ENGINEERING ASSESSMENT
OTTAWA CITY HALL BUILDING
111 SUSSEX DRIVE
OTTAWA, ONTARIO

December, 1985

Prepared for:

THE CITY OF OTTAWA

Prepared by:

J.L. RICHARDS & ASSOCIATES LIMITED
Consulting Engineers & Planners
864 Lady Ellen Place
Ottawa, Ontario
K1Z 5M2

JLR 85-9252

INTRODUCTION

In an effort to consolidate all City Departments at one location, Ottawa City Council is expanding on a plan to further develop Green Island to house a Complete City Hall Facility utilizing, if possible, the existing City Hall structure.

To assist in this development, the City has commissioned J.L. Richards & Associates Limited to carry out an engineering assessment of the existing structure and report on the existing condition of such systems with projected useful life expectancy of each as well as conformance to present Codes. The report does not address the architectural aesthetics of the building exterior, interior finishes, exterior landscaping, parking, site services, the determination of occupational loads or comment on related washroom facilities. Appendix 'A' is included to offer a brief history and architectural comment (Ottawa Citizen November 23, 1985) for background information.

EXECUTIVE SUMMARY

Constructed in 1958, the Ottawa City Hall Building represents a typically maintained 27 year old structure reflecting the depreciated state of that time, but with such serious defects as weathering, compliance to present-day codes and expiry of the normal service life of the mechanical and electrical systems.

Integration of the building into any expanded structure must include detailed attention to securing and improving the building envelope systems of precast panels and glass windows, strengthening the building structure to new code earthquake and snow loadings, and completely upgrading or replacing the mechanical and electrical systems to achieve the more efficient working environment available by today's technology.

REGISTERED PROFESSIONAL ENGINEER
G. A HEARNDEN
PROVINCE OF ONTARIO

ENGINEERING ASSESSMENT
OTTAWA CITY HALL BUILDING
111 SUSSEX DRIVE
OTTAWA, ONTARIO

- TABLE OF CONTENTS -

- TABLE OF CONTENTS -
(continued)

ENGINEERING ASSESSMENT
OTTAWA CITY HALL BUILDING
111 SUSSEX DRIVE
OTTAWA, ONTARIO

- TABLE OF CONTENTS -
(continued)

1.0 ARCHITECTURAL

1.1 General Description

Ottawa City Hall, located at 111 Sussex Drive is an eight storey building with a heated parking garage underneath and a mechanical penthouse on the main roof. The overall building height, measured from parking garage slab to the main roof level, is 114 feet. A typical floor measures 60' x 240' with a gross floor area of 14,400 square feet. The second and third floor areas are augmented with a 48' x 112' structure to the front of the building which is commonly referred to as the Central Chambers or Whitton Hall. The various present-day uses of the floor levels are as noted:

Rooftop Penthouse	- service rooms
Eighth Floor	- cafeteria, print room and service room (heating plant)
Fourth to Seventh Floors	- office areas
Third Floor	- office areas and gallery overlooking Whitton Hall
Second Floor	- office areas, two meeting rooms and Whitton Hall (assembly area)
Ground Floor	- main entrance and lobby, exhibition hall and offices
First Floor	- heated parking structure

Due to the definition of 'grade' in The Building Code Ontario Regulation 583/83 (herein referred to as the OBC), the parking garage level is considered the 'first storey' in the calculation of building height. There has been discussion to amend the definition of 'grade' in the near future in which case the main entrance level would be considered as the 'first storey' in establishing the building height. The importance of this distinction will reflect whether sprinklers are mandatory in the parking garage of this building and may affect whether subsection 3.2.6 "Additional Requirements for High Buildings" of the OBC is applicable.

This section of the report describes the architectural building features and their condition. These features include fenestration and exterior doors, exterior wall panels, construction of floor and roof assemblies, public corridors, travel distances and requirements for exits. Comments in reference to earthquake provisions, sprinkler protection, fire alarm and detection systems, emergency lighting, exit signs and lighting, standpipes and hose systems, etc. are found in sections describing the structural, mechanical and electrical components of the building.

For purposes of orientation, this report considers that the front of the building, ie. the building elevation facing Sussex Drive, is the west elevation. Hence, the two side walls face east or west and the two end walls face north or south.

1.2 Fenestration and Exterior Doors

The existing fenestration consists of single glazed window units set into non-thermally broken aluminum framing members. The glazing system and the many operating vents combine to create excessive drafts and cold air infiltration in the winter months; as well, the window and blind system is not providing adequate solar reflection in the summer and consequently, the interior space along the south and east faces of the building have been reported as being very warm and uncomfortable.

Leakage of water through the fenetration was noticed at many locations around the perimeter of the building. This leakage has caused cosmetic damage to the plaster finishes on the columns abutting window frames and minor deterioration of the base of the window frames, particularly at ground floor level.

Caulking of glazing to frames and frames to precast panels is very hard, brittle and cracked and has surpassed its useful life expectancy.

The main reason the windows are leaking can be attributed to window frames being set out from the precast exterior cladding combined with poor flashing and caulking details; as well, frames were positioned approximately 3" to 6" above the exterior grade level and adjacent to the low roof over the Central Chambers. Consequently, the build-up of snow against these frames has accelerated the deterioration noted on the ground floor level and fourth floor window frames, west side.

The windows and frames can be expected to remain serviceable for at least 10 to 15 years, provided they are properly maintained. Caulking around windows and frames, as noted earlier, has reached its service life and should be replaced in the near future to minimize water leakage. The major problem associated with the fenestration problem is that the glazing system is very drafty and affects the comfort levels in the building. Although the payback period on window replacement is very long (refer to Section 5.0 'Building Energy Performance') consideration must be given to solve the leakage problem and improve the interior air circulation adjacent to the exterior walls.

The doors to the exterior are single glazed units set in metal frames. All doors operate satisfactorily and can be expected to remain serviceable for a number of years. Two of the original door closures and all door weatherstripping will have to be replaced in the near future.

1.3 Exterior Cladding

The exterior cladding system consists of 4" and 6" limestone precast panels around the perimeter of the main building. The penthouse is clad with 1" slate panelling with a brick back-up wall.

The problems associated with the limestone and slate panel are as follows:

(1) The limestone panels are badly stained from water running off the metal window flashings and sills.

(2) The limestone panels are rust stained on the north and south elevations from capped off electrical receptacle boxes.

(3) Several of the precast units have worn prematurely as aggregate in the panels is visible. This problem is most noticeable on the south elevation.

(4) Precast panels at the four corners of the main building, at the upper floor levels, appear to have separated from one another and have displaced outward from ½" to 1". Joints between these panels are void of mortar and hence, open to the elements. Although a physical test was not carried out to determine the safety of the connection of these panels to the interior frame, it is suspected that some connections have failed or have elongated and are about to fail. Serious consideration must be given in the near future to determine the cause(s) of this problem and to assess the condition of the precast connections as life safety would be threatened if a panel was to dislodge and fall. It should also be remembered that precast connections were not designed for the very stringent earthquake requirements of the OBC. For instance, connections now must be designed for the panel dead load plus the full weight of the panel applied in a horizontal direction.

(5) The slate panels on the penthouse wall have had to be positively tied back to the back-up masonry wall due to failure of their connections. In two locations, these slate panels have been removed and a painted plywood filler panel erected instead.

(6) The brickwork around the base of the penthouse wall has split and spalled due to water infiltration. These bases will have to be rebuilt and properly flashed in the near future. If

left unattended, they will continue to decay and deteriorate and eventually lead to a gradual failure of the masonry wall system.

(7) Caulking of precast to precast and precast to metal frames is hard, cracked and brittle and has surpassed its useful life expectancy. As well, mortar between limestone panels has cracked and fallen out in a number of locations and should be repointed to prevent the infiltration of water into the interior.

1.4 Roofing

The roofs of the building were inspected by Batton, Sears and Associates Consultants Inc. Their report is found in Appendix 'B' of this report. Conclusions which were drawn have been re-documented as follows:

(1) The roofing system has surpassed its useful life expectancy as general failure of all roof membranes has occurred. The complete removal and replacement of felts, insulation and vapour barrier is recommended.

