PAPER READ BEFORE THE

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Time does not permit of my dealing with more than one type of school building, namely the Grade School. The High School, the Technical High School, and the Technical or Trade Schools are sufficiently large subjects to require papers to themselves.

The modern City School building means far more than it did a few years ago. It now serves not only as a place where large numbers of children are instructed in the elementary branches of reading, writing, and arithmetic, but it must also contain provisions for training, calculated to fit them for life's occupations and finally it must afford room where their bodies may be developed and strengthened to resist the physical strain of city life. Then too, the school is rapidly becoming the centre for the social life of a large portion of the community, and should be planned for use by adults without interfering with its scholastic purposes during the daytime. In addition to making the school building serve most suitable its possible uses, the Architect must be of course consider the economic phases of the construction and probably this will give him more trouble than all the rest

Hardly any two people will agree as to what an economical school building is. The Architect is apt to judge by the cost per cubic foot, the school trustees or the taxpayer by the cost per pupil. The teacher judges the building by its arrangement and equipment for work, and the average individual by its appearance.

Allthese are methods of judging, but only partial methods. The buildings built for a low cost per cubic foot may include a large amount of waste space. The building of low cost per pupil may have poor accomodation or equipment. The well planned building may be poorly built. The appearance may be deceptive. To judge rightly requires the expert knowledge of the Architect, combined with a knowledge of the requirements of the teacher, and here it may be remarked that the Architect is not always to blame for excessive cost in school buildings. Members of the School Board and the Superintendents of schools do not realize how much they have to do with the cost of buildings. It is not always the extravagant Architect; it is not always costly materials or construction that is primarily responsible for costly school buildings; It is including in these buildings cubic feet which are not essential for the work.

The problems to be considered are three:

(1) To determine the essentials, and the nonessentials that are desirable.
(2) To plan economically to meet these requirements, having always in mind as essentials for the children, light, air comfort, and refining influence, and to plan so that everything is available, as far as may be for the other uses, to which the buildings may be put as social centres for adults.
(3) To study carefully all materials, balancing initial cost and annual maintenance.

The first problem has to be solved by the educators. They have to decide as to whether they require rooms for manual training, domestic science, kindergarten, gymnastics, medical inspection, nurses, etc.

With regard to problem No. 2, an economical plan is one without waste space. If a 10 ft. corridor is wide enough, then 12 ft. is waste. If a height of 12 ft. will light a room, 24 ft. wide, then 14 ft. is waste. If classrooms open from one side of a corridor only, it is a waste of corridor space which might serve rooms on both sides. A compact building is one that has no useless cubic feet.

Another very important factor in economic planning, although it does not appear as an economy in the initial building, is the arrangement for future enlargement or extension of the school with a minimum amount of disturbance of the original portion of the building to be erected, and in Cities of rapid growth such as these of the West, this should never be lost sight of.

The four parts of a school building that are fundamental are:- (a) Class rooms. (b) Corridors. (c) Staircases (d) Cloak rooms and toilets.

The requirements of the educators in this country follow more on the lines of those of the United States than of Europe, so I will confine myself to details of planning in accordance with Canadian, or (as it really is) American practise.

The normal class room accomodates from 30 to 50 pupils at fixed individual desks, probably a good standard is about 40. The total floor area should not be less than 18 square ft. per pupil while the height of the room should be sufficient to provide a minimum of 220 cubic ft. volume of air per pupil. The standard I have set for the size of class rooms in the local schools 24 x 32 x 13 ft. in height, very slightly exceeds the floor area given, and is considerably in excess of the volume of air laid down as the minimum.

