Architectural Design Brief

Architecttura Architects

Aug 23, 2024

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Overview

The design team's goal for this project was to provide a design concept and vision to accommodate three separate uses— the Civic Centre, Library, and Museum— into one main building. This process began with a program review of all spaces within the various users to determine the gross floor area required from a mathematical perspective. The final requirements for each use were itemized into a Functional Space Program (FSP), which is included in the appendix section of this report. The process then transitioned to creating block diagrams representing the space needs by use, department, optimized adjacency, and providing options on how best to fit the required program within an existing building along with possible building additions. The team focused on the following criteria, in no particular order, to determine how best to fit the program within the available building area: accessibility, entrance location for visitors and staff, access to parking, existing building features such as height and construction type, special requirements within each use such as daylighting, security for staff and visitors, limiting daylighting to special use areas, and visitor drop-off and shipping/receiving areas requiring loading dock access. Upon completion of the detailed block plans, the process transitioned to finalizing schematic design floor plans and the final exterior concept design for the new CK Community Hub building. The final schematic design drawings are provided in the appendix section of this report. Input and stakeholder involvement were actively incorporated throughout all phases of the design development as outlined above.

Table of Contents

Introduction

The CK Hub project involves a renovation and expansion of the existing building located within the Downtown Chatham Centre (formerly Sears). The renovation will require an adaptive reuse of the existing building, previously designated as a shopping center (retail use), to a combined general office and assembly occupancy (library and museum) type use. The building will be expanded to the north and south elevations to meet building program requirements.

Regarding the renovation, the building will undergo a complete exterior envelope renovation that will involve the removal of masonry veneer along the exterior face, exposing the concrete block substrate, as well as the existing metal siding located on the second floor of the south elevation along the main floor roof section. All expansion areas along the north and south building elevations will be entirely removed to make way for the new building expansion. Additionally, building services such as electrical and sanitary and storm sewers will be entirely upgraded. The existing HVAC system will also be entirely replaced due to its end-of-life condition. Please refer to the MEP design brief for further information relating to the proposed new electrical, mechanical, and plumbing systems.

Exterior Envelope

The exterior finishes will include metal composite panel (MCP), fiber cement board (FC), stone veneer (SV), granite veneer (GV), aluminum curtainwall (ACW), and insulated glazing. Additionally, insulated metal panels (IMP) will be used in mechanical penthouse locations above the second floor. The metal composite panel will be utilized as an exterior finish rainscreen system in all locations 42" above the finish grade level. The base of the exterior wall where the metal composite is utilized will be finished with granite veneer to protect the base of the exterior wall along the finish grade or sidewalk level. Stone veneer will be used to finish the exterior wall to emphasize the stately presence of the building concept, particularly along the principal street elevation near the main entry. This stone veneer will be applied as a rainscreen with adequate air space. The remainder of the exterior envelope at street level will be comprised of aluminum curtainwall with insulated glass. Glass spandrel will be used within the curtainwall system where the roof and floor systems intersect with the exterior curtainwall to conceal building structure elements. Fiber cement panels will also be used in the exterior envelope above the roof conditions along the south elevation above the lower main floor roof location.

The exterior envelope insulation (R) will be increased to meet current building code and energy efficiency standards. The entire envelope will be treated with a minimum 3.5" (90mm) thick spray insulation, achieving a minimum R 22-24.5 rating. The exterior envelope containing curtainwall will be equipped with 1" insulated glass that is tinted and treated to provide a minimum R-7 rating.

Interior Finishes

The existing building is constructed with poured concrete columns and poured concrete floor construction for the second superstructure. The roof superstructure comprises steel columns, steel-framed roof, and steel deck. The intent for the interior finishes is to expose all superstructure on the first and second floors for the interior portions of the Museum and Library, as well as the open office area within the Civic Centre. All public entrance and lobby areas, public corridors that connect all major areas within the CK Community Hub, will have acoustic ceiling tile (ACT) finishes throughout. This design provides a horizontal chase where major ventilation ductwork, conduit, and raceways will be used to service and access all building zones while maintaining a clean appearance that conceals all services above the ceiling. Consequently, all spaces adjoining the open exposed ceiling areas—such as offices, meeting rooms, council chamber, staff work areas, community rooms, and program rooms— will also be equipped with acoustic ceilings to ensure sound control, lighting efficiency, and optimized appearance. All customer service desks, main reception, security desk, and service points for the library will feature wood veneers and solid surfacing to enhance longevity and create a warm and inviting appearance. All wall surfaces will be constructed with abuse-resistant drywall and finished with a subtle primary color consistent throughout the public zone, allowing for easy maintenance throughout the building's lifecycle. Interior walls will also be dressed with painted accent colors and commercial fabric wall finishes where suitable. Floors will be finished with ceramic tile in all public corridors, vinyl plank flooring within the museum and library public zones, community rooms, and program rooms. Carpet tile will be utilized in the Civic Centre staff areas, meeting rooms, council chamber, and open office areas. Anti-static floor finishes will be used in computer server, IT rooms, and service rooms.

Exterior Architectural Finishes

Architectural finishes will accentuate certain exterior areas of the building. Metal composite wood veneer (MCP-WV) will be used in all soffit areas within the roof projections. All exposed columns will be finished with an exposed concrete finish for abuse resistance. Architectural features are also incorporated into the design concept. Perforated stainless steel panels will be utilized as building signs and feature displays, correlating with the museum's artistic characteristics, the library's maker generation, and the Civic Centre's need for art expression.

Structural Analysis

The structural design team has reviewed all conditions surrounding the proposed additions to the existing building. The design team has also studied the effects of the additions on the existing roof structure. Additionally, some areas will require structural enhancement due to the expanded second-floor area extending onto an existing one-storey roof. The structural team has also evaluated the existing structure and accommodated all necessary upgrades and reinforcement for the support of the new floor area within the current estimated cost. The structural design will consist of completing all floor and roof structures for the building additions on the north and south sides of the existing building. Programmatic functions, such as library book collection shelving and Civic Centre office areas, was also reviewed the existing structural system to ensure that live and dead load capacities are achieved in areas requiring new office furniture, book shelving, and mechanical equipment within roof penthouse locations. The overall structural design will meet current building codes and utilize a structural steel superstructure with below-grade poured concrete foundations.

Accessibility and Universal Design

The building design will comply with all Ontario Building Code (OBC), Accessibility for Ontarians with Disabilities Act (AODA), Municipality of Chatham-Kent Design Standards, and the Facility Accessibility Design Standards (FADS) guide referenced within the design criteria (see supplemental FADS guide). The current design meets all design standards identified with the FADS document. Additionally, the design team collaborated directly with the Accessibility Committee of Chatham-Kent to review Facility Accessibility Design Standards, their input relating to; washrooms, main entrance, parking, access to upper floors, reception counters, information kiosks, assisted listening devices, and other public facing areas. The current design address all submitted comments related to accessibility. To promote inclusivity, the design includes gender-neutral washrooms, family washrooms with change tables, and nursing rooms for family use during their visit to the CK Community Hub.

Sustainability and Green Building Design

The new CK Community Hub building has incorporated design features to ensure effective carbon reduction measures. In addition to the HVAC and electrical design principles outlined in the MEP Design Brief, the design team explored the viability of sustainable solutions related to district energy sources and localized on-site solutions such as geothermal energy resources. The design considers solar passive strategies, including analyzing the effects of solar heat gain from adverse sun angles, providing overhangs in the form of canopies at all south-facing facades, and using tinted high-grade glazing for sun control on west-facing facades. The electrical design included daylight harvesting to control and reduce indoor artificial lighting during peak daylight hours, thereby reducing energy costs. Specific design details are further outlined in the Chatham-Kent Community Hub Systems Report or Design Briefs for all mechanical and electrical items located in the supplemental resources.