(2) Moisture is penetrating at exterior parapet locations. Leakage into the interior has resulted and deterioration of the exterior cladding has occurred. Moisture penetration into the cladding would adversely affect the securing anchors. Field tests to determine the state of the precast panel connectors is recommended unless a new cladding system is planned for the building.

(3) The counter flashings are not performing satisfactorily and consequently, moisture infiltration has occurred.

(4) The thermal composition of the roof assemblies do not meet with minimum standards of codes at present.

(5) The flashing detail at the window washing track has been a constant source of moisture penetration. Re-design of the support detail is recommended.

1.5 Elevators

The elevators of the building were inspected by Irving, Methé, Caron and Associates Ltd. Their report is found in Appendix 'C' of this report. Conclusions and recommendations which were drawn have been re-documented as follows:

(1) Provide new switches for the governors, pit and auxiliary pit and guards for lighting. Install working platforms in the pits.

(2) Modify car door openings to comply when out of levelling zone.

(3) Provide new controllers, generators, selectors and a full testing of equipment after installation, as required by OBC.

(4) To obtain approval for firefighters' elevator and to ensure safety of occupants, the present hoistway doors should be renewed to suit new elevator code requirements.

(5) Provide for the addition of sufficient emergency power to run one elevator at a time during emergency conditions (such as a fire).

(6) Provide for the addition of an emergency recall system to the lobby floor and in-car emergency operation during emergency conditions.

(7) Install new illuminated buttons in the corridors and in the cars. Buttons should be installed at the authorized height, including handrails and gongs for stop identification for the blind.

(8) Provide a new elevator from the parking garage level to the main lobby. This should be designed to accommodate the handicapped. Such an installation would eliminate the need for the main elevators to serve the parking garage level and hence, provide better service to the upper floor levels.

1.6 Building Classification and Occupancy

The building is an eight storey structure with a penthouse and a heated parking garage at grade. The penthouse need not be considered as a storey as its sole use is for building service. As presented in subsection 1.1, this building, under current codes, should be examined as a nine storey building of an overall height of 102 feet, measured between grade and the floor level of the top storey. The major uses of each floor level and the classification by group or division of the floor, as defined in OBC are as follows:

Floor Level	Use	Classification
Eighth Floor (Top Storey)	- Cafeteria and Lounge - Service Rooms - Offices	- Group A, Division 2 - Refer to Section 3.5 - Group D
Fourth Floor to Seventh Floor	- Offices	- Group D
Third Floor	- Offices - Gallery over Whitton Hall	- Group D - Mezzanine in Assembly Occupancy
Second Floor	- Whitton Hall - Meeting Rooms - Offices	- Group A, Division 2 - Group A, Division 2 - Group D
Ground Floor	- Offices - Exhibition Hall	- Group D - Group A, Division 2
First Floor (Parking Garage)	- Parking Garage	- Group F, Division 3

1.7 Occupant Load

The present occupant load of the various floor levels of the building, based on Section 3.1.14 of OBC, is as follows:

Floor Level	Use	Floor Area (ft^2)	Area per Person (ft^2)	Occupant Load	
8	- Assembly	2200	12.9	170	)
	- Service Room	—	--	5	)-185
	- Offices	1000	100.0	10	)
7	- Offices	12800	100.0	128	
6	- Offices	12800	100.0	128	
5	- Offices	12800	100.0	128	
4	- Offices	12800	100.0	128	
3	- Offices	15900	100.0	159	)
	- Gallery	48 fixed seats	--	48	)-20
2	- Offices	7500	100.0	75	)
	- Meeting Rooms	123 seats	--	123	)
	- Whitton Hall	72 seats	--	72	)-41
		600 sq.ft. of			)
		standing room	4.3	140	)
Ground Floor	- Offices	3840	100.0	38	
	- Exhibition Hall	6255	30.0	208	
First Floor (Garage)	- Parking Garage	55000	500.0	110	
				1670 persons	

The following should be considered as part of the planning for general renovations to the building:

(1) Due to the existence of only four units of exit width (two exit staircases of two units of exit width each - refer to

subsection 1.8.3), the maximum number of persons allowed by the OBC to occupy any one floor level is 240. Consideration should be given to reduce the occupant load of the second floor level to 240 persons, otherwise a third means of egress from this level would be necessary.

(2) Consideration should be given to maintaining a cumulative occupant load of all floor levels above and including the second floor of less than 1200 persons (four units of exit width x 300 persons), otherwise subsection 3.2.6 "Additional Requirements for High Buildings" would be applicable and become necessary as part of a major building renovation. Presently, the building, as defined, need not meet subsection 3.2.6 if the occupant load of the second floor level is reduced to 240 persons, hence giving a cumulative occupant load of 1144 persons.

1.8 Fire Safety Requirements

1.8.1 Floor and Roof Assemblies

Unless noted otherwise, the floor assemblies of the building are essentially comprised of:

- carpets or v/a tiles
- 2" of concrete topping or terrazzo
- 4" of reinforced concrete slab
- structural steel beams (not protected)
- ¾" thick layer of plaster
- ¾" thick acoustic tiles
- hung T-bar acoustic tile ceiling (optional)

The ground floor assembly is comprised of:

- 4" of terrazzo topping
- 2½" to 3" reinforced concrete slab
- reinforced concrete joist and beam framing

The main and penthouse roofs and the roof over the Central Chambers are comprised of:

- felt and gravel roofing
- insulation
- lightweight concrete fill of variable thickness (provides positive slope to roof drains)
- 4" precast concrete panel (likely siporex panels)
- structural steel beams (not protected except roof area in the mechanical service room)
- ¾" thick layer of plaster (no plaster finish in the service room area)

Natural light into the Central Chambers is achieved by 9 - 4 ft. diameter domed skylights set into the roof of this area. The skylights appeared in good condition, free of cracks, leakage or damage from the effects of condensation.

The condition of the roofing and flashings are presented in sub-section 1.4.

As defined in sub-section 3.2.2 of the OBC, the fire protection requirements for the floors and roofs of a building of this height and size, as currently occupied, is as follows:

(1) the floor assemblies shall have a two hour fire separation and be of non-combustible construction;

(2) the roof assemblies over a Group A, Division 2 occupancy shall have a one hour fire resistance rating and be of non-combustible construction unless they are protected by a sprinkler system which is electronically supervised;

(3) the floor of the gallery which overlooks Whitton Hall shall have a one hour fire resistance rating;

(4) structural columns shall be protected with a fire resistance rating at least equivalent to that required for the supported assembly;

(5) the floor assembly immediately above the parking garage shall be of non-combustible construction with a two hour fire separation. The parking garage need not be sprinklered to NFPA requirements as it is not considered as a basement in the current OBC.

Under a major renovation to the existing building, the following items should be considered as a means of upgrading the floor and roof assemblies:

(1) Install a sprinkler system to protect the roof assemblies, otherwise protect the structural steel roof beams to achieve a one hour fire resistance rating.

(2) Protect the ground and second floor levels with a sprinkler system due to the existence of the interconnecting spiral staircase and fire exits through the building lobby (further reference is made to subsections 1.8.3 and 1.9).

(3) It is recommended that the existing ceiling finishes be removed and the unprotected steel beams and top of columns sprayed with an approved fire-resisting material or wrapped with gypsum wallboard to achieve a two hour fire rating for the following reasons:

    (1) The plaster finish under the steel beams of the floor assemblies is punctured in a number of places on each floor level (i.e. electrical wiring, conduits, telephone and computer cables, ducts and grilles, access holes to service plumbing connections, drains, etc.).

(2) No known ULC or FM rating is published for the floor assembly as described above.

(3) The support system for the plaster/acoustic tile ceiling is unknown.

(4) It is likely that new ceiling finishes would be planned as part of a major facelift to each of the floor areas (with the possible exception of the sixth and seventh floor levels which have been upgraded recently).

(4) All openings through floors, ie. supply air grilles, etc., should be properly dampered to maintain the integrity of the separation.

(5) The skylights in the roof over the Central Chambers are within 16 ft. of the exterior wall of the main building. Hence, consideration should be given to protect the openings on the west face of the building above the low roof area.

