SITE LAYOUT PLANNING FOR DAYLIGHT AND SUNLIGHT

A guide to good practice

SECOND EDITION

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IHS
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bretrust

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2.2 EXISTING BUILDINGS

2.2.1 In designing a new development or extension to a building, it is important to safeguard the daylight to nearby buildings. A badly planned development may make adjoining properties gloomy and unattractive.

2.2.2 The guidelines given here are intended for use for rooms in adjoining dwellings where daylight is required, including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be analysed. The guidelines may also be applied to any existing non-domestic building where the occupants have a reasonable expectation of daylight; this would normally include schools, hospitals, hotels and hostels, small workshops and some offices.

2.2.3 Note that numerical values given here are purely advisory. Different criteria may be used based on the requirements for daylighting in an area viewed against other site layout constraints. Another important issue is whether the existing building is itself a good neighbour, standing a reasonable distance from the boundary and taking no more than its fair share of light. Appendix F gives further guidance.

2.2.4 Loss of light to existing windows need not be analysed if the distance of each part of the new development from the existing window is three or more times its height above the centre of the existing window. In these cases the loss of light will be small. Thus if the new development were 10 m tall, and a typical existing ground floor window would be 1.5 m above the ground, the effect on existing buildings more than 3 × (10 − 1.5) = 25.5 m away need not be analysed.

2.2.5 If the proposed development is taller or closer than this, a modified form of the procedure adopted for new buildings can be used to find out whether an existing building still receives enough skylight. First, draw a section in a plane perpendicular to each affected main window wall of the existing building (Figure 14). Measure the angle to the horizontal subtended by the new development at the level of the centre of the lowest window. If this angle is less than 25° for the whole of the development then it is unlikely to have a substantial effect on the diffuse skylight enjoyed by the existing building. If, for any part of the new development, this angle is more than 25°, a more detailed check is needed to find the loss of skylight to the existing building. Both the total amount of skylight and its distribution within the building are important.

2.2.6 Any reduction in the total amount of skylight can be calculated by finding the VSC at the centre of each main window. In the case of a floor-to-ceiling window such as a patio door, a point 1.6 m above ground (or balcony level for an upper storey) on the centre line of the window may be used. For a bay window, the centre window facing directly outwards can be taken as the main window. If a room has two or more windows of equal size, the mean of their VSCs may be taken. The reference point is in the external plane of the window wall. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be analysed. The VSC can be found by using the skylight indicator (Figure A1 in Appendix A) or Waldram diagram (Figure B1 in Appendix B), or appropriate computer software.

2.2.7 If this VSC is greater than 27% then enough skylight should still be reaching the window of the existing building. Any reduction below this level should be kept to a minimum. If the VSC, with the new development in place, is both less than 27% and less than 0.8 times its former value, occupants of the existing building will notice the reduction in the amount of skylight. The area lit by the window is likely to appear more gloomy, and electric lighting will be needed more of the time.

2.2.8 Where room layouts are known, the impact on the daylighting distribution in the existing building can be found by plotting the 'no sky line' in each of the main rooms. For houses this would include living rooms, dining rooms and kitchens; bedrooms should also be analysed although they are less important. In non-domestic buildings each main room where daylight is expected should be investigated. The no sky line divides points on the working plane which can and cannot see the sky (Figure 15). (In houses the working plane is assumed to be horizontal and 0.85 m high; in offices 0.7 m high; in special interiors like hospital wards and infant school classrooms a different height may be appropriate.) Areas beyond the no sky line, since they receive no direct daylight, usually look dark and gloomy compared with the rest of the room, however bright it is outside. According to BS 8206-2[2], supplementary electric lighting will be

A1.11 For both ends of the obstruction, draw lines from the points plotted to the edge of the direction finder, in the direction away from the centre of the direction finder. Shade the area within the shape created.

A1.12 This process is repeated for every obstruction visible from the reference point. If a house is visible it will usually be necessary to divide it into a series of obstructing elements, eg the eaves, line from eaves to ridge, top ridge, line down to other end of the eaves, and the side of the house if it is visible. Each element is plotted in turn.