Acoustic Control

The design of the new CK Community Hub incorporates the latest standards for Sound Transmission Class (STC). This measures sound travel between rooms, and reverberation, which measures reflective airborne sound within spaces. Solutions also included sound insulation within wall cavities, ceiling-mounted sound panels within open areas, noise diffusion or white noise systems to reduce sound travel throughout open areas and between office locations. Additionally, floor finishes and commercial furniture techniques, such as carpet tile and fabric partitions, will be used for noise reduction and sound control.

Lighting Design

The lighting design for the new CK Hub Building involves both interior and exterior architectural lighting. Interior lighting design meets optimal standards for office, library, and museum spaces, as well as public areas like the council chamber, community rooms, and meeting rooms. Exterior lighting includes architectural feature lighting to highlight the building façade and general lighting for exterior plazas and entrance areas to ensure safety and security. Specific design details are outlined in the Chatham-Kent Community Hub Systems Report or Design Briefs for all electrical items located in the supplemental resources.

Security and Surveillance

The security design involves both electronic and physical measures. Electronic security includes alarms, cameras, and passage control reflected within the interior doors of the building. This involves swipe cards, FOBS, and other related devices to monitor pedestrian travel throughout specific zones of the building interior. The Civic Centre office portion and second-floor meeting rooms is equipped with secure access control to limit use and access from the general public. Each use, including the library, museum, and Civic Centre, will have passage control measures accommodated at each entry door in addition to back-of-house areas such as loading docks, refuse areas, and service rooms. Additional security devices, such as Radio Frequency Identification (RFID), will be installed at all library entrances to provide effective security measures and reduce theft incidence. Specific design details are outlined in the Chatham-Kent Community Hub Systems Report or Design Briefs for all security and surveillance items within the electrical section located in the supplemental resources. Physical security measures are also utilized on the building's exterior to mitigate threats from vehicles or other transportation devices damaging exterior building entrances. Methods include planters, integral retaining walls, bench seating, and bollards.

Fire Safety and Evacuation Planning

All fire safety design measures comply with the Ontario Building Code (OBC) and the local fire department requirements from the Municipality of Chatham-Kent. The building design provide for fire alarms, principal firefighter entrances, fire routes, and a fire department connection. A fire suppression system and fire pump for pressure equalization is also incorporated into the building. Fire safety techniques, such as fire exit maps and diagrams, are posted throughout the building's exit doors and corridors to ensure safe evacuation in case of an alarm. Specific design details are outlined in the Chatham-Kent Community

Hub Systems Report or Design Briefs for all fire safety-related items within the electrical section located in the supplemental resources.

IT and Communication Systems

The new CK Hub Building incorporates the latest technology throughout the entire building. The design will include WIFI availability throughout the interior and A/V technology in all meeting rooms, community rooms, and the council chamber. In addition to server rooms, the building will be equipped with IT closets and communication systems to optimize utilization for all internal spaces. Building controls are used to monitor and adjust indoor climate settings, access control at building entrances, and provide surveillance monitoring along the building's exterior. Specific design details are outlined in the Chatham-Kent Community Hub Systems Report or Design Briefs for all IT and communication items located in the supplemental resources. Further details will be outlined in the A/V or audio-visual Design Brief.

Parking and Transportation

The building design provides for parking and drop-off areas close to the building exterior. New vehicle parking is also provided at the south entrance, including both barrier-free and standard parking spaces. Existing on-street parking is also considered to be modified to provide additional barrier-free parking. Pedestrian drop-off zones will be located at the main entrance off King Street. All remaining visitor and staff parking is accommodated in the parking garage adjacent to the south entrance of the building.

Landscaping and Exterior Spaces

The building's exterior is enhanced with landscaping, exterior plazas, and seating areas to soften the transition from the street to the building entrance. Design details include planters with low vegetation, in-ground trees within protected below-ground planters, solid wood benching for seating areas, and patterned concrete tinted with two color accents to soften the appearance of standard concrete walkways. All vegetation is selected for its suitability to grow within the specific location, street-facing orientation, and hardiness to the local region. Soft exterior lighting of all exterior plazas, walkways, and entrances will be integrated into the street pole lighting and roof soffit above the main entry.

Signage and Wayfinding

Signage display boards are located at all main entrance locations from the building exterior and within the adjoining mall entrance. The design accommodates video displays, text and numerical indicators on directory boards, and floor plans showing the location of all major uses within the building interior. Signage is also provided to identify room use with numerical indicators for all interior spaces. Room signage utilizes tactile and braille identification along with numerical and room identification. Directory signage for building identification also follows a similar approach. Each identified use, such as the library, museum, and Civic Centre, also has signage at the principal interior entrance from the lobby areas.

Community and Cultural Heritage

The design strategy for representing cultural heritage involves incorporating a large sign feature near the south principal entrance of the building. This includes a large billboard-type sign featuring a two-story wall with an art image representing the “past, present, and future” vision provided by the marketing team of Chatham-Kent. The community aspect is also addressed by providing rotating art exhibits and traveling exhibits within the museum, along with interior art pieces, stained glass inserts, and murals throughout the building’s common spaces. The program also provides multi-use programming and community rooms for use by the general public and building users.

Cost Management and Budgeting

The design team utilizes building information modeling (BIM) for effective cost management. This involves producing a virtual 3D model of the entire building design to provide quantity take-offs for all building-related elements. Each building element is modeled and identified by its material type, allowing for accurate quantification. This approach ensures that all building elements portrayed in the 3D design renderings are accurately quantified. The team employs this technique for building finish materials such as flooring, millwork, doors, and frames, as well as structural elements like concrete and steel. This approach provides an in-house quantity surveying technique for monitoring, checking, and ensuring budgets are on track. In addition, the team also utilized an external quantity surveying firm, Lakeland Consulting, to confirm current budget and to ensure budgets are properly managed throughout further design stages of the project.

Conclusion

In conclusion, the summary is based on a practical approach to all building-related elements identified above. The existing Sears building, converted into the new CK Community Hub building, is ideal in many aspects. Firstly, the open space design of the former department store is well-suited for planning and converting the building for the proposed uses, which all require an open space plan. Secondly, the building's condition is very sound and stable. The existing construction, using poured concrete and structural steel, is ideal for its purpose, as any new building would incorporate a similar structural approach. Lastly, the building is well-situated to serve as a Landmark Building with a civic presence.

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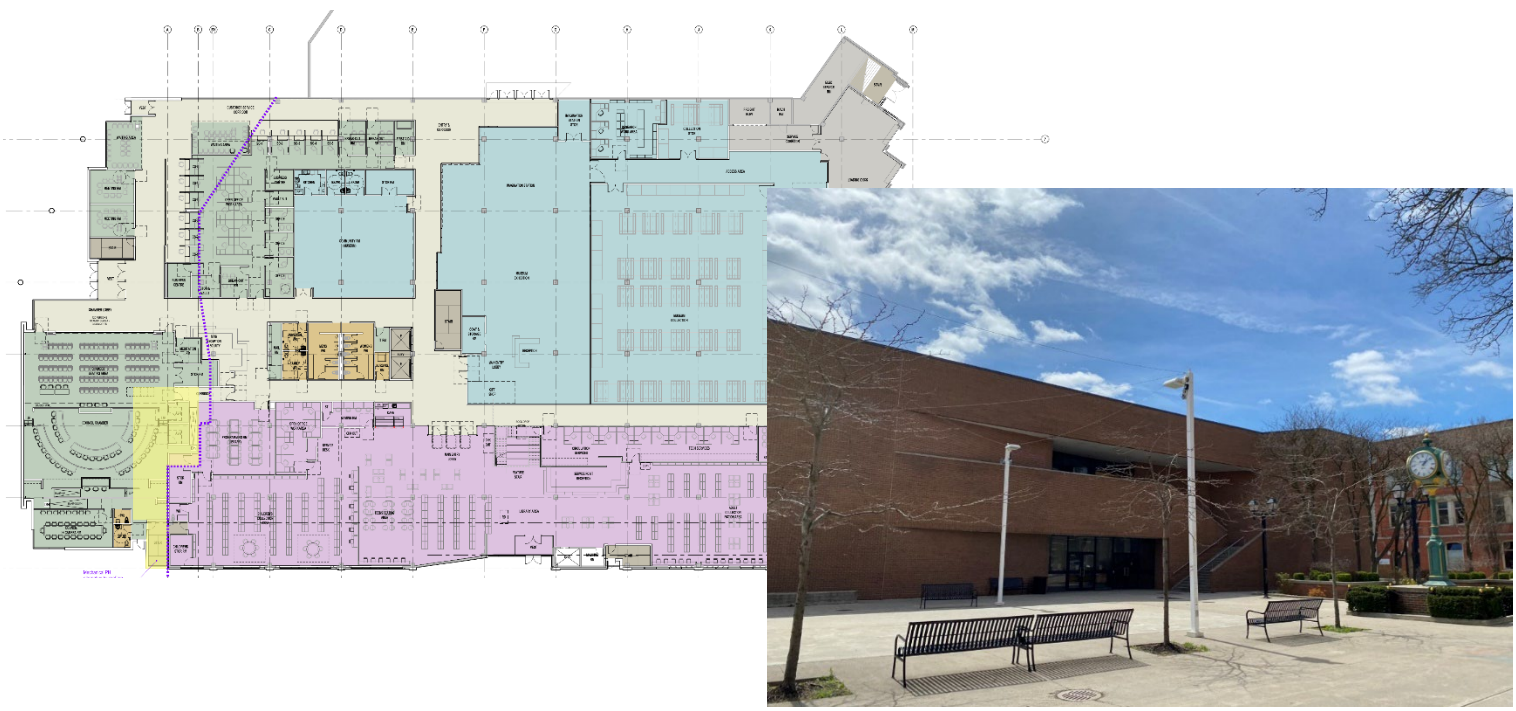
ENGINEERING FORWARD