1.8.2 **Safety Requirements within Floor Areas**

Floor levels intended to serve as office space can be treated as open space concepts and the travel distance to the exit must be less than 130 ft. (40 metres). If this is the case, then the horizontal distance between exits must be at least equal to one half of the maximum diagonal dimension of the floor area or 120 feet. The travel distances within the office areas of the Ottawa City Hall, as measured from the most remote corner of the floor area to the exit door, is no more than 110 ft. and therefore acceptable from the OBC point of view. The horizontal distance between exit doors is only 85 ft. and hence, not in accordance with OBC provisions. This matter should be discussed with the authority having jurisdiction to determine whether they consider the existing situation as being acceptable and safe for tenants.

Floor levels intended to serve as assembly occupancy (ie. cafeteria, meeting rooms, Whitton Hall and its gallery) must be treated differently than office space, particularly for areas of high occupant loads, ie. numbers in excess of 60 persons. Rooms intended for the assembly of high occupant loads should have two means of egress with egress into a public corridor with a one hour fire separation. Travel distance within the room to the corridor or from the corridor to the exit stair should not exceed 98 ft. (30 metres).

In the case of the cafeteria, located on the eighth floor, at present there is only one means of egress from this area. Egress from the cafeteria through the private lounge cannot be considered as an acceptable means of egress at this time; as well, the travel distance from a remote corner of the cafeteria to the public corridor is in excess of that stipulated by the OBC. Doors from the cafeteria into the public corridor do not contain proper hardware. Latch sets are ineffective, hold open devices are not actuated by smoke detectors or the building fire alarm system and doors have no release hardware. Return air grilles located in transoms and side lights of doors which require a rating, are not dampered as required in the OBC.

A protected corridor with a one hour fire separation is required on the third floor level, due to the assembly occupancy of the gallery overlooking Whitton Hall. This corridor is composed of 6" terracotta tile with plaster finish on each side. A two hour separation is required between the walls of Whitton Hall and the remainder of this floor level. In this case the existing walls are composed of two wythes of 8" terracotta block with a plaster finish on the exposed surfaces. Problems related to fire separations, travel distances, etc., as stipulated by the OBC, on this floor level, include:

(1) The door from the gallery area requires a 1½ hour fire rating. The existing wood double door, frame and hardware do not meet this requirement.

(2) Return air grilles located in the transoms and side lights of the doors leading into the public doors are not dampered.

(3) Hold open devices on doors into the public corridor are not actuated.

(4) In section 6.2.3 of the OBC, public corridors should not be used as return air plenums.

(5) The railing in front of the gallery is only 36" high as opposed to 42" as stipulated in the building code. It is likely that this railing cannot resist horizontal loads as stipulated in Part 4 of the OBC.

Fire safety requirements on the second floor level require that a public corridor serve as access to exits from the assembly areas (ie. Whitton Hall). OBC problems on this floor are similar to those noted on the third floor level. In addition, large openings exist in the public corridors which are in excess of 120 sq.ft. (11 sq.m.) and hence, a code violation. These openings are located at the entrances to the Mayor's office and meeting room 'B'. Problems associated with the spiral staircase from the second floor level are highlighted in subsection 1.9.

Other areas of concern include:

(1) Only one means of egress from the two meeting rooms. Should occupant load exceed 60 persons, then another means of egress is required.

(2) Doors from all assembly areas require a ¾ hour rating with release hardware and latch. The existing doors are of wood construction with push/pull hardware.

(3) Given the limited number of exits from this level, the occupant load must be restricted to 240 persons.

(4) The double door from the meeting rooms do not swing in the direction of travel.

1.8.3 <u>Interior Stair Exits</u>

Two interior stairways serve as the exits from the floor levels above the main entrance level. Each stair shaft measures approximately 9'-0" x 15'-9" clear and are composed of 6" terracotta block with a plaster finish on each side. The stairs are 4'-0" wide and hence, represent two units of exit width as defined in the OBC. The stairs and landings are of cast-in-place concrete with a 2" terrazzo finish. Treads measure 11" with a 1½" backslope, and risers measure 7¾". The finish on the treads have no non-skid finish nor non-skid strips with the exception of the stairs to the parking garage level.

The doors into the staircases measure 3' x 7' and are of hollow metal construction. A 11" x 11" viewing window with wire glazing is in each of the doors. The metal doors and metal frames were not labelled. Each door has 1½ pairs of 4" x 4½" hinges, a push plate, pull bar and a closure. The doors from the fourth floor level into the exits contain a latch set and release hardware instead of the push plate/pull bar.

The <u>exit door</u> from the south staircase is a 32" wide metal door with self-closing hinges and a push plate. Persons using this staircase for exiting to the exterior must pass through the door and into an interior passageway located on the ground floor level. This interior passageway is composed of walls of wired glazing. Exit to the exterior is then achieved through a 35" wide metal door with release hardware located in the west exterior wall.

The exit door from the north staircase is a 36" wide aluminum clad door set into a wood frame. Hardware includes a latch set, release hardware and self-closing hinges. Persons using this staircase for exiting purposes must travel through the Exhibition Hall/Main Lobby of the building to either the main exterior doors at the front or rear of the building. Exit from the parking garage is also achieved using this staircase. The parking garage is reported in sub-section 1.11.

Areas of concern about the exits from the building include:

(1) Doors and their hardware into the stairshafts are not labelled and by OBC definition. They require a one hour fire-resistance rating. A door consultant should inspect the doors to assess their rating and recommend corrective action.

(2) The exit doors from the two staircases are not rated, contain improper hardware and are too narrow for the requirements of the exit.

(3) Exit from the north staircase through the lobby of the building is allowed by the OBC provided the path of travel does not exceed 49 ft. (15 metres), the lobby is not located within an interconnecting floor space except as described in subsection 3.2.9 of the OBC and the floor area is sprinklered; hence, consideration must be given to revise the discharge from this exit or ensure that the spiral staircase meets subsection 3.2.9 and the ground floor level is sprinklered.

(4) Exit from the south staircase is through a interior passageway of wire glazing located on the ground floor level. These glazing walls and subsiduary doors into the passageway are not considered as appropriate fire separations or fire-resistance ratings.

(5) The terracotta walls of the two staircases are not reinforced in accordance with Part 4 of the OBC.

(6) Handrails in the staircases do not exceed 12" beyond the top or bottom stair nosings as stipulated in Part 10 of the OBC.

1.9 Spiral Staircase

The spiral staircase located between the ground and second floor levels is a concrete structure. The stairs are approximately 6'-8" wide and, due to its spiral nature, treads measure 6" on the inside to 22" on the outside. Risers are nominally 7" deep. The stairs are finished in terrazzo tiles and the stairs do not contain any non-skid strips. The guard rail around the second floor opening and the handrail of the stair is 39" high with a 2" wide metal top railing and vertical metal bars on 10" centres. Problems related to the construction of the staircase and OBC requirement are as follows:

(1) The guardrail appeared flimsy and can unlikely resist the horizontal forces stipulated in Part 4 of the OBC.

(2) The spacing of the vertical bars in the guardrail and stair handrail is in excess of that stipulated in the OBC (ie. railings should be designed to prevent the passage of a 8" spherical object).

(3) Under the provisions of the OBC, staircases of this nature can be referred to as an opening through a floor assembly or an interconnecting floor space. They are permitted if they

serve the first storey and the level next above or below, but not both, and the floor space is sprinklered. Unfortunately, neither of these provisions are met under the current definitions in the OBC. Should the definition of 'grade' be altered as intended in future amendments to the OBC, the ground floor can be considered as the first floor and then one of the stipulations noted herein will be met. To meet the second requirement, under a major building renovation, consideration should be given to providing sprinkler protection in accordance with 3.2.9 of the OBC.

1.10 Service Rooms

The main service room is located on the eighth floor of the building. Fuel fired appliances are located in this area; hence, this area, under current OBC provisions, should be separated from the remainder of the building with a one hour fire separation. Two metal doors in metal frames serve as access to this area. One of these doors is open and set with a fusible link to close. The ceiling of this area is composed of exposed precast panels supported by concrete encased steel beams. Some leakage at the head of windows and underside of precast slabs was noted during the building inspection.

The transformer vault and main switch room are housed in the parking garage and enclosed in exposed 12" concrete block walls. Doors separating these rooms are of metal construction with weighted-type closures. Under the provisions of the OBC, a three hour fire separation is required around these rooms and, based on hollow block construction with 50% voids, the 12" concrete block wall should suffice as a three hour wall.

