclosure. This is to be coordinated at time of design and must adhere to Metrolinx DRM for outdoor outlets.

7.9 BUILDING AUTOMATION SYSTEMS

Refer to CI-0702 Mechanical and to the Building Automation Systems performance specification.

7.10 BUILDING UPS TELECOMMUNICATIONS

All Metrolinx UPS systems must be connected to the Metrolinx network infrastructure for future monitoring.

7.10.1 NETWORK CONNECTIVITY

Each of these devices requires a minimum of two network outlets. These network outlets are to be cabled back to the nearest telecommunications room network rack and terminated as per the copper horizontal cabling standard.

7.11 SERVICE COUNTER AREA FAX / PRINTER DEVICES

Each service counter booth will have a network printer, fax and copier device. This device shall be located on the electrical drawings along with the location of the below network and power outlets.

7.11.1 MILLWORK REQUIREMENTS

A location for this device must be identified within the service counter area. This location is to be determined by Station Operations. The physical dimensions of this unit are (WxDxH): 22 x 762 x 26 in. (558 x 665 x 660 mm) and is to be accommodated within the millwork space. Additional clearance above the unit is necessary for operation of the top tray of the MFP. There shall be no obstructions within 24" or 610mm above this unit.

7.11.2 NETWORK CONNECTIVITY

Each of these devices requires a minimum of two network outlets. These network outlets are to be cabled back to the nearest telecommunications room network rack and terminated as per the copper horizontal cabling standard. These are to be used for both fax and data lines from the telecommunications room.

7.11.3 POWER REQUIREMENTS

Each of these device locations requires a single 20amp duplex receptacle. Emergency / Backup power is required but does not need to be a dedicated circuit.

7.12 STATION ATTENDANT PC

The Station PC is required for each station attendant. The current PC model is an HP DC8200 SFF PC. The PC is intended to provide ATLS Snagit View and PC Whiteboard Services to the station attendant. This computer requires a Keyboard and Mouse as well as a monitor on-top of the station attendant's desk. The purchase and installation of this PC is the responsibility of the Metrolinx I&IT Department.

7.12.1 MILLWORK SIZE REQUIREMENTS

The PC's dimensions are as follows: 4.0 x 13.3 x 14.9 in (100 x 338 x 379 mm). This unit is oriented vertically under the service attendant's desk. The PC requires a minimum of 200mm at the rear of the machine and a minimum of 80mm in-front to allow for cabling and other devices to be connected front and back. An additional 75mm is required on either side of the unit as well for proper ventilation. This unit requires proper ventilation when placed under the desk. This is not to be installed in any location which does not allow proper air movement.

7.12.2 POWER REQUIREMENTS

Including Monitor, PC, KVM, and other devices a minimum of two 20a Duplex Receptacles on UPS Power are required. These receptacles may not be ganged into a single box and must allow for a minimum of 100mm between outlets. These outlets must be within close proximity to the PC location within the desk. Refer to DRM Service Counter Standards for details.

7.13 FUEL MANAGEMENT SYSTEMS (RAIL)

Fuelling Systems require an isolated facility room for their control and management systems. These are to be isolated from the telecommunications and electrical rooms. Within these rooms adequate space for a half height network and server rack is required. This is to be a floor standing rack with a minimum of 1m clearance on three sides. One side may be placed against the wall.

2 x minimum 53mm conduits are required from this location to the nearest telecommunications room for telecommunications and integration into the GO Transit network infrastructure. See Metrolinx DRM for conduit specifications and requirements.

1 x minimum 27mm conduit is required from this rack to the location of the Fuel Management System Network Switch for network data cables. This is to be coordinated with the Fuel Management System integrators. See Metrolinx DRM for conduit specifications and requirements.

7.13.1 POWER REQUIREMENTS (IT RACK)

Each rack Location requires 2 x 20amp NEMA L5-20P outlets on The Emergency UPS panel from the telecommunications room. These outlets are to be on separate breakers and follow all electrical standards outlined in the Metrolinx DRM.