Chatham-Kent Community Hub
Systems Report



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V&R Project No. 24-067
August, 2024

Table of Contents

1. Introduction

This Report is to provide an overall review of the building systems anticipated and recommended to serve the new Town Hub building for Chatham-Kent within the existing Sears facility (downtown) in the city of Chatham, Ontario. The new community hub will play an important role in the life and function of the city and county providing both a look at the past with the new museum space, and a look forward with a new council chamber and administration area. A large library and resource to the community is also integral to the design and will play a large role in the community access to the space and building.

The existing systems are reviewed for their condition/age, capacity, conformance to present Codes and Standards, but the intent is to replace and provide new systems that provide efficiency and sustainability to serve the building and the various spaces for many years to come. The suggested mechanical systems will also play an integral part to the various spaces, temperature requirements and occupant comfort.

2. Executive Summary

As the report will outline the various systems within the New Community Hub, the systems recommended are to provide a basis of design looking at efficiency, occupancy, and building and space performance requirements. Due to the nature of the existing building and it's past life, the systems suggested will all be new within the building adjusting to the various spaces.

HVAC systems provided will be new and will provide ventilation rates dedicated to the space, not wasting energy but on demand and specific to the needs of each space. Dedicated Fancoils utilizing the latest in refrigerant technology and efficiency integrated with dedicated fresh air systems will be within Library and Administration areas. Museum spaces will be equipped with systems (dedicated Air handling units and boiler/humidifier systems) that are providing air change rates, high tolerance in temperature and humidity control providing the conditions needed for the occupancy and artifacts on both display and within storage. The mechanical systems play a vital role within the entire facility and the varied spaces proposed.

Plumbing and Sprinkler systems will be new and redistributed both underground and throughout the ceiling spaces to serve the new washrooms, staff and public facilities and will include sprinkler coverage for both the new addition and renovated spaces. Large incoming water lines will be re-utilized at building entry.

Electrical Systems will be new and dedicated to this building, including a new service. This building (currently the old Sears) will be removed from the main service serving the entire complex/mall, and will be provided with new and sized to suit the new building needs/loads. New

Comms/Security/Fire Alarm/Data Systems will be throughout the new and old building sections providing new dedicated systems with the latest technologies.

3. Mechanical Systems

3.1. Codes and Standards

All proposed systems are based on basic proven design principles and applicable codes and standards including:

Ontario Building Code
Ontario Fire Code
Ontario Gas Utilization Code
O. Reg. 308 under the Environmental Protection Act

CAN/CSA-B51	Boiler, Pressure Vessel and Pressure Piping Code
CAN/CSA-B52	Mechanical Refrigeration Code
ASHRAE 62	Ventilation for Acceptable Indoor Air Quality
ASHRAE 90.1	Energy Efficient Design for New Buildings
NFPA 10	Portable Fire Extinguishers
NFPA 13	Installation of Sprinkler Systems
NFPA 14	Installation of Standpipe and Hose Systems
NFPA 90A	Installation of Air Conditioning and Ventilating Systems

Further to these listed above, Energy efficient systems that improve on base-line design principles, codes and standards also will consider the following where applicable:

LEED Building Standards

Zero Carbon Building (ZCB)

Canada National Energy Code

GMF Funding (Energy Target Improvements)

3.2. Space Requirements

The major mechanical equipment (plumbing, fire protection and heating, ventilation, and air conditioning (HVAC) equipment) serving the building to be located in the ground and second floor Mechanical Rooms as well as roof areas. This includes air handling units, boiler, pumps, domestic water and fire protection equipment and systems.

3.3. Storm Water

Storm water will be collected from roof drains and will be connected to site services. Existing to be maintained where possible and replace sections to coordinate with new services and/or new partitions. It is recommended that all piping be insulated with new to mitigate/minimize any noise projection within the occupied space. New Storm lines from extended roof areas and addition to connect to existing at rear of building, with anticipated new connections to main Storm as new front council chamber addition requires.

3.4. Sanitary Waste

Sanitary waste collected from each plumbing fixture and floor drain will be connected to the underground sewage system, terminating 1.5 meters (5'-0") outside of the building. A clean-out will be provided for the sanitary waste pipe before it leaves the building. Floor drains will be equipped with trap seal primers. Sanitary venting will be provided in accordance with Part 7 of the Ontario Building Code and vented up through the roof to the exterior. First floor, floor-slab to be cut-out as required to suit the new plumbing load and requirements of fixture placement and exiting.

All elevator pits will have a drain and sump pit/pump to meet the Elevator Code & TSSA requirements. Drainage/waste line to be coordinated with new elevator location.

New plumbing fixtures will comply with the low flow requirements and are Water-Sense labelled fixtures where possible, meeting both LEED and GMF requirements. Wall mounted, flush valve Lav's to be installed where possible and coordinated with plumbing chase/wall type.

3.5. Weeper System

A weeping tile system, if required at the elevator pit, will be connected to the storm system through a sediment interceptor and pumping chamber. This is expected for the new Passenger Elevators, with the Freight Elevator existing condition to remain as is.

3.6. Domestic Cold Water

The building is currently fed with a dedicated 100mm (4") domestic cold water line from the street/city services on level one outside of the loading bay on the south side. It currently downsizes to a 2-1/2" line with a 2" meter. It is recommended that the existing line be utilized from street to building, and that the meter be replaced with new and upsized to suit the new building load, complete with a backflow preventer and new isolation valve assembly.

Potable water will be distributed to all areas of the facility to serve plumbing fixtures, domestic hot water, mechanical system make up water, etc.

3.7. Domestic Hot Water

The base-line recommended system for the Domestic Hot Water system is a high efficiency condensing type natural gas fired storage type domestic hot water heater with storage. Location of Domestic Hot Water heating system is anticipated to be within the existing 2nd floor expanded mechanical room.

Alternative Carbon/GHG reduction selection would be to provide an air source Heat Pump unit with an electric back-up heater. The associated condenser section would be roof mounted (level 1 roof). It should be expected that this solution also requires more floor area as the amount and size of the equipment increases, as well as roof mounted equipment would need to be coordinated with existing roof area available (coordinated with solar and RTU’s).

