JOURNAL

ROYAL ARCHITECTURAL INSTITUTE OF CANADA

VOL. 22 TORONTO, SEPTEMBER, 1945 NO. 9

G.H. Wood's

SANITATION PRODUCTS

Made in Canada by Brompton Pulp and Paper Company Limited, Montreal, Que. Mills located at Bromptonville, East Angus, Que., and Red Rock, Ont.

BRANCHES

HALIFAX • SYDNEY • SAINT JOHN
MONCTON • QUEBEC CITY • THREE RIVERS
SHERBROOKE • OTTAWA • KINGSTON
HAMILTON • ST. CATHARINES • KITCHENER
LONDON • WINDSOR • WINNIPEG
REGINA • CALGARY • EDMONTON
VANCOUVER • VICTORIA • KELOWNA

Exclusive Distributors

G. H. WOOD & COMPANY LIMITED

323 KEELE STREET · TORONTO 440 ST. PETER STREET · MONTREAL

Branches from Coast to Coast

JOURNAL

ROYAL ARCHITECTURAL INSTITUTE OF CANADA

Serial No. 241 TORONTO, SEPTEMBER, 1945 Vol. 22, No. 9

CONTENTS

PLATES

Editorial and Advertising Offices - - - - - - 57 Queen Street West, Toronto 1

J. F. SULLIVAN, PUBLISHER

SUBSCRIPTION RATES

Canada and Newfoundland—Three Dollars per year. Great Britain, British Possessions, United States and Mexico—Five Dollars per year. All Other Countries—Six Dollars per year. Single Copies—Canada 50 Cents; Other Countries 75 Cents.

R . A . I . C
JOURNAL
SEPTEMBER 1945

THROUGHOUT the war, the experience of architectural and engineering professions, as such, has been one largely of frustration. Individual efforts in war plant building, Shipshaw and the like, have, of course, been immense, but opportunities for acting as professional bodies in any united programme to assist the government in any aspect of the war have been few. We can recall only one — the occasion on which the two professions were called upon to present ideas for the successful solution of the land mine problem. We are of the opinion that the two professions could have made substantial contributions to the war effort — we believe they can be of a service now in such a critical matter as housing, if they were invited.

THE highlight in the architectural news, this month, is a further indication of the Government's or the Prime Minister's unwillingness to recognize Canadian professional ability. The Prime Minister has asked General de Gaulle, as a favour, to allow Mr. Greber to come to Ottawa for a further scheme of beautification. If Town Planning were involved for the complete reconstruction of Ottawa, we would be the first to approve the appointment, through competition or other means, of the best man available, from whatever country. He might be Mr. Patrick Abercrombie, Mr. Bartholemew or he might be a Canadian. It is unlikely that he would be Mr. Greber. That, of course, is the job that should be done for a capital city that is occupying an increasingly important position in world affairs. Actually the job proposed is a Napoleonic one of window dressing in which buildings will be knocked down and squares formed, gardens will be laid out and trees planted. The poor will remain where they are, or will be squeezed more tightly, and the overall planning of the city will be made more difficult for the town planners who must inevitably be appointed in the present decade.

IF that is the programme, there is no need to ask favours of General de Gaulle. We have no very high opinion of what has already been done in Ottawa. We speak, of course, as a Torontonian, but one who has seen Times Square, the Brandenburg Gate and the Etoile, and we know of no place that is such a hazard to life and limb, whether on foot or in a vehicle, than Confederation Square in Ottawa. There are Canadians who would have done a better job, and there are Canadians who could handle practically and with greater dignity the programme that is, at present, contemplated.

WE have much pleasure, in this issue, in presenting with the permission of the Minister of Education for Ontario, an Interim Report on Elementary Schools, that a committee appointed by the Minister prepared. Considerable interest has been shown in the work of the committee by architects across Canada, and while the recommendations in the Report were made for an Ontario problem, they may not be without interest to architects in other Provinces. The Report is, as stated, an interim one, and criticism addressed to the Editor would be appreciated. A school based on the recommendations of the Committee will soon be built.

— Editor.

INTERIM REPORT ON ELEMENTARY SCHOOLS

By THE COMMITTEE ON PLANNING, CONSTRUCTION AND EQUIPMENT OF SCHOOLS IN ONTARIO, MAY 28, 1945

TABLE OF CONTENTS

INTERIM REPORT ON ELEMENTARY SCHOOLS

To the Honourable George Drew,
Minister of Education to the Government of Ontario:

Sir,

The Committee on Planning, Construction and Equipment of Schools in Ontario presents an Interim Report on Elementary Schools.

1. We were appointed by an Order-in-Council approved by the Honourable, the Lieutenant Governor, dated the 28th of November, 1944, and our terms of reference were as follows: "That the persons named hereunder be appointed to a Committee on Planning, Construction and Equipment of Schools in Ontario to inquire into: the planning and equipment of schools; standard methods of construction; standards for mechanical services; the useful physical life of school buildings; for the purpose of making such recommendations as would appear to be in the best interests of the people of the Province of Ontario."

2. Not stated in the above, but implied in the term "standard methods of construction", and actually stated in discussions with the Director of Education, was a suggested line of research into "Standardization" of construction and planning. In this research, the Committee has attempted to discover a method of construction and a technique of planning that will produce, at the same time, a less expensive school: one that will be an improvement on former schools in a more flexible plan, and one in which the effective lighting on the pupils' desks would be greatly increased. Such a programme follows closely in spirit the plans of the British Government (see Standard Construction for Schools, London, 1944), and the research in the United States in standardization of construction methods and materials[1].

3. The Committee is aware that there are in the Province of Ontario many schools that are now outmoded in planning, where the cost of maintenance is high. Additions to such schools would be difficult and costly to construct, and would, in all likelihood, be merely perpetuating for decades an obsolete basic structure.

4. The successful development of the One Storey Elementary School type, which the Committee recommends, would have the advantage of easy extension, greater flexibility of arrangement, speedy construction and easy demolition when the school had outlived its usefulness. We are of the opinion that developments in science that should be placed at the disposal of educators and children in the Schools of Ontario will be as great in the next twenty-five years as they have been in the last. The use of radio and of visual education through sound films are already anticipated, and, indeed, are being used today in progressive schools.

5. An argument in favour of a measure of standardization in school planning, and construction, though not one that carried particular weight in the consideration of the Committee, was the opinion frequently held in construction circles that the demands on the construction industry during the next decade will be such as to make some measure of standardization necessary in most buildings[2].

6. The Committee has not designed a standard school, since such a plan would serve no useful purpose, but has designed typical classrooms. If acceptable to the Department, these plans would provide a unit of planning for the small and the larger elementary school. In them is concentrated a large part of the labours of the Committee, because in the unit classroom is involved the accommodating of forty pupils[3], their exits and entrances to the outside and to corridors; the lighting on each row of desks; the hanging of clothes and the working space for projects. With the acceptance of this unit, we are convinced that uniformity of room sizes and construction may be achieved without imposing on the Province a uniform and monotonous school type. It is true that there will not be, as at present, the wide range of "Styles", that go under names like Collegiate Gothic and Georgian. Schools may be designed, and have been designed, that admirably fulfilled their function and were pleasing to the eye, even if they did not display on their exterior the trappings of an earlier age. The school designed from the inside out, in which every detail of plan and section is considered from the point of view of the child and the teacher, may come as a shock to School Boards whose members associate symmetry with order, and the portico of classic columns with the dignity and importance of the school neighbourhood. Such an attitude has, in the past, produced many fine buildings which preserve their dignity long after their useful life has ended. The Committee takes the view that a school is something dynamic, rather than static, in which the teaching of education may be carried on in an atmosphere that will develop all that is best in the teacher, along with all that is latent and best in the child. It is our opinion that such an atmosphere can be created in an attractive workshop, and is less likely of fulfillment in a monument.

7. It should be further said, in support of the single one storey school, that uniformity of a kind must be expected in the individual school, though not in schools in general. Conditions of site, local building traditions, local materials and the ingenuity of the architect will prevent the building of stereotyped schools throughout the Province. So far as repetition is concerned of windows and doors in the individual school, it should be pointed out that repetition, and some degree of standardization is the very basis of architecture. One has only to think of the Roman aqueducts, of the Parthenon or the streets of London or Bath to realize that, far from producing monotony, standardization may produce real beauty.

8. On your instructions, Sir, we have prepared this Interim Report. Since our appointment on November 28th, we have met fortnightly, while certain Sub-Committees have been meeting weekly, others intermittently. Even so, we have not completed our task. We have studied British and other reports, and have visited schools in Ontario, and in the United States[4]. We have corresponded with architects in Britain and the United States, and have sought advice on different matters with the Departments of Education in fourteen States. We are in particularly close contact with the State of Connecticut, whose code for school buildings we consider a model of its kind. Based on the studies referred to above, we are rewriting the

1 ASA Project A62, American Standards Association, is an example.

2 "The Construction Industry in Relation to Post-War Economic Policy," by O. J. Firestone.

3 Forty pupils per classroom in the elementary school is a recommendation of The Department of Education of the Province of Ontario. For the Committee's views, in that connexion, see Paras. 47 and 48.

4 Skokie, Crow Island and Rugen Schools (all outside Chicago, Illinois).

regulations affecting school buildings, and these regulations, if they meet the approval of the Minister, will take the place of the many pamphlets that now form the School Building Regulations of the Province.

9. We are aware that your Department is constantly being asked for the findings of this Committee by those School Boards who are presently engaged in the designing of schools, and desire the most recent information. This report, therefore, will deal with some matters on which we are agreed; and will indicate others, which are still receiving study, and may be revised, in part, by further investigation; and by the results of the experiment in School Building at Port Sydney which the Committee is very happy, indeed, to undertake.

10. Under the following headings we have listed items that should be studied by the School Boards and their architects. Some, you will notice, are definite recommendations, while others suggest research on which we are engaged, and are given in some detail in the Appendix. Others have been taken directly from the draft regulations which will be included in our final report. Positive recommendations, mentioned above, appear in the text with explanations, but, as a matter of convenience, are separated and listed on page 179.

SERIOUS COMMON ERRORS

11. There are several errors that repeatedly arise in the conduct of school building programmes. The most serious ones are listed below, that they may be noted and avoided.

a. Commencing the design of the building before present and predictable future educational and community needs have been thoroughly considered. The Department should be consulted in these matters.

b. Undertaking a building project in the absence of a comprehensive and well-defined future building programme, involving additions or new buildings on the site, or in the same school district.

c. Using sites that are too small or otherwise unsuitable for school buildings.

d. Fixing appropriations before ascertaining the money actually needed.

e. Choosing an architect by means of a so-called "plan competition", or on non-professional bases.

f. Hurrying the preliminary planning of a building.

g. Leaving until after construction is under way, consideration of the functional design and equipment of individual rooms.

h. Making inadequate allowances for equipment costs and for the costs of grading, planting, walks, drives et cetera.

PROFESSIONAL ADVICE

12. School design and construction constitute a highly specialized branch of architecture. To give positive assurance of success, the school architect must be thoroughly conversant with trends and recent developments in the philosophy and practice of education; he must realize fully the demands and significance of each school activity, individually and in relation to the whole; he must possess the vision to interpret the aims of the educator, the ability and imagination so to co-ordinate his architectural elements that they will best fulfil their educational functions. Beyond this, the school designer must have the other qualifications of any good architect—artistry, technical knowledge and skill, tact, integrity and business ability.

13. The choice of the architect is both the right and duty of the local Board, and the selection cannot be made too early after the decision to build has been made. The architect can be of use in the selection of a site. His is the responsibility for the design of the school, and his vision of the plan, or the site, will, necessarily, be clearer than that of many Board Members. He will, for instance, realize, on the site, that the building may be properly oriented or not; that later additions will be possible, and without detriment to the master plan for the school: that drainage will be normal or difficult; or that levels are such as to require, or not to require, expensive fill. As a rule, he will keep himself informed of local town planning proposals and will know of sites set aside for school purposes, and, more particularly, of proposed traffic routes that might seriously impair the usefulness of a school and the safety of the pupils. Where cost is being discussed, it is important that the Board be guided by the architect, whose business it is to know costs and to be able to advise the Board that their budget is adequate or not. There are many pitfalls that can be avoided if the architect is at the service of the Board from the beginning.

14. The Committee recommends the early appointment of an architect.

THE SCHOOL SITE

15. An excellent building, in itself, does not constitute a good school. The site is as much a part of a school as is the building itself. Its qualities may augment or seriously curtail the performance of proper educational functions.

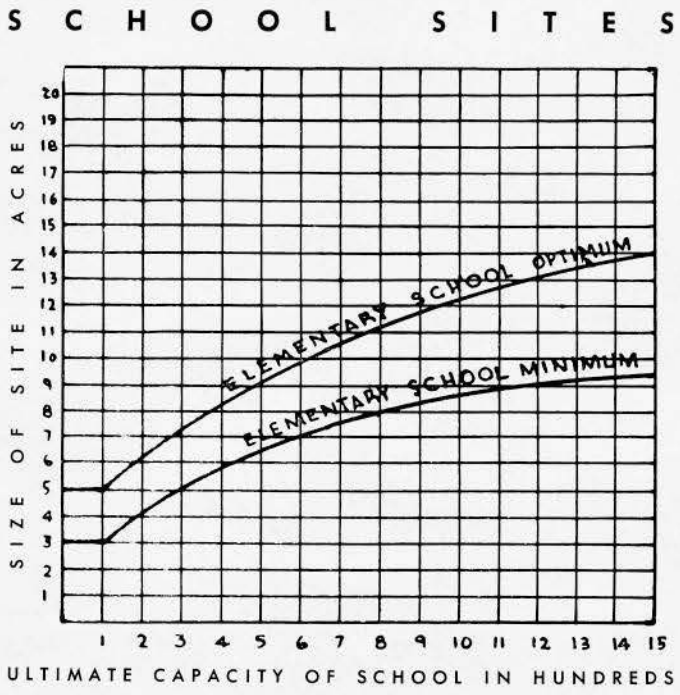
16. A modern educational programme extends beyond the four walls of a building. It turns to the out-of-doors to broaden and vitalize traditional school activities. The school garden, properly employed, offers to the child far more vivid learning experiences than can the schoolroom alone. Through corrective exercises, group games and athletic sports in the open air, the school reaches out to promote the physical health and social well-being of the pupil and the community.

17. School grounds, like the buildings, can give double returns when they are used, not only for ordinary school purposes, but as community recreation centres as well. Here children and adults alike may gather outside the regular school hours for play and relaxation, using to advantage the facilities that would otherwise lie idle.