A secondary service room is located above the cloakroom at the ground floor level. The room is used to reheat or recool supply air to the ground floor level. This room is accessed by way of an open hatch in the floor with a steel ladder to it. The walls of the room are of exposed terracotta block and the ceiling finish is concrete with exposed steel beams. The OBC requires that this area be protected with a fire separation; hence, the steel ceiling beams should be protected to ensure a two hour rating between the second floor and a rated hatch cover installed over the access opening.

The following upgrade should be considered as part of a major building renovation:

(1) A door consultant should report on the suitability and ratings of existing doors, frames and hardware. Doors and hardware not meeting with OBC requirements should be replaced with proper labels.

(2) Protection of all exposed steel beams and installation of a hatch cover in the secondary service room.

1.11 Parking Garage

The underground parking garage located beneath the main building measures 190' x 290' with a total area of approximately 55,000 sq.ft. A storage room is attached to the west wall of the garage; this room measures 12' x 110'. Vehicle access is achieved by way of two overhead garage doors located on the east wall of the garage. Pedestrian exit from the garage is achieved by way of two exterior doors located next to the overhead doors or an exit stair to the ground floor level.

The part of the roof of the garage which is beneath the landscaped area, is showing signs of water leakage and minor concrete deterioration in spite of the fact that the majority of the roof was re-waterproofed and landscaped five or six years ago. Many of the shrinkage cracks in the slabs are actively leaking water as the build-up of efflorescence on the underside of the slab and down the sides of beams and joists was prevalent. Only two minor areas of concrete delamination of the underside of the roof structure was noticed. This does not mean that the remainder of the podium slab is in good condition as delamination of the top surface of the slab beneath the waterproof membrane may have occurred. The fact that chloride ions, from salt sprinkled on the podium slab during the winter, are immersed into the concrete slab means that the potential for continued and further deterioration of the slab is high and will remain so unless contaminated concrete is removed.

As noted above, pedestrian exit is achieved by way of two exterior doors and an exit staircase. Problems associated with the exiting requirements are as follows:

(1) The two exterior doors measure 24" wide x 74" high, are of metal construction with release hardware and a closure. The OBC requires that exit doors be at least 31.5" wide x 80" high.

(2) At the time of the site visit, a vehicle was partially blocking access to one of the exterior exit doors. Vehicles should be restricted from parking in front of exit doors.

(3) The door into the interior staircase was 35" wide and of metal construction with a closure and latch set. The door, frame and hardware were not labelled.

(4) Contrary to the OBC, there is no vestibule in the garage at the entrance to the interior staircase.

(5) The handrail in the interior staircase measured only 32" high from the nose of the tread and does not extend at least 12" beyond the last nosing at the top and bottom of the stairs as stipulated in Part 10 of the OBC.

(6) The south wall of the interior staircase is not properly sealed to the abutting concrete column and thus does not provide a fire separation at this location.

Other problems in the garage which are not associated with OBC requirements are:

(1) The storage room at the west end of the garage is very musty, leaking water and not ventilated. It should not be used for storage of paper or other products susceptible to decay from moisture unless measures are taken to ventilate and seal the room.

(2) Gaseous automobile fumes were recorded in the interior staircase between the parking garage and ground floor levels.

(3) Gaseous automobile fumes were noted in the vestibule of the front entrance to the ground floor level of the building.

(4) The door hardware of the vestibule to the elevators was in poor condition.

2.0 STRUCTURAL

2.1 Loading Conditions

The structural building components of the Ottawa City Hall were analyzed for conformance to Part 4 of The Building Code, Ontario Regulation 583/83 and was based on the structural drawing, prepared by deStein and McCutcheon, dated December 1956, which were supplied by the City of Ottawa. Gravity, wind and earthquake loads, stipulated in the OBC are as follows:

a) Gravity Loads,

Office Use	- live load plus 20 psf for partition weight allowance
Assembly Use	- live load of 100 psf
Ground Floor Level	- live load of 100 psf
Service Rooms	- live load of 75 psf
Exterior Podium Slab	- live load of 250 psf
Roof	- snow load of 49 psf plus snow drift adjacent to walls of higher roofs

b) Wind Loads, p = q Ce Cg Cp

Where, q = 7.8 psf
Ce = 1.0 to 1.2 depending on building height
Cg = 2.0
Cp = 0.5 suction to 0.8 pressure

c) Earthquake Loads, V = ASKIFW

Where, A = 0.04
K = 0.7
I = 1.0
SF = 1.0
W = dead weight of building plus 25% of the applied snow load

2.2 Roof Framing

The main building, penthouse roof framing and the roof framing over the Central Chambers consists of 4" precast concrete slabs (likely siporex panels) spanning 8'-0" to structural steel beams. These beams are in turn supported by girders or directly by columns. All columns, spandrel beams, beams around openings and beams over the mechanical service room are concrete encased for protection.

The roof framing was analyzed for snow loads defined in Part 4 of the Ontario Building Code. It was found that,

1) The main roof beams located in a 16 ft. to 22 ft. band around the exterior walls of the penthouse are approximately 100% overstressed due to snow drifts adjacent to the walls of the penthouse. It is pointed out that the effects of snow accumulation presented in the building code at the time this building was constructed was vague and left to the designer's direction.

2) The roof beams over the Central Chambers which are located adjacent to the high walls of the main building, are also overstressed due to snow drifts.

3) Other roof framing, other than as noted above, was analyzed based on a superimposed snow load of 49 psf and found to be acceptable.

4) It is likely that the precast roof slabs adjacent to the high roof areas are not capable of supporting the roof snow load and the accumulated snow drifts. Shop drawings of these slabs were not available to verify this statement.

2.3 Typical Floor Framing

The floor framing above the ground floor level consists of a 4" reinforced concrete slab underlying a 2" concrete or terrazzo topping. The concrete slabs span 8'-0" to structural steel beams. The top flanges of these beams are fully embedded in the floor slabs and hence, are deemed fully laterally supported. The steel beams, in turn, are supported by structural steel girders or steel columns. The spandrel beams, beams which frame around floor openings and the steel columns are all encased in concrete. The interior beams and girders are not protected with any fire resisting material.

An analysis carried out on a number of the concrete slabs, steel beams, girders and columns has shown that these structural elements can support a superimposed live load of 100 psf in addition to the floor dead loads, except those beams which support terracotta partition walls. In this case, live loads are reduced to 50 psf. Hence, floor areas without masonry partition walls could be used to accommodate either office or assembly occupancy.

2.4 Ground Floor Framing and Podium Slab

The framing of the ground floor consists of a 4" terrazzo topping over a 2½" to 3" concrete slab supported by 14" concrete joists or a 4" to 6" reinforced concrete slab. The joists or slabs, in turn, span to reinforced concrete beams. The beams are supported by reinforced concrete columns.

The framing of the exterior podium slab is similar to that of the ground floor slab (ie. concrete joists, beams and columns). Over these slabs are concrete brick pavers set on a sand bedding. A waterproof membrane over the podium slab was installed to prevent the ingress of water through the concrete framing and into the parking area, however, it has not been effective as water staining and leakage is prevalent throughout the garage (the condition of the parking garage is presented in section 1.11).

Areas of the ground floor framing within the building envelope were analyzed based on a superimposed live load of 100 psf in addition to the floor dead loads. It was found that:

(1) Considering the effects of pattern loading on the ground floor slab, the 16 ft. long joists which frame continuously between 22 ft. long joists will experience full negative moment over their entire length when live loads are applied only on the 22 ft. long joists. These shorter joists do not contain continuous top steel reinforcement.

(2) Contrary to CAN3-A23.3-M27 "Code for the Design of Concrete Structures for Buildings", the main concrete beams of the ground floor level do not contain minimum shear reinforcement as stipulated. The code at the time of construction allowed no web reinforcement when shear stresses from service loads did not exceed 90 psi. Analysis indicated that the actual shear stress is less than this code value.

(3) The concrete joists and beams supporting the exterior podium slab cannot support superimposed live loads of 250 psf as required by the Building Code for areas susceptible to heavy truck traffic or fire fighting equipment. However, slab framing can safely support a 100 psf superimposed live load provided heavy truck loadings are not allowed on the landscaped area.