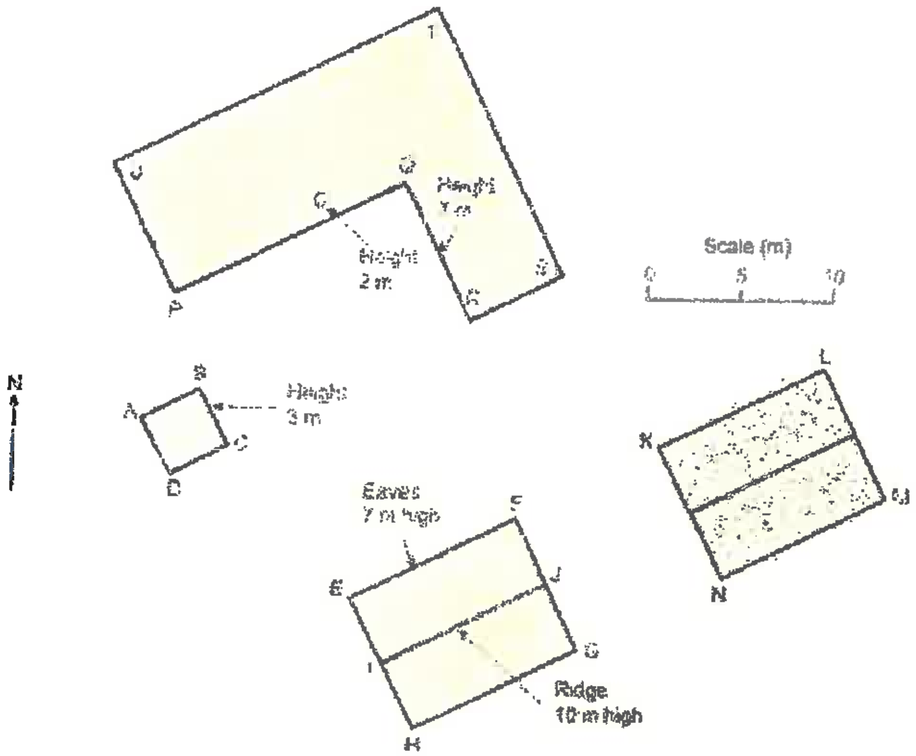
A1.13 Figure A9 gives a plan of an example housing layout. It is required to find the daylight and sunlight reaching point O on the plan. The layout is marked on the direction finder as shown in Figure A10. The base of the direction finder is laid parallel to face POQ. Each obstruction is then considered in turn.

A1.14 A proposed extension QRS is plotted as follows. Only the line QR needs be plotted as this is the only face of the extension that can be seen from point O. Point Q is 5 m from O, and 5 m above it. This is a distance to height ratio of 1. This end of the extension is therefore plotted at point Q' on the direction finder, at a distance of 1 unit from the centre, along the line (in this case the wall of the building) towards Q. The other end of the extension, point R, is 10 m on plan from O and 5 m above it. So R' is marked where the radial line OR intersects the distance: height arc of 2 (10 divided by 5). Points Q' and R' are then joined together. Note that the horizontal extension plotted on the direction finder is parallel to the line of the extension on the original plan.

A1.15 A line is then drawn from the end of the plotted extension R' to the edge of the direction finder, along the radial line from the centre of the direction finder. The area to the right of this line is shaded; these shaded areas represent areas of the sky that the extension will block. In this case the new development has been plotted in a different colour (red) to the existing buildings (green). This is to facilitate the calculation of daylight and sunlight with and without the new development.

A1.16 EFGH is a house with a pitched roof. In this case, both the eaves and the ridge are plotted. Point E is 21.5 m from O and 5 m above it. So the distance:height ratio is 21.5 divided by 5 = 4.3. Point E' on the direction finder is therefore plotted 4.3 units from the centre, along the radial line towards point E. Point F' is plotted in a similar way, and the two are joined together to give the line of the eaves as an obstruction on the direction finder.

A1.17 However, in this case the ridge also forms an effective obstruction, because the house is far enough away so that its roof can be seen from point O. Line I'J' is the line of the ridge plotted on the direction finder. It forms an additional obstruction. The lines E'I' and F'J' are also drawn; these correspond to the sloping edges of the roof. All the area behind the lines E'F', I'J', and J'F' is shaded; this represents the sky blocked by the house.