18. The Committee has investigated the site requirements of the Departments of Education of some twelve States, with the following results. Taking the Connecticut Code as a workable ideal which the Committee would recommend, six States (California, Colorado, Illinois, Maine, Nebraska, New York) were in agreement, while one (Michigan) would increase both the minimum and maximum standards. Utah was writing its code, and while unable to state positively its position, was in general agreement. The four remaining States (Iowa, Pennsylvania, Texas, Ohio) gave us existing statistical information of no value as a basis of comparison.

19. The Committee has taken into consideration that the adoption of such a recommendation will add to the cost and maintenance of school sites. In regard to costs, it is clear that School Boards have not always realized how small a proportion of their capital expenditure is that paid for land in most instances.

20. The Committee recommends that the areas shown on the accompanying graph be the minimum and optimum requirements for elementary school sites.



MAINTENANCE OF GROUNDS

21. In regard to maintenance, the financial problem of increased help must be faced, but the Committee is strongly of the opinion that the educational value of work on grounds by the pupils themselves is not inconsiderable. The temptation to throw litter and to destroy trees, is discouraged, where all are responsible for the tidiness and the beauty of grounds and trees, and the experience of team work as a community effort cannot but be of value in the moulding of the character of the young citizen. Under the guidance of teachers, and with the help of normal maintenance staff, there is no reason why the care of school grounds should not be assumed by the children with enthusiasm and with profit[5].

22. The Committee, therefore, recommends that the principals of elementary schools be asked to organize the boys and girls of the school to assist the maintenance staff in the care and tidiness of outside school property.

PLAYGROUNDS

23. There are in Ontario elementary schools, 253,110 girls and 261,982 boys. The Committee finds that, in most Ontario school playgrounds, the area given up for girls' recreation is altogether too small, and no regulation exists stating how much should be apportioned to them.

24. The Committee recommends, therefore, that, if a separation is desirable, the grounds be divided more equally between boys and girls. Such dividing line between the boys' playground and the girls' should be indicated by a grass strip and low shrubbery, and not by any barrier like a fence or wall.

BASEMENTS

25. Except for the heating plant, the Committee can find no good reason for basements in Ontario schools, and this would be especially true for the one storey elementary school. The existence of rooms in a basement is merely a temptation to use the space for purposes for which it was never intended. In view of our findings in regard to the importance of adequate light and ventilation, the use of basement rooms for classroom purposes would obviously be a retrograde step.

26. The Committee, therefore, recommends schools without basements, except for specific purposes. The floor should be placed directly on the ground with suitable fill for drainage. It shall be placed slightly above adjacent finished grade. If any space is allowed below, the floor above that space should be of fire resisting construction. A part basement might be required for heating or the like.

PLANS

27. The Committee recommends the following plans, having regard, in the interests of economy, to minimum requirements of space.

A. shows a classroom, accommodating 40[6] desks, double rows, 20'-8" wide, clear between columns, with 7'-9" bays (4 per room), and with project space and coats placed on the side wall.

B. shows a classroom, accommodating 40 desks, double rows, 20'-8" wide, clear between columns, with 7'-9" bays (4½ per room) with project space and coat space placed at the rear.

C. shows a classroom, accommodating 40 desks, single rows, 22'-8" wide, clear between columns, with 7'-9" bays (4½ per room) with project room and coat space placed at the rear.

GENERAL DESCRIPTION OF CLASSROOMS

28. The internal dimensions of all three classrooms were dictated both by functional and economic structural requirements. Each room was planned for bilateral lighting in a one storey school, but may be used with unilateral lighting.

---

5 Such procedure has been followed, for many years, in a school for about six hundred boys in Otago, New Zealand, and there, even the exacting requirements of a lawn for cricket were handled by the boys. The grounds were well kept by a system of fatigues, and the task was looked upon as something necessary in the school life, and not as a drudgery.

In Skokie School (Winnetka, Illinois), the Superintendent, Mr. S. R. Logan, writes: "We do depend upon children under the leadership of teachers to keep their grounds in a neat and orderly condition. In addition to the regular routine for which the physical education classes take responsibility, there is a periodical clean-up day. Because the lawns are rather large and the Park Board makes its large machines available for cutting the grass, the children are not called on for that work. Under different conditions, it certainly would be proper and desirable to do so. At the junior high school, shop classes maintain outdoor equipment to the extent of their ability. . . . We think that such work, particularly if the students have a good deal of responsibility in the organization and management of it, has much more than a pecuniary value."

The report issued by the Government committee on Public Schools in England suggests that the shortage of help, due to the war, has indicated that a great deal of work, both inside the schools and outside, that was formerly done by servants, is now being done, and will continue to be done after the war, by the boys. The suggestion is very definitely made by that committee that, even in the great English Public Schools, there should be no pampering, and that there was no valid reason why a boy or girl at school should not be required to do at school, jobs that he would not find disagreeable or unreasonable at home.

6 Recommendation of The Department of Education for elementary schools in Ontario.

29. The advantages of bilateral lighting became apparent to the members of the Committee when they visited the Rugen School at Glenview, Illinois, where light readings demonstrated its efficiency in comparison with all other types of natural lighting, and particularly when compared with unilateral lighting (from windows on one side of the classroom only). It was from consideration of this feature that studies were prepared which resulted in the transverse section showing windows on the outer wall, and clerestory windows above the corridor roof on the inner side of the room. Vertical windows were used in the clerestory at the Rugen School

30. A 7′-9″ module was adopted for column and beam centres, as multiples of this dimension proved convenient for determining the longitudinal dimensions of the types of classroom shown, and the span of 7′-9″ permitted the use of 2″ planking for roof construction. The width of the respective rooms was determined by the length of beams. For Classrooms A. and B. the beams are 22′-0″ in length, and for Classroom C., 24′-0″ in length. These dimensions allow for the slope in the roof.

31. For bilateral lighting, the bottom of the beams at the windows is 9′-0″ above the floor, and 12′-9″ at the inner row of columns. Either vertical or sloping clerestory windows may be used. If unilateral lighting is used with a flat ceiling, special attention should be paid to the problem of lighting the inner portion of the room. The Committee is persuaded, at this stage of its investigation, that with uninterrupted window opening, and with adequate artificial lighting, a ceiling height as low as 10′-0″ would give good results. However, in order to obtain the recommended level of illumination on the inside row of desks, it would be necessary to operate the inner row of lights continually.

32. Directly below the roof boards, between the beams, a ceiling of ½″ fibre board may be provided, finished in a light colour non-gloss paint to reflect the light. This would provide thermal insulation, and acoustic treatment.

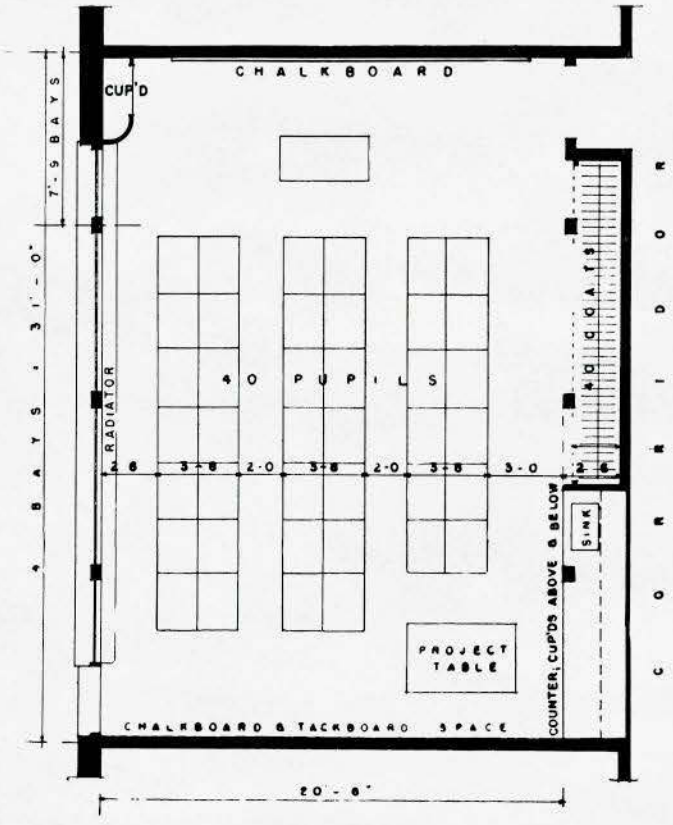
33. The coat closets provide for the hanging of coats on coat hangers supported by a rod. These hangers may be permanently secured to the rod by loose rings to prevent them falling to the floor. The hangers are spaced three to one foot, and will accommodate all the coats. Above the hangers two shelves are provided for hats and sundry articles. The shelves should be located so as to provide ventilation spaces at the front and back and a vertical stop should be provided at the back of each shelf. Provision should be made for the ventilation of the cupboards. Provision should be made for ventilation through or below the doors. Tackboard may be applied to the face of the doors.

CLASSROOM A

34. The minimum classroom with bilateral lighting.

(See Plan)

In Classroom A. the location of coat closets at the back of the room has been abandoned. In the former location, by



SCHEME A. ELEMENTARY CLASSROOM

lengthening the room, they increase the perimeter of the building, and lengthen the runs of heating and plumbing pipes. In Classroom A., they have been placed along the corridor side of the room, where space also was found for a sink and project cupboards. As the coat closets are located back of the face of the structural columns, no increase is incurred in the length and size of the main roof beams. One section shows the clerestory windows sloping inward at an angle of 30 degrees above the corridor. This arrangement presents a great effective window area to the sky, and conseqently admits more light than the vertical clerestory. (See Sections, page 177.)

35. Clerestory lighting, however, presents the problem of overcoming glare and direct sunlight in a classroom thus lighted, and several expedients were given consideration, with a view to overcoming this objection. The Committee agreed that the longitudinal axis of classrooms with bilateral lighting should be north and south, in order to provide east and west exposures for lighting, and thus avoid direct rays of noonday sun through clerestory windows of any type.

36. The use of baffles at the columns and mid-way between them to prevent objectionable glare, and, as an alternative, the use of a type of glass which would accomplish the same purpose, are being given consideration by the Committee, as it is thought important that the elimination of this nuisance should be automatic, and not dependent on the operation of manual controls.

37. The clerestory windows provide natural lighting at the inner desks, coat closets, sink and project space. Indirect artificial lighting may be provided by lights in suitable asymmetric reflectors, ranged along the tops of the cupboards, etc., at the base of the clerestory windows for use on dull days. With this arrangement, the greatest intensity of artificial light will occur on the inner side of the classroom.

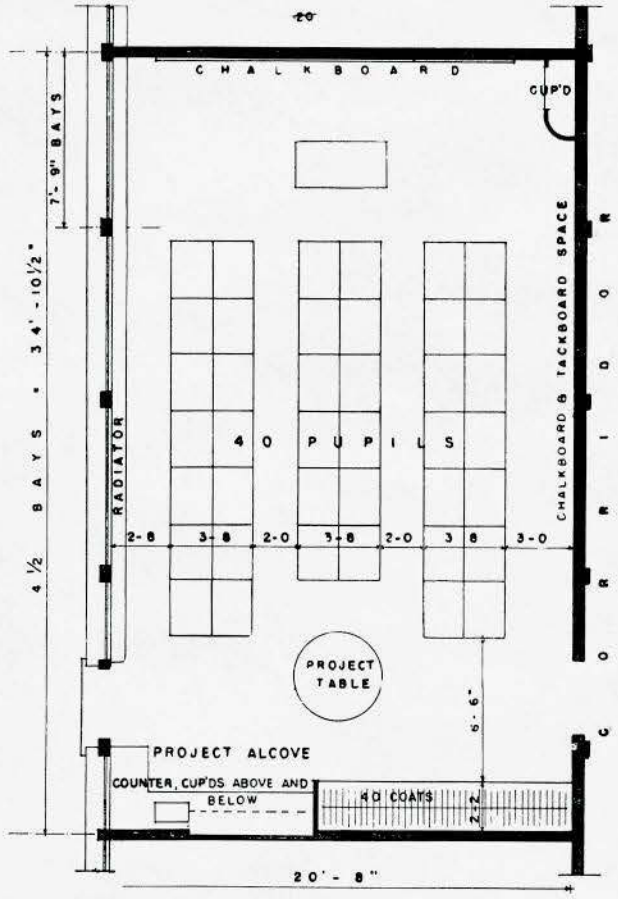
38. In order to accommodate forty pupils in a classroom of the dimensions given, double rows of desks and seats are required. The double rows of seats are an old feature revived. This seating arrangement is favoured by some leading educational authorities, and in a school in Forest Hill Village, and in many other schools, where it has been adopted, is giving satisfaction.

39. It is recommended that seats and desks be of the movable type.

CLASSROOM B

(See Plan below)

40. Classroom B. retains the minimum net width for setting, but is 3'-10½" longer than Classroom A., and the coat room and project area have been placed at the back of the room. This arrangement permits the use of continuous chalkboard or tackboard along the inner side.

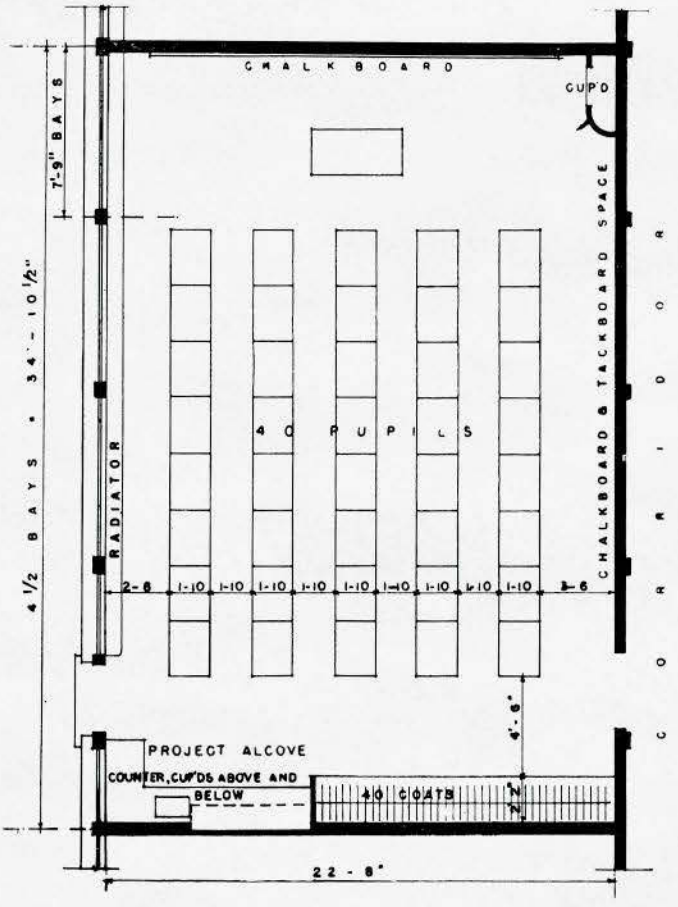


SCHEME B. ELEMENTARY CLASSROOM

CLASSROOM C

(See Plan below)

41. Classroom C. provides a room of the same length and arrangement as Classroom B., but has been widened 2' to accommodate five rows of single desks.