2.5 Lateral Load Analysis

The overall base shears were calculated based on the criteria set forth in subsection 2.1 and it was determined that the governing conditions were as follows:

(1) For wind and earthquake loads applied along the transverse axis of the building (ie. east-west direction), the wind loads are more severe and hence, govern in the analysis.

(2) For wind and earthquake loads applied on the longitudinal axis of the building (ie. north-south direction) the earthquake loads are more severe and hence, govern in the analysis.

A brief description and findings of the lateral load resisting elements of this building are presented as follows:

2.5.1 Lateral Loads Applied in the East-West Direction

The wind loads on the building, when applied in the transverse direction, are resisted by ductile moment resisting steel frames, one on each of the main grid lines. There are 16 such frames at 16 ft. centres in the building. Moment resistance is achieved by way of rigid and semi-rigid beam-to-column connections. Moments are transferred from beam to column and visa versa by way of:

(1) Steel 'Tee' sections located on the top and bottom flanges of the beams at floor levels 2, 3, 4 and 5. These 'Tees' are bolted to the flanges of the beams and flanges of the columns.

(2) Steel angle sections located on the top and bottom flanges of the beams for floor levels 6, 7 and 8.

(3) Simple double angle connections at the main roof level.

The induced moments, shears and storey drifts were calculated at each beam-to-column connection of a typical steel frame using a computer program called P-frame. This program uses stiffness techniques to calculate the external reactions, member end forces and deformations. Upon determination of the member end forces and external reactions on the frames from applied wind loads, the typical frame was analyzed for each of the following loading cases as stipulated in the OBC:

(1) Dead plus Live.

(2) Dead plus Wind.

(3) Dead plus Live plus Wind, all times 0.75.

The following was concluded:

(1) Except as stated in subsection 2.2 and 2.3, the building frames can support the dead and anticipated live loads (ie. 100 psf in assembly areas and 50 psf plus 20 psf for moveable partitions in office areas).

(2) Except for the interior columns between the sixth and seventh floors of the structural frame, all members of the typical frame can resist the various loading cases as noted above.

(3) When analyzed for the dead plus wind loading case, the interior columns and their connections of the typical steel frame between the sixth and seventh floor levels were found to be approximately 40% and 60% overstressed based on the techniques used to design beam-colums as set forth in CSA Standard S16-1969. It is possible that this overstress may be reduced somewhat under a limit states design approach; however, no attempt has been made to verify this. Consideration should be given to upgrade these affected columns and connections under a major building renovation.

(4) The storey sway and overall building sway was calculated based on the applied wind loads. The calculated, theoretical overall building sway was found to be approximately 4" or L/306 and in excess of L/480, as stipulated in CSA Standard S16-1969. Historically, the building has not experienced any adverse affects due to excessive sway. For instance, racking and breakage of windows in frames or diagonal cracks appearing in interior partition walls under gusting winds has been

reported. Hence, it is reasonable to assume that the many masonry partition walls, elevator core, central mechanical shaft and the two interior staircases are adding to the stiffness of the building frames and helped to reduce sway effects. Nevertheless, should interior partition walls be removed or exiting conditions changed under a major building renovation, the designer should be aware that the removal of these stiffening elements will alter the sway characteristics of the building and may lead to possible problems.

2.5.2 Lateral Loads Applied in the North-South Direction

As stated above, earthquake loads govern for the analysis of the building in the north-south direction. In fact, the base shear generated from earthquake applied loads is approximately two times those generated by wind forces.

The structural drawings did not indicate a direct means of transferring the lateral floor loads to the base of the building in the longitudinal direction. These loads are normally transferred by way of ductile space frames, reinforced shear walls or diagonal cross bracing, to name a few. It is not likely that the original designers were relying on the elevator core, mechanical duct shaft or staircase walls to provide the required lateral resistance as these walls are of terracotta block construction and not reinforced. The designers were relying on the many beam-to-column double web angle connections to transfer lateral loads to the ground.

An article entitled "Analysis of Flexibly Connected Steel Frames", published in the Canadian Journal of Civil Engineering, September 1975, suggests a means of assigning a moment capacity to various types of beam-to-column connections. For double web angle connections, it is reasonable to assume that approximately 300 in-kips or

25 foot-kips can ultimately be transferred through the connection without failure. This is then defined as the upper limit to which the frame can transfer moments across a beam-to-column joint. The portal method of analysis was used to determine beam and column end moments. When beam end moments exceeded 25 ft.-kips times a factor of 0.6 (referred to as the allowable transfer moment which equals 15 ft.-kips), the members were flagged as being overstressed. It was discovered that:

(1) Except for the beam-to-column connections at the second floor level, for <u>wind</u> applied loads, beam end moments are less than the allowable stated above.

(2) For <u>earthquake</u> applied loads, beam end moments at floor levels 2 to 5 inclusive, are all above the allowable limits of 15 ft.-kips. For beam connections above the fifth floor, beam end moments are less than the allowable.

(3) The columns between the ground and second floor levels were checked for dead plus earthquake loads and it was found that these columns were overstressed by approximately 15 to 25%. No other columns were examined as part of this report but it is likely that most of the lower level columns will be slightly overloaded.

(4) Sway in the longitudinal direction was not determined but it is likely that the overall 'theoretical' sway would exceed the permitted values. As stated in the previous section, the interior partition walls, staircases, elevator and mechanical shaft walls are all contributing to minimizing the sway effects. The affects of sway should be considered if the removal of these walls is anticipated in the building renovations.

2.6 Slab-on-Grade and Foundations

The slab of the parking garage is a 6" reinforced concrete slab-on-grade. The original drawings indicate that the slab was reinforced wiht 3/8" diameter steel bars at 10" centres, each way or 4 x 4 x 4 ga. x 4 ga. welded wire mesh. The slab is supported by a 6" layer of compacted crushed stone. The slab surface is in good condition with no evidence of spalling or concrete deterioration. Several grooves or channels have been cut into this slab for the purpose of draining ponded water to the existing catch basins.

The ground floor and podium slabs are supported by reinforced concrete columns. These columns appeared in good condition except for possible deterioration at their bases adjacent to the concrete slab-on-grade. The exterior skin of concrete was dusty and signs of efflorescence and rust staining was observed on several column bases.

The main building structure is supported by 4 ft., 4½ ft. and 5 ft. square concrete caissons. The bearing stress on the soil/rock beneath these caissons was calculated to be 22 ksf. The condition of the caissons was not determined due to inaccessibility. It is warned that the caissons may have been affected by the penetration of chloride contaminated water due to salt carried into the garage from vehicles. It is suggested that several bases of garage columns and tops of caissons be exposed to determine whether the concrete has deteriorated from the affects of chloride ion attack.

The podium slab is supported around the perimeter by a 14" thick foundation wall bearing on a 3'-0" wide strip footing. The interior columns which support the podium slab rest on 6½ ft. and 7 ft. square reinforced concrete spread footings. Bearing pressure on the soil beneath the typical spread footing was calculated to be approximately 4.7 ksf based on dead loads plus

250 ksf live loads. Under these same dead and live loads, the typical spread footing is approximately 40% overstressed. However, assuming a live load on the podium slab of only 100 psf, the concrete stresses in the spread footings would likely not exceed those stipulated in CAN3-A23.3.

`.0 MECHANICAL

3.1 Fire Protection Systems

The existing fire protection system in the building consists of a standpipe and hose system, including fire extinguishers, for each floor above grade, and a wet pipe sprinkler system for the building's parking garage. Two fire hose cabinets are located on opposite ends of the public corridors of each floor above grade. Sprinkler coverage in the garage is augmented with an anti-freeze system to prevent freezing in cold weather. All floors above grade have no sprinkler coverage at present. The exhaust hoods for the cafeteria kitchen are protected by a dry chemical system.

The exterior building services includes siamese fire department connections located on the northeast corner of the Lower Ground Floor exterior wall. These appear to be in good condition. The two standpipe risers for the building are fed from these siamese connections.

The incoming fire protection sprinkler system 6" diameter mains are located on the west wall of the Lower Ground Floor parking garage. These enter the building at city pressure and divide into two (2) alarmed zones. This system does not include or require fire booster pumps. However, present Code requirements would require these. The piping in this system is approaching its rated service life but is in serviceable condition.