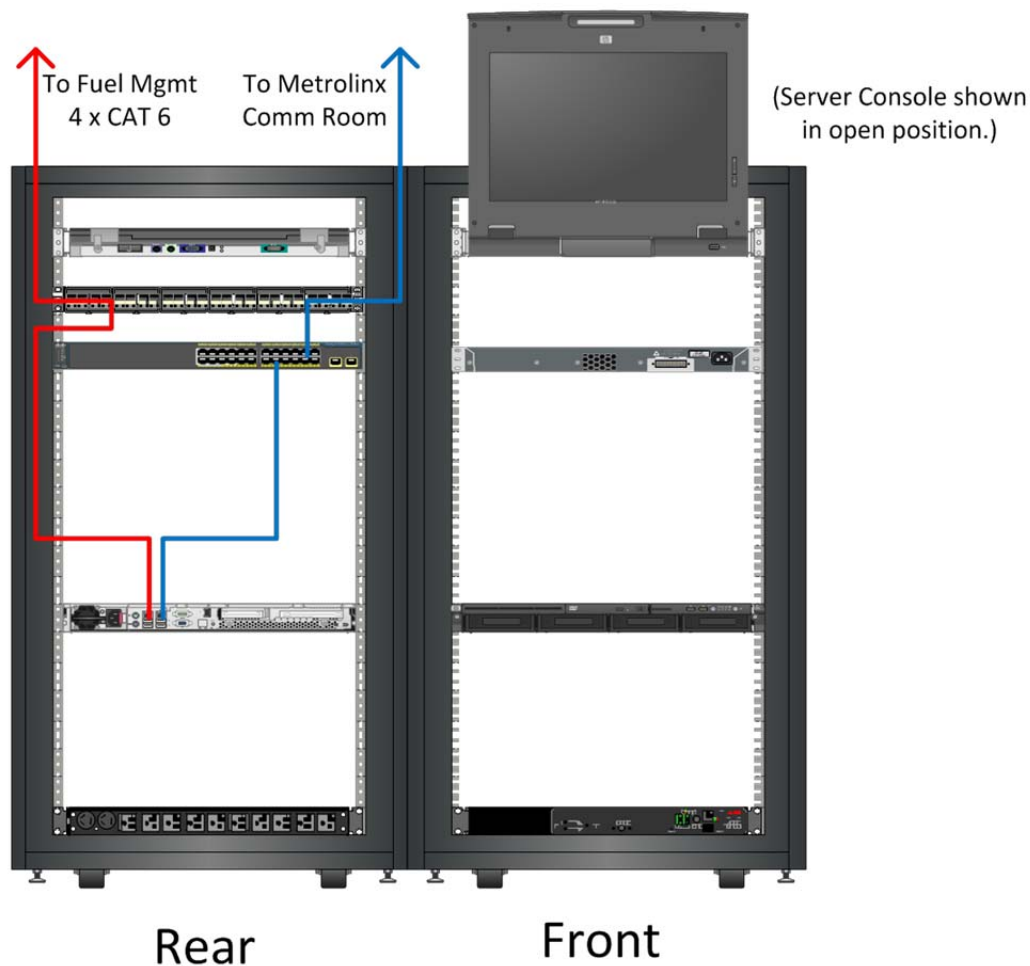
One APC – Model AP 7752 is to be installed in the lowest rack unit of the rack. This is provided by Metrolinx IT.

7.13.2 RACK SPECIFICATIONS AND ELEVATION

The rack shall be a Middle Atlantic WMRK-2442 rack.

All rack frames and accessories are to be Middle Atlantic WMRK Series and are to conform to the following specifications.

- Overall dimensions shall be 1227H x 650W x 1124D
- All racks are to include 70% vented locking front door
- All racks are to include split 79% vented locking rear doors
- All racks are to include locking, removable side panels
- All racks are to be grounded to the telecommunications room grounding bus-bar



7.13.3 SERVER REQUIREMENTS

Each Fuel Management location will require only one network server for local data collection and authorization of the fuel delivery. These servers will communicate with the central management server located in Metrolinx data centers. These servers will be provided by Metrolinx and will come prepared with our current Network Server OS image and network configurations. The application is to be provided and installed by the application vendor and systems integrator.

The server will connect to both the Fuel Management System network infrastructure and the Metrolinx IT network. This is to allow Metrolinx to retrieve data from the fuel management systems but not fully integrate the systems network devices (i.e. fuel pump controls, metering and PLC systems).