SCHEME C. ELEMENTARY CLASSROOM

CONCLUDING REMARKS ON PLANS

42. The Committee took actual prices in May, 1945, on two 8 room schools having equivalent accommodation in all respects —one being one storey; and one, two storey—and the result showed a saving in cost in favour of the one storey school.

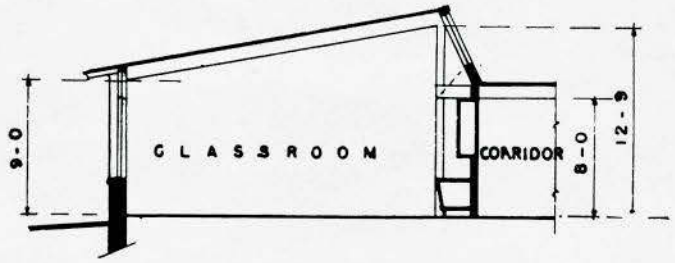
43. In presenting the "minimum" elementary school classrooms, the Committee offers an experimental proposal. Such rooms will be constructed in the school to be built from the Committee's plans at Port Sydney, Ontario. The experience there gained will determine the recommendations to be made in the final report.

44. In submitting these plans for a minimum classroom, the Committee wishes to stress the importance of leaving to the individual architect, scope for developing his own original

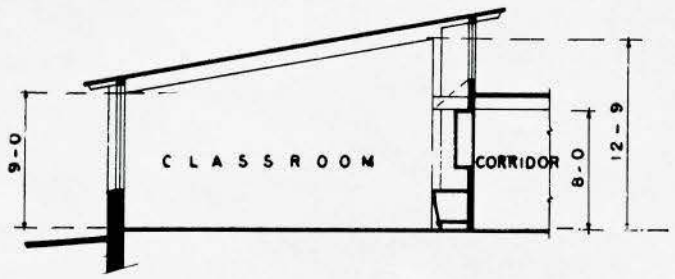
ideas, and they are not offered with the intent of rigidly imposing on him an unalterable classroom arrangement. Post-war developments in materials and methods may make deviations from these proposals desirable. The plans are presented to give direction. Considerable freedom should be given the architect in the arranging of classroom units in the plan of the individual school. Bilateral lighting is shown, but plans, other than those presented, are possible, which might provide better accommodation for project space and more freedom of movement within the room.

45. No apology is made for the radical changes in elementary school design which are here suggested. Lighting of 6 to 10 foot-candles intensity for the children at the inner row of desks in a standard classroom served by unilateral lighting, when 30 foot-candles is an accepted standard requirement, has convinced the Committee that the provision of adequate classroom lighting was one of its primary functions.

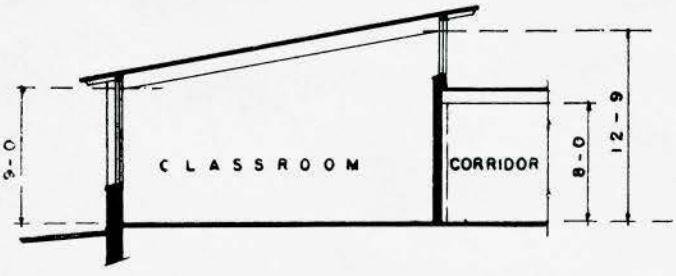
46. The Committee recommends that elementary schools be one storey in height.



SLOPING CLERESTORY WITH FIXED SASH
CROSS SECTION OF ELEMENTARY CLASSROOM SCHEME A



VERTICAL CLERESTORY WITH OPENING SASH
CROSS SECTION OF ELEMENTARY CLASSROOM SCHEME A



VERTICAL CLERESTORY WITH OPENING SASH
CROSS SECTION OF ELEMENTARY CLASSROOM SCHEMES B AND C

CLASSROOM CROSS-SECTIONS

SIZE OF CLASSROOM

47. Our work, in so far as the typical classroom is concerned, has been rendered more difficult, particularly in the vital problem of natural and artificial lighting, by the Department's present standard of forty pupils per room. The classroom plans shown above indicate minimum space requirements for that number of pupils, but, in each case, space conditions would be improved by a reduction in that number, or by increasing overall dimensions. The Committee realizes that, except for the physical problem of providing space, the number of pupils per classroom is outside its terms of reference. We feel, however, that this is a matter that should be given considerable study.

48. The Committee recommends, therefore, that the Department give further study to its requirements of forty pupils per classroom.

NATURAL LIGHTING

49. The Committee recommends that as much daylight as possible (and economically feasible) be admitted to the classroom by windows. (See also Appendix A, page 179.)

ARTIFICIAL LIGHTING

50. Natural daylight in the classroom shall be supplemented by artificial lighting, sufficient to maintain at all times, during which the rooms are in use for school functions, illumination in accordance with the values given in Table 1, Appendix A, page 179.

51. General illumination in rooms for study or instruction shall provide an even distribution of light over working areas throughout the room (including chalkboards, tackboards, floors, walls and ceilings). All surfaces shall be free from glare, extreme contrasts and dense or sharp shadows. Lamps shall be so installed in regard to height, location, spacing, reflectors, refractors, diffusers and other suitable accessories, as to accomplish these objects.

52. In certain rooms, such as a sewing-room, laboratories, etc., individual lights to supplement the general illumination may be required.

53. All lighting units placed within the pupils' normal field of vision, shall have a relatively low surface brightness in the direction of the pupils' eyes. (See Appendix A., page 180, section B, 3.)

54. In unilaterally daylighted rooms, each row of lights parallel to the long wall of the room shall be controlled by a separate switch.

55. Photo-electric control of lights in classrooms is recommended to eliminate faulty judgment of adequacy of illumination by the teacher. One photo-electric control is adequate for all similar and similarly oriented classrooms.

56. The Committee recommends that provision be made for electric illumination wherever electricity is available at reasonable cost. (See Appendix A, page 181, section B, 1.)

STRUCTURAL REQUIREMENTS

57. It is not possible in an interim report to cover all the requirements of the structural portions of school buildings.

58. Since both the Department and the Local Authorities are entitled to adequate assurance that the building is constructed

in accordance with sound practice, **it is recommended that the National Building Code of Canada[7] be considered as the minimum governing code for all structural requirements. Local requirements of building codes exceeding those of the National Building Code must be followed.**

59. We are of the opinion that all partitions should be removable without affecting the structural frame of the building, with the exception of fire walls.

HEATING AND VENTILATION

60. Well planned and properly executed floor (panel) heating systems have disclosed in Europe and the United States many advantages with regard to comfort and health, and also with regard to operating costs. As the differences in first cost and operating results in this country between these and the more conventional forms of heating systems are not yet available, it is still impossible to make a final comparison. It must be borne in mind that this type of heating may, in order to be satisfactory, require details of construction.

61. For single storey schools, the floor heating system is of particular interest. Its advantages, in this case, would be:

a. The heat is released in the strata of the room where it is most desirable.

b. The room will tend to give more comfortable conditions due to a more even distribution of heat.

c. Lower breathing level temperatures than in radiator heated rooms may be used without discomfort, which in itself is conducive to well-being and efficiency.

d. The fuel costs for equal degree of comfort are, therefore, lower than for radiator heating.

Note: A section dealing with this method of heating is contained in Appendix B, page 181.

62. Minimum cost ventilation could be best ensured by positive air exhaust from rooms, partly or entirely through or near wardrobes.

63. Recirculation of air from the building should not be employed, except where one room (such as auditorium, gymnasium, etc.) is served by this system. (See Appendix B, page 183.)

64. Wherever classrooms are equipped with mechanical exhaust ventilation, wardrobes, washrooms, etc., shall be also equipped with forced exhaust ventilation. (See Appendix B, page 183.)

65. Minimum Requirements:

a. Temperature 67 to 70 degrees Fahrenheit in the classroom at the local base temperature (approximately 15 degrees Fahrenheit above recorded lowest outside temperature).

b. Ventilation should be ample. The Committee is giving further study to the recommendation of the Connecticut Code that 15 cubic feet per minute of fresh air per pupil be supplied in each classroom.

7 The National Building Code of Canada was prepared under the joint sponsorship of the National Housing Administration of The Department of Finance and the Codes and Specifications Section of the National Research Council. Communications regarding this Code should be addressed to the Secretary of the last mentioned body.

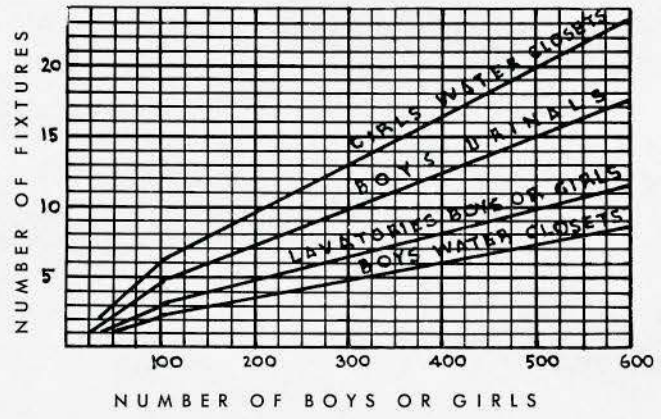
PLUMBING FIXTURES

66. Our recommended requirements for toilet fixtures have been taken, after considerable study, from the present regulations of The Department of Education in the State of Connecticut. The requirements for children up to one hundred in number approximate closely the existing requirements of The Department of Education in the Province of Ontario. Above one hundred pupils, the requirements are substantially lower. The Committee is of the opinion that a space and financial saving may be made here with advantage.

67. The toilet requirements in the existing regulations were made some years ago, based on the requirements of the school where all the children went out to recess at the same time. The modern staggered recess means that fewer children are using the toilet accommodation at any given time, and fewer fixtures are, therefore, necessary. It is true that all elementary schools are not following the staggered system, but if School Boards understood that, in addition to other advantages, a saving, amounting to several hundred dollars and in the larger schools, many thousands of dollars, could be made, the staggered system might become more general.

68. The Committee recommends the following requirements for plumbing fixtures for elementary schools.

TOILET FIXTURES



ACKNOWLEDGMENTS

69. The Committee is indebted to the Ontario Association of Architects for the generous use of their Boardroom for the meetings of the Committee, and to the University Club of Toronto, where weekly meetings of the Sub-Committee on Regulations have been held. Acknowledgment of our indebtedness to witnesses who have appeared before us; to Principals and Superintendents of schools which we have visited, will be given in our final Report, but it would be only proper to acknowledge here our great obligation to officials of the Department of Education for their courtesy and advice at all times.

Respectfully submitted,

E. R. Arthur, Chairman
Clare D. Carruthers
Burwell R. Coon
James H. Craig
E. L. Dodington
C. Blake Jackson
Forsey Page
John B. Parkin
Karel R. Rybka
Jack Ryrie
Alfred Ward
George N. Williams

SUMMARY OF RECOMMENDATIONS

Professional advice

1. The early appointment of an architect. (See Para. 14.)

School sites

2. That the areas shown on the graph be the minimum and optimum requirements for elementary school sites in Ontario. (See Para. 20.)

Maintenance of grounds

3. That the principals of elementary schools be asked to organize the boys and girls of the school to assist the maintenance staff in the care and tidiness of outside school property. (See Para. 22.)

Proportion of grounds for boys and girls

4. That, if a separation is desirable, the grounds be divided more equally between boys and girls. Such dividing line between the boys' playground and the girls' should be indicated by a grass strip and low shrubbery, and not by any barrier like a fence or wall. (See Para. 24.)

Basements

5. Schools without basements, except for specific purposes. (See Para. 26.)

Plans

6. Plans A., B. and C., having regard, in the interests of economy, to minimum requirements of space. (See Para. 27.)

Movable seats and desks

7. That seats and desks be of the movable type. (See Para. 39.)

One storey school

8. That elementary schools be one storey in height. (See Para. 46.)

Size of classes

9. That the Department give further study to its requirements of forty pupils per classroom. (See Para. 48.)

Daylight

10. That as much daylight as possible (and economically feasible) be admitted to the classroom by windows. (See Para. 49.)

Artificial light

11. That provision be made for electric illumination wherever electricity is available at reasonable cost. (See Para. 56.)

Structural requirements

12. That the National Building Code of Canada be considered as the minimum governing code for all structural requirements. Local requirements of building codes exceeding those of the National Building Code must be followed. (See Para. 58.)

Plumbing fixtures

13. That the requirements for plumbing fixtures be those shown on the graph on page 178.

N. B.: It should be noted that the above recommendations apply to Elementary Schools.

APPENDIX A

Lighting

The use of the eyes is so important in educational processes, and the evils attendant upon eyestrain, especially among the immature, are so well known that good lighting is acknowledged by all authorities to be a prime essential in schools. The exact constitution of good lighting is, however, less well understood. In the design of a system of illumination, either natural or artificial, modern practice takes into account four fundamental factors: quantity of illumination, spectral quality or colour of light, distribution of illumination and distribution of brightness.

1. Quantity or intensity of illumination.

Intensity of illumination is measured in foot-candles. Measurements of illumination cannot be made by the eye alone, but must be made by some recognized type of photometer, e.g., the photo-electric illumination meter.

Minimum recommended, and minimum permissible values of illumination intensity for various locations in the elementary school are listed in Table 1, below.

Table 1

Location	Minimum recommended ft.-candles	Minimum permissible ft.-candles
Classrooms and laboratories, on desks, tables and chalkboards; study halls, libraries and offices on desks or tables; shops, on work	30	20
Sewing rooms and all other rooms where fine detail work is to be done,—on the work	50	35
Sight-saving classrooms, on desks and chalkboards	50	40
Gymnasia, on the floor	20	10
Auditoria, assembly rooms, and lunch rooms, on the floor	10	5
Corridors, stairs, locker rooms, toilets, on the floor	5	4

2. Spectral quality or colour of light.

In general we can consider equal quantities of illumination of different spectral qualities to be equally effective in producing vision of the average black and white tasks met with in school classrooms. However, when coloured objects are viewed, their apparent colours are profoundly influenced by the colour of the light falling on them, and both colour and brightness contrasts necessary for vision may be materially altered. For these reasons our choice of light sources in schools is practically restricted to three common types—natural daylight, tungsten filament incandescent lamps, and white or daylight fluorescent lamps. Even among these sources there are wide variations in psychological effect. It is generally considered that for equal appearance of good lighting, a higher intensity of natural daylight or of fluorescent light is required, than of incandescent light. Foot-candle for foot-candle, however, these sources are approximately equivalent in producing vision in the classrooms; the difference is mainly apparent as a feeling of coldness or warmth of the light.