The existing sprinkler system in the garage is approaching its rated service life. Removal of the sprinkler heads at random locations for subjection to Underwriter's Laboratory Testing may be necessary to verify their operation. The main supply piping to the sprinkler system appears to be in good condition and, while its remaining service life is indeterminate, it should be expected to remain serviceable for another twenty (20) years.

Sprinkler load coverage for the Lower Ground Floor parking garage is 106 sq.ft. per head. This density complies with current Code requirements for ordinary and light hazard classifications.

All fire hose cabinets are in good condition. However, their installation does not comply to current Ontario Building Code Regulations for the following reasons:

(1) 2" pipe runouts to the fire hose cabinets are undersized.
(2) 1½" hose connections in the fire hose cabinets are undersized.
(3) The position of the existing fire hose cabinets does not allow the hose stream to reach remote spaces within the building.

All air supply and return ventilation grilles have fire dampers installed where fire separations exist.

3.2 Building Heating Systems

The existing building heating system consists of two boilers which generate low pressure (15 psig) steam for distribution to air handling steam coils, unit heaters, and hot water convertors.

The two steam boilers are 'Scotch' firetube boilers, each rated at 134 hp. These are equipped with light oil fired Ray oil burners, with horizontal rotary atomizing cups. These boilers were included in the original installation and have approached their rated service life. The maintenance history for these revealed the boilers required retubing in 1968. Recent maintenance outages revealed the boilers have developed pinholes in their tubes and are due for retubing soon.

All condensate pumps have surpassed their rated service life but remain in reasonable condition requiring only normal annual maintenance to date. No excessive steam trap maintenance incidents have been reported.

The light oil fuel delivery system to the burners consists of two (2) De Laval Model 313 positive displacement screw type pumps, each with a capacity rating of 4.5 USgpm at 45 psig. Both pumps are of the original installation and have surpassed their rated life. Although these pumps are in serviceable condition, no spare parts are available and are no longer being manufactured.

The dual fuel oil system originally was equipped to heat and delivery heavy oil to the burners but this system was abandoned in 1969 in favour of remaining on light oil only.
The light oil fuel storage system consists of two (2) storage tanks, each with a 10,000 Igal capacity. These tanks are not equipped with cathodic corrosion protection and have exceeded their rated service life. No leakage or other associated maintenance problems have been reported for these during their service life.

Building heating for the fourth to eighth floors inclusive is accomplished through an air distribution arrangement at the perimeter window sills, which are heated by steam coils at the central unit. The 2nd and 3rd floor Council Suites and ground floor are heated by wall fin elements, supplied by hot water through a steam convertor. The 8th floor Mechanical Penthouse and lower ground floor parking garage are heated by steam unit heaters. All heating elements have approached their rated service life but no significant consistent maintenance problems have been reported, except for isolated cases of unit heaters requiring replacement.

All steam and condensate pipes appear to be in serviceable condition based on the visible part of the inspection, lack of reported maintenance incidents, and diligent water treatment. No consistent valve failure incidents have been reported for the steam and condensate distribution system. The estimated remaining service life for the steam and condensate piping is expected to be five years.

3.3 Ventilation Main Building System - Second to Eighth Floors

The main building above the ground floor is divided into East (System A) and West (System B) zones. System A has a rated capacity of 49,200 cfm while System B is at 42,200 cfm. In each system, air is supplied at high pressure to sound attenuating and air volume control boxes at each window bay in the ceiling space. From these boxes the air is supplied through flexible ducts to induction type grilles set under the windows. The system is perimeter only, with no interior air supplies.

The air distribution arrangement at the window bays is not optimum due to the location of the induction grilles between the windows and the venetian blinds. During the heating season, a draft effect is experienced due to the upward motion of warm air combined with a window downdraft which deflects the warm air toward the building interior in a horizontally stratified pattern. In response to this occurrence, some of the deflection louvres at the window bays have been re-arranged.

The return air passes through door grilles to the corridors and to the main return shaft where it rises to the recirculating fan which, depending on the season, exhausts all or part of the air or returns it to be filtered, washed, cooled and reheated as required. The return air pattern contravenes current Ontario Building Code Regulation since public corridors must not be used as return plenums.

The average air supply rate for the spaces served by Systems A and B is 1 cfm/sq. ft. This rate is suggested not to be adequate for spaces which have a concentration of CRT terminals or for areas which have high occupancy concentrations presently observed in the building.

In general, the apparent minimal air movement in the spaces served by these systems is due to considerable interior high ceiling partitioning of spaces, the increased distance for the return air pattern, and the absence of interior air supply grilles in all spaces except enclosed meeting rooms.

Minimum outside air ventilation rates for Systems A and B are in the order of 0.2 cfm/sq. ft. Visual inspection of the outside air dampers for these systems revealed they are loose and provide a poor control.

3.4 Systems A and B - Ground Floors

The ground floor area is treated separately by joining System A and B in a mixing unit and reheating or recooling as desired. The supply air is distributed through a high velocity duct system to the sound attenuating and volume control boxes in each bay in the ceiling space and from there is supplied to the area by ceiling diffusers. The return air is taken through a central return air grille and brought back to the main return air shaft and the return air fans of System A and B. The heating and cooling coil is located in the ground floor mezanine equipment room.

To prevent ventilation air for the City Clerk's Office in the south wing from entering the mixing unit and being incorrectly heated by the averaging type of control system, a bypass duct has been installed. This bypass duct branches from System A supply air duct before the airstreams from Systems A and B join. The duct rejoins the main supply air duct to the south wing after the north-south split in airflow. The bypass duct includes a cooling coil and modulating damper controlled by a room thermostat which operate to bypass air through the cooling coil as required.

3.5 System C - Council Suite

System C with a rated capacity of 4,550 cfm, is of the high velocity dual duct type and its equipment is also located in the ground floor mezzanine equipment room.

Outside air is taken at either side of the main entrance and brought back in a joint high velocity duct to a plenum chamber where it mixes with the return air. Outside air schedules for this system indicate a minimum outside air setting of 40%, and maximum setting of 55%. The supply air is blown through a hot and cold deck and distributed to sound attenuating mixing boxes, where the hot and cold air is mixed as desired by separate room thermostats. From the boxes the air is fed to ceiling diffusers. The return air passes through individual return air grilles and through acoustically lined ducts in the ceiling space.

3.6 Cafeteria Kitchen - Eighth Floor

Ventilation for the kitchen is drawn from the adjacent cafeteria and exhausted out through kitchen exhaust hoods. The operation of this system is inefficient since no direct makeup air is introduced into the kitchen.

The American Standard kitchen exhaust fan, with a 4500 cfm capacity rating, has surpassed its rated service life but is serviceable. This fan originally had a 3000 cfm capacity, but the fan speed was modified to increase the capacity.

3.7 Garage Ventilation

The lower ground floor parking garage is ventilated by two (2) exhaust fans, which draw outside air through the two louvered garage entrance doors. These American Blower Model E belt driven fans are rated at 23,000 cfm each, and have surpassed their rated service life since they are of the original installation. However, no maintenance problems have been reported for these fans, which remain in service.

These fans are operated from the Commissionaire's office in the parking garage, where they are manually switched on during peak traffic periods from 8:00 a.m. to 9:00 a.m. and 4:00 p.m. to 5:00 p.m., or during other heavy traffic periods, at the Commissionaire's discretion.

Current Ontario Building Code requirements call for a minimum continuous exhaust of 14 m^3/hr for each square metre of floor area. The system exceeds this ventilation rate slightly at 14.9 m^3/hr. However, compliance with Code provisions requires the method of fan operation to be met by either a CO monitoring system or continuous operation.

3.8 General Exhaust System

This system is of high velocity type. The air enters through a ceiling grille in the toilets, etc. and then passes through an acoustically lined low velocity duct to a pressure reducing station. From there on the duct tapers into a round high velocity duct which carries the air up to the exhaust fan in the open part of the penthouse where it is exhausted.

The exhaust fan for this system is rated at 8000 cfm and has surpassed its rated life but remains serviceable.

3.9 Elevator Machinery Room Exhaust System

A propeller fan exhausts air from the Machinery Room when the temperature within gets too high as controlled by a thermostat. Makeup air enters the room through the elevator shaft. This fan has surpassed its rated life but remains serviceable.

3.10 Lower Ground Floor Ventilation Systems

The transformer room and the equipment room each have two grilles with automatic fire dampers installed, one at low level and one at high level, to allow cross ventilation.

