

Popular summary (in English)

Title of dissertation:

“Daylight compliance of multi-dwelling apartment blocks – Design considerations, evaluation criteria, and occupant responses”

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Summary

This thesis focuses on the daylight performance of Swedish apartment blocks. It presents the parameters affecting indoor daylight levels, it assesses whether daylight provision is adequately regulated, and it examines occupants’ responses regarding daylight conditions in their dwellings. As a result, the work presented in this thesis contributes to knowledge supporting the development of more appropriate daylight criteria for residential spaces, that could be considered by policy makers in their endeavours to upgrade building regulations.

The main outcomes of this thesis can be summarised under three main themes: 1) limitations of current daylight criteria in Swedish building regulations, 2) determinants of daylight compliance and considerations for future regulations, and 3) inhabitants’ response regarding daylighting and electric lighting use in apartments.

Limitations of current daylight criteria in Swedish building regulations

The formulation of the current two daylight criteria in the building code is not optimal because of three limitations: 1) the way to assess daylight is not clearly defined for all types of spaces, 2) surrounding buildings that may shade are not always considered, and 3) sun position is not considered.

Another consideration relates to the regulatory hierarchy characterizing the building code. In Sweden, some parts of the building code are mandatory requirements, while other parts, including quantified daylight criteria, are only stated as general recommendations, which are not legally binding per se. Ironically, of the buildings evaluated in this thesis, the ones erected following the introduction of quantified daylight criteria in 1975 were shown to perform worse than the ones erected prior to that year. This is an indication that quantified daylight criteria need to be stated as mandatory requirements if they are to be followed, similarly to how current energy compliance criteria are stated today.

Determinants of daylight compliance and considerations for future regulations

Densifying the built environment was shown to block daylight regardless of apartment design, which indicates that daylight provision is primarily dependent on the exterior environment. This observation leads to the proposal of instigating early-design compliance testing criteria at the urban scale. Among different characteristics of residential rooms, the amount of façade

glazing relative to floor area, and the amount of sky visible from windows were shown to be the most influential parameters of indoor daylight levels.

The importance of criterion choice in order to judge whether spaces are adequately daylit or not was also assessed. The current Swedish criterion was found to be the easiest to comply with compared to other criteria. A shift to a more advanced daylight criterion could consider using the Useful Daylight Illuminance (UDI) metric, which is superior to the current regulation as it accounts for orientation and sunlight, and can be used in tandem with thermal comfort evaluations. Significant compliance similarities were found between the current criterion and a UDI-based criterion.

Inhabitants' response regarding daylighting and electric lighting use

Three important considerations can be summarized following a survey on daylight conditions of apartments. Firstly, higher levels of daylight are associated with less frequent electric lighting use. Secondly, room orientation is a key factor in reducing electric lighting use. Occupants reported less daytime lighting use in west-facing rooms, which can be attributed to residential occupancy patterns, i.e., people returning home when the sun is due west. This finding illustrates the need for daylight criteria that account for sun position. Thirdly, it seems that there is an agreement among occupants on which rooms are prioritized in terms of daylight. The majority of respondents selected the bedroom as the room they would tolerate underlit if they had to pick a room. On the other hand, very few occupants would choose to have their kitchen or living room as the darkest room of their apartment. This information could be considered in future regulations that wish to differentiate between room types.

Overall, this thesis demonstrates the importance of urban planning for daylighting, the implications of using different designs on daylight availability, the need for proper well-formulated regulations and a rigorous compliance path, the connection between daylight availability and electric lighting use, and the fact that occupants have specific preferences regarding the illumination of their apartments.