3. Distribution of illumination.

In a school room it is important to have as little variation of illumination intensity as possible, over the working plane. Reasons for this are:

a. High brightness contrasts caused by large variations in illumination produce glare and/or eye fatigue due to constant functioning of the adaptive processes of the eye[1].

b. It is unfair to expect students in the same classroom to perform tasks competitively under widely different visual conditions.

As a practical ideal of illumination distribution to which design should be aimed, the ratio of illumination on the brightest desk to that on the darkest desk should be approximately 2:1.

4. Distribution of brightness.

Brightness is measured in candles per square inch, or per square foot.

As previously stated, large variations of brightness (brightness contrasts) produce glare and/or fatigue of the eye due to constant functioning of the adaptive processes[1]. It is possible to eliminate, to a large extent, these extreme contrasts between large areas by careful choice of finishing materials and painted surfaces. It must be borne in mind, however, that brightness contrast between an object to be seen and the background against which it is seen, is necessary for vision. Elimination of contrasts applies only to large areas, and to small areas of extreme brightness, such as some light sources. A few suggestions for elimination of brightness contrasts follow:

a. Adequate control of direct sunlight by baffles, blinds, etc.

b. A few large, rather than several small window areas with dark spaces between.

c. Choice of light sources having a brightness not excessive in comparison to the average brightness of the general field of view.

d. Use of light coloured paints or finishes on walls and ceilings.

e. Use of light coloured furniture.

f. Use of light coloured chalkboards with dark coloured or black chalk[2].

A—Daylighting

The high values of illumination intensity obtainable by daylight throughout a large portion of the school year, as well as the highly desirable effect of openness produced by large window areas, makes the problem of illumination by daylight of prime importance in all schools, but particularly in elementary schools. Several systems of classroom daylighting are discussed below. In all of the allowable systems, the prime source of light is a large window in the outside wall of the room. This window should extend from not more than three feet above the floor to as close to the ceiling as is useful for admitting skylight directly to the working plane at the opposite side of the room.

1. Unilateral lighting. (See Figure 1.)

Until recently the standard type of cross-section for a classroom was as indicated in Figure 1, where the large window in the outside wall is the only source of daylight. The chief disadvantage of this system is the extremely rapid decrease of illumination intensity as distance from the window increases. The ratio of illumination on the outside row of desks to that on the inside row is usually about 10:1. Such a system produces poor visual conditions for students seated in the inside row, due to low illumination and high brightness contrasts. Electrical lighting is usually necessary over the inside row of desks at all times.

An improvement on this system is provided by installation of certain types of glass blocks in place of the window, which reflect and refract skylight upward to the ceiling, thus diffusing it more uniformly over the room. Where such blocks are used, the lower 2'-6" of the window must be glazed with transparent glass to avoid a completely closed-in sensation in the room. This system is of little use unless the ceiling of the room is high and the area of glass blocks large. One major advantage, however, is automatic control of direct sunlight by reflection to the ceiling.

Wherever the unilateral system of daylighting is used, the window shall be to the left of the students.

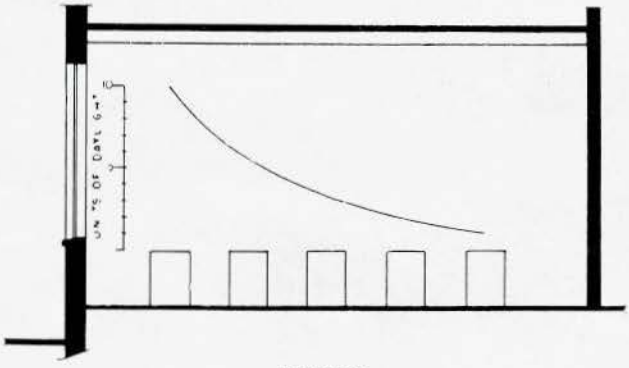


FIGURE 1

2. Corner Lighting.

In some schools, the window on the outside wall is extended around the back corner and some distance along the back wall. This system increases the illumination at the back of the room, but has very little effect at the front of the room. The appearance of such a room is very cheerful and open. This type of room is highly recommended for kindergartens and nursery schools, and for other rooms where little prolonged visual effort is required. Where adequate artificial lighting is provided, this type of room may be considered equal to or slightly better than unilaterally lighted rooms for prolonged visual effort.

1 Adaptive processes referred to here are the retinal sensitivity and pupil diameter changes caused by variations in retinal illumination.

2 At the present stage of investigation, this should not be read as a definite recommendation of the Committee, except for visual superiority and as an aid to more efficient artificial illumination. Other factors, such as cost, durability and suitable chalks, will be dealt with before such a recommendation is made in the final report of the Committee.

3. Bilateral Lighting.

In an attempt to increase the daylight illumination on the inside row of desks, several schools have been built using vertical or sloped clerestory windows over the corridor roof in addition to the large window in the outside wall. Such construction, of course, is possible in one storey schools only, or on the second storey of a two storey school. These experiments have proven to be eminently successful, and this type of daylighting is highly recommended, especially where electricity is not available at reasonable cost.

Figure 2 shows the illumination distribution across a typical classroom cross-section of this type. Note that the ratio of illumination on the outer row of desks to that on the inner row is approximately 2:1.

Where this system is used, precautions must be taken to prevent direct sunlight from entering the room at undesirable angles through the clerestory windows. The preferred axis of such a room is north-south, receiving east and west light.

In classrooms of this type it makes little difference whether the students face one end of the room or the other.

Even on overcast days, the illumination intensities in such a classroom are satisfactory. On only a small percentage of days in the school year, when the sky is very heavily overcast, would any supplementary artificial light be necessary.

4. Light obstruction.

The distance from a schoolroom window to any light obstruction, such as walls, buildings and trees, shall be twice the height of that obstruction above the sill of the window. This formula applies to both ordinary and clerestory windows.

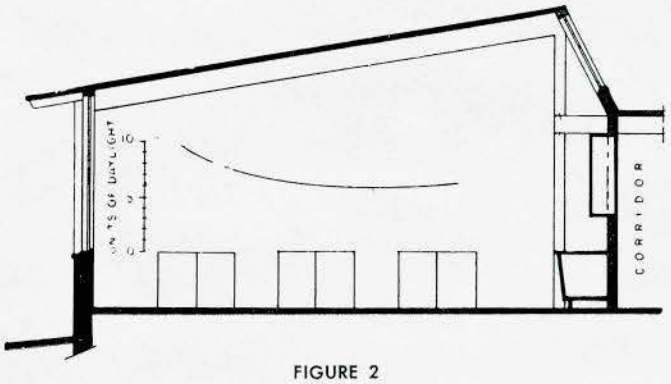


FIGURE 2

5. Control of Glare.

Adequate control of sky glare and direct sunlight should be provided in the form of fixed or movable baffles (preferably fixed baffles, if possible) or suitable shades. Shades should be of a highly diffusing, light coloured material, and should operate in two sections up and down from the centre of the window.

B—Artificial Lighting

1. Provision shall be made for electric illumination wherever electricity is available at reasonable cost. (Reasonable cost shall be interpreted as meaning average cost equal to or less than 8¢ per kilowatt-hour.)

2. a. In rooms which are used at night for any school or community function, the general artificial illumination on a plane 30" above the floor shall be designed to provide depreciated values of illumination as listed in Table 1.

b. In rooms which are not used at night for purposes other than cleaning and maintenance, the general artificial illumination may be designed to provide depreciated values of illumination equal to the difference between the values listed in Table 1, and the daylight illumination on the darkest desk on the darkest continuously overcast days of the school year. On the darkest continuously overcast days of the school year in Ontario, the sky brightness is approximately 55 candles per square foot, and the average school window transmits only about 60% of the light incident on it, due to average conditions of dirt.

3. Where any lighting unit is placed within an angle of 45 degrees from the student's normal line of vision, all surfaces exposed to view shall have a surface brightness not exceeding 3 candles per square inch in the direction of the student's eyes, over any square inch of its exposed surface.

4. a. In unilaterally or corner lighted rooms, each row of lights parallel to the long wall of the room shall be controlled by a separate switch. In most rooms of this type, the inside row of lights will have to be in operation continuously while the room is in use. As the human eye is a notoriously poor judge of illumination intensity, photo-electric control of lights at least on the outside row is desirable, especially where electricity is relatively expensive.

b. In bilaterally lighted rooms, separate control of lights is not a necessity due to the more uniform distribution of daylight, but for power economy some gradation of the amount of artificial light provided is desirable. Here also, photo-electric control is desirable to eliminate the human factor of inability to judge the adequacy of illumination.

APPENDIX B

Heating and Ventilation

Indoor air that is free of pollution and is kept at an optimum temperature is of primary importance for health and for efficiency. Economic considerations, however, limit the use of such heating and air conditioning systems, which would at all times, and automatically, ensure the maximum of comfort and efficiency. The need of compromise which was thus forced onto the highly mechanized automatic heating and air conditioning installations, in order to render their operation and maintenance economical, has defeated, to a great extent, their technical advantages, and, for some time now, the trend has been back to the simple and well-established heating methods.

A. Hot Air Heating.

Heating with hot air, which has many adherents, should be restricted to small, one or two room schools. In order to supply, without discomfort to the occupants, all the heat needed for comfort in the building, large quantities of air must be circulated. They exceed considerably the minimum quantities of fresh air considered necessary for the well-being of the pupils. In order to supply the heat economically, it then becomes inevitable to recirculate air from the classrooms. This is objectionable, as it renders impossible the separation of classrooms and tends to spread infection and to create lesser evils such as spreading of odours, dust, etc. These considerations apply equally to directly heated (small) and indirectly heated (large) plants. Another drawback is that recirculation from the coldest points of rooms (under windows) is not always possible—particularly with floors on ground—and the coolest air in the room is forced to travel often right across the floor, to recirculating openings causing marked drafts.

Heating with unit heaters has been used, to some extent, but— if these operate intermittently—is not satisfactory, due to changes in air currents and air temperatures; even continuous, variable temperature operation, has the drawback of highly concentrating heat supply, and considerable air currents along floors to return ducts.

The same reasoning applies, to a great extent, to unit ventilators, unless they operate entirely without air return. In addition, fully satisfactory control of heat supply is difficult and expensive.

B. Hot Water Heating and Steam Heating.

In general, until further research has broadened the field, it can be considered safe practice in schools of more than two classrooms, to employ direct radiation (or convectors) using hot water as heating medium, provided that simultaneously sufficient fresh air is brought into the classrooms to ensure comfort and good health.

The reasons for the preference for hot water heating over steam heating systems are the following:

a. Hot water ensures continuous heat supply at varying temperatures; this is closely approached by sub-atmospheric steam heating, though the control of the hot water systems is easier and simpler.

b. If equipped with a circulating pump, it is independent of the relative location of radiators, mains and boiler (as long as care is taken to properly vent the system).

c. Hot water heating supply and return mains may be run parallel, that is, they may grade in the same direction, and often have been installed with negligible slope, whereas steam heating systems require, for satisfactory and quiet operation, opposite grading of steam and retain mains, sufficient slope and location of condensation receivers below low point of return.

d. Minor deviations from accepted requirements of installation, will tend to defeat quiet operation in steam heating systems, whereas a hot water heating system is under all working conditions quiet.

e. A very important point is that usual water temperatures of hot water heating systems are, below the temperature, apt to decompose organic dust particles which create small amounts of irritant fumes, and lead to feeling of dryness: even well designed vapour systems tend to reach, at times, 200 to 215 degrees Fahrenheit, when this decomposition becomes inevitable.

These reasons apply generally, but they assume more importance in single storey buildings, particularly if it is desired to eliminate overhead piping.

The only disadvantages of the hot water heating system—against a sub-atmospheric steam heating installation—are that it is somewhat sluggish in heating-up or cooling, and, due to lower temperatures, is somewhat more susceptible to freezing, if operated carelessly.

Heating by direct radiation, if properly planned, has proven itself reasonably satisfactory, as it ensures:

a. Placing of heating surfaces where most needed, in order to counteract heat losses, namely, under windows and at outside wall.

b. Preheating of air introduced for ventilation through windows, and correcting for inadequacies of leaking window frames and sash.

c. Counteraction to the radiant cooling effect of windows, etc., on the nearby pupils.

d. Air circulation throughout the room, due to the inherent convection currents, thus giving reasonably even temperature distribution in the heated space.

e. Good central control of the heat in accordance with outdoor temperatures or other demand factors.

f. Reasonable first cost.

Disadvantages are occasionally cited:

a. The space requirements of radiators and the difficulty of keeping them clean.

b. The massed heating surfaces which may be objectionable to nearby pupils. This is, however, usually due to faulty design.

c. Noticeable and possibly objectionable convection currents and cold floors—particularly where floors are laid on grade (this later objection does not apply to the hitherto usual classrooms with heated spaces underneath).

C. Ventilation of Classrooms.

The required quantity of fresh air could be introduced — with radiator heating — through windows or other openings directly from the outside; the spent air should be exhausted through suitable ducts or ventilators in or near the wall opposite the air inlets, and should be preferably forced by means of fans, to ensure positive air movement regardless of atmospheric conditions.

Supplying heated fresh air—without recirculation—through a central supply system would be an improvement over the above simpler method, particularly as it would eliminate possible drafts from open windows in cold weather. The cost of such a system would be moderate, and it would allow the maintaining of an optimum air humidity, if desired.

Systems of ventilation which employ recirculation of some of the air should be eliminated for the same reasons as hot air heating.

D. Panel Heating.

Very satisfactory results have been obtained in many British schools, and in some schools in the United States with heated floors—which is one of the many forms of the recently much discussed panel heating. In this country, no practical results are yet available with these forms of heating, and they must be considered experimental. If properly planned, they have a beneficial effect on the comfort and, through it, on the health and efficiency of the pupils. It must be borne in mind that, with floor heating:

1. Even in our climate, the floor temperature must still be kept at or below body temperature, as in milder climates. This will necessitate larger heating surfaces, which may exceed the available floor area, unless some or all of the following measures are applied:

   a. Windows should be at least double glazed, and may require triple glazing in the colder sections of the Province.

   b. Heat transmission through roof areas of single storey buildings should be reduced by suitable insulation.

   c. Uncontrolled air ingress through window cracks, etc., should be restricted to a minimum, or better, eliminated.

2. Due to the slow temperature change of the heated floor, controls must be exacting and anticipating, which adds to their cost.

3. Due to the distribution of heat supply over the entire room, it is difficult to provide draftless ingress of air, and this may force introduction of a supply ventilation system.

4. At the present time, panel heating systems probably will be more expensive than good direct heating systems. This is due to the considerably increased amount of work which needs to be done at the site, and the need of particularly skilled mechanics to do this work.