With regard to the lighting of class rooms, it is now universally agreed that the light should be obtained from one side only. A partial exception is sometimes made for corner rooms, which may have windows in the end at the rear of the desks, and opposite to the teacher. The best practice however discountenances this and favours a blank wall opposite the teacher, so as to avoid the glare in his or her eyes from windows behind the pupils. The best light for a class room is that which comes from the left side only and the total window area should equal about one quarter the floor area of the class rooms where outside conditions are normal, and the width of the room where unilateral lighting is used should never be more than twice the distance from floor to window top, which gives the basis of my setting the standard width of local class rooms at 24 ft. The windows should extend up to within a few inches of the ceiling, while the stools should be from 3 to 3½ ft. from the floor. Whether the windows should be massed or grouped with narrow mullions or evenly distributed is a matter for debate, but personally I favour the grouped windows as lessening the number of shadows cast, as compared with those caused by wall space between distributed windows.

Another great factor in obtaining evenly distributed light, is the provision of prism glass in the upper portion of the windows which also has an additional usefulness in windows exposed to the sun as it admits light while reducing the glare to a minimum by refraction, thus enabling opaque window shades to be hung over the lower portion of the windows, the resultant lighting being nearly as satisfactory as that obtained from a Northern exposure.

Kindergarters when introduced in the plan, should be located to receive the morning sun and planned with every opportunity for appropriate decoration.

One door, preferably at the Teacher's end of the room, and hung to open outwards, and always in the direct line of travel to the stairway, is sufficient, as the Teacher has then better control of the children in case of an alarm of fire. Where cloak rooms and adjoin the class rooms I am now omitting the door between the cloak rooms and corridor for the same reason, and merely providing a door at each end of that room, communicating with the class room.

The Assembly Hall,(if such a room is required) is best placed on the Ground Floor, particularly if likely to be used in connection with the "Social centre" movememt.

It is highly undesirable to place it on the third or top floor as, for the sake of economy, it is ofter done, ~~nore~~ not merely because of the additional danger from fire or panic, but in the event of it being used as a gymnasium-- the resultant noise and vibration is a nuisance if not an actual cause of damage to the building.

Other rooms: No rules can be arranged for the arrangement of the other rooms required, such as Teacher's and reception rooms, domestic science and manual training rooms, etc. as each school building presents a different problem with regard to size, position and arrangement, but I am of the opinion that there is no great objection to the manual training and domestic science rooms being placed in the basement, provided it is not more than 6 feet below grade, and at least 12 feet in height.

After determining the size and arrangement of the class and other units, the next important step is their grouping with corridors and staircases. The most common type of plan places the rooms on either side of the corridor with the stairs at the ends and while this arrangement is the most economical in the cubic content the corridors cannot be properly lighted as they receive direct light from the ends only. A common modification of this plan places the stairways on the sides, and has the advantage of bringing them in better relation to the rooms, gives somewhat better lighting but increases the area per class room in proportion to the total floor area of the building. The question then would be, does the improved lighting and ventilation warrant a 10% increase in cubic content? In my opinion it does, and surely this is carrying economy far enough as compared with Germany, where the prevailing custom is to place class rooms on one side of the corridor only, giving direct outside lighting in the corridor, which practise is also to be found in the British Isles, and other parts of Europe. We will say therefore that the width and natural lighting of the corridors should not be sacrificed in the interest of additional class room space, and although no fixed rule can be laid down, it may be said in general, that for main corridors, 12 feet may be taken as a minimum with 8 feet for side or secondary corridors, although 14 feet and 10 feet would be better.

Stairways: The number of stairways and exits in a school building is a matter of calculating accomodation for the number of pupils and the number of floors to be served. It is a problem for the individual building and all that can be given is a working rule suggested by practice and experience, namely that 120 persons in lines of two abreast can pass a given point in less than one minute. If therefore stairways and exits in sufficient numbers are introduced and properly placed to empty our building in three minutes or less, we are entirely safe.

The location of stairways is a matter of great importance. They should be separate, and arranged to serve definite groups of rooms, in such a way as to help a natural division of pupils, and thus avoid congestion. A closed balustrade ~~or boxed in type or stair~~ of proper height is to be preferred to the open balustrade or boxed in type of stair. The stairway should be not more than 5 feet in width with a handrail on both sides and constructed in runs of not more than 10 steps with a rest or intermediate landing.