A1.18 House KLMN is plotted in a similar way, except that the side of the house KN has to be plotted, because it will be visible from O.

A1.19 The nearest point on shed ABCD, point B, is 12 m from O and it is 1 m above point O. So its distance to height ratio is 12. This is actually off the scale of the direction finder, thus this shed is unlikely to be a significant obstruction to daylight. In general, obstructions whose distance is more than 10 times their relative height can be ignored.

A1.20 The resulting plot of the obstructions can then be used with the indicators as described below. For use with the sunpath and sunlight availability indicators, the south point of the layout should be marked on the direction finder.

Table A1 Scales of plan for use directly with indicators

Height of obstruction above reference point (m)	Scale of plan
1	1:100
2	1:200
3	1:300
4	1:400
5	1:500
6	1:600
[illegible]	1:700
8	1:800
9	1:900
10	1:1000
15	1:1500
20	1:2000

APPENDIX B

WALDRAM DIAGRAM TO CALCULATE VERTICAL SKY COMPONENT

B1 As an alternative to the skylight indicator described in Appendix A, a special form of Waldram diagram (Figure B3) can be used to estimate the VSC on an external wall or window. Although it will usually be more time consuming to use than the skylight indicator, the Waldram diagram is more precise and may be used for very complex obstructions. The basic approach is to plot all the obstructions on the diagram; the remaining area is proportional to the sky component on the vertical plane.

B2 Figure B3 is used in the same way as the conventional Waldram diagram for interior daylighting, except that no window outline needs to be plotted as only external surfaces are being considered. Each cm^2 on the Waldram diagram corresponds to 0.1% sky component. Its total area is just under 400 cm^2 corresponding to the sky component of just under 40% on an unobstructed vertical plane.

B3 The horizontal scale on the Waldram diagram is the azimuth angle in degrees from the line perpendicular to the vertical reference plane. The vertical scale is the altitude angle in degrees above the horizontal measured from the reference point on the vertical plane (usually the centre of the window). On the Waldram diagram, vertical edges of obstructions plot as straight vertical lines; horizontal or sloping edges generally plot as curved lines.

B4 To plot a corner of an obstruction or a point on a sloping edge, first measure the angle on the plan at the reference point between the line to the point on the obstruction and the perpendicular to the window wall. This gives the position on the azimuth scale of the Waldram diagram. The position on the altitude scale is given by:

Altitude angle = arctan (h/d) degrees

B5 Here h is the height of the point on the obstruction above the reference point, and d is the distance between the two points on plan. In this case, the centre scale of the Waldram diagram should be used, ignoring the droop lines. This altitude angle is not necessarily the same as the angle on any sectional drawing. For example, suppose point B on the roof line of the obstructing building in Figure B2 needs to be plotted. Its azimuth angle measured from the plan is 40°. On plan it is 20 m from the reference point P and it is 8 m above it on section. So its altitude angle is arctan (8/20) = arctan (0.4) = 22°. These two angles give its coordinates on the Waldram diagram (Figure B3).

B6 The droop lines on the Waldram diagram can be used to plot horizontal edges. The solid droop lines are for edges parallel to the plane of the reference point. The droop line is chosen according to the altitude angle of the horizontal edge in a section perpendicular to the reference window wall. So, for example, in Figure B2 the altitude of the ridge line CD is 30°. It is therefore plotted (Figure B3) along the 30° solid droop line, between azimuth angles corresponding to those of C and D on the plan.

B7 The broken droop lines on the Waldram diagram are used to plot horizontal edges perpendicular to the plane of the reference point. The side FG of the roof of the extension in Figure B2 can be plotted in this way. The required droop line can be chosen by finding the coordinates of any point on the obstructing edge using the method described above. Alternatively if an elevation of the wall containing the reference point is available, the angular altitude of the horizontal edge can be measured off it. The correct droop line is the one which intersects the side of the diagram at that point on the altitude scale. In our example, point G has an altitude of 20° measured on the elevation (Figure B2, Elevation). It is plotted at the far edge of the Waldram diagram in Figure B3 at 20 on the altitude scale. The broken droop line through this point is the edge of the extension FG.