If any of the above precautions are neglected, the heating and ventilating system will show serious shortcomings during the colder season, *viz.*, it will either not permit the introduction of the required fresh air, or it will have to be operated at objectionable and even detrimental surface temperatures, as an increase of the heating surface beyond the available floor area is difficult.

E. Requirements.

Although many authorities recommend classroom temperatures of 65 to 68 degrees F., the general practice has been to design school heating systems for 70 degrees F., which must be ensured at the recognized base temperature (outdoors) applying in the particular locality. This is usually taken at 15 degrees F. above the lowest recorded local temperature for the ten preceding years.

In addition, sufficient heating capacity should be provided to warm the minimum amount of fresh air required for proper ventilation, through the above temperature range. (In lower cost schools, this is often neglected, and forces elimination of air supply on very cold days.) This shall be either distributed over the entire school or centralized, where central supply ventilation is provided.

For floor heating systems, the desirable room temperature may be set 3 to 5 degrees F. lower.

The minimum quantity of fresh air supplied to the classrooms, when in use, should be 15 cubic feet per minute per pupil. To ensure this, either the exhaust ventilation system, or the supply ventilation shall be designed for this full capacity.

Wardrobes and clothes cupboards should be provided with exhaust ventilation from the top and, of course, with an air inlet at the bottom. If general exhaust is mechanically forced, wardrobe exhaust must also be mechanical.

Washrooms shall be provided with exhaust ventilation which must be mechanical, if other parts of the building have mechanical exhaust ventilation, in order to prevent back-flow.

Auditoria, gymnasia, laboratories, domestic science rooms, etc., shall be ventilated by means of exhaust ventilating systems designed to thoroughly dispose of any pollution originating therein. Supply ventilation may have to be added for some cases.

The designer shall be responsible for low surface temperatures of heating surfaces, quietness of operation of mechanical equipment, reduction of air currents to limits conducive to health and comfort, etc.

Heating systems in small schools may be centrally controlled, either manually or automatically. In larger installations, zoning according to exposure is justified. Individual automatic room temperature control is a refinement which has lost some of its earlier importance, due to recent improvements in zone or central controls, and elimination of steam heating systems with constant steam pressure.

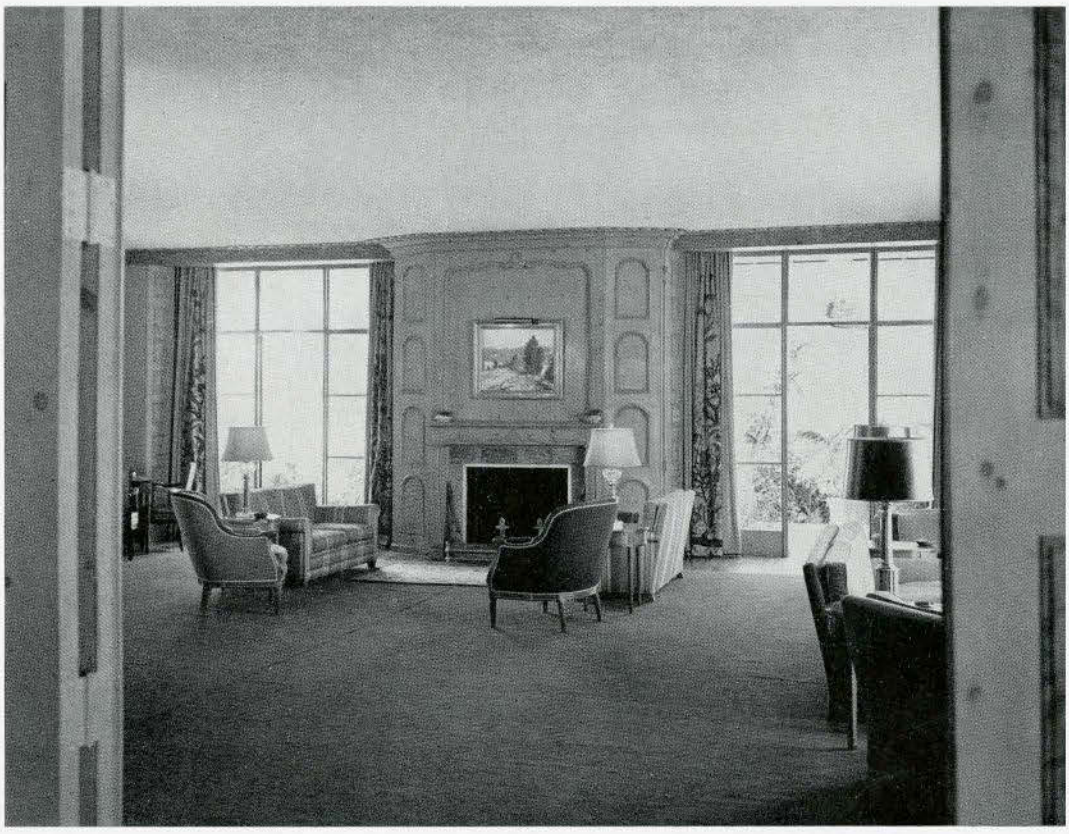
Some of the aspects of heating and ventilation, such as maintaining a given air humidity, cleaning or air supply to classrooms and other related subjects have not been dealt with in this report.

The Committee wishes to express its indebtedness to the authors of the Connecticut Code for School Buildings. The section "Serious Common Errors" (para. 11) has been copied from that Code.

Photos, P. Lalime

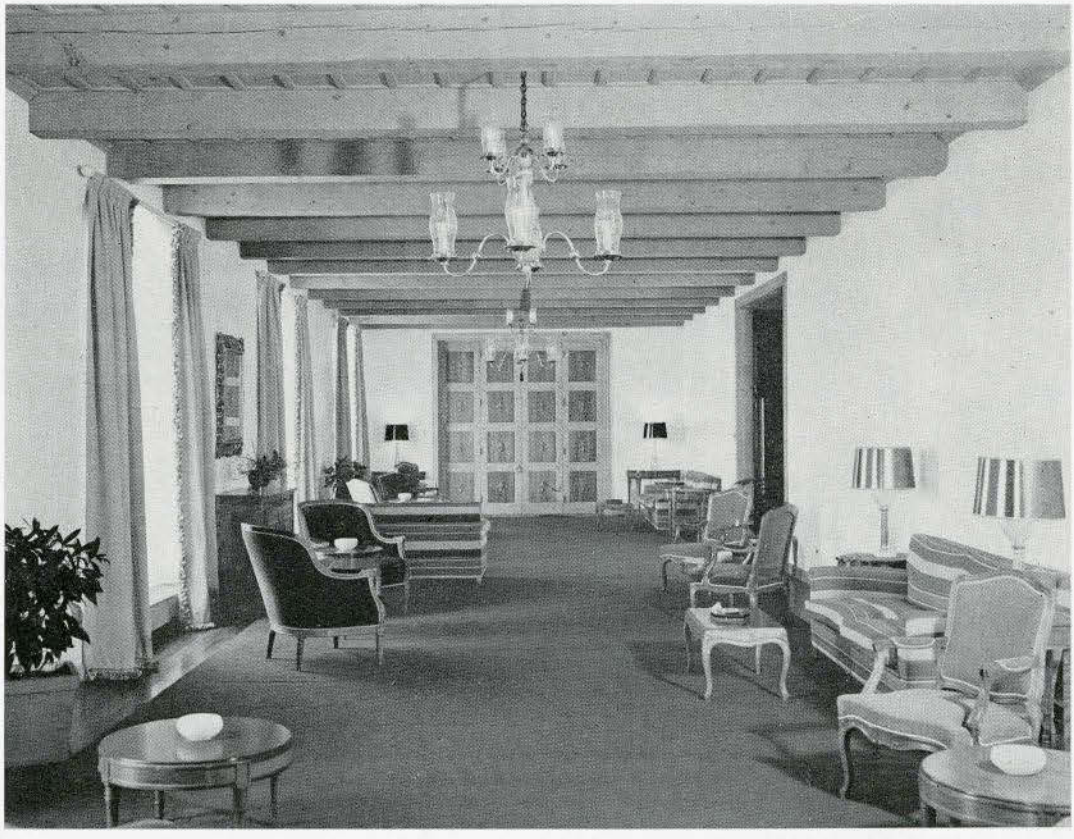
SAGUENAY INN, ARVIDA, QUEBEC

FETHERSTONHAUGH AND DURNFORD, ARCHITECTS



FIREPLACE IN MAIN LOUNGE

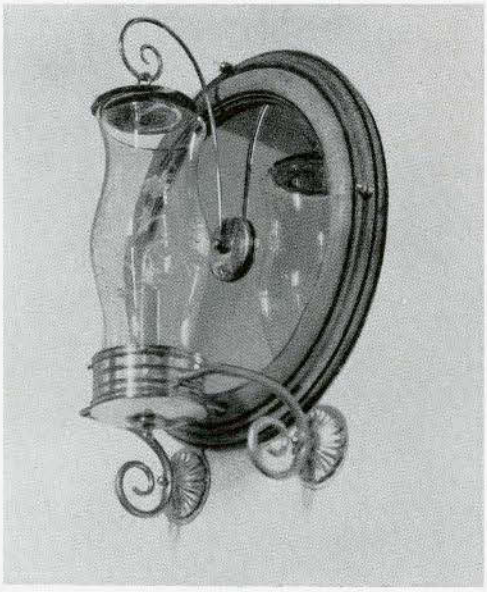
Canadian Craft Window Hangings to Special Design.



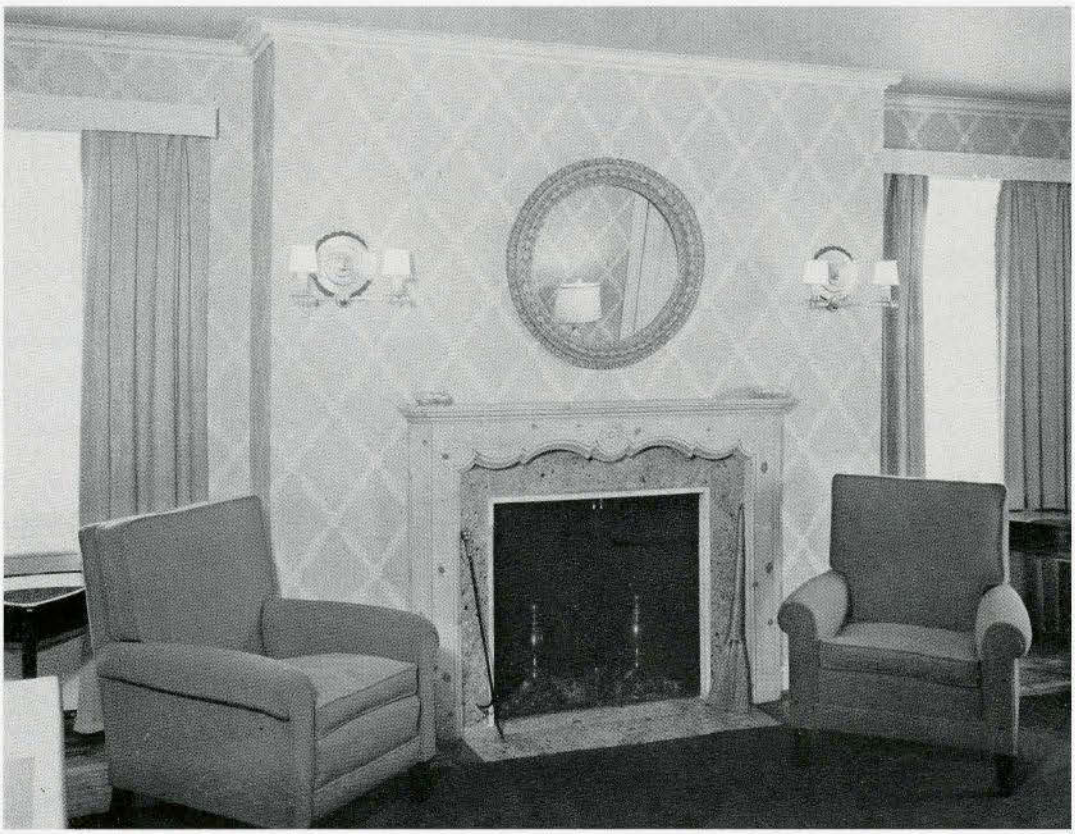
MAIN LOUNGE LOOKING TOWARD DINING ROOM

Demerara Wood Panels with Aluminum Fleur-de-Lis Mounted.