3.11 Vault Document Storage

The archives storage vault area, which is located adjacent to the parking garage, is not ventilated at present. While this is an unoccupied area, the absence of ventilation has led to an extremely poor quality environment for its use.

3.12 Air Handling Equipment

All fan equipment for the main building air handling systems described in the foregoing have surpassed their rated service life. The past maintenance history for this equipment reveals only two bearing changes were necessary on the original air supply system fans, while the return air fans have only required regular lubrication maintenance since their installation. As such, these fans still remain in serviceable condition.

The air handling units are also equipped with Roll-O-Matic renewable media air filters. This style of air filter is not currently in wide use.

3.13 Air Conditioning Systems

3.13.1 Central Chilled Water System

Air conditioning requirements for the building's central air handling units are met by a single Carrier chiller, rated at 330 tons, which distributes chilled water through a 6" line to the cooling coils in the Mechanical Penthouse, and a 4" line to the ground floor and Council Chamber systems.

At present, the chiller maintenance contract covers monthly maintenance checks and is valued at $2,300.00 annually. Discussions with Carrier service representatives revealed the following maintenance history:

(1) The starter controls were updated in 1984.

(2) A new purge system was installed in 1976.

(3) The annual bearing inspection indicates the bearings to be in good condition.

(4) The condition of the tubes for the chiller is unknown at this time as no eddy current testing has ever been performed.

(5) The electrical stator coils will require baking and dipping maintenance within one year at an estimated cost of $7,000.00 to $8,000.00.

Site operational data obtained by the manufacturer reveals the chiller usually operates within 30 - 40% of rated capacity. Cursory cooling load estimates indicate the chiller not to be oversized for this building's cooling loads. However, since the return water temperature for the system, as observed by the chiller manufacturer, is consistently low, it therefore follows that heat transfer through the air coils for the air handling units may be impaired and the coils are in need of cleaning.

The existing chiller has surpassed its rated service life. It is expected that the solid state controls which were installed in recent years will soon be outdated. However, if eddy current tests are performed and the results from these indicate no major tube problems, then the chiller could be expected to remain in service for another 15 years if a good annual maintenance program is sustained.

Condenser water for the chiller is cooled by a 4-fan Marley wooden cooling tower, Model 12-104, which has a maximum flow rating of 1050 USgpm. The outer casing is manufactured of corrugated asbestos cement board with removable louvres. The tower is of the original installation and has surpassed its rated service life but visual inspection has revealed it is in good condition and may be refurbished for extended service.

Both the chilled water and condenser water circulation pumps are Harland models which are rated at 1100 USgpm at 59 ft. head. These pumps have surpassed their rated service life but are in reasonable condition.

The existing air handling units are equipped with heated humidifier sprays on the cooling coils. This method of humidification does not currently experience wide use and has surpassed its rated service life.

The ready availability of maintenance reports indicates water treatment on the chilled water system has been diligently maintained. The chilled water piping has approached its rated service life but appears to remain in good condition.

3.14 City Clerk's Office - Local Air Conditioning System

Space cooling for the City Clerk's Office is provided by a cooling coil located in the existing bypass air ductwork, as described in the foregoing ventilation sections of this report.

This system is served by a local Trane Model RAUA 1005-C packaged mechanical refrigeration system with air cooled condensing unit located in the lower ground floor parking garage. This unit is rated at 10 Tons and has an estimated remaining service life of 10 years.

3.15 Miscellaneous Air Conditioning Systems

The following miscellaneous air conditioning systems are included in the existing building equipment:

(1) Two (2) water cooled units, each rated at 3 tons, serving a small computer room on the 3rd floor, and a word processing room on the 6th floor respectively. These units are approximately 5 years old and have a remaining service life expectancy of 10 years.

(2) One (1) air cooled unit, rated at 5 tons, which serves a photocopy room and computer room situated on the 8th floor. (The spaces served by this unit were being vacated at the time of the site survey). The outside air condenser for this unit is located on the roof and has Carrier Motomaster control on the condenser fan to regulate unit operation under low ambient conditions. This unit is approximately 20 years old and has surpassed its rated service life.

(3) One (1) small Tehcumseh model refrigerated unit rated at 2.5 tons for the garbage room. Excessive evaporator coil plugging has been observed. The compressor fan for this unit was replaced in 1968. This refrigeration unit has surpassed its rated service life.

3.16 Controls

The existing controls system is of the pneumatic-electric type from Honeywell. The major functions of the control system include maintenance of space temperatures by averaging seven (7) space thermostats to operate steam valves and reheat coils, control of outdoor air, exhaust and return air dampers, humidification sprays control, boiler water level control and domestic water heater temperature.

Although the existing control system is operable and functioning, the system is approaching 30 years of age and as such is outdated, with parts being difficult and sometimes impossible to obtain. Gradual replacement of some minor components was begun approximately two (2) years ago. The drive motor for the multipoint temperature indicator which is located in the eighth floor Mechanical Room requires constant maintenance and is in need of replacement.

3.17 Domestic Hot Water

Domestic hot water for the building is adequately provided by a single tank located in the eighth floor Mechanical Room. Water temperature in the tank is maintained by a controller which modulates a steam valve sized to pass 470 lb. of steam per hour at a pressure of 9 psig. Domestic hot water is then distributed to the building through a 2" and 1½" line respectively.

The domestic hot water storage tank and piping are of the original installation and have surpassed their rated life; however, both appear to remain serviceable. No maintenance related problems have been reported for this tank and its associated system.

3.18 Storm Drainage System

All roof drains and catch basins ultimately feed into a 15" diameter main storm drainage line. An examination of all roof drain sizes revealed the existing system complies with current building codes but no form of stormwater management is employed.

Visual inspection of the roof drains and their associated screens revealed the system remains in serviceable condition, despite the fact it has approached its rated life.

It was reported that if the catch basins block up during severe winter storms, the storm drainage from the site usually backs up into the parking garage on the Lower Ground Floor.

3.19 Sanitary Drainage System

All sanitary waste from washroom and sink fixtures, and floor drains ultimately drain into a 6" diameter main sanitary line. A sand interceptor, which is located on the lower ground floor, discharges into a sewage pump pit. Waste from the sewage pit is pumped into a 3" diameter sanitary line, which connects into the 6" diameter sanitary main.

A review of all sanitary stack vent and pipe sizes from the original drawings indicate compliance with current Ontario Plumbing Code Regulations. All stack vent terminations on the roof are adequately flashed and installed according to current Code requirements.

Most washroom fixtures are of the original installation and are approaching their rated service life, but all fixtures are serviceable and in good condition. Some minor on-going maintenance problems have been reported, such as flush valves wearing out and requiring replacement.

The visible inspection of the drainage piping from all sinks reveals most traps and piping are in serviceable condition. Visual inspection and comparison of the drainage piping's present accumulated service life of 30 years with the anticipated rated service life of 50 years suggests a remaining service life of 20 years.

The cafeteria kitchen dishwasher is equipped with a grease interceptor, which was installed during the original building construction. This interceptor remains in serviceable condition.

<u>**Domestic Water Distribution**</u>

Domestic cold water enters the building at city pressure through the north wall of the lower ground floor parking garage though a 4" Ø main, and runs below grade to the pump room on the lower ground floor. The domestic cold water flow then enters a booster pump, which discharges into a 3"Ø main riser and is then distributed throughout the building through various line sizes.

No nameplate or maintenance data is available for the domestic cold water booster pump, other than the fact that its motor is rated at 3 hp. This pump is of the original installation and has surpassed its rated life; however, it remains in serviceable condition.

The incoming 4"Ø main and its associated shutoff valve are showing signs of severe exterior corrosion. Maintenance staff are reluctant to operate the shutoff valve for fear of causing adjacent pipe failure. The steel piping and valves for the domestic water have surpassed their rated life but remain serviceable. All copper piping has a remaining service life expectancy of 20 years.

Activation of various individual washroom fixtures concurrently, confirms the system is adequately sized for existing flow and pressure demands.

5.0 BUILDING ENERGY PERFORMANCE

The average annual light oil consumption for the building and domestic water heating requirements is 380,000 L, from 1982 to 1984 inclusive.

The total annual electrical consumption for the building in 1984 was 7,553,250 kWh. The maximum peak monthly electrical demand recorded in 1984 was 690 kW.

