

SESSION II.
1906.
NEW ZEALAND.

PARLIAMENT BUILDINGS

(REPORT ON THE VENTILATION OF), BY PROFESSOR R. J. SCOTT, M.INST.C.E., M.INST.M.E.

Laid on the Table by Leave of the House by Hon. William Hall-Jones.

REPORT.

SIR,—

Christchurch, 19th July, 1906.

I have the honour to report that, in accordance with the request contained in the letter of the Under-Secretary for Public Works dated the 27th June, 1906, I visited Wellington and investigated the condition of the ventilation of Parliament Buildings with a view to suggesting what steps should be taken for the improvement of the same.

EXISTING CONDITION OF VENTILATION.

Dealing more especially with the Chamber of the House of Representatives I find that,—

- (1.) *South Side not Windproof.*—The south side of the building is in bad repair and by no means windproof, admitting severe draughts in southerly weather.
- (2.) *Doors and Passages.*—There are many doors and passages communicating with the galleries, and, these doors being sometimes open and at other times shut, a serious disturbing factor in the working of any system of ventilation is introduced.
- (3.) *Air-exit from Public Gallery.*—There is an independent exit from the Public Gallery which under certain conditions is the cause of unpleasant downdraughts.
- (4.) *Insufficient Exit for Vitiated Air.*—There is insufficient provision for the exit of the vitiated air, especially in the galleries.
- (5.) *Insufficient Supply of Fresh Air.*—The supply of fresh air is altogether too small, the present plant, under existing working-conditions, being capable of delivering only some 12 cubic feet per minute per person, whereas 30 is the minimum which should be provided. The result is that the atmosphere of the chamber must contain more than 0.1 per cent. carbonic acid as against the 0.04 per cent. of a normal atmosphere.
- (6.) *Air too dry and overheated.*—The air is delivered in a much too dry and even partially burnt condition. This is due to the arrangement of the heating apparatus. The air is warmed by being passed through iron tubes directly over a coke fire, and that portion passing through the tubes nearest the fire becomes greatly overheated. The moistening arrangements also are inefficient.
- (7.) *Air distributed badly.*—The air enters the chamber through the various inlets at widely different temperatures and speeds. At some the velocity is as high as 7 ft. per second, giving rise to almost unbearable draughts; at others it is zero, or there is even a downdraught. The faulty design of the air-distributing trunk is responsible for this condition of things, which is aggravated by each inlet being subject to independent control.
- (8.) *Coke-fumes.*—Coke-fumes from the furnace find their way into the chamber.

CONDITIONS TO BE SATISFIED TO SECURE EFFICIENT VENTILATION.

I am of opinion that to efficiently ventilate the chamber without draughts it will be necessary under all external weather conditions,—

- A. *Plenum to be maintained.*—That a slight plenum shall be maintained within it;
- B. *Vitiated Air discharged.*—That the vitiated air shall be promptly discharged;

- C. *Ample Supply of Fresh Air.*—That there shall be an ample supply, of not less than 30 cubic feet per minute per person, of fresh, moderately warmed or cooled, and sufficiently moistened air;
- D. *Air to be uniformly distributed.*—That this air shall be delivered uniformly over the chamber in such a manner as to reach all its occupants without perceptible motion;
- E. *Range of Heating of Air to be limited.*—That the range over which the air-supply is heated shall be limited, extremely cold weather being provided for by additional heating appliances within the chamber and lobbies.

RECOMMENDATIONS.