MAIN STAIR. ALUMINUM BALUSTERS AND LIGHT FIXTURES

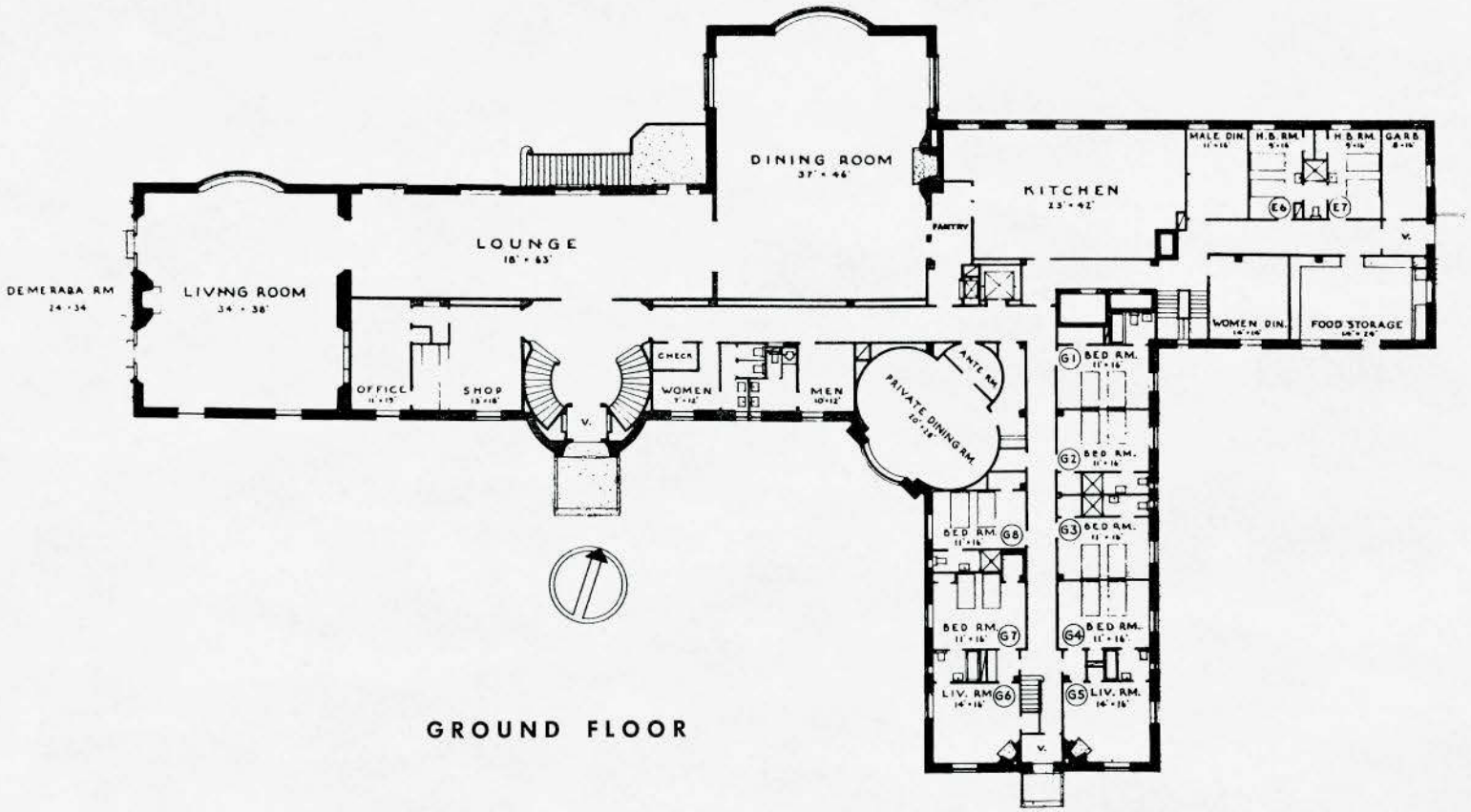


DINING ROOM WALL FIXTURE IN ALUMINUM AND BRASS

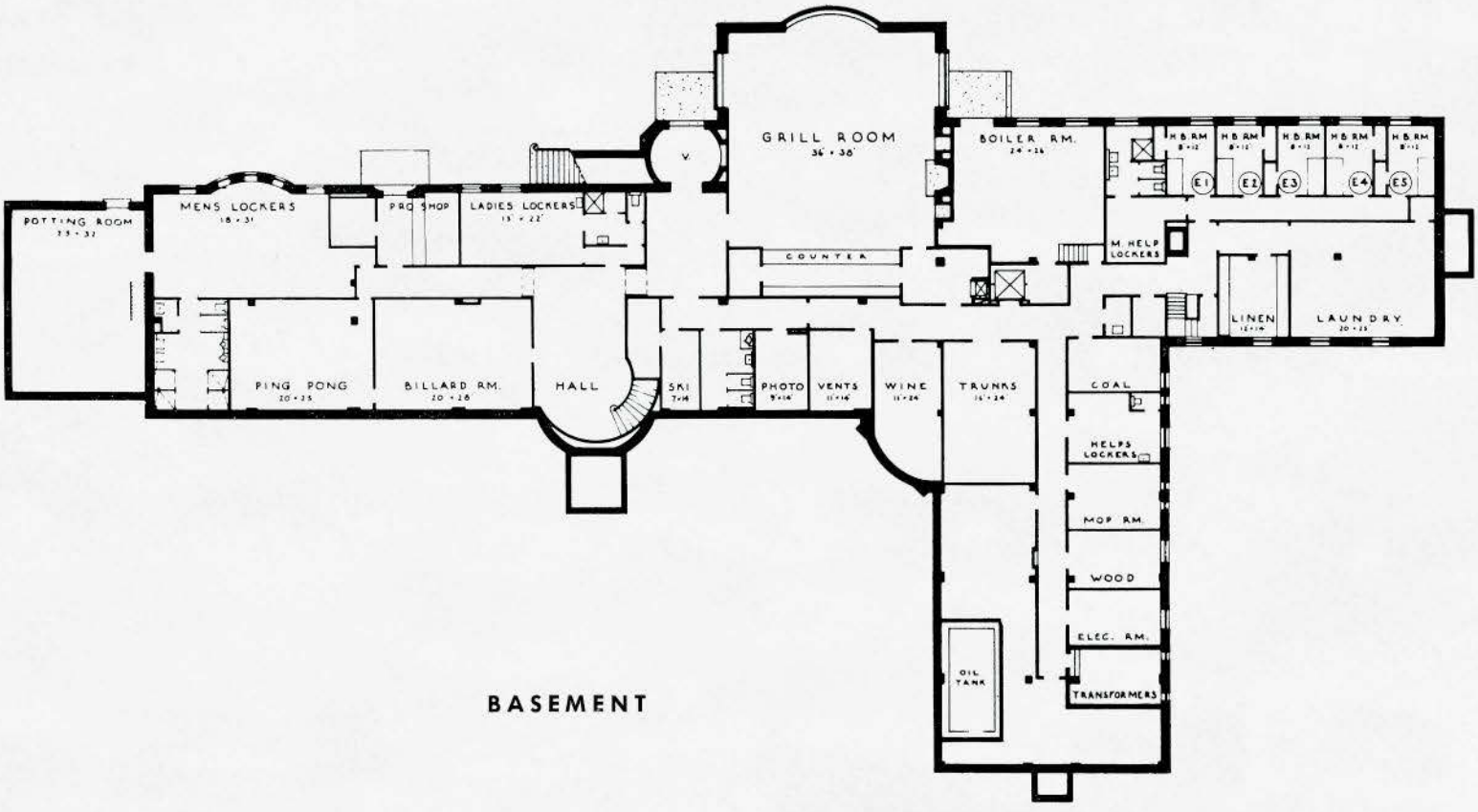


FIREPLACE IN DIRECTORS' SITTING ROOM

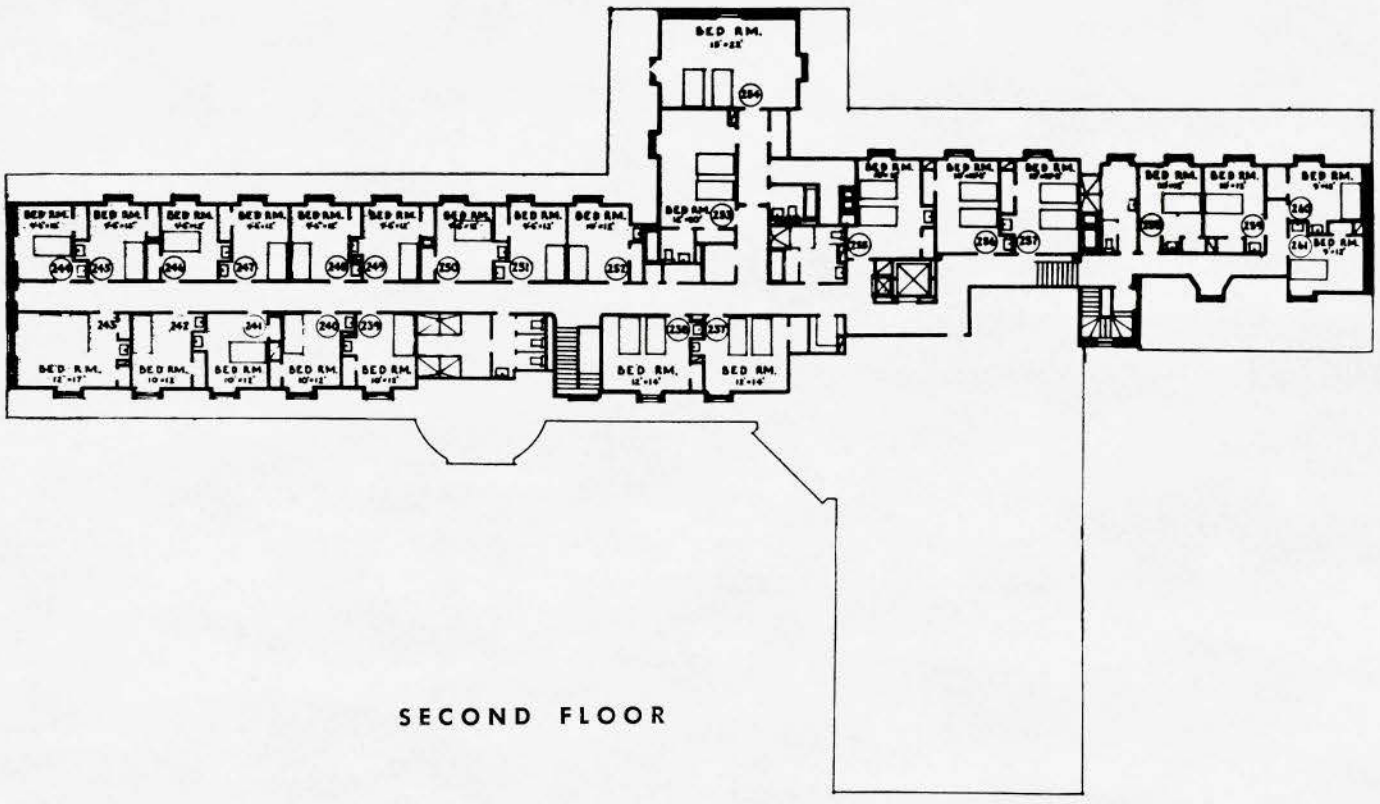
THE GRILL



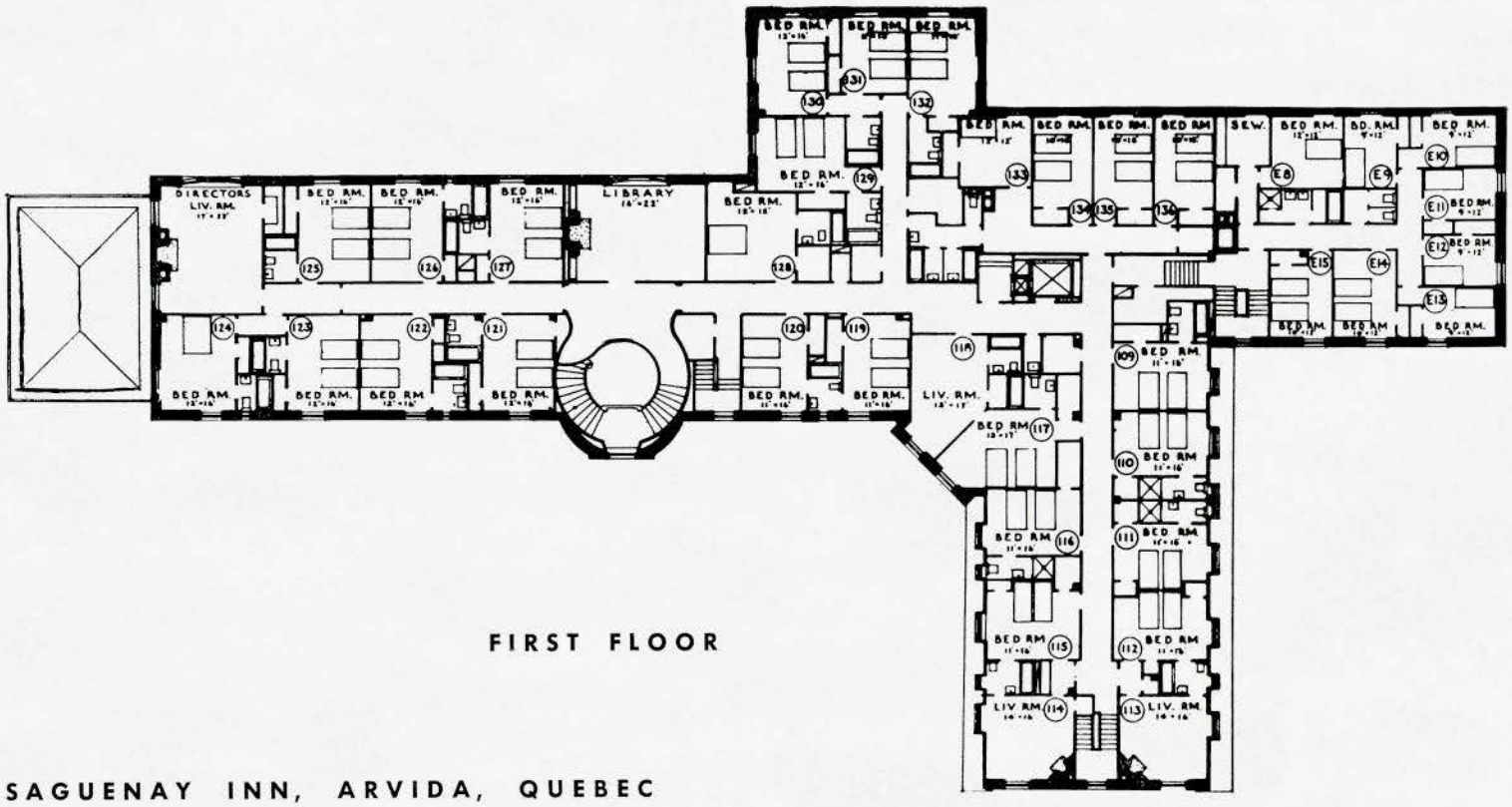
GROUND FLOOR



BASEMENT



SECOND FLOOR



FIRST FLOOR

SAGUENAY INN, ARVIDA, QUEBEC

ADVANCES IN THE ART OF SCHOOLROOM DAYLIGHTING

By FRANK WYNKOOP, A.I.A.

Frank Wynkoop, A. I. A. Born 1902, Denver, Colorado; education, High School and post-graduate. Began practice 1921. 1925 to 1936 designer in offices in Los Angeles, Seattle and Fresno. Opened office in Bakersfield 1937. Licensed to practice in State of Washington 1929, California 1937, Oregon 1942. President Seattle Architectural Club 1928. Member A.I.A. 1940. Designed Edmond Meany Hotel, Seattle, Washington, while with R. C. Reamer, Architect. Principal practice at present Public Works.

Editor's Note: The article by Mr. Wynkoop appears by coincidence in this issue, and is not part of the Interim Report on Elementary Schools by the Committee on Planning, Construction and Equipment of Schools in Ontario.

An architect acquainted with technical papers on natural illumination cannot fail to be impressed with the backwardness in actual practice, as expressed in fenestration and planning. Many accepted rules dictating the depth of schoolrooms in relation to height and window area result at best in undesirable extremes of light intensity and brightness in the interior.

"Why, with an abundance of light outdoors, do we go indoors and turn on lights?"

The modern one-storey school, free of such restrictions, affords great latitude in the experimental daylighting of classrooms. No school design today should, during the school day, require supplementary artificial illumination except under extreme circumstances such as heavy storms.

Laboratory tests have less value than empirical findings. The architect and his associated engineers are perhaps the only people aware of all the actual problems.

The approach involves questions of planning (as required by school boards for educational purposes), of daylighting principles, and of structural devices.

Planning Requirements

We shall concentrate our discussion on the elementary school with a so-called activity programme. Educators describe this programme as one which permits children "to engage in worthwhile, satisfying experiences." In purely physical terms this amounts to providing a great deal of extra usable floor space.