Risers should never exceed 6½ inches, and treads should never be less than 10 inches (local schools 6 and 12)

In the matter of stairways and exits, the use of what is customary by the pupils a number of times each day during the entire school year, will always prove the most efficient means of egress in case of emergency, it is therefore a matter of first importance to construct all stairways of incombustible materials and further render them fire and smoke proof by the provision of fireproof landings, the whole being separated from the rest of the building by fire resisting screens, glazed with wired glass, and fitted with swing doors.

It is customary in mixed schools to provide at least three entrances, One for the Public, and one ~~for~~ each for the two sexes. The size of the school will determine the additional entrances required, but one should be provided in each staircase wing in addition to any others desired, and it is hardly necessary to mention that particularly in this country a suitably loby or wind porch should be provided, so as to interpose two sets of doors between the interior of the building and the outer air. All doors should be fitted with a type of panic bolt that easily releases on pressure being applied from inside the building.

Toilet Rooms & Cloak Rooms: These are the subjects of more argument than any other feature of the school design. Toilet rooms are sometimes grouped in the basement, sometimes placed on all the different floors, in a very few instances a toilet has been provided for each class room, situated in one end of the Cloak Room, but as may be readily imagined, the last named has many objectionable features.

I should say the ideal system would be a fair allowance of toilet rooms for both sexes in the basement during recess and at the times of entering and leaving the building, as well as in connection with the gymnasium and baths, if such may be provided, and also a few toilets on each floor, those for the two sexes being of course as completely and widely separated as possible. In schools limited to two storeys, I do not consider too much hardship is caused the children by requiring them to go to the Basement during session, but there is the drawback that it is liable to become a means for gathering of pupils for mischief or play.

One thing certain is that the most economical location for toilets is in the basement, but wherever located specially careful provision should be made for mechanical ventilation apart from the general ventilation scheme of the building.

Cloak Rooms- Two chief systems are in use, separate general cloakrooms near the entrances for each sex, and class cloakrooms attached to each class room, either in the form of a long narrow room adjoining the class room, or a series of cupboards along one of the walls with revolving or sliding shutters. In either case it is essential to provide adequate ventilation from the class room through the cloak hanging space.

The first named system is not much in vogue in this country although generally adopted in Europe, its main advantages are (1) Economy of cubic feet. (2) Pupils leave behind out clothing muddy overshoes, etc. on entering the building. The disadvantages being the difficulty of supervising the crowds of pupils at the times of entering the building, and the danger of pilfering. To obviate these difficulties, individual lockers are generally provided for high school pupils, but these are impracticable for grade schools on account of the space required and the costliness generally

Economical Construction-

There will always be different views as to what this means, with some it is equivalent to inexpensive if not cheap. Even Even amoung men who are trained to judge- Architects and Builders- there will be difference of opinion. Probably the soundest decision

is that in favour of the most permanent materials, but the least expensive of each class.

A schoolhouse should represent the most thorough and careful construction possible, both as to materials and execution. Ornate finish is unnecessary, but good taste and refinement should appear in all the details.

It is wise economy to make the floors, dados, stairs, handrails, etc. all of the most durable materials even at considerably increased expense. Wooden dados or wainscoting should be avoided generally, also an excess of projecting molds and trim, while sanitary bases, rounded angles, etc. as understood in hospital construction, might well be copied in all schools.

The fundamental question is however, not that of the finish, so much as the framework or shell of the building. This ought in my opinion, to be always of fireproof materials, but unfortunately it is not every School Board or community that has reached the point where it thinks it can afford really fireproof construction, and after all there are many who hold the opinion that a school building can be perfectly safe without being fireproof, if proper methods of construction are employed.

Where funds will not permit the erection of a fireproof building, it does not require a very large additional outlay to fireproof the corridor floors and stairways, nor is it necessary to erect separate buildings in which to house the heating apparatus as this at small expense can also be isolated in a manner to eliminate all danger. All steelwork should be protected, all plastering be on wire lath, and wooden furring and partitions should eliminated. Fire standpipes and hose should be placed in conspicuous and convenient positions on each floor. And since in even a fireproof building smoke from some trivial local fire, not necessarily dangerous, may spread through the building and possibly create a panic, let me again urge the necessity for the stairways and corridors being so planned as to offer the most ample and direct exit for all parts of the building.