To fulfil the foregoing requirements I would recommend that,—

- A. *Building to be made windtight, and Van Kannel Door to be fitted.*—To enable a plenum to be maintained within the building it be made windtight; that the number of exits be limited, and space-conditions kept as far as possible constant by the use of self-closing doors; also that a Van Kannel door be fitted at the outside entrance to the Public Gallery.
- B. *Air-pump Ventilator to be fitted, and Skylight and Galleries to be connected.*—To insure the prompt removal of the vitiated air, the present exit-cowl in the lantern roof to be replaced by a Boyle's patent air-pump ventilator, and that this ventilator be connected to the central aperture of the skylight, apertures at the ends of the skylight, the ceiling of the Public Gallery, and the ceilings of the private galleries (Speaker's, &c.).
- C. *Sturtevant Plant to replace Existing Appliances.*—To provide an ample and satisfactory air-supply the present appliances be replaced by a Sturtevant standard heating and ventilating plant, capable of dealing with a maximum quantity of 16,000 cubic feet of free air per minute, of raising the temperature of this amount through 35° Fahr., and delivering it at 75 per cent. relative humidity.
Description of Plant; Relative Cost of Fuel.—In this plant the air is warmed by being passed over steam-pipes, and thus excessive overheating is less likely to occur than with the direct system; further, since the steam used by the fan-engine goes on to, and is utilised in, the heater, the cost for fuel will be less than one-half the expenditure which would be required for fuel and current with appliances similar to those now in use.
- D. *Present Air-trunks replaced by many; Air led to Risers at Floor-level; to Skirting-boards; introduced at Very Low Velocity.*—In order that the fresh air may be uniformly distributed, the two existing main air-trunks be replaced by thirteen trunks of differing size connected by ducts to spaces behind or in front of the risers round the central floor-space of the chamber, along its passage-ways, between the seats of the members, and between the seats in the Ladies', the Public, and the private galleries; also at the skirting-boards at each end of the chamber and in the Press and Hansard Galleries. That the air be introduced to the chamber from these spaces at low velocity through numerous gauze-covered openings.
- E. *Radiators to be used; Single Central Heating Station recommended.*—To avoid the necessity for overheating the air in order to raise the temperature of the walls of the building in extremely cold weather, radiators be placed in the chamber, the lobbies, and the connecting passages. Further, since I am of opinion that with the exception of the chamber of the House of Representatives, and possibly that of the Legislative Council, the Parliament Buildings can be best ventilated by natural as opposed to mechanically created air-currents, and warmed by the use of radiators, it appears to me desirable that sufficient boiler-power should be installed with the new plant to enable the whole of this heating to be effected from a single central station, and isolated boilers to be dispensed with. Such an arrangement would be productive of economy in labour and fuel, and greater efficiency in heating.

DETAILS OF WORKS TO BE CARRIED OUT TO GIVE EFFECT TO RECOMMENDATIONS.

A. DETAILS OF STRUCTURAL REPAIRS, ALTERATIONS, AND ADDITIONS.

Plastering.—The interior of the southern side of the building to be plastered. All necessary windows to be made tight, and disused windows thoroughly blocked. (The Public Gallery and staircase especially require attention.) The two windows on the staircase of the Public Gallery to be permanently closed. The cellar-steps to be isolated by a partition with door at top.

Revolving-door.—A Van Kannel revolving-door to be fitted at the external public entrance.

The door between the *Hansard* lavatory and the Public Gallery to be closed.

The door between the *Hansard* Room and gallery-staircase to be felt-edged and spring-closed.

Passage thrown into Hansard Room.—The passage that now exists round the inner *Hansard* Room to be done away with, the space being again thrown into the room, and the opening to the Press Lobby permanently closed. If this is not possible, a spring-closed door should be fitted at this opening.

Doors to be made self-closing.—The door from the Press Reporters' Room to the main corridor to be made self-closing and draughtproof, as must the double folding-doors at the entrance of the passage to the Speaker's and Legislative Council Galleries.

The door between this passage and the lobby of the Ladies' Gallery should also be made self-closing, and the door leading thence to the stairs closed in such a manner that it may still serve as an emergency exit.

Self-closing doors to be fitted at each end of the passage on the ground floor leading from immediately behind the Speaker's chair to the front of the House.

A double folding or revolving door to be placed between the "Ayes" lobby and the main entrance.