The rooms of the past, averaging 22 ft. by 32 ft., have proved inadequate for the diversified activities. Using conventional window lighting and increasing the length of the classroom brought about the general use in California of a classroom 23 ft. wide by 40 ft. long, with 9 or 10 ft. of length to the rear end of the room devoted to cloak space and a work alcove. This arrangement put the farthest children beyond the effective reach of the teacher, and it also permitted no more than one or two arrangements of seating, because of the unilateral direction of the light. This has brought a desire for wider rooms embracing approximately the same floor area, and lighted in such a way as to provide complete flexibility in arrangement, and short distances for the teacher. Storage facilities have to be designed for specific purposes.

The room designed for such activity programmes must provide ample work counter space, a possible reading circle and a library group, and a teacher's desk or station so placed that she can easily supervise all groups. In California an outdoor walled terrace of the same area as the classroom has been added as an adjacent outdoor classroom.

Lighting Requirements

For the sake of economy, it is desirable to use daylight alone throughout school hours.

Requirements are:

Sufficient intensity of light, under any and all outdoor conditions from 9 a.m. to 3 p.m., for close seeing tasks of young pupils whose eyes are still in the formative stage.

Correct light without recourse to manual control. Experience indicates that such controls are neglected and misused.

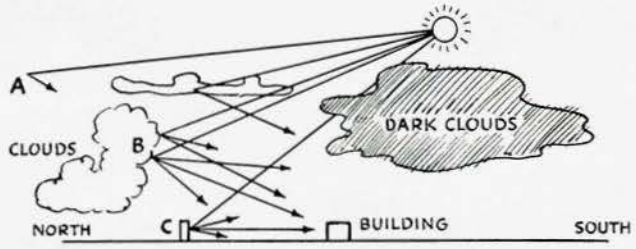
Adequate artificial illumination to supplement daylighting under extremely unfavourable outdoor daylight conditions, and to permit night-time use of the classroom, as well as janitor service in the evening.

Light should have a slightly directional effect—in other words it should cast some shadow — and interior intensity or volume should be so high that there will not be uncomfortable sense of glare when occupants face windows (glare is not an absolute quality but an effect of extreme contrast).

Light should be of equal intensity throughout the room. Light should have colour characteristics that are soothing and not depressing.

Intensity and diffusion of light should be so level that any furniture arrangement is possible without eye discomfort.

Fenestration should allow a view of outdoor landscape for psychological purposes as well as for eye exercise.



ASPECTS OF BRIGHTNESS. Reflected light from clouds (B) is brighter than from a clear sky (A). A white wall (C), even if it stands in the shade, is a more powerful reflector than sky (A)

Daylighting Principles

Light should approximate as nearly as possible the conditions found in nature. One highly desirable attribute that has been almost universally neglected is easy transition from outdoors to indoors and vice versa. An extreme example of discomfort is that of coming suddenly into bright sunlight from a motion picture theatre. This often produces headaches and is undoubtedly harmful to the eyes. School corridors are transitional elements between classrooms and the out-of-doors and should therefore have even higher illumination than the classrooms instead of being the darkest part of the entire building.

It is logical to expect the eye to operate most efficiently under ratios of brightness met most frequently in nature. In terms of intensity, the general average of daylight illumination outdoors is in the neighbourhood of 4,000 foot candles, with a maximum of 6,000 and a minimum of 60 foot candles and an extreme high of 10,000 foot candles. In this context, intensity means the amount of light falling from a vertical direction on one square foot of a horizontal plane.

Brightness is something else. It means the amount of light that strikes the eye from a unit area in any direction, no matter whether the source is the sun or the sky or some object reflecting light. In nature the greatest ratio between maximum and minimum brightness in a segment of the horizon 60 degrees wide seldom exceeds 36:1 and the average is only 13:1. A hazy sky is several times brighter than a clear one and has the same white colour as the sun, while the light from a clear sky is very poor in yellow and red rays, and calls for correction by the addition of reflected sunlight.

Another characteristic of the eye is that visual acuity is at its best when the central area under observation is brighter than the surroundings by about 2:1. Vision suffers when this contrast is more than 10:1. White paper is assumed to be the object under observation.

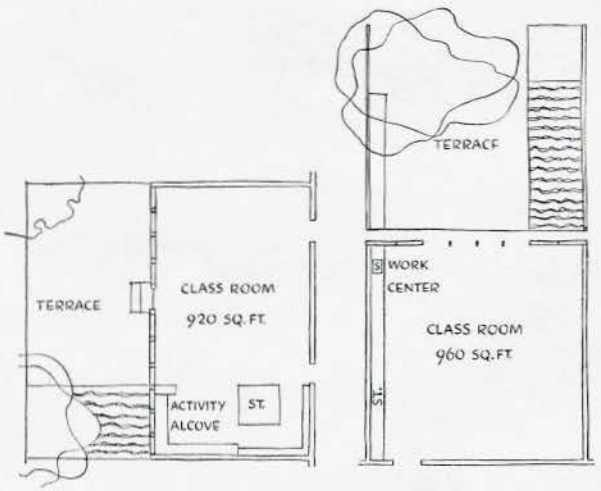
Translating these terms into classroom practice, it is the writer's opinion that natural illumination in classrooms should not fall below 15 foot candles and should never fall below one-hundredth of the illumination intensity prevailing outdoors. (These measurements never involve light coming directly from the sun.) The line of vision from within a classroom should never include a view of the sun or of objects very strongly reflecting the direct sun. In other words, the sun is far from being the only possible source of light. The sky is a major source, and every object reflects sunlight in some degree thus becoming a source of light. Some objects are brighter sources than the sky itself: thus sunlit snow may be 40 times as bright as a deep blue sky, and even in the shade a white wall is brighter than a clear sky.

On dark days, when outdoor intensities reach fewer than 1,500 foot candles, it is probable that the indoor level cannot in practice be raised above 15 foot candles (a ratio of 1:100); under such conditions supplementary artificial illumination will be required. Hourly tests were conducted in New York City at the Central Park Weather Observatory during the year 1938. So far as the school day was concerned, embracing the time span between 9 a.m. and 3 p.m., there were only two months during which intensities fell below the requisite 1,500 foot candles during school hours. This occurred in December and January, between 9 and 10 a.m., and between 2 and 3 p.m. When outdoor lighting intensity reaches the maximum of 10,000 foot candles it should be possible to obtain 100 foot candles indoors; for the average outdoor level of 4,000 foot candles it should be possible to obtain 40 foot candles indoors; and it may therefore be said that 40 foot candles constitute the design requirement.

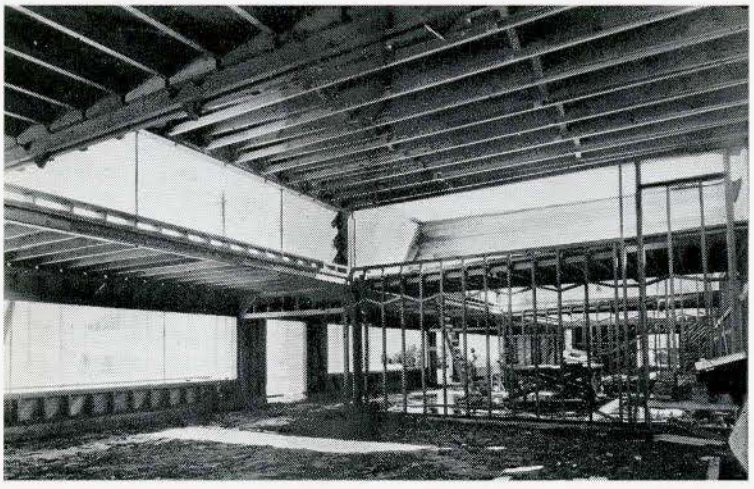
Large windows are required for this purpose and one often hears it said that "such large windows would be glaring." In point of fact, glare is not the result of big areas of high absolute brightness but is the result of excessive brightness *contrasts* which exist where small windows are cut into large areas of wall.

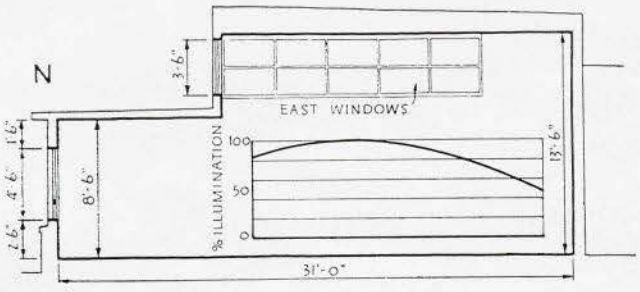
Design for Seeing Ease

Interior finishes are as important in daylighting as the reflector of a lamp in artificial illumination. Ceilings should



CLASSROOM TREND. Oblong classrooms, such as that shown to the left, have tended to become too long when activity alcoves were added. The square classroom is preferred





1. *Avenal School. Photograph shows construction, and section the effect, of lighting by means of* monitors, *like those of factories, offset to the north and west of each classroom*

be matte surfaced in a colour just off white, with a reflection factor of 85 per cent. The walls above the chalkboard should have a reflection factor of about 65 per cent. and the balance, including pinning boards, around 50 per cent. Because the eye is more sensitive to light from below, the lower wall and floor may be reduced to 35 per cent. and 20 per cent. reflection factors.

Bright reflection from polished desk tops and counters should be avoided. Desk tops should be light in colour to avoid the strain consequent upon strong contrast between the desk and the books or papers in the direct field of vision.

Extensive bright matte surfaces acting as secondary light sources (outside of the direct line of vision) are not only the best reflectors but the best means of avoiding glare. Also they produce the yellow and red rays lacking in clear sky light.

Summarizing we may say that a well lighted interior falls within the following limits of tolerance:

Intensity: maximum obtainable ratio 1 indoors to 100 outdoors; minimum intensity 15 foot candles.

Distribution: maximum ratio of 1:2, with the character of the light well diffused.

Brightness: (meaning the reflection factor of everything within every possible line of vision) maximum ratio of 1:15.

Examples

The development of a square, well-lighted classroom led to the use of clerestory lighting. The author's first experiment at the Avenal School involved the use of square monitors with clerestory lights running around the angle formed by two adjacent sides.

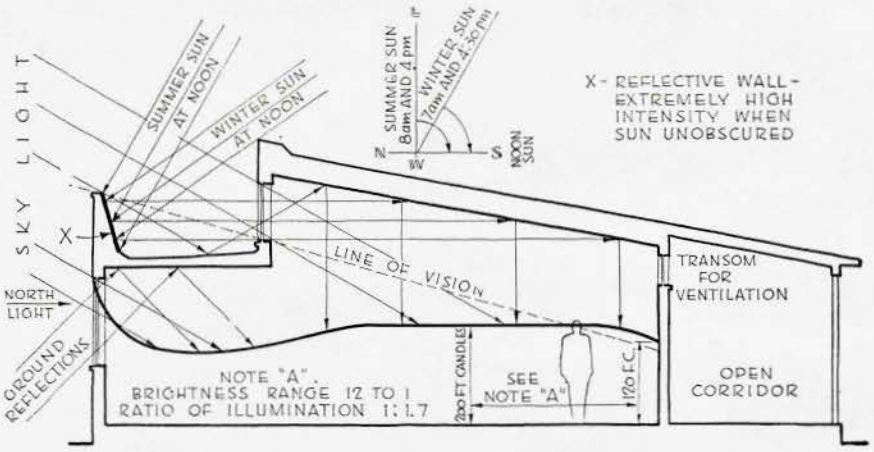
In the Paso Robles School, published in the June, 1945, issue of *Architectural Record,* the system was changed to something roughly corresponding to the sawtooth system in factories. In order that the light might be diffused, and in order to avoid the glare of direct sunlight, all windows were placed to the north. An invention was made there which permitted the deflection of additional sunlight into the room by means of a parapet wall acting as a reflector (see diagram). (The high brightness of white-walled buildings in strong sunlight is familiar to us all.) This parapet has been especially useful on clear sunny days when there has been an absence of white clouds to act as reflectors from the north. The parapet is outside the direct line of vision from within the classroom.

Structural Characteristics

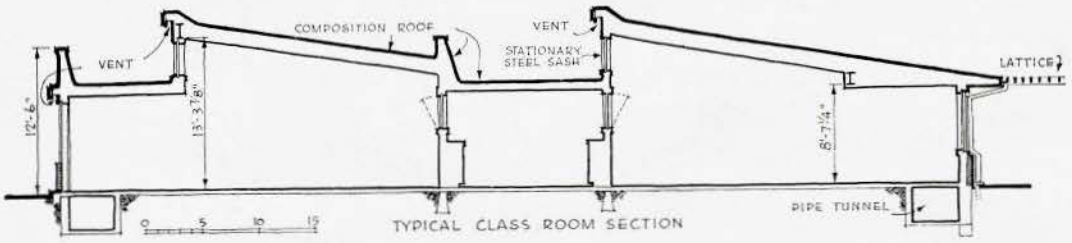
This solution is simple in construction and presents no special difficulties in framing to resist seismic forces. The windows are continuous both in the lower exterior wall and in the clerestory. The lower window mullions are pipes of 2-in. diameter. The upper or clerestory mullions are pipes of 1½-in. diameter, with steel hanger rods threaded through the pipe. A 16-in. steel beam at the head of the clerestory windows spans the entire 32-foot length of the room. On it are carried the sloping rafters above the high ceiling area of the room and from it the lower roof is carried by suspension. Both rooms are used as diaphragms transferring the lateral forces to solid-sheathed shear walls acting as partitions between classrooms, and to the columns on the corridor side plus the corridor shear walls.

Plan Variations

The basic type of plan and vertical section that was adopted at Paso Robles School has proved to be flexible enough to lend itself to a number of planned variations. At Paso Robles it was used with a *single-loaded* corridor running east-west. The corridor was kept to the south and the parapet and clerestory were run full-length along the northern side. In the case of the Lakeside School the corridor again runs east-west but is *double-loaded.* This means that one row of lower classroom windows has to face south and is protected against the entry of direct sun rays by a louvered sun-break. The Delano plan is perhaps the most interesting because the corridors run north and south and the clerestories are run transversely across the corridors as well as the rooms. Once the factors involved are thoroughly understood, many such variations can be worked out, provided only that all sources of extraneous glare are carefully screened or eliminated.



2. *In schools of the Paso Robles type, discovery of sawtooth principle, with sloping ceiling and an auxiliary reflecting parapet outside*



3. *Lakeside School.* **Longitudinal** *clerestories, like those of Paso Robles, used on* **both sides** *of an east-west corridor instead of a single side. This involves differentiations*

4. *Proposed Delano School addition. Here the corridors will run north-south instead of east-west, and sawteeth will be turned* transverse. *Shading by colonnades is useful*

General Observations

Although data are available that help estimate in advance the intensities of light under different relationships of room depth, height, and window area, yet the value is slight, because there are so many variables of surface, material, colour, and surroundings.