B8 Once all the obstructions have been plotted, measure the remaining area not covered by obstructions (squared tracing paper is ideal for this). This is then divided by 10 to get the VSC. In our example, the unobstructed area on the Waldram diagram (Figure B3) is just over 290 cm^2, so the VSC is just over 29%.

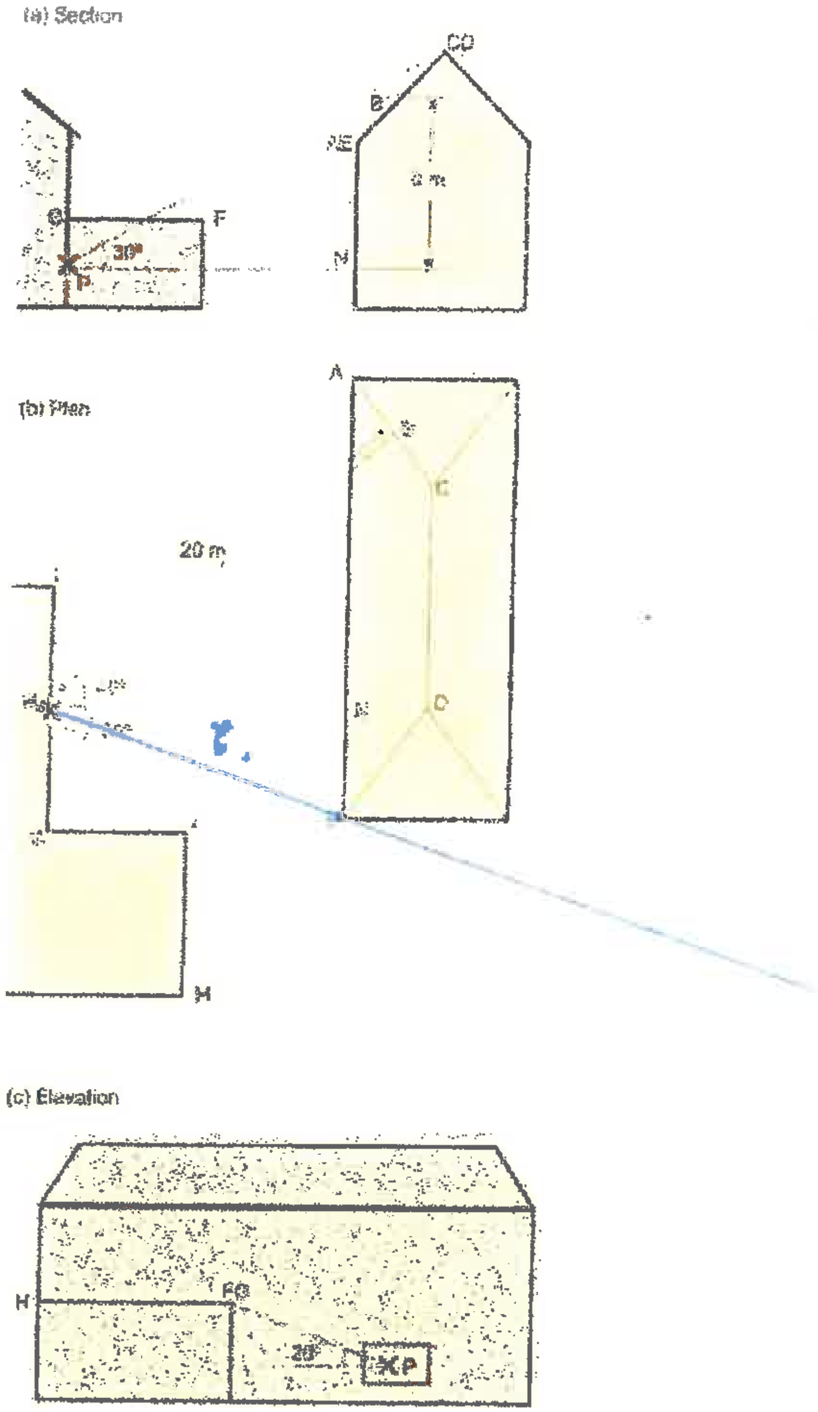


Figure [illegible] Section, plan and elevation of a hypothetical sample situation