The foregoing data indicates the annual building energy consumption to be high at 2465 MJ/sq.m. (64 ekWh/sq.ft.).

Replacement of existing fenestration to address the problem of infiltration covered under Sectin 1.2 of this report would result in a lengthy payback period. Experience dictates that more favourable payback periods can be achieved by proper caulking and weathersealing of the windows if the analysis is considered on an energy basis only.

5.0 CONCLUSIONS

The exterior cladding and windows have problems with air infiltration, water leakage, fastenings and deterioration.

The roof membrane needs replacement.

All floor assemblies require upgrading to a two-hour fire separation.

Exiting to the exterior from the two main staircases through the lobby and through a non-rated interior passageway violates the present code.

The guardrail and handrail of the spiral staircase are improper and potentially dangerous.

The podium slab over the parking garage is leaking and cannot support the heavy loads of fire fighting equipment.

The present floor framing can support the office and assembly occupancy as set out. However, alterations which offset this use may require heavier loadings and, therefore, a complete structural examination of the framing in these areas.

The roof structure requires reinforcement to new code snow loadings.

A support system to resist earthquake loads in the longitudinal building direction should be verified.

Although still adequately functioning the building heating and air conditioning systems are generally beyond their normal life expectancy with most replacement parts not available for repairs. The annual energy consumption is high by today's standards and a complete modernization of the mechanical systems is warranted.

The building plumbing is still serviceable but very much reflects the standards of the 1950's. Any renovation should consider new fixtures.

The fire standpipe system requires upgrading to present code requirements and the basement sprinkler system should be completely tested and new sprinkler heads installed.

The main electrical service equipment is not overloaded. However, it is antiquated and would be a major problem should a breakdown occur. The distribution system is likewise largely beyond its normal useful life expectancy except for some branch panels which have recently been replaced.

The lighting system is generally the original fixtures which are insufficient and beyond useful life.

The office power distribution system requires extensive refurbishing to meet today's demands for computer terminals, etc.

The fire alarm system is relatively modern but requires updating to meet current codes.

Focus

The Citizen, Ottawa, Saturday, November 23, 1985

City Hall deserves place in architectural heritage

Cityscape
Rhys Phillips

It is no small irony the year civic politicians considered demolishing Ottawa's city hall is the year the Royal Architectural Institute of Canada chose to honor one of its principal architects with a gold medal for lifetime work.

This award to John Bland, who along with partners Vincent Rother and Charles Trudeau won the 1955 national design competition, is not necessarily an iron-clad argument for saving a particular building. But it does require we step back and consider its place in the architect's work, in our political history and in Ottawa's built environment. What emerges is not only an important building in Bland's career and Ottawa's civic development but also an architectural achievement which attracted considerable professional admiration and which had a significant impact on Canadian architecture.

John Bland's primary contribution was as an educator and town planner. After post graduate studies in town planning in England, he returned to McGill University in 1939 and acceded to the directorship for architecture in the dark war year of 1941. He held the post until 1972. During the war, Bland and five practicing architects held the architecture school together with heavy reliance on engineering. This strong dose of the practical was offset by Bland's courses on architectural history and his use of such visiting lecturers as artists Arthur Lismer and Gordon Webber to teach drawing and design. The result was a remarkable balance between strong analytical ability and open mindedness to design. Following the war, Bland introduced curriculum innovations integrating the social sciences with architecture and eventually established an influential town planning program.

Professionally, alone and with partners, he designed the towns of Deep River (1943) and Port Cartier (1958-59); did major planning studies for Edmonton (1949), Sudbury (1951); Vancouver (1951) and Ottawa (1964); and did the master plan for Gaspé's Forillon National Park.

In Ottawa, besides city hall, he designed the National Research Council's hydraulics laboratory, the master plan for Carleton University's Tory and Library buildings and the Northern Electric research and development laboratories in Kanata.

At 74, John Bland continues as curator of the Canadian Architecture Collection at the school he led for over 30 years, "imbuing it" according to the institute citation, "with a standard of excellence in architectural education which serves as a model to his peers and successors."

Given Bland's contribution to architecture and urban planning in Canada, demolishing what well might be considered his master work is an ironic tribute. But what of the building; does it deserve recognition beyond its designer?

By the time a national design competition for an Elgin Street site was announced on September 9, 1955, a 25-year search covering 36 different sites seemed to be resolved. Curiously, neither the press release nor the guidelines contained any heroic call for a building worth the fine citizens of the nation's capital, or proclaimed any aesthetic goals symbolizing the seat of democratic government. But while Canadian architects attended their drafting boards, Prime Minister Louis St. Laurent and federal district commission chairman Major General Howard Kennedy reopened the site question. Dead set against the Elgin location, the federal government in November, 1955, offered the stunning Green Island site. *The Citizen* entered the fray with a Dec. 7 editorial supporting the land exchange despite problems posed by the Sparks family's will deeding Elgin's Civic Square. Opinions raged. Ottawa West MP George McIlraith wanted a more central location while a Driveway/Frank Street site was favored by the Ottawa Home Owners and Tenants Association.

Not surprisingly, Mayor Charlotte Whitton was the most outspoken critic. She favored Pinehill near the western entry to Rockcliffe, "the most magnificent promontory outside of Parliament Hill." But after a full technical analysis of both sites, council made its second "final" choice of the island site on January 31, 1956.

And what of the national competition? Undeterred by the site debate, the entry of Rother, Bland and Trudeau was declared the winner in December, 1955, well before the final site decision.

Council's site committee declared the jury's selection a "beautiful" one for Green Island. Acceptance of the transplanted design was not, however, unanimous. Local architect William Gilleland, in a letter to the mayor, called for a team to assist with a redesign. More seriously, the FDC produced two negative but contradictory assessments. While Kennedy complained that a lower, less monumental design was required, his own architectural subcommittee wanted greater monumentality and suggested a 20-storey tower!

The architects vigorously defended their winning design. They said they had designed for both the Elgin and Green Island sites, a doubtful claim given the November offer date. In the end, they agreed to extend the eighth floor penthouse across the full length, a compromise which well may have been detrimental to the original conception.

Criticism died away and in 1957 the cornerstone was laid on the site Samuel de Champlain had been moved to note in his journal was remarkable for its "natural beauty."

Not surprising to followers of government construction projects, all did not go smoothly as the steel-framed building rose. Costs jumped from $2.8 million to $3.5 million (while Mayor George Helms complained in October, 1957 of poor "public relations" between the architects and council. His strong letter on March 5, 1958 indicated he was "considerably disturbed with the slow progress" of construction.)

Delays notwithstanding, on Aug. 12, 1958 Princess Margaret officially opened a city hall Ottawa could call its own; there was great pomp and circumstance.

Remarkably, the new building was a hit with its new owners and within a year had assumed an important place in Canada's postwar architecture.

Hailed as an avant garde design, the city hall was also a carefully detailed public space which combined impressive natural material with the best new synthetic building materials.

Forty-eight thousand square feet of Canadian Queenston limestone alternated with 23,000 square feet of special heat absorbing and glare reducing grey plate glass (not to mention windows that actually opened). Marble from Vermont and Italy was spaced with Canadian aluminum from Canada's state-of-the-art smelters. Walnut and oak trim lined acoustically perfect walls in a council chamber lit by nine large skydomes.

Artwork formed an integral part of the architect's program. Award-winning Canadian sculptor Louis Archambault designed two

(City Hall, page F4)

Summary and Recommendation

A review of our findings and observations made within this report are presented below. Our observations were restricted as a result of inclement weather experienced during the time that this report was being prepared.

It appears that a general failure of the main roof has occurred at this time and that the only thing preventing serious ingression of water into the building interior is the integrity of the existing vapour barrier. Moisture penetration appears to have occurred during the past and continues to be a problem at all exterior parapet location at all roof levels.

The poor design of these parapets has been the major contr uting factor to this problem. Moisture ingression and possible condensation problems are contributing to the deterioration of the building exterior cladding and could be adversely affecting the securing anchors.

The poor design of the counter flashings has also caused moisture infiltration and will continue to be a problem in the future.

The thermal composition of the roof assemblies does not meet with the minimum recommended standard of todays roof installation. In fact the roofs of the balconies do not have any insulation what-so-ever.

.../18