SPECIFICATIONS:

These servers are to be a current model HP DL-320 Server with the following specifications:

Min Processor	2.13 Ghz Quad Core (Intel Xeon E5606)
Min Memory	4 GB

Min Disk	2 x 146 GB 10 K RPM (RAID 1+0)
Min Network Interfaces	2 x 1000 Mb/Sec
CD Rom Drive	HP 9.5mm SATA DVD-ROM Optical Drive
Power Supplies with	HP 365W Redundant Power Supply Kit
iLO Management	Dedicated iLO Management Interface
Operating System	Windows 2008 R2 Standard

7.13.4 NETWORK REQUIREMENTS

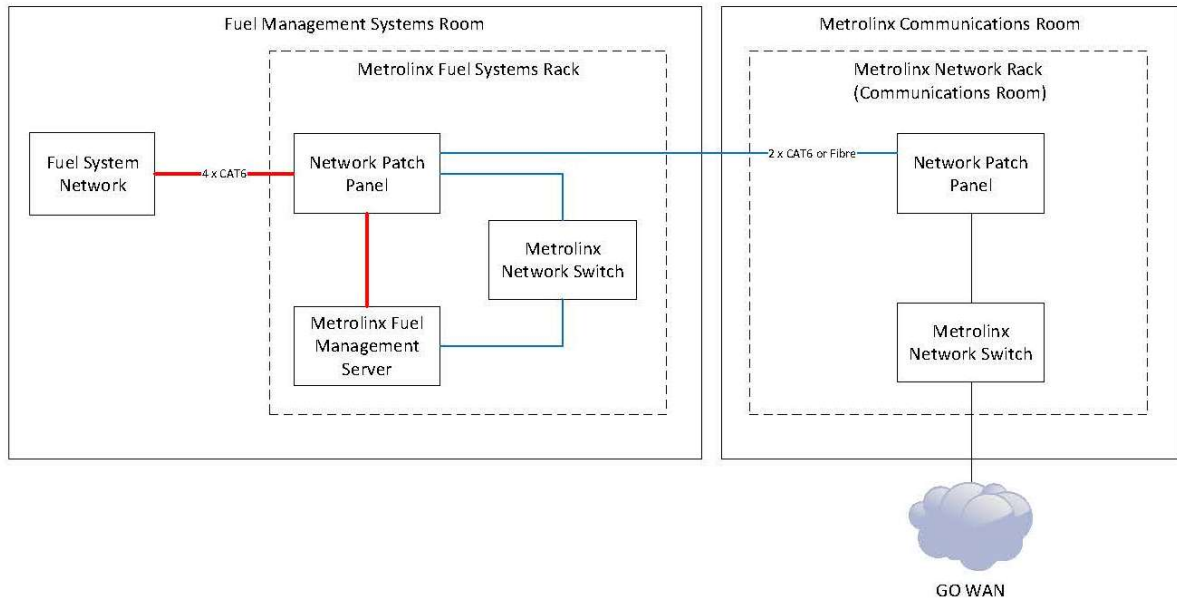
In locations where the fuel management system rack is installed within 90m of the telecommunications room, two Category 6 network cables are to be installed in the 2 x 53mm conduits. In location where this rack will be beyond the 90m limit, a 12 strand fibre cable is to be installed and terminated within the Fuel System Rack using LC type terminations. This is to be terminated as per this documents fiber termination specifications and requirements.

A network switch is to be installed into this rack and integrated with the existing Metrolinx network infrastructure at the site. This is to be provided and installed by Metrolinx IT personnel. Final connections to the fuel system are to be made by Metrolinx IT personnel.

7.13.4.1 IP ADDRESSING

All IP Addresses for these devices are to be provided by Metrolinx IT department.

7.13.5 SINGLE LINE SYSTEM DIAGRAM



7.14 FUEL MANAGEMENT SYSTEMS (BUS)

Fuel Management Systems for our Bus Fleet Vehicles are to be connected to the Metrolinx Internal Network Switches. These can be cabled directly to the remote Fuel Management system through standard conduits to the nearest telecommunications room patch panel using CAT-6 cabling. Two network outlets are required at a minimum at these locations. All standards for Horizontal Copper Cabling are to be followed.

7.14.1.1 IP ADDRESSING

All IP Addresses for these devices are to be provided by Metrolinx IT department.

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