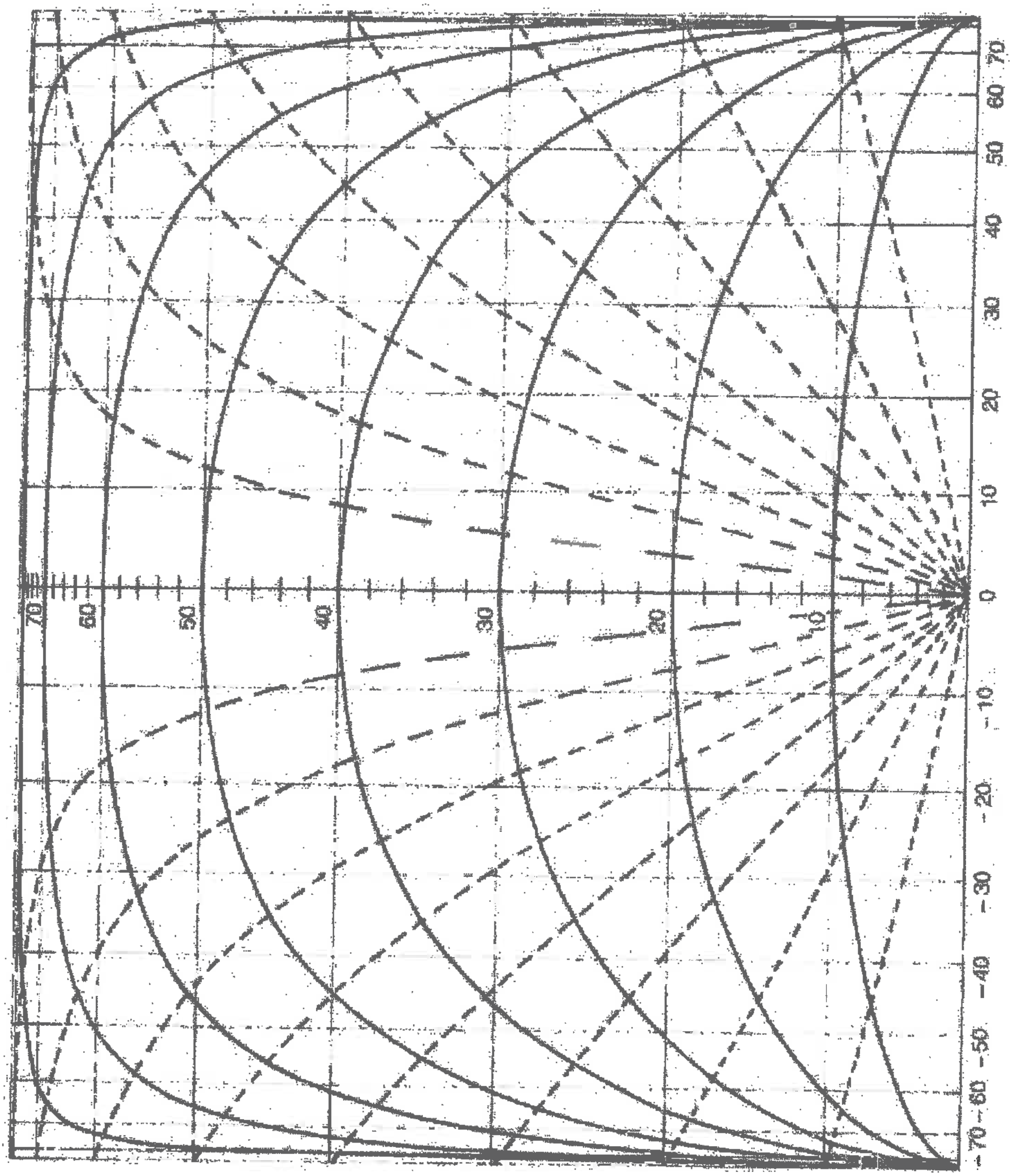


Figure B1: Waldram diagram for calculating VSC