A short summarized description of the three last contracts let by the Edmonton School Board, namely the King Edward, Westmount and Highlands Schools, will serve to show that we are getting close to the foregoing standards.

In construction the buildings are fireproof using the Kahn system of reinforced concrete for the floors. The finished floors of the rooms are all maple laid over cinder concrete, those of the corridors of Asphalte with mosaic in the main entrance vestibule. The stairs are of two types, in the first and last named Schools, the stairs and balustrades are constructed of reinforced concrete with slate treads, while in the Westmount School, the staircases are of steel with slate treads and landings.

All the class rooms are lighted from one side only, with the most satisfactory results, window heads are placed less than a foot from the ceiling. Blackboards are of best slate, above which is run a strip of cork linoleum 12" wide, upon which drawings and small pictures can be pinned.

All Class rooms are provided with Teacher's cupboards or book cases.

There has been a minimum of woodwork used throughout the buildings. No casings or architraves are used for windows and doors, but the plastering is rounded into the frames.

The doors, too, deserve special mention, as they have only one small glazed panel, otherwise being perfectly flat of the type known as the "Sanitary door".

The entrance doors are fitted with panic bolts.

Heating & Ventilation-

This is a subject large enough to warrant a lengthy exhaustive paper to itself, but I will endeavor to briefly enumerate some of the main features.

The matter of heating and ventilation is the most difficult problem before any Architect having to provide buildings for the accomodation of large bodies of children, as it is most difficult to secure a system which operates unfformly and efficiently throughout a building in all kinds ofweather, and the problem is, of course, intensified in an extreme climate where the open window is impossible for several months in the year, and where the system must be close and self contained.

It is hardly necessary to mention that the old style furnace with it's many objectionable features has entirely disappeared in favour of either high or low pressure steam.

In a climate such as this, I do not consider what is known as the "hot blast" system of combined heating and ventilation gives satisfactory results, as direct radiation is required tocounteract the chilling effects of the extreme cold on the windows and external walls.

We will say therefore, that direct radiation is necessary to heat all rooms, the best results being probably obtained from low pressure steam operated on the vacuum system, which thoroughly clears the radiators of all air and condensation and induces the steam to pass throughout the building practically without pressure, thereby obtaining more efficient heating and resultant economy in fuel.

A brief description of the Heating & Ventilation system embodied in the 1913 local schools will convey a summary of my views upon this most important subject. The heating then is carried out by direct radiation supplemented by a vaccuum created by a steam driven pump, operating at about 10 lbs. pressure. This is reduced to about 2 to 5 lbs. for the heating system. While the engine is running the condensation from the entire system is returned to a closed tank in the boiler room, and by means of a float valve it is automatically delivered to the boilers by a feed pump. There is also a by pass which allows the water to run to the drains when so desired.

The radiators throughout the system are controlled automatically by the Johnson system of temperature control, which felieves the Teachers of all responsibility with regard to the temperatures of the rooms, and automatically closes down or opens up the steam valves of the radiators as required.

The ventilation is a combination of the "plenum" and "exhaust" systems, it being the intention to rely during the warm weather entirely on the two smaller exhaust fans, which are located in the main foul air outlet ducts in the roof space.

The fresh air is drawn into the building from about mid height of the building, thus getting the air as pure and free from all contamination as possible, nearer the ground it would probably contain a larger amount of dust, while at the roof level it would be liable to contamination by noxious gases emanating from toilet vents, smoke flues, etc. The air then passes to the primary heater or tempering coil, where it is warmed to a temperature of about 50 degrees F. what are known as "Vento" pin coils being used for this purpose, certain sections being controlled by hand valves and the remainder are provided with diaphragm valves operated by a thermostat located in the main duct beyond the fan discharge. The tempered air then passes through a water spray air washer, which, in this stage of the City's growth with its comparative freedom from the smoke nuisance, serves mainly the purpose of humidifying the

air. The fan driven by a silent chain drive and set on a cork bed to eliminate sound, then drives the air through the reheating coils to the upper or hot air portion of the plenum chamber or through a byepass to the cool air chamber.