The door between this lobby and the common lobby to be made self-closing.

When the House is sitting it is of importance that all self-closing doors should be permitted to close, and also that as far as possible the double doors at the entrances from the "Ayes" and "Noes" lobbies should be in use.

B. DETAILS OF ARRANGEMENTS FOR REMOVAL OF VITIATED AIR.

Boyle's Ventilator; Collecting-box.—The existing outlet-cowl on lantern roof to be replaced by a Boyle's patent air-pump ventilator of 16 square feet cross-section communicating directly with a collecting-box placed under the unglazed portion of the roof.

Central Exit.—The existing central-exit pipe to be connected to this chamber, and the rectangular baffle-plate at its entrance to be lowered 4 in.

End Exits.—The apertures immediately below the ends of the skylight to be reopened and arranged to discharge into D-shaped ducts connected to the main collecting-box by inclined pipes (one to each of 3 square feet cross-section).

Exit from Public Gallery.—A pipe of 5 square feet cross-section to be led from ceiling of Public Gallery to main collecting-box.

Exit from Private Galleries.—A pipe of 3 square feet cross-section to be arranged to connect the existing apertures in the ceiling over the private galleries with the main collecting-box.

Dampers for Primary Adjustment.—All these connections with the main collecting-box to be provided with dampers for the primary adjustment of the air-currents. These dampers to be capable of adjustment from within the lantern only, and of being permanently fixed.

Main Exit controlled by Adjustable Valve.—The exit from the main collecting-box to the air-pump ventilator to be controlled by a valve actuated from the floor of the House, but under the sole control of the ventilation attendant. This will be the only adjustable valve in the system.

Exit-pipes, if external, to be jacketed.—If it is found necessary to lead the discharge-pipes from the galleries outside the roof, they must be protected by an external casing giving at least 3 in. of dead-air space around them.

C. DETAILS OF THE ARRANGEMENTS FOR THE SUPPLY OF WARMED OR COOLED AND MOISTENED AIR.

Intake.—The intake is to be screened from wind-action in such a manner as to maintain the air-pressure thereat as nearly constant as possible.

Rain-screens; Fan and Engine; Hot and Cold Delivery.—The air is to be drawn through double filtering-screens and rain-curtains by a Sturtevant slow-speed fan, actuated by a single-cylinder directly-connected low-pressure steam-engine, and discharged through or past a Sturtevant steam-coil heater into two (hot and cold air) receivers. The hot receiver to be fitted with a moistening-jet.

Main Delivery-trunks; Control of Temperature by Thermostats.—From these receivers the air is to be led off by thirteen main trunks; each trunk is to be arranged to communicate with both receivers through valves controlled by thermostats in such a way that a uniform temperature of delivery is maintained by the action of the thermostats varying the proportion of warmed to cold air, the total quantity discharged into the trunks remaining constant.

Permissible Variation in Temperature 2° Fahr. from Particular Temperature for which Thermostat set.—Each Thermostat is to be capable of being set to effect such control within 2° Fahr. variation over a range of temperature of at least 20° Fahr.

Primary Adjustment.—Hand-adjusted dampers are to be placed in each of the thirteen trunks, and an adjustable deflecting-plate is to be fitted at each duct-offtake. By these means it will be possible to so adjust the resistances of the various channels and the relative temperature of the air entering them as to insure uniformity of ventilation and temperature throughout the House.

Thermostats maintain Temperatures constant irrespective of Amount of Delivery; Amount varied by varying Engine-speed.—After such an adjustment has been once made and the movable devices clamped, the thermostats will automatically take care of the temperature, and no hand-adjustment will be required. Should, however, it be desirable to vary the quantity of air delivered, this could at once be done by varying the speed of the fan-engine.