Domestic hot water will be heated to 60°C (140°F). Domestic hot water will be distributed to all fixtures requiring hot water. A series of mixing valves to reduce the water temperature will be utilized downstream of the storage at either point of use or per floor in providing a reduced water temp of 43°C (110°F) at the fixture. Recirculation will be provided to ensure hot water is provided at each fixture without a long delay.

3.8. Natural Gas

The building is complete with an existing natural gas service that is connected to the existing utility mains on the street. It is anticipated that the system will be increased in pressure or replaced to provide the anticipated loads the base-line building systems demand. The system will be complete with a gas meter and pressure regulating station, located outside the building, as per the local authorities’ standards. Natural gas will be distributed to gas fired appliances like domestic hot water heaters, boilers, Roof-top units, etc. as required. It is anticipated that all new gas lines will be installed throughout the building as required from meter set at exterior. Coordination with Utility (Enbridge) is required when building/appliance/system loads are determined.

3.9. Fire Protection

A wet-pipe automatic sprinkler system will be provided to serve all areas of the facility in accordance with the Ontario Building Code, NFPA 13 and the Owner's Insurer's requirements. A dry system is recommended for the main server room.

The building is complete with an existing sprinkler system separated into 2 zones (Level 1 and Level 2). It should be anticipated that a new sprinkler system will be installed with the existing demolished back to the main incoming. The existing main incoming line is 200mm (8”) which is sufficient for the new system. New zone valves and header to be installed with an increase in zones and distribution to match the various spaces by occupant type and fire-barrier for both levels (1 and 2). The new header will reconnect to the existing building pump connection (Siamese) at the rear (south) side of the building.

It is anticipated that a fire standpipe system will be provided for the building, in accordance with the Ontario Building Code, NFPA 14, and the Owner’s Insurer’s requirements. Fire hose cabinets, each with 40 mm (1.5 inch) hose valve, 30-meter (100 ft) hose, hose rack, and 4.5 kg (10 lb.) This will also be incorporated into the new sprinkler/standpipe system.

ABC fire extinguishers will be provided as required as either 5lb and 10lb per NFPA requirements.

The provision of a fire pump is not expected (with an existing operational system in place) but will be reviewed at time of design with Hydraulic calculations and city water pressures. Implications of Fire Pump will not only add cost to the Sprinkler and Standpipe systems but will also have further interconnections with Fire Alarm and back-up generators.

3.10. HVAC Systems (Council and Office areas)

The heating system will be designed to maintain the temperature in the facility at a minimum of 22ºC. Humidity will be maintained at 35% RH minimum.

Ventilation will be provided to each room at the minimum rate in accordance with Ontario Building Code requirements and ASHRAE 62. Washroom and general exhaust systems will be provided to serve all areas and will discharge through exhaust ducts to exhaust fans and/or DOAS energy recovery units.

Air will be circulated to and from the various occupied spaces via a system of ducts, diffusers, grilles, dampers, etc. Ductwork generally will be galvanized sheet metal constructed in accordance with ASHRAE recommendations and SMACNA standards.

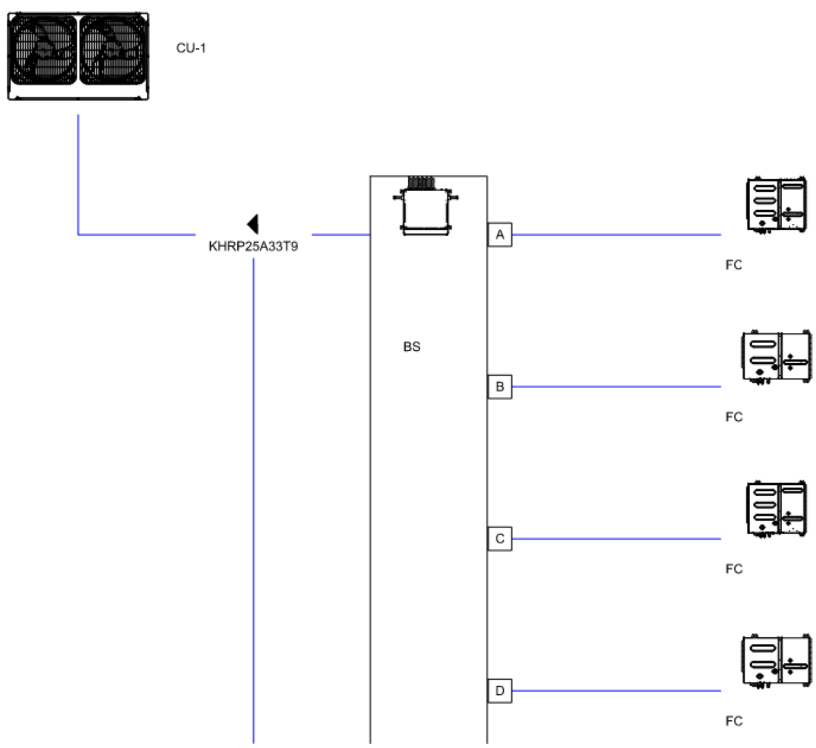
Air distribution within the rooms will be through ceiling mounted air diffusers selected to meet room noise criteria but not to exceed NC 25-30. Room temperature will be controlled by means of local wall mounted thermostats.

The air conditioning system will be designed to maintain temperature in the facility at a maximum of 24ºC. Humidity will be maintained at 45% RH maximum.

Rooms will normally be provided with individual temperature control. Rooms with similar exposures and use will be grouped together with one temperature zone control. The estimated number of zones is as follows: First Floor: 8 zones; Second Floor: 25 zones.

The building will be provided with heating and cooling systems using air source variable refrigerant flow (VRF), a heat pump system with piping (hydronic & refrigerant), heating elements and fan coil units. Air source heat pump units will be located on the roof of the addition. Fan coil units will be located above the ceiling. All other major pieces of equipment will be in mechanical rooms.

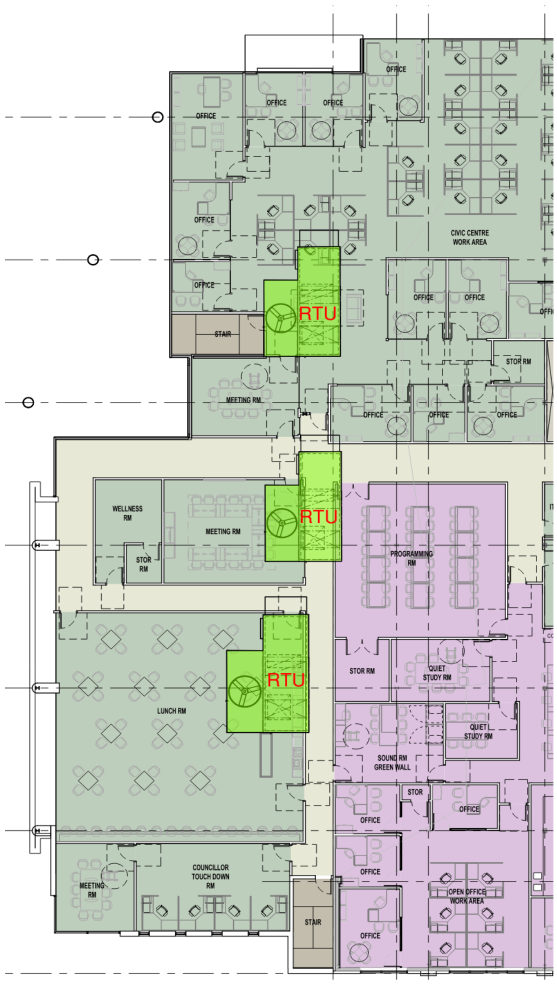
Heating will be provided by the system through the above ceiling fan coil units distributed/ducted throughout the building.



Typical VRF systems Schematic :

Refrigerant piping will interconnect the heat pump units with all the fan coil units. Heat transfer to/from the heat pumps and the fan coil units will be through the refrigeration piping system.

The ventilation system is comprised of a Dedicated Outdoor Air Unit (RTU-DOAS), exhaust fans mentioned above, fan coil units and air distribution system.



