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Daylight integration in commercial buildings: key aspects and benefits.

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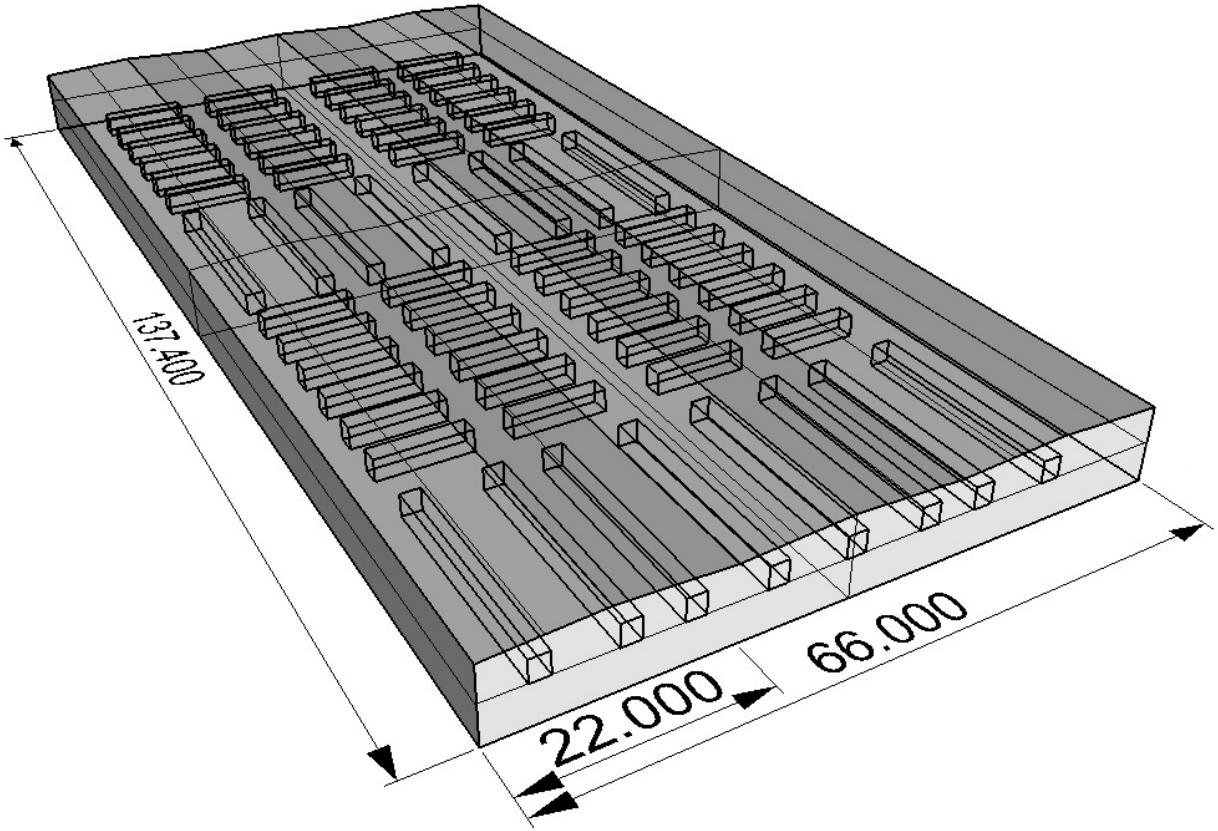
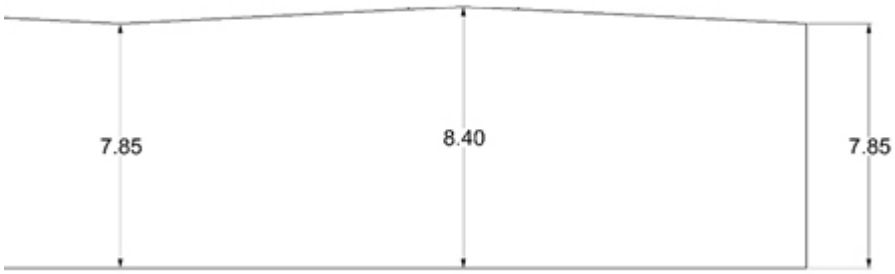
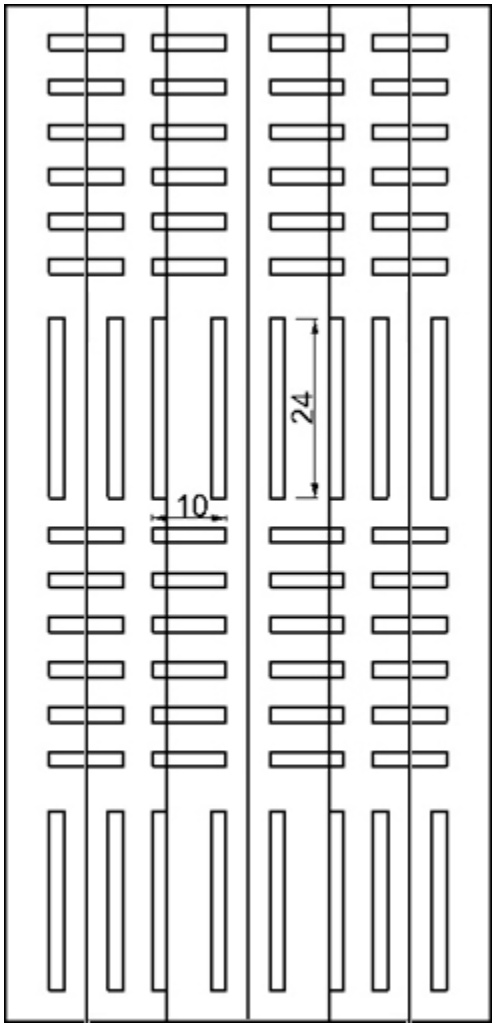
Building design assumptions