Distribution of Air-trunks.—The thirteen air-trunks are to be led as follows: Centre of chamber and main passage-way (floor), 1; sides of chamber, side passages, and intermediate arc (floor), 2; ends of chamber (skirting-board), 2; walls of chamber (half height, existing), 2; lobbies (quarter height, existing), 2; Public Gallery (floor), 1; Ladies' Gallery (floor), 1; private galleries (floor), 1; Press and Hansard Galleries (skirting-boards), 1.

Velocities of Flow.—The trunks and ducts to be so proportioned that a velocity of about 750 ft. per minute near the trunk-entrances may be gradually reduced to something approaching 120 ft. per minute in the ducts, at maximum flow.

D. DETAILS OF ARRANGEMENTS FOR DISTRIBUTION OF AIR IN HOUSE.

Limited Number Wall-ports retained.—The four wall admission-ports on either side of the chamber, the two in the recess of the Ladies' Gallery, and the admission-ports in the lobbies are to be retained, but the regulating-dampers are to be removed from them, and they are to be fitted with bell-mouthed upward-discharge orifices faced with wire gauze.

Other Wall-ports closed.—All other wall-ports are to be closed.

Expanding Mouth and Channel Discharge; Introduction of Air at Floor of Chamber.—Suitable ducts leading from the main trunks, and placed not more than 6 ft. apart, are to be connected by expanding terminations with spaces formed, if possible, behind—if not, by the addition of fascia-boards in front of—all those risers in which the present floor admission-ports are located, the air being discharged from these spaces through numerous gauze-covered openings.

Similar arrangements for the introduction of air are to be made at each side of the main and the two side passage-ways, and also at the skirting-boards at either end of the chamber.

Introduction of Air in Galleries.—In the Public Gallery 78 ft., in the Ladies' Gallery 48 ft., and in the private galleries 56 ft. run, of "riser" distribution, and in the Press Galleries 50 ft. of "skirting-board" distribution are to be fitted.

Total Inlet-area; Distribution of Area.—The total nominal inlet-area in the chamber and lobbies must not be less than 160 square feet, distributed approximately as follows:—

	Per Cent. of Total.
Floor of chamber	52
Lobbies	8
Public Gallery	16
Ladies' Gallery	8
Private Galleries	8
Press and Hansard Galleries	8
	100

E. DETAILS OF ARRANGEMENTS REQUIRED TO AVOID OVERHEATING OF THE AIR-SUPPLY.

Radiators to be placed in Chamber.—Three radiators are to be placed in the Chamber—one near or under the table of the House, and one in each corner under the Ladies' Gallery.

Radiators in the Lobbies.—Two radiators to be placed in each of the lobbies, and one in the east and two in the west transverse passage.

Radiators supplied with Heat from Boiler.—These ten radiators to be only used in the worst weather, and to derive their heat from the boiler of the heating and ventilating plant.

Wet- and Dry-bulb Thermometers.—Three wet- and dry-bulb thermometers, with direct reading-scales, to be placed in the House, to enable the temperature and humidity of the atmosphere to be readily observed.

CONCLUDING REMARKS.

Scheme must be applied in its Entirety; Works which might be carried out before House again meets.—In conclusion, I desire to state that I am confident that if the scheme I have suggested be adopted in its entirety the results will be eminently satisfactory, but that for partial application I can accept no responsibility. I think, however, that the chamber might be made more comfortable for the ensuing session if it were possible to carry out the works classified under the headings A, B, and E before the House again meets.

Cost of Scheme.—I have not sufficient data on which to base an accurate estimate of the cost of the proposed scheme, but approximately it may be taken as being of the order of £1,700 for the whole of the works proposed.

I wish to express my thanks for much valuable information and ready assistance given me by members of the staff of the Public Works Department and of the House; also to the Rev. D. C. Bates for assistance in determining the temperatures and condition of the atmosphere during my experimental trials.

I have, &c.,

ROBT. J. SCOTT, M.Inst.C.E., M.Inst.M.E.

The Hon. the Minister for Public Works, Wellington.

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