Floorplan Sketch 1 : Council and Office DOAS RTU located on new Roof area

The DOAS units (estimated 3) located on the roof are to provide the filtered and tempered 100% outside air to the various spaces to satisfy the fresh air ventilation requirements of the building. DOAS units will be comprised of:

- supply fan section c/w VFD
- exhaust fan section c/w VFD
- 30% - 50 mm (2") prefilter section (supply air stream)
- 30% - 50 mm (2") filter section (exhaust air stream)
- 85% - 300 mm (12") final filter section (supply air stream)
- DX preheating coil section
- DX cooling coil section
- total energy (enthalpy) heat wheel section
- outside and exhaust air dampers

Air from the DOAS will be supplied to the spaces at a neutral temperature of about 18°C (65°F). Preconditioning of the fresh air will be done via economizers, heat recovery wheels, etc. to minimize HVAC system energy use.

The total energy (enthalpy) wheel will reclaim temperature and humidity from exhaust air to precondition the fresh air before delivery into the spaces. Heat recovery wheels will be provided with bypass dampers to bypass the wheels during economizer operation. The unit air side economizer will use outdoor air when OSA enthalpy is suitable for free cooling of the spaces. The supply and exhaust fans will be controlled with VFDs to modulate supply and exhaust fan speeds to maintain duct static pressure set points.

Fan coil units located above ceilings will be used to heat, cool, and ventilate the various spaces. The units will be a direct expansion (DX) design with both heating and cooling capabilities available at all times to meet the zone loads. The units will provide zone temperature control for each room or group of rooms with similar exposures and loads through a space thermostat. Where rooms are served by perimeter heating elements and fan coil units, they will be controlled by the same room thermostat such that heating and cooling operation are coordinated.

Overhead ceiling diffusers will be used for air delivered by the fan coil units. Return to the fan coil units from the rooms will be via ceiling return grilles, transfer ducts and a return air plenum system.

Preconditioned outside air from the central DOAS Units will be delivered to each fan coil unit. The quantity of outdoor air delivery will be controlled by C02 or occupancy sensors located in each zone. Sensors will control fresh air dampers in response to C02 set point deviation. Minimum occupied ventilation is based on floor area requirement of ASHRAE 62 – 2004.

It is anticipated that within the council space area that a smudging space for indigenous use will be implemented. The space to consider the environment and so be designed to suit the community needs. A dedicated exhaust fan and make-up air system (transfer air) to provided with custom grille and capture ceiling area. Exhaust fan to be roof mounted.

3.11. HVAC Systems (Museum)

The Heating Ventilation Air Conditioning (HVAC) system will be designed in accordance with the Ontario Building Code as well as the ASHRAE 62 minimum outdoor ventilation design condition recommendations. The heating and cooling system design loads are calculated based on procedures described in the ASHRAE Application for Museum Handbook and room data sheet operating performance suggested by Owner with the aid of load calculation software. The new HVAC equipment provided in this facility will meet or exceed the efficiencies in accordance with ASHRAE 90.1 standard and OBC-SB-10 latest revision.

The project includes various designated occupancy building areas such as: Museum's Collection storage, galleries, admin/offices, and exhibit area.

Special air ventilation and filtration systems will be provided for the museum's galleries and collection areas. The HVAC system will consist of new indoor air handling units (AHUs) connected to air ducting to provide minimum ventilation rate as required all year around. The units will be equipped with supply fans driven by VFD electric motors, DX cooling and hot gas reheat coils connected to built-in multistage compressors with remote condensers, Hotwater heating coil or multistage built- in electric heater (GHG reduction solution) to temper the air in winter and air filtration system comprised of MERV 8 Prefilter / Adsorbent-Chemisorbent Intermediate Carbon Filter / MERV 15 Final Filter. Also, the AHUs will be provided with dedicated minimum fresh and exhaust air system comprised of dedicated intake fresh air equipped with MERV 8 and exhaust fan c/w ducting system discharging away from any intake.

Air will be circulated to and from the various occupied spaces via a system of ducts, diffusers, grilles, dampers, etc. Air distribution within the rooms will be through ceiling mounted air diffusers or grilles.

The building's mechanical systems will be sized in accordance with the local outdoor climatic site conditions, room designation and number of people, thermal resistance of building envelope components such as walls, windows, and roof. The system will also maintain pressurization between clean and dirty areas, as well as gallery to general public. This is to ensure air transfer is minimized and temperature and humidity control is maintained as required for each space. It is expected that the pressure differential between positive and negative spaces is maintained and monitored at 10Kpa.

Temperature and Humidity control within the museum display and storage spaces play a vital role in maintaining the items within the collection as well as allowing for flexibility in which systems are displayed and curated from other collections. The HVAC system needs to be designed and maintain specific control of systems to avoid damage of goods within the collections. The common damage categories are often described as biological, chemical and mechanical. Biological is typically mold related where systems need to be designed to maintain RH levels that do not exceed 70% RH and that do not have cold spots within the room and spaces. Chemical often refers to Oxidization, where Low RH's should be maintained with slow/gradual changes in temperatures. Mechanical damage is also a result of RH, and poor control of low humidity levels allowing pieces/artifacts to become brittle and/or shrinking and/or expanding. In general, humidity, air change rates and temperature control play a very important role in the preservation of artifacts/items within any collection. Environmental guidelines for museums as well as working with the curator of the spaces to best understand the requirements will be taken into account and incorporated into the design of the HVAC systems.

Design temperatures used in the computation of the heating and cooling loads are taken from the Ontario Building Code, Supplementary Standard SB-1 and are as follows:

Outdoor ambient design conditions:

Summer: 30°C db / 24°C wb (86°F db / 75.2°F wb) plus 10% safety factor

Winter: -18°C (-0.4°F) plus 15% safety factor

Indoor occupied mode design conditions:

Admin/Offices/Interactive Centre/Exhibit/Lobby:

Summer:24°C + 1°C; 50% RH + 3% RH

Winter: 21°C ± 1°C; 30% RH -3% RH

Galleries and Collections 24/7 occupied mode:

Summer: 21°C ± 1°C; 50% RH ± 5% RH

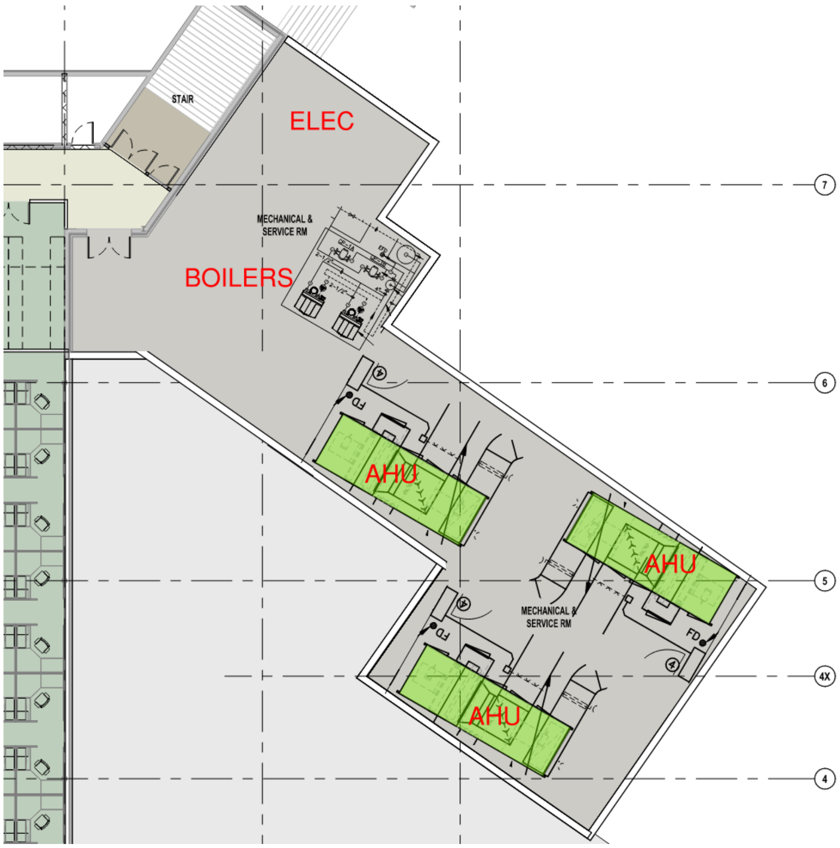
Winter: 21°C ± 1°C; 50% RH ± 5% RH

Indoor Air Quality controls will be provided for each individual system. Zone temperature controls will be provided for each unique space or zone within the facility.

