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TECHNICAL NOTE

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PREPARED FOR Corporation of the City of Ottawa, Department of Planning and Works.

SUBJECT **OTTAWA CITY HALL**

Air Conditioning Problem in City Clerk's Office

As arranged by telephone a visit was made to Mr. Dobbin's office at City Hall on January 4, 1962 to look into problems in air conditioning the City Clerk's office. With Mr. Dobbin were Mr. Bennet, the building superintendent, Mr. Holt, stationary engineer, and Mr. Gedds, air polution engineer. The problem and the air conditioning system was explained by Mr. Holt. The City Clerk's office and other offices were then visited with Mr. Holt, Mr. Bennet and Mr. Hastey, City Clerk.

The main problem seems to be excessive temperatures in the City Clerk's office during winter months, especially on cold sunny days. This office occupies the whole of the south end of the building (the front facing Sussex Drive is referred to as the west; it actually faces north of west). The three outside walls E, S, W are of clear glass that has subsequently been painted with a plastic to reduce solar transmission. The plastic is not very noticeable and presumably reasonably clear. Drapes have been added, but these are of a very open mesh and do not reduce direct transmission appreciably.

In addition to the temperature problem there seems to be considerable discomfort occasioned by solar glare. Some of the employees find it necessary to wear sun glasses at times.

The air conditioning system for the whole of the building is basically an air system. There are hot water convectors below most windows but these are meant only to prevent condensation and are not used for room temperature control. All eight floors (except for the Council Chamber and Mayor's offices) are supplied from two systems on the eighth floor, one for the west half and one for the east half. The supply air temperature on each system is regulated by seven averaging thermostats (probably located in the return air at floors 2 to 8).

The Mayor's offices and the Council Chamber are conditioned by a two-temperature system located on a mezzanine floor at the ground level just behind the elevators. An outside air connection permits the use of outside air when required for cooling and control in winter and a cooling coil provides summer cooling. Heating and cooling are provided by boilers and a 350-ton centrifugal water chiller located in the eighth floor equipment room.

The ground floor is supplied from both the east and west systems. Equal quantities, about 6400 cfm, from each main duct pass through the booster heating and cooling coils located on a mezzanine floor behind the elevators. This flow is then divided half to the City Clerk's office and half to the rest of the ground floor (i.e. foyer etc).

Overheating in the City Clerk's office appears to arise from excessive solar radiation. The air supply aggravates the problem since its temperature must be maintained sufficiently high to satisfy the rest of the building and there is no separate control of either quantity or temperature of the supply to the City Clerk's office. In any case the supply temperature of this air must be sufficiently high to heat the north portion of the ground floor. The supply temperature is at present kept as low as possible to alleviate conditions in the City Clerk's office, but this sometimes leads to underheating other areas.

A very approximate calculation indicates that, with 0°F outside and 70°F inside, the heat loss from the City Clerk's office will be about 170,000 Btu per hour with still air outside and about 260,000 Btu per hour with a 15 mph wind. This requires supply air temperatures of approximately 95°F and 107°F (6400 cfm). On sunny days the solar gain might be about 135,000 Btu per hour or perhaps more. Thus the actual heating requirement will be from 35,000 to 125,000 Btu per hour. It would appear that the 0°F outside case could be handled by reducing the supply air quantity. Alternatively, the supply air temperature would have to be lowered to 75°F and 88°F. In warmer weather, however, the losses become 125,000 to 185,000 Btu per hour at +20°F outside and 75,000 to 110,000 Btu per hour at +40°F outside. The solar gain would now appear to exceed the losses, so that conditions can only be maintained by supplying air at a temperature lower than room temperature. In 40°F outside weather for instance, a minimum supply temperature of about 61°F might be required (i.e. 1920 cfm outside air and 4480 cfm recirculation).

With 50°F outside the approximate heat loss will be from 50,000 to 75,000, so that the maximum excess solar gain will be about 85,000 Btu per hour, which will require a supply air temperature of about 58°F or about 3840 cfm outside air and 2560 cfm recirculated air.

The above calculations are very approximate and do not include any internal heat gains, so that they cannot be used as a design basis for modifications to the system. They do however indicate, subject to confirmation by more exact calculations that temperatures can be controlled during the winter months by using a recirculation system with provision for up to about 2/3 outside air.

The present system could perhaps be modified to provide satisfactory conditions. That is, the present booster heating and cooling coils could be split and half of each coil be installed in the supply duct to the City Clerk's office, the other half in the supply to the north portion of the ground floor. In addition, a fan and dampers could be installed so that outside air could be substituted for part of the supply to the City Clerk's office, as required to control temperatures. The system could then be operated as it is at present for winter night time and summer operation. This would perhaps lead to control complexities and might adversely affect the balance on the main system.

It might be as economical and more convenient to install an entirely separate system for the City Clerk's office, to provide for recirculation, with some outside air supply and exhaust as required to prevent excessive temperatures. The system would consist of a fan, cooling coil, heating coil, dampers, outside air supply and exhaust convections, control valves and temperature controls. The controls on a temperature rise in winter would close the heating valve and then open the outside air supply and exhaust dampers and close the recirculation dampers. For summer operation the outside air supply could be fixed for minimum ventilation requirements and the temperature controlled by regulating the cooling valve.

It is realized that space for additional equipment on the mezzanine floor is very limited. It may in fact be difficult or impossible to install an additional fan and coils. Hence, it might be more feasible to substitute a larger two-temperature system for the present one supplying the Council Chamber and Mayor's offices, and to supply the City Clerk's office also from this new system.

A temperature and humidity recorder has been placed in a shaded location in the City Clerk's office. The first week's record indicates night time temperatures of about 72°F, with a rise starting at 7:30 to 8:00 a.m. and reaching 80 to 84°F from about 11:00 a.m. to 3:00 p.m. approximately. The initial rise may be partly due to operating the booster coil to provide sufficient heat for the north portion of the ground floor, but the maximum reached in the afternoon is most certainly due to the large solar gain. The night time temperatures indicate that the supply quantity is about optimum for night and cloudy day operation.

In summary then, it would appear that the present system cannot be operated to provide acceptable conditions in the City Clerk's office. Whether or not the present system can be modified to take care of high solar gains (i.e. install a fan to mix outside air with the present supply, leaving night time and summer operation essentially unchanged), or whether an entirely new system for this area is more feasible can only be judged after a careful study of the whole system and the effect of modifications on the present system balance and a cost estimate of the various alternatives. It is suggested that an air conditioning consultant be retained for such a study.

Consideration should perhaps also be given to more effective glare control. A higher absorption plastic coating on the glass or a more effective drapery material might be considered.