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Aperture-Based Daylight Modelling: Forging the Link Between Inside-Outside Daylight Evaluation

The process that leads to the initial conception of the shape, form and size of a building (i.e. massing) is usually the starting point of an architectural design: the building is designed from the *outside-in*. Commonly used guidelines refer to quantities such as the vertical sky component determined at a point on the building envelope. Similarly for sunlight, the evaluation is carried out at a point on the facade. Massing-stage daylight/sunlight evaluations are nearly always carried out as a matter of routine.

The design of the interior spaces is usually finalised after the massing-stage evaluation. The next step is to determine daylight/sunlight performance measures for the occupied spaces with windows/rooflights. In other words, an *inside-out* evaluation. Until relatively recently, the sole daylighting metric in common use was the daylight factor. In the last decade, metrics founded on climate-based daylight modelling (CBDM) have gained in popularity and are now encouraged by various guidelines and standards, e.g. the 2018 European Standard and the 2020 WELL Building Standard. Irrespective of the next-stage method (daylight factors or CBDM), the *inside-out* evaluation essentially begins from scratch. In short, there is no linkage between the methods used at the planning stage and those for building performance.

Aperture-Based daylight modelling (ABDM) is a new modelling schema to evaluate building apertures (or any planar surfaces on the building envelope) based on numerical measures of their connectedness to the sun, the sky and the view of the external environment. ABDM is founded on essentially geometrical principles, but nevertheless it can provide meaningful indicators of the daylight/sunlight potential of building apertures (or surfaces, e.g. PV panels). The evaluation of sunlight, skylight and view at the building aperture presents something of a paradigm shift compared to existing approaches. Although 'radical'in terms of conception and simplicity, ABDM offers the potential of seamless refinement to CBDM-type solutions. In other words, the (purely geometrical) ABDM metrics can be gradually 'climatised'to more realistically represent the prevailing sunlight and skylight conditions derived from localised weather files using CBDM.

The multiple goals of achieving sustainable development in the built environment whilst providing interior spaces that sustain and promote health and well-being, and doing so within the cost-constrained realities faced by developers, necessarily results in competing interests. One of the essential functions of planning is to reconcile the competing interests with the least possible compromise for all relevant stakeholders, not least the future occupants of those buildings. The increasing importance given to both the internal environment (e.g. occupant well-being) and the overall building performance (e.g. net zero) will, sooner or later, result in the realisation that current practice must somehow be upgraded to account for these factors at the earliest stages of design/planning. Aperture-based daylight modelling has the necessary properties to serve as the basis for the evaluation method to fulfil that need.

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