The HVAC system dedicated to areas considered to have large difference of influx of people will be equipped with permanent installed carbon dioxide (CO2) monitoring sensors in main return duct for demand control ventilation to limit CO2 levels in accordance with ASHRAE 62-2016 and saving energy.

Calculations for the design heating and cooling loads will be based on the building envelope components as described above, building occupancy as well as the lighting and receptacle power densities. The mechanical HVAC systems will be sized in accordance with the designed thermal resistance of building envelope components such as walls, windows, roof, and the building room classification.

The heating distribution to the indoor AHU's serving the Museum to be fed from a Hotwater heating boiler loop. The baseline design includes for high efficiency gas fired boilers (2), boiler pumps and associated system circ pumps with hot water distribution piping to the AHU's. The GHG/carbon reduction initiative would be to install multistage-electric heating coils within the AHU.



Floorplan Sketch 2 : Museum AHU-Boilers and Main Elec Service in New Penthouse Area

The digital control of the HVAC systems will include energy conserving operating strategies in the software packages such as unoccupied temperature set back. High efficiency motors will be used to provide power to mechanical systems. Variable speed drive motors will be provided for the supply and return fans in the HVAC air handling units. Total energy recovery wheel (ERW) will be installed as required by OBC SB 10 Energy Standard.

Museum Collections:

The HVAC system for the Collection spaces will consist of a new AHU with supply and return ductwork to the spaces with air diffusers and grilles.

The AHU will be provided with supply fans equipped with VFD electric motors, DX cooling and hot gas reheat coils connected to built-in multistage compressors with remote condensers on grade, hot water coil to temperate the air in winter and air filtration system comprised of MERV 8 Prefilter / Adsorbent-Chemisorbent Intermediate Carbon Filter / MERV 15 Final Filter. Also, the AHUs will be provided with dedicated minimum fresh and exhaust air system comprised of dedicated intake fresh air equipped with MERV 8 and exhaust fan c/w ducting system discharging away from intake.

A Carbon reduction option (as noted in summary) is to replace the hot water heating coil with a built-in multistage electric heater (so reducing the total hot water load and gas consumption of the building and removing heating boiler systems).

The new intake fresh air to be minimum 1m above grade and 3m away from general exhaust discharge.

The HVAC AHU system will be provided with duct mounted steam humidifier disperser piped to the remote room wall mounted electric steam generator.

Museum Admin/Offices and Lab:

The HVAC system for the Admin, Offices, Lab and workshop areas located on the main floor will consist of new AHU located within the mechanical room connected to new dedicated supply and return ducting system equipped with space air diffusers and grilles. VAV boxes will be equipped with dedicated electric or hot water coils reheat coil.

The Lab and Workshop rooms will be provided with 100% supply and exhaust air.

The AHU will be provided with supply and return fans equipped with VFD electric motors, DX cooling and hot gas reheat coils connected to built-in multistage compressors with remote condensers on grade, hot water heater to temperate the air in winter and air filtration system comprised of MERV 8 Prefilter / MERV 13 Final Filter. Also, the AHU will be provided with dedicated intake fresh air and exhaust relief ducting system and economizer for free cooling.

Just like the rest of the museum area, the carbon reduction option (as noted in summary) is to replace the hot water heating coil with a built-in multistage electric heater (so reducing the total hot water load and gas consumption of the building and removing heating boiler systems).

It is required that the new intake fresh air is to be a minimum of 1m above grade and 3m away from general exhaust discharge.

The HVAC AHU system will be provided with duct mounted steam humidifier disperser piped to the remote room wall mounted electric steam generator.

Museum Galleries

The HVAC system for the main floor Galleries will consist of new AHU connected to dedicated supply and return ducting system equipped with space air diffusers and grilles.

The AHU will be located on a dedicated upper-level mechanical penthouse. The AHU will be provided with supply and return fans equipped with VFD electric motors, DX cooling and hot gas reheat coils connected to built-in multistage compressors with remote condensers on roof, hot water heat to temperate the air in winter and air filtration system comprised of MERV 8 Prefilter / Adsorbent-Chemisorbent Intermediate Carbon Filter / MERV 15 Final Filter.

Just like the rest of the museum area, the carbon reduction option (as noted in summary) is to replace the hot water heating coil with a built-in multistage electric heater (so reducing the total hot water load and gas consumption of the building and removing heating boiler systems).

It is required for the new intake fresh air to be minimum 1m above roof and 3m away from general exhaust discharge.

The HVAC AHU system will be provided with duct mounted steam humidifier disperser piped to the remote room wall mounted electric steam generator.

It is anticipated that the galleries and general museum space will be isolated from the other portions of the building via pressurization vestibules. As noted within the main HVAC system of the Museum, pressure differentials to be maintained as either plus or minus pending the type of space (ex. gallery to lab).

3.12. HVAC Systems (Library)

The heating system will be designed to maintain the temperature in the facility at a minimum of 22ºC. Humidity will be maintained at 35% RH minimum.

Ventilation will be provided to each room at the minimum rate in accordance with Ontario Building Code requirements and ASHRAE 62. Washroom and general exhaust systems will be provided to serve all areas and will discharge through exhaust ducts to exhaust fans and/or DOAS energy recovery units.

Air will be circulated to and from the various occupied spaces via a system of ducts, diffusers, grilles, dampers, etc. Ductwork generally will be galvanized sheet metal constructed in accordance with ASHRAE recommendations and SMACNA standards.

Air distribution within the rooms will be through ceiling mounted air diffusers selected to meet room noise criteria but not to exceed NC 20-25. Room temperature will be controlled by means of local wall mounted thermostats.

The air conditioning system will be designed to maintain temperature in the facility at a maximum of 24ºC. Humidity will be maintained at 45% RH maximum.

Rooms will normally be provided with individual temperature control. Rooms with similar exposures and use will be grouped together with one temperature zone control. The estimated number of zones is as follows: First Floor: 10 zones; Second Floor: 10 zones.

The Library Area will be provided with heating and cooling systems using air source variable refrigerant flow (VRF), a heat pump system with piping (hydronic & refrigerant), heating elements and fan coil units. Air source heat pump units will be located on the roof of the addition of the penthouse. Fan coil units will be located above the ceiling. All other major pieces of equipment will be in mechanical rooms.

Heating will be provided by the system through the above ceiling fan coil units distributed/ducted throughout the building.

Refrigerant piping will interconnect the heat pump units with all the fan coil units. Heat transfer to/from the heat pumps and the fan coil units will be through the refrigeration piping system.

Fan coil units located above ceilings will be used to heat, cool, and ventilate the various spaces. The units will be a direct expansion (DX) design with both heating and cooling capabilities available at all times to meet the zone loads. The units will provide zone temperature control for each room or group of rooms with similar exposures and loads through a space thermostat. Where rooms are served by perimeter heating elements and fan coil units, they will be controlled by the same room thermostat such that heating and cooling operation are coordinated.