The solutions herewith presented have proven practical and beneficial in Southern California where the sun is relatively brilliant. Also, there is no problem of snow in the trough formed by the lower part of the roof and its parapet. Other solutions may be necessary in climates with weaker sun and more snow and yet it is extremely desirable from a daylighting standpoint to avoid the control problems that are involved where windows face east, south or west. Further research is desirable even in the hot climates. For example, what are the heat reflection characteristics of a white sun-reflecting wall? In actual use this kind of a reflector has developed no objection but the writer would still like to know.

Courtesy Architectural Record

THE PROVINCIAL PAGE

AEDIFICAVIT

Photo, Karsh

A. T. GALT DURNFORD, LIEUT. COMDR. (S.B.) (E.) R.C.N.V.R.

Among those who have lately returned to private practice from the Services is A. T. Galt Durnford of the firm of Fetherstonhaugh and Durnford. Lieut.-Commander Durnford retired in July of this year as Boom Defence Designs Officer of the Directorate of Harbour Defence, Naval Services Headquarters, Ottawa.

His friends were a good deal puzzled when they heard that Galt was engaged in, and later responsible for, Boom Defence Design for Canada, until they had a definition of the word "Boom". In the choice of an Architect for such work the authorities showed unusual discrimination and perhaps unconsciously followed a sound precedent. We have no record of the activities of all Architect designers of military engines but undoubtedly the most celebrated was Leonardo da Vinci.

Galt was born in Montreal in 1898 and named after his grandfather Sir Alexander Tilloch Galt, who was an outstanding Canadian in the mid 19th century and one of the Fathers of Confederation.

After receiving his schooling in Montreal and Switzerland, Galt enrolled in the School of Architecture of McGill University and since then his pencil has never been still for a moment. He studied at McGill under Professors Ramsay Traquair and P. E. Nobbs and emerged in 1922 with the degree of B.Arch.

After graduation Galt joined the colony of earnest young Canadian Architects in New York City. From the office of George B. Post and Sons he went to Delano and Aldrich. Here he found agreeable soil and climate and flourished mightily in the company of his great friends, Bill Wurster and W. R. Amon.

It was during his two years at D. & A's. that Galt developed his natural aptitude and love for Architectural detail which has characterized his work ever since. In his spare time he studied Oriental Music.

Returning to Montreal in 1924 he opened an office, practising under his own name for the next ten years. During this time he was responsible for many fine houses and made a name for himself as an outstanding Canadian Architect.

The present firm of Fetherstonhaugh and Durnford was established in 1934 and in January, 1941, Galt was commissioned as Lieut. (Special Branch) R.C.N.V.R. and commenced the interesting and valuable work which, during four and a half years, carried him to both coasts of Canada and the United States, and by bomber to the United Kingdom.

In 1932 Galt married a daughter of Sir Arthur and Lady Currie and they have two children. Characteristically turning adversity to advantage they overcame the housing shortage by converting an old coach house overlooking the Ottawa River into a very charming small house where they have been living during the past two years.

ALBERTA

In spite of much that has been said, thought, and written regarding the making of cities better places for living, the present conditions created by the return of men from war services with the need for providing, in great haste, homes and work, have set in motion a strong tide in which the improvement of standards of living are liable to become submerged. Considerable expenditures are being made on housing of poor standard on the plea that it is a "temporary necessity" and also on utilities such as improved transportation by road, by street cars or buses, regardless of any improved standard of the general lay-out of our cities for the amenities of life and its environment. Ideals recommended in a period when there was no such forward drive in these matters are apt to be too readily set aside and opportunities disregarded.

It cannot be denied that "temporary necessity" is a compulsion impossible to be resisted. This temporary building, nevertheless, is a potential social danger. "Temporary" is an undefined and relative term. It may be understood to mean three or four years, or ten or twenty. In actual practice it is liable to extend quite indefinitely unless, at the same time that temporary building is being put up, a parallel scheme for permanent provision is made part of the same program. The two schemes ought to be treated as necessary part of one another. Where this is not done the result is fairly certain to be that the temporary provisions will block the permanent, better, future developments. Worried city departments are glad enough to be able to make any kind of plausible provision to cope with the instant needs. They are not being asked for more than that and have no guidance beyond that. In many cases they have the opportunity of making use of disused war service buildings. They may obtain these free where they sit, but the cost of transportation is considerable. The farther cost of adaptation is also so considerable that the question arises whether entirely new buildings would not cost less. This question is practically settled by the lack of lumber. These huts at least provide usable lumber and when this is in demountable sections, it is a considerable asset. The conversion of service huts to houses, even by an expensive operation, provides some practical opportunities of which we cannot afford not to take advantage. The opportunity arises to make pleasant arrangements upon unoccupied land. This is no doubt being done to a considerable extent. But the groupings are apt to be in separate and scattered situations which scarcely effect a general improvement. When such groupings are on a large scale much temporary improvement is possible but it cannot be permanent unless the scheme provides at the same time for a regular systematic replacement by permanent work on a prescribed time schedule. Small scattered groupings without any such scheme for replacement are likely to lead to ultimate deterioration. Yet even these may be a benefit where they provide openness of lay-out. A substandard dwelling in an open environment may be better than one of higher standard in congested conditions.

The two most vocal complaints regarding the temporary housing that is being provided are the want of basements and the meagre provision for heating. The complaints regarding want of basements is often contested by architects. But it comes from an authoritative quarter, the housekeeper, and is based on intimate experience. The architects' answer is the utility room. A utility room of about 100 sq ft. does not, to the housekeeper, adequately replace an area of five or six times that amount to be found in the basement. It is some-

times contended that a basement is largely waste space, that washing can be done in the kitchen in a sink specially designed for washing. This is all very well for light washing which is no considerable problem in any case. The weekly wash of bed linen cannot be so lightly dismissed. This is an unavoidable weekly operation and imperatively demands space. To hang up, dry, air, smooth and fold large bed sheets in inclement weather intolerably clutters up either kitchen or utility room. In a basement all this can be conveniently done whilst the kitchen remains free for its proper purposes. In addition, the basement provides space for groceries that are purchased in quantities, such as potatoes, apples, oranges, etc., for packages bought in numbers and put into use by degrees. It is the suitable place for preserves. It is invaluable as a place for odd chores, for painting articles of furniture, for preparing paints for the maintenance of the house, for hobbies of many and various kinds carried on by the older folks or by the children. These hobbies involve a messiness not to be tolerated in the living rooms, but they are valuable assets to family life. The basement provides a rumpus room where the wholesome noisiness of children need not disturb the whole house. The basement is a practical necessity as a place for the heating furnace. Thus used it ensures better warmth below the ground floor than is probable in a basementless home. A space heater in a hallway can scarcely be so efficient. It is asserted that a basement is necessarily a place of untidiness. This is no plea for its elimination but only for its better arrangement.

All these do not exhaust the services of the basement. When such matters are considered, is it any wonder that the voice of the housekeeper is not to be silenced by the provision of a minute utility room?

Cecil S. Burgess.

ONTARIO

One hundred and twenty years ago, Nicholas Sparks crossed the Ottawa river from the Hull side and carved a home for himself on the cliffs of the South shore, thereby becoming the first citizen of Ottawa.

It is nearly two score years since our own arrival in Ottawa, and it is our earliest recollection that we tried in vain to find an exit from the flag stop designated as a station, until a kindly native advised that there was a short cut through the longest bar in Canada.

This is a parochial prelude to a provincial column, but our excuse is that the past month has seen some progress in the consideration of the future of Ottawa, and in setting up of some measure of control which while not rectifying past errors should nip any future boners in the bud.

An editorial in the *Ottawa Journal* summarizes the situation in most excellent fashion and we quote therefrom:—

"The Dominion Government by order-in-council has taken two important steps to the end that the National Capital 'may be developed in an orderly manner.'

"In the first place, the Government designates an area of some 900 square miles as the District of the National Capital and authorizes the Federal District Commission to discuss with any of the sundry municipal authorities 'proposals or plans for development, improvement, beautification or new construction therein.' This authority does not go beyond advice and consultation.

"Another order gives the Federal District Commission control of building construction within this area by any department or branch of the Dominion Government. No building, says the order, 'or other work, shall be erected, altered or extended' by the Government on this property, or by anyone on any property within the area owned by the Government except with the Commission's approval. From the decisions of the Federal District Commission under this order there is the right of appeal to the Cabinet.

"The second order may be of more use than the first, because the power to advise and consult, without any authority to compel or to share costs, may turn out to be more theoretical than practical. But we are making progress when we declare that no Government branch, neither Works nor Research nor the Services, may build or alter a building in this 900-square-mile block without getting the consent of the Federal District Commission.

"There is significance, too, in the formal setting out of the boundaries of this enlarged Federal area, because it is natural to suppose that if and when a Federal District is created on the Washington plan (with modifications) it will follow in the main these limits now established. What we have now is a measure of Federal control, or at least supervision, over a development on both banks of the Ottawa river for a 40-mile stretch from Fitzroy Harbour to Cumberland, its width including Gatineau Park and, south of Ottawa, a considerable part of Gloucester township."

A little straw of news is often the humble herald of the big story, so without comment, and we hope without prejudice, we reproduce a headline from the *Evening Citizen* of August 28th., "May re-appoint Jacques Greber to Plan Capital."

Speaking of controls, and in response to many enquiries from other Outposts of Empire, we do not know when construction controls will be relaxed but we hope it will be soon, so that practice will again become a joy, and not just a grind.

A. J. Hazelgrove.

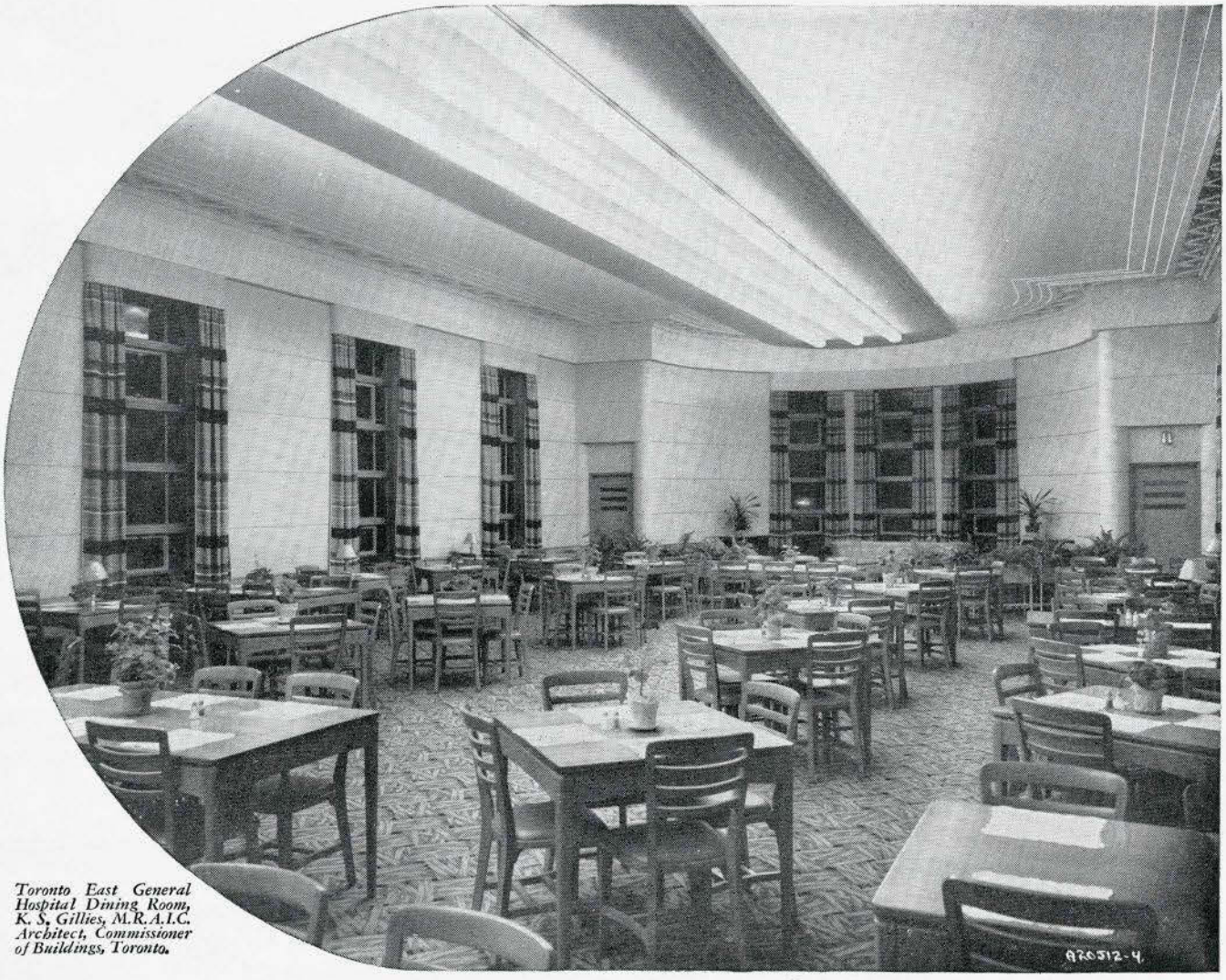
P.S.—*August 30th.*—The Prime Minister announces the formal decision of the Dominion Government to develop and beautify Ottawa, Hull and environs as Canada's National Memorial to those who sacrificed their lives in World War II.

Mr. King also announced that he had secured the permission of General Charles de Gaulle for Mr. Greber to undertake the work for the Canadian Government.

A. J. H.

We regret that, owing to an error on our part, credit was not given to *Building in Canada* for photographs on pages 141 and 142 in the July issue. We were unaware that these photographs had been taken by *Building in Canada*, and we apologize for the omission of the credit line.

☆ ☆ ☆



Toronto East General Hospital Dining Room, K. S. Gillies, M.R.A.I.C. Architect, Commissioner of Buildings, Toronto.

Curtis Planned Lighting

ENGINEERED BEAUTY AND COMFORT

Curtis lighting equipment is adaptable under all conditions for all spaces in public buildings, hospitals, etc.

Through close co-operation with architects and engineers, Curtis lighting equipment is fitted into the architectural design to become an integral part of the finished room.

Curtis lighting is planned not only to harmonize with the design, but to be fully *adequate* for the purpose for which the room is used.

Because Curtis lighting is always properly placed and directed, eye-comfort, eye-efficiency and room beauty are assured.

Architects and engineers are invited to utilize the experience and help of our lighting engineers and specialists.

Consult Curtis for EFFICIENT LIGHTING

Curtis LIGHTING of Canada Limited

260 Richmond Street W., Toronto