

On east and west streets, if the whole south front of buildings on the north side are to receive sunlight at noon, December 21st, then the width of the street must be:—At the equator, 0.43 the height of buildings on south side; at Winnipeg, 3.33 that height; at Edmonton, 4.33 that height.

Or the shadow cast at Winnipeg is in length 7.77 times that at the equator; at Edmonton, 10 times that at the equator (at noon, winter solstice).

As the condition at the winter solstice is evidently the most unfavorable for sunlight planning, and because, as shown, such condition obtains to a great extent from about the middle of October to late in February, this condition should be the one to receive the greatest study. If ample sunlight can be provided for this period of four months, our problems, with few exceptions, are solved.

Orientation of Detached Buildings

How should a detached building be constructed and oriented so that not only the exterior wall surfaces, but also the surface of the ground around them shall have the direct rays of the sun for as long a time as possible on December 21st?

For our investigations let us first take the case of a cube with sides of say 25 ft., this being fairly typical of a small dwelling house, and consider its condition as to sunlight at noon, December 21st, if it be located in latitude 42° north (Canada's furthest south point). As we build our house further north, the conditions, of course, become more unfavorable.

By orienting our cube, or building, with sides northeast-southwest, etc., every side receives sunlight; there is no area of perpetual shadow—and shadow curves indicate that more sunlight is received in the vicinity of the building. It would appear that for a detached building the latter position is preferable.

By adding extensions to our cube or square building, we get another typical building, the "L." The axes of the building should still be at an angle of 45° with the cardinal points, and the interior angle formed by the extension should face the south.

The matter of orientation is considered an important one for hospitals. Fig. 2 shows that in practice, Atkinson is upheld by our Canadian architects. The figure illustrates the layout of the Central Alberta Sanitarium near Keith, Alta. Note the orientation of the buildings and how important is the placing of a north point on architectural plans.

Orientation of Rural and Residential Buildings

Having established the best orientation for an isolated detached building, the next matter is to determine what effect the grouping of buildings has on the question.

Until the shadows cast by adjoining buildings are such that all sunlight is cut off from some surface of the building under consideration, or until there results a ground area or areas of perpetual shadow, there would appear to be no advantage in changing the orientation of buildings considered favorable for isolated conditions.

Buildings on a north-south street must be much further apart than on northwest-southeast and northeast-southwest streets, if minimum standards of two hours or less of completely lighted walls are enforced for southern exposures.

It would appear, then, that streets in an open rural or residential development, and where no important factor dictates otherwise, should preferably be placed so that buildings thereon and with faces parallel thereto, have their sides at an angle of 45° with the cardinal points.

This means that streets in such a development should run northeast-southwest and northwest-southeast, and not north-south and east-west as is the general custom.

The plan of the townsite of Kipawa, P.Q., published on page 261 of the February 27th issue of *The Canadian Engineer*, shows an actual case in course of development. This townsite was planned by Thomas Adams. It will be noticed that the development is so open that each house and even that the development is so open that each house and even that the development is so open that each house and even that every building in the business section can be treated as a separate unit, so far as sunlight and shadow are concerned.

The streets are not square with the cardinal points, but run in directions that permit a desirable orientation of buildings. For example "The Avenue" is practically a northwest-southeast street, and "Hillside Road" a northeast-southwest street. It is only fair to add that Mr. Adams' position is, I understand, that frequently there may be other factors that make it desirable to face buildings in other directions. In such cases, having provided for sufficient open spaces between buildings to avoid objectionable shadows, the important thing is to design the disposition of rooms to suit the particular orientation. But I think that it will be admitted that a building with its sides angling somewhat with the cardinal points will receive sunlight, as a rule, on all its faces, and if square with the cardinal points is sure to have one unlighted wall, a condition to be avoided where possible.

Writing in 1864, Horace Bushnell, in his essay on "City Plans (Work and Play)," said:—

Orientation of Attached Buildings

"It is also a great question, as respects the health of the city, in what direction, or according to what points of the compass, the streets are to be laid. To most persons it will appear to be a kind of law that the city should stand square with the cardinal points of the compass—north, south, east and west, and where this law appears not to have been regarded, how many will deplore so great an oversight, and even have it as the standing regret of their criticism. Whereas, in the true economy of health and comfort, no single house or city should ever stand thus, squared by the four cardinal points, if it can be avoided. On the contrary, it should have its lines of frontage northeast, southwest, northwest and southeast where such disposition can be made without injury in some other respect; that so the sun may strike every side of exposure every day in the year, to dry it when wet by storms, to keep off the mould and moss that are likely to collect on it, and remove the dank sepulchral smell that so often makes the tenements of cities both uncomfortable and poisonous to health."

Mr. Bushnell has applied the considerations that affect single buildings and open development to the conditions of close or urban development. With this conclusion, Atkinson also agrees.

The space between rows is, in many cities, the width of the street, no set-back being insisted on. Mr. Atkinson in this connection states in his "Orientation of Buildings":—

"In the north-south street the distribution is symmetrical, the buildings on either side receiving an equal amount. In the east-west street the north face of the street receives no sunlight during six months of the year, and the buildings on the south side are in perpetual shadow during the same period. In planning towns, the east and west street should be avoided as far as possible and, where unavoidable, the buildings should be of moderate height and built in detached blocks. In the checkerboard plan, the best distribution of sunlight is obtained when streets run northeast-southwest and northwest-southeast."

Conditions Alter Cases

Messrs. Swan and Tuttle have approached the whole matter from a different angle—not starting with a study of detached buildings—and have considered a development almost entirely on New York lines, where closely placed or contiguous high buildings face only on the main and not, to any extent at least, on the cross streets. The main street will receive most sunlight when it is oriented north and south. This conclusion is supported by many useful tables prepared by Swan and Tuttle. And it is shown that while no sunlight may be received all day on an east-west street as far south as latitude 30°, yet in latitude 50° north, under the same conditions, a north-south street receives over an hour of sunlight.

"Blocks improved with houses in rows or with apartment houses, then, should have their length parallel to north-and-south streets and their breadth parallel to east-and-west streets." But such a development is generally