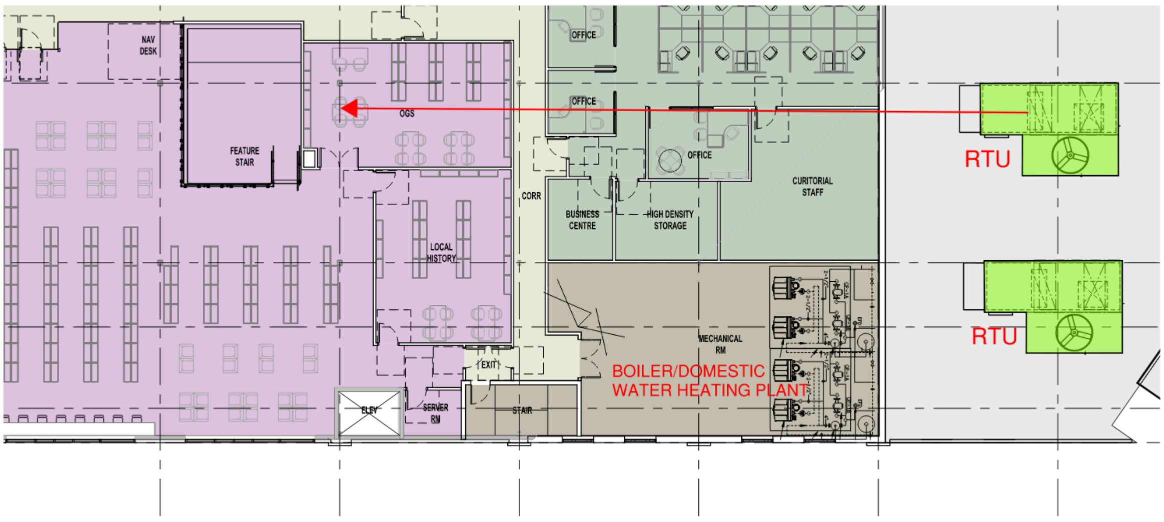
Overhead ceiling diffusers will be used for air delivered by the fan coil units. Return to the fan coil units from the rooms will be via ceiling return grilles, transfer ducts and a return air plenum system.

Preconditioned outside air from the central DOAS Units will be delivered to each fan coil unit. The quantity of outdoor air delivery will be controlled by C02 or occupancy sensors located in each zone. Sensors will control fresh air dampers in response to C02 set point deviation. Minimum occupied ventilation is based on floor area requirement of ASHRAE 62 – 2004.

Air from the DOAS will be supplied to the spaces at a neutral temperature of about 18°C (65°F). Preconditioning of the fresh air will be done via economizers, heat recovery wheels, etc. to minimize HVAC system energy use.

The total energy (enthalpy) wheel will reclaim temperature and humidity from exhaust air to precondition the fresh air before delivery into the spaces. Heat recovery wheels will be provided with bypass dampers to bypass the wheels during economizer operation. The unit air side economizer will use outdoor air when OSA enthalpy is suitable for free cooling of the spaces. The supply and exhaust fans will be controlled with VFDs to modulate supply and exhaust fan speeds to maintain duct static pressure set points.

The base-line design recommendation would be roof mounted (existing Roof area) RTU's that are high efficiency gas fired units c/w ERV's. The unit will supply via ductwork to the spaces with single zone controls interconnected to BMS.

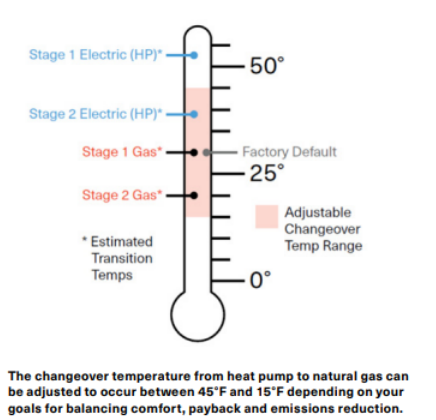


Floorplan Sketch 3 : Library RTU-Boilers and Main Elec Service in New Penthouse Area

For a Carbon reduction option, it is recommended to consider several hybrid heat pump RTU's/DOAS with gas back-up heat / second stage of heating. The unit will supply via ductwork to the spaces with single zone controls interconnected to BMS.

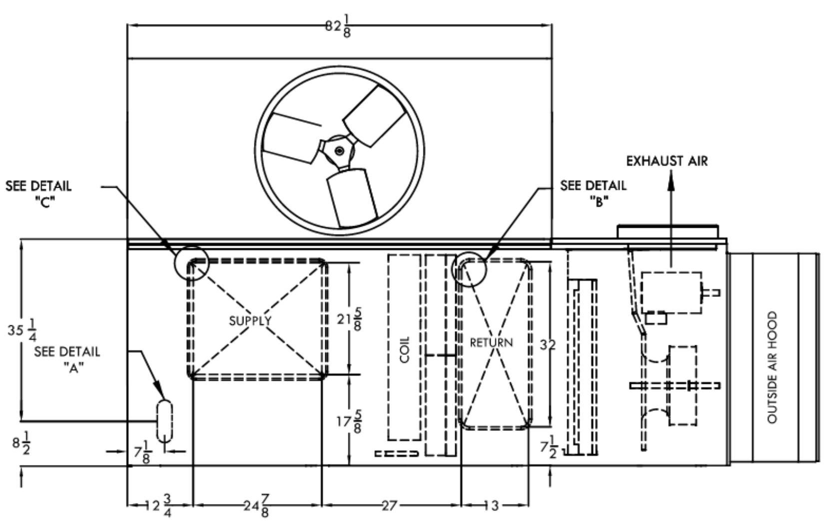
The RTU's for the Carbon Reduction option will have the following:

- Air-source heat pump cooling (in lieu of DX cooling)
- Air-source heat pump as first stage of heating (in lieu of Gas modulating burner)
- Gas-fired burner as second stage of heating
- High efficiency energy recovery wheels
- Dehumidification (hot gas bypass)
- VFD driven plenum fans



- ERV (Energy Recovery Wheel) to precondition the fresh air

- Hybrid Heat Pump RTU/DOAS provides an alternate solution to all gas heat, on both maximizing the efficiency of the heat pump and compressor for cooling, but now also for heating. It is estimated that 70% of a typical heating season would operate in the range capable within the HP, and only require the second stage of gas heating around 30% of time.



Sample Unit

3.13. Additional Spaces and Building Considerations

Within the building it is anticipated that there will be a main Server room, to which we recommend a dedicated air cooled Liebert Split System. Further to this a back-up split system may be required for redundancy depending on the level of protection required and in coordination with IT services.

Any smaller IT rooms throughout the space would be equipped with a dedicated air-cooled split system with low-ambient cooling capability.

The elevator machine room would also receive an air-cooled split system with low-ambient cooling capability, as well as an exhaust fan and transfer for dedicated ventilation control.

Miscellaneous heating in stairwells, loading bays, mechanical rooms to be electric and sized as per the required heat loss, and or space control.

It should be noted that the existing roof is completely covered (up to 90%) with Photovoltaic solar panels. This is a sub-contract utilizing the roof (rental) with meter and separate connection to grid. Any new roof mounted equipment would require modification to the Solar Grid with an anticipated reduction of 30%. With a possible allowance (as noted by owner of building) to reduce by 20%, it is expected that some panels (10%) will be required to relocate to the lower roof area.

3.14. Controls

The microprocessor based direct digital control energy management and control system (EMCS) will be provided to monitor and control the indoor environment related to temperature, humidity, room pressure, CO2/VOC levels. In addition, the system will also monitor, and control various HVAC and plumbing equipment and systems as needed.

3.15. Mechanical Performance, Sustainability, and Carbon Reduction Measure

The building mechanical systems will be designed to minimize the impacts on the environment of the building throughout its life cycle by employing environmentally sound principles. This includes the construction, operation and demolition of the building and its components and systems. This will be achieved through a reduction in material use, reuse/recycling of materials, substitution of more environmentally friendly products and improvement of indoor conditions and air quality. The following schemes will be employed:

- Low water consumption plumbing fixtures (Water-Sense labelled Fixtures)
- Variable frequency drives (VFDs) have been provided at all air handling units.
- Pumps are fitted with VFDs or electronically commutated motors (ECMs)
- No natural gas/fossil fuels are used for domestic hot water heating or hydronic water heating.
- Mechanical equipment has energy efficiency ratios (EERs) and coefficients of performance (COPs) that exceed minimums set out in the City's net-zero checklist.
- Hot water heating equipment is AHRI certified.