The separate ducts leading to the different rooms commence at these plenum chambers and are so controlled that each individual duct automatically takes warmer or cooler air as the condition of any particular room require, the requirements of rooms varying in accordance with aspect, direction of wind, etc. The whole ventilation system is designed to supply 30 cubic fett of fresh air to each pupil per minute, and volume dampers are placed in each duct to regulate this. The toilets in the basement are provided with foul air outlets only and these in the back of each fixture, thus ensuring the passing of air from the other rooms through the toilets and out through the vent ducts, giving no chance of any unsanitary odors finding their way to any portion of the building.

The warm fresh air at the temperature of about 68 degress then enters the class rooms at a height of about 8 feet from the floor, and passes out through the cloak rooms, to the foul air ducts, thus ventilating the cloak rooms, which then run to the attic or roof space where they gather into two main outlets in each of which is placed an electrically driven exhaust fan operated from the basement.

Large dampers are placed in the main vent ducts in the roof and connected to diaphragm valves operated by air pressure from the automatic temperature regulating the system, and controlled by switches on a switchboard in the boiler room. This permits the building to be closed up tight at night.

Sanitation: Great advance has been made in recent years in the plumbing fixtures installed in schools. the first step recognized as absolutely necessary was the abolition of the range closet system and the adoption of an individual type water flushed fixture ofproper form and construction. Of these the hand pull method of flushing was not satisfactory owing to the forgetfulness of the children, and the automatic flushing at intervals was not sanitary, and entailed a great waste of water, which in these days when all departments of the City utilities are endeavoring to show profits, means huge water bills. Of all systems tha automatic seat operating valve closets were found most satisfactory, and are now installed in the best schools, economy and efficiently, deciding in favour of that method of flushing connected to siphon jet hard-fired vitreous china bowls. A vent for each closet should be provided, either in the fixture itself or probably better still, in the back of the stall a fewinches above the bowl. The stalls may be constructed of a variety of materials, among which may be mentioned slate, enamelled iron and wired glass. They are best arranged in a double battery with a working space between the backs, while the space may be also used as a vent chamber by providing a cap to same. The closet stall partitions should be kept 12 inches above the floor at the bottom, and about 5 ft. 6 in. above the floor at the top, the backs should extend to the floor, especially if the working space is used as a vent chamber.

Whether stalls should have doors or not is an open question The tendency at the present time in many localities is to omit them, where this is done the stalls need not exceed 3 ft. 6 in. in depth, otherwise 4 ft. 6 in. is the minimum, and they should be 30 inches wide on centres.

With regard to urinals, probably the best type is one of solid white glazed porcelain 18 or 20 inches in width, 42 to 50 inches high with a projecting lipped bottom, sides back and top all in one piece glazed on all exposed surfaces and having integral shields projecting about 4 inches from the face of the urinal thus forming partitions. These urinals are set together in batteries as required, and the flushing accomplished by means of an automatic tank with a spray flushing device. Each urinal should have a vent opening covered by a porcelain shield near the bottom so that perfect ventilation of the fixture is assured.

Of the Drinking Fountains on the market at the present time, the pedestal or wall fountain of the bubbling type is now in common use, and appears to be the best, particularly if the cup as well as the basin is made of vitreous china.

The remaining fixtures required in the equipment of schools, such a lavatories, slop sinks and possibly shower baths, hardly require any special mention.

Let the School building, then, be well planned, solidly constructed, thoroughly fireproof, abundantly lighted, with adequate straight corridors and ample stairways, let it be well ventilated and cheerful within, and refined and dignified without, and it will be a source of pride to the community, as well as a credit to its designer.