Location: Helsinki - Operating hours 7-22 - 4695 hours/year - Installed power 56236 W - Total energy lighting: 264025 kWh/y - Target Illuminance 500 Lux (floor level) - LED Luminaire with DALI ballast 1%

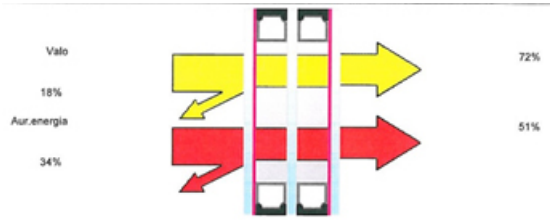


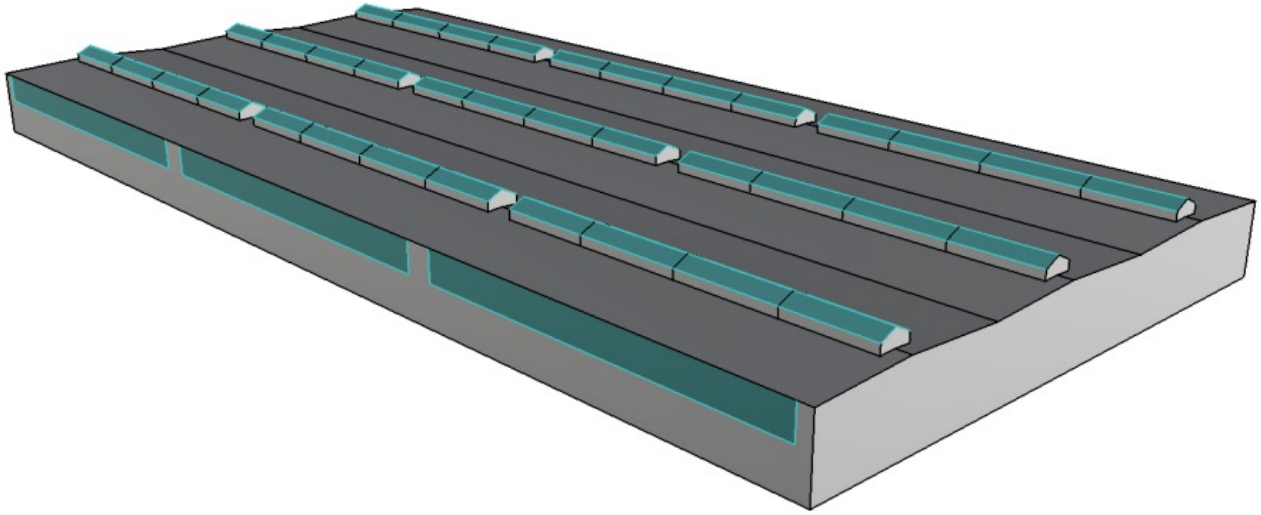


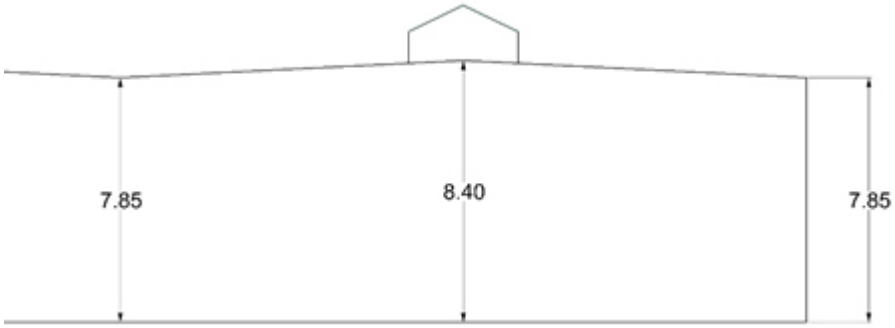


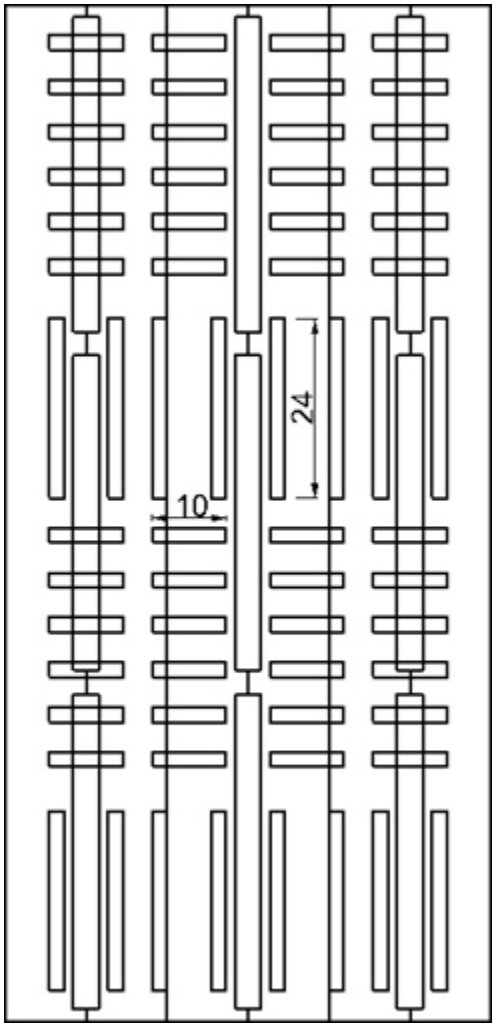
Daylight sources

- Skylights - glass material VT 72%
- Clerestories - polycarbonate material VT 40%





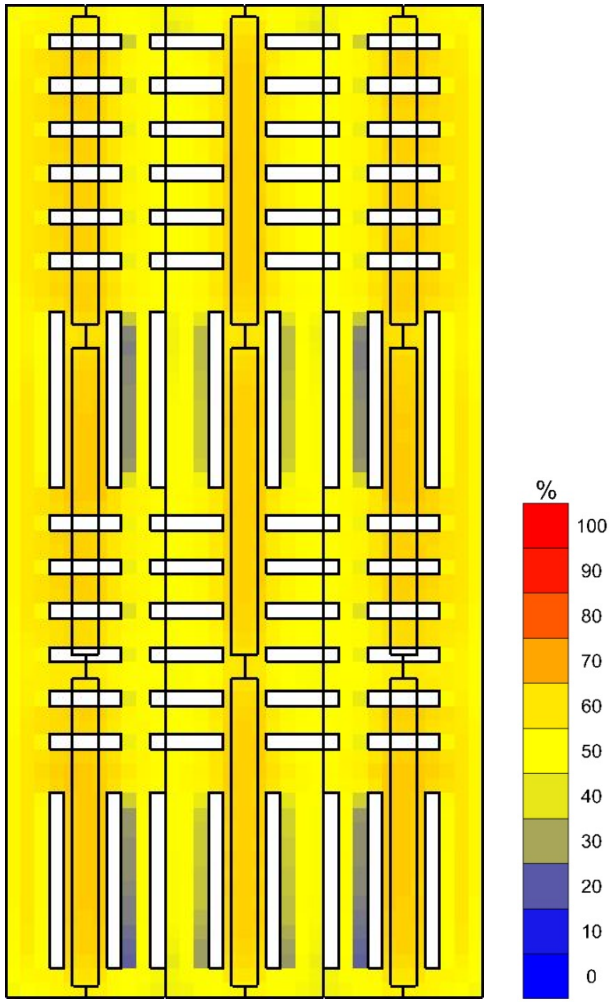




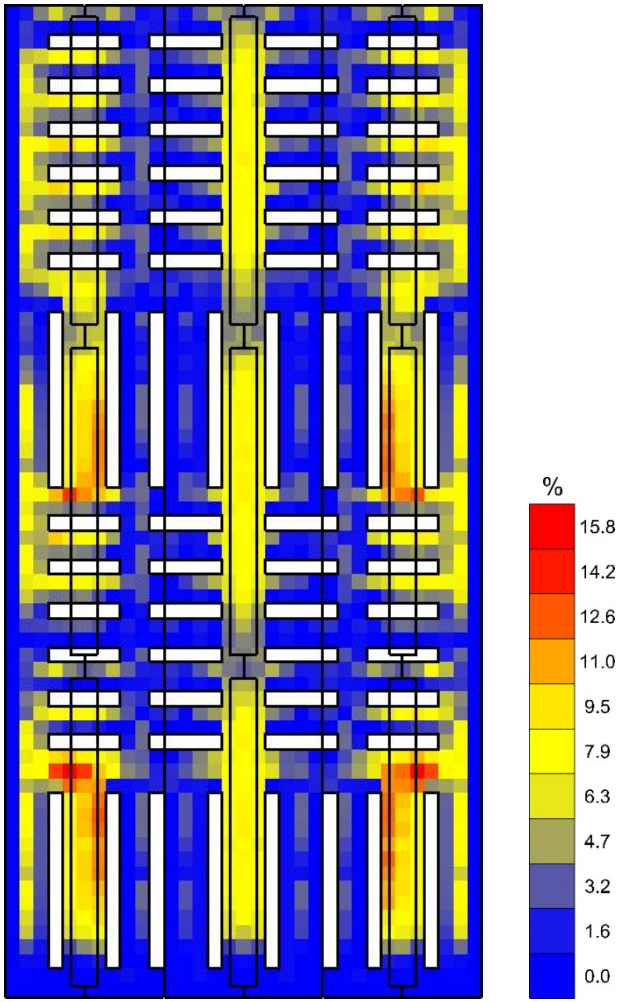
Daylight analysis

Annual dynamic simulations based on weather data for electric light contribution calculation

- Continuous Daylight Autonomy (CDA)
- Useful Daylight Illuninance (treshold 3000 Lux)



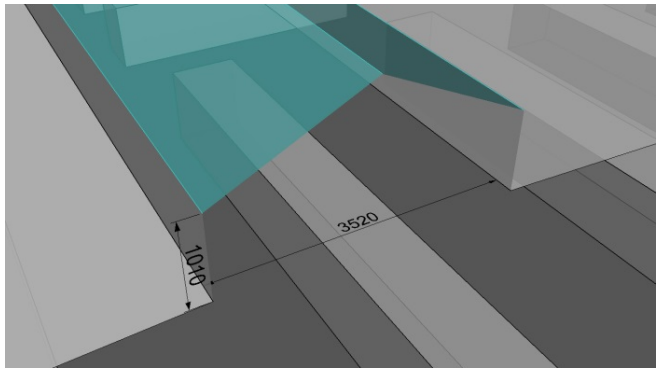
Continuous Daylight Autonomy (CDA)
Case R-g72-d70p50-ww

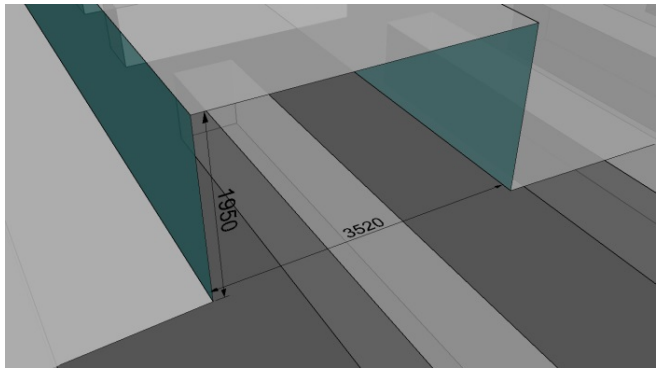


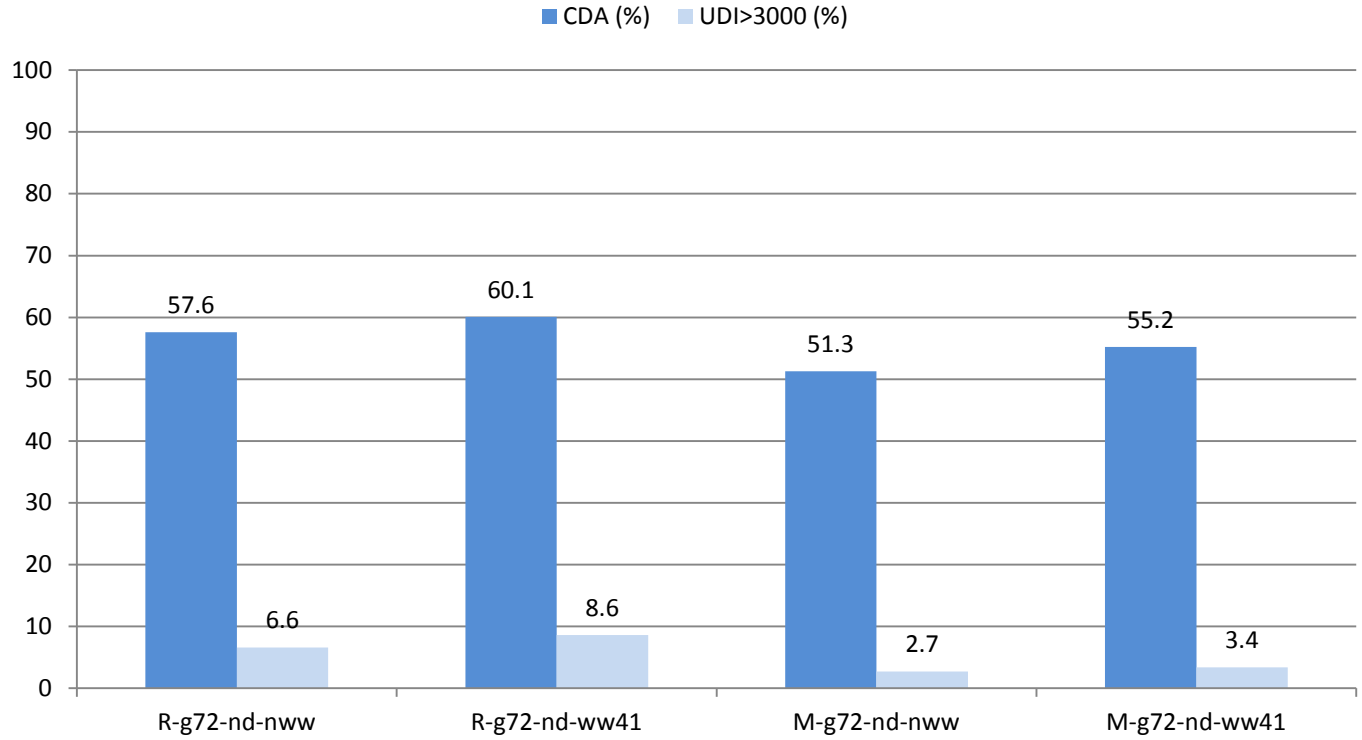
Useful Daylight Illuminance (UDI>3000)

Skylight types

- Ridge
- Monitor

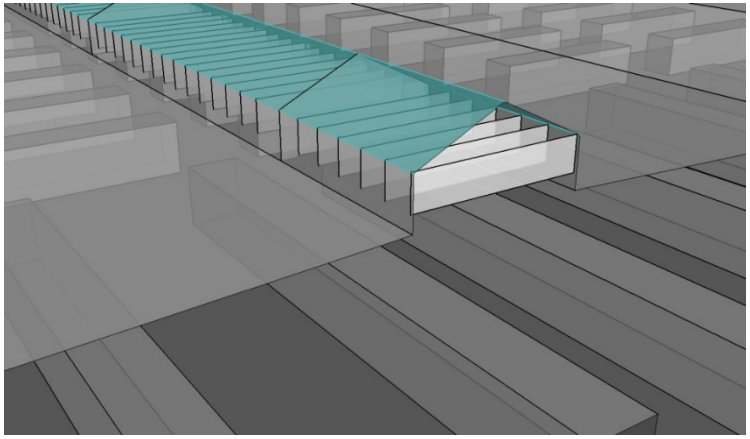


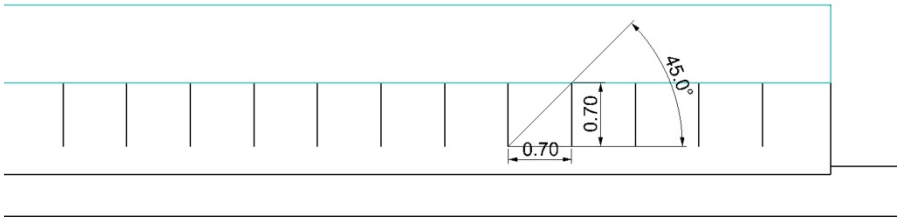




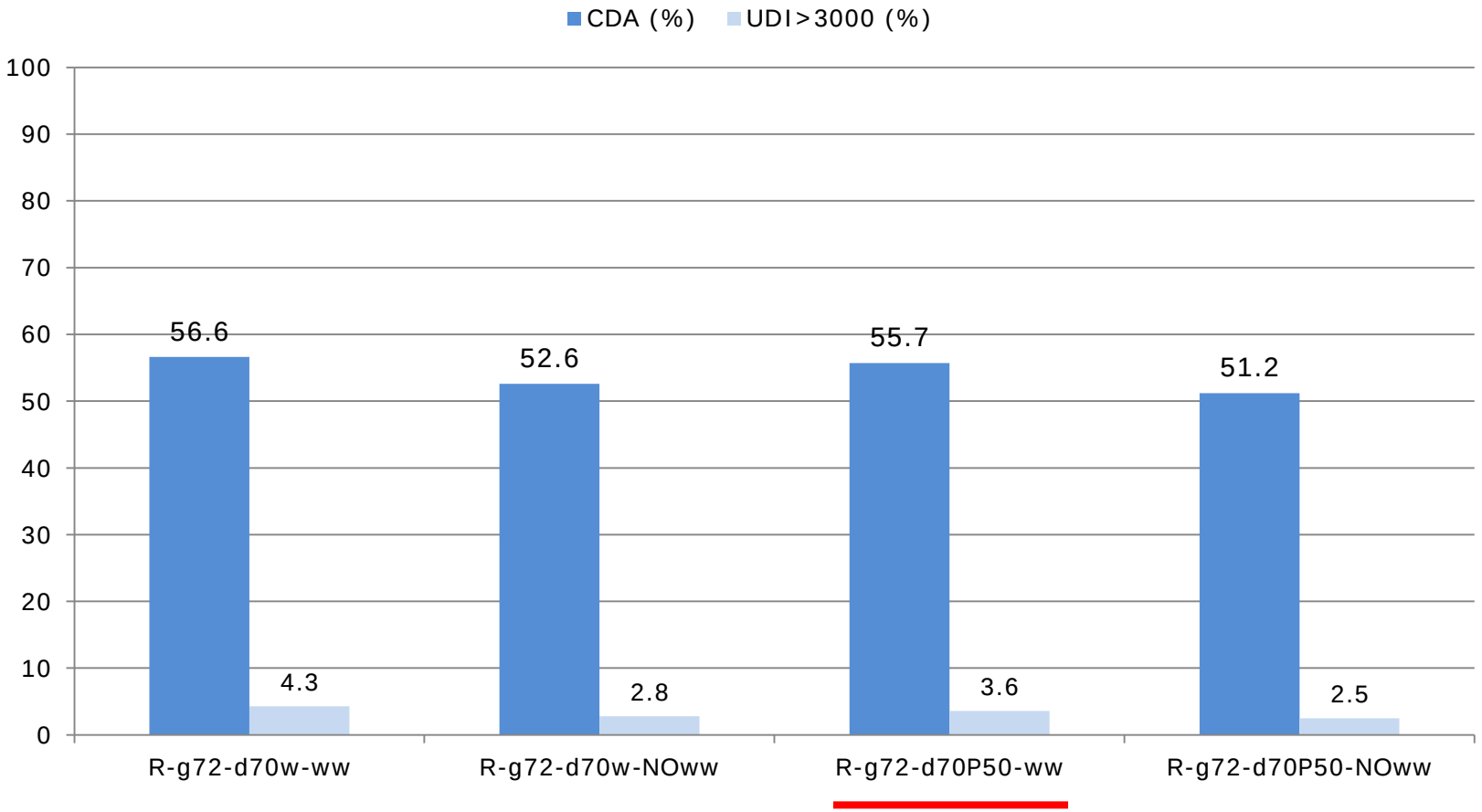
CDA Continuous Daylight Autonomy
UDI>3000 Useful Daylight Illuminance > 3