- No CFC-based refrigerants are used in the design and all refrigerants to meet the new latest refrigerant standards (2025 implementation).
- Refrigerants have an Ozone Depletion Potential (ODP) of zero.
- Thermal heat recovery is implemented at each air handling unit to eliminate waste heat.
- Water metering on potable water
- Energy efficient mechanical equipment and systems including heat pumps, VRF
- Energy recovery systems (ie. ERV)
- Use of Non CFC and ozone depleting refrigerants
- Indoor air quality enhancement through proper control of indoor & outdoor contaminants
- Indoor comfort enhancement through proper systems design and selection
- A direct digital controls (DDC) building automation system (BAS) shall be provided to enable occupancy schedules, economizer, etc.

3.16. Base VS Carbon Reduction Plan

Baseline vs Carbon Reduction Chart for the systems listed above (within report):

Item	Base Line Design (B)	Carbon Reduction Design (C)	Capitol Cost implications (from B to C)	Operation Cost Implications (B vs.C)
Domestic Water Heaters	Gas Fired	Heat Pump	30% increase	10% increase
Museum AHU Heating	Gas Fired Boiler System	Elec Reheat Coils	35% decrease	10% increase
Library RTU Heating	Gas Fired RTU	Heat Pump RTU	15% increase	10% decrease
BAS System	Stand Alone	Full BAS	80% increase	15% decrease
Low Flow Fixtures	Standard	Water-Sense	10% increase	10% decrease

The values shown are representative of what is expected based on previous experience within working projects and previously designed projects utilizing these same systems.

It is recommended that Energy modeling of the proposed facility be done to best understand the potential savings in both capital cost funding, and operation cost. Modeling would likely be required for any municipal/energy funding stream for the project.

3.17. Space Planning Reference

Refer to Architectural plans in Coordination of Mechanical Rooms and Space/building layout.

4. Electrical Systems

4.1.1. Codes and Standards

The system descriptions contained in this brief reflect the state of the design at the present stage. All proposed systems are based on basic proven design principles and applicable codes and standards including:

Ontario Building Code
Ontario Fire Code
Ontario Electrical Safety Code (OESC)
CAN/ULC S524 Standard for the Installation of Fire Alarm Systems
CAN/ULC S537 Standard for the Verification Fire Alarm Systems

4.2. Space Requirements

The major electrical equipment serving the building to be located in the ground floor Electrical Room as well as roof. The new main electrical room for the (now severed) building area will house the main electrical service equipment and the emergency power incoming service. No connection to the remaining Mall electrical power service will remain. The emergency service will include for both a life safety transfer switch and distribution and an emergency power transfer switch and distribution per code requirements. Each main building area, the Library, the Museum and the Council Chambers will require its own electrical service room to house its main switch and distribution.

4.3. Electrical Building Service

The current Sears Store electrical power system was served from the existing Mall main electrical service room. This will be disconnected and removed in its entirety and a new electrical service will be provided from the street to service only the Library/Museum/Council Chamber building with a new, rated, wall separating the space from the remaining Mall building.

A new high voltage feeder will be sourced from the local Utility and a Utility-owned pad mount transformer will feed the new facility subject to confirmation of mechanical loads and systems and Utility availability. Normal Electrical power to the building is will be supplied from the Utility, Entegrus – Chatham, at high voltage via underground primary cables to a hydro-owned pad mounted transformer likely located at the south end of the building near the hydro feeders that serve the existing Mall.

The Main electrical service is anticipated to be 1500 to 2000 kVA 600Volt 3 phase 4 Wire. The Entegrus website allows for a 1000 kVA service when fed from their 27.6 kV distribution grid with up to 2000 kVA only with special approval by their distribution engineering group.

Existing Electrical room to be stripped and house new incoming. New electrical service distribution to feed both new penthouse/boiler rooms for main distribution on second floor and first floor.

4.4. Emergency Power

Emergency power will be provided by a new, diesel fired, emergency generator located at grade level south of the building in a sound attenuated weatherproof enclosure. Emergency power will enter the building through the main electrical room and be broken down into life-safety and emergency power branches and distributed at 600Volt to each main mechanical space to feed the required and voluntary emergency power loads as designated by the users. It is anticipated that the emergency lighting, exit lighting, fire protection and alarm would be on the life-safety branch while vertical transportation, sump pumps, partial heating and data and communications would be fed from the conditional or voluntary branch. It is still to be determined if the museum conditioning or council chamber operations would be required to be on the generator.

4.5. Fire Alarm System

A new fire alarm system will be required to serve the building. A new fire alarm control panel will be provided in the electrical service room with annunciators at each main building entrance or at designated firefighter's entrances. New signals (audible and visual) will be provided throughout this building and new devices and wiring will be provided to bring the detection and alarm capabilities up to current Codes and Standards for zoning and audibility.

The new fire alarm system will consist of addressable initiating devices and non-addressable signaling with all new wiring in Class A configuration.

4.6. Lighting

All lighting in the building will be new. All interior and exterior lighting sources will be current, LED type, at 3500K fed at 120Volt. Certain areas of the Museum area may require 3000K rated fixtures as will be coordinated with the curator of the space. Any Specific track or display lighting to be provided as required to specific pieces or area walls of display.

Lighting in museum areas that will house sensitive artifacts will be limited to the levels and wavelengths as recommended for the item types to be stored or displayed and to be suitable for travelling exhibitions from other collections. Lighting in museum storage areas will be OFF unless the space is occupied. Lighting levels to suit space requirements in a range of Lux levels from 150 (Historic docs/paintings) to 800 (sculpture display) as the space so requires.

Lighting controls will be provided to meet Ontario Building Code minimum requirements for space control, energy savings and daylight harvesting except where the use of a space or safety concerns dictate otherwise.

Emergency lighting and exiting lighting will also be conventional LED fixtures simply fed from the emergency power system. Emergency battery units will only be required where emergency transfer switches are located and in main emergency distribution rooms.

Lighting Controls will be an integral part of the lighting systems that provide a single network and yet individual to each space and area requires. This will not only provide access for maintenance but also provide savings and efficiency on the operation of the lighting systems.

4.7. Communications and Security Systems

Communications, data and security systems will be provided as empty box and raceway systems as dictated by the Owner’s systems suppliers. A raceway system for Category 6 cabling will be provided to all points of utilization such as desks, equipment, cameras, wireless access points, etc. If required, full data cabling systems can also be provided to meet systems’ requirements at the Owner’s direction. Active equipment would be by the Owner or provided under an Allowance in the tender price.

Dedicated Communications rooms will be located central to each building use (Library, Council, Museum) to provide a separate communications hub for each. Alternatively, the Owner may consider a combined communications infrastructure distribution location on each floor but will need to direct how much separation of the departments would need to be provided within any common spaces to maintain proper administration of each separate use.

It should be noted that the security systems provided should be part of this cost. If not required, full data cabling systems can also be provided to meet systems' requirements at the Owner's direction. Active equipment would be by the Owner or provided under an Allowance in the tender price.

4.8. Audio Visual Systems

Audio visual communications, display and presentation systems will be supported with rough-in and cabling as required by the AV Consultant's designs. Refer to the Audio Visual Consultant's preliminary design report for further details.

4.9. Roof Mounted Solar Power System

Presently, an existing Solar Power Array is located on the roof of the subject building. This solar array is connected into the electrical system of the adjacent Mall. The electrical safety authority will require this array and its connection to meet the requirements of the Electrical Safety Code and as such may require modifications at their direction when the building electrical service is replaced. Specifically, all electrical systems in a building are required to be able to be disconnected at a single location and the building grounding systems shall be derived at a single point. Discussions are underway to determine the extent of the modifications, signage, or interconnections that may be required to ensure the safety of all building occupants and users. It is anticipated that some solar relocation will be required to suit the new condensers from the new HVAC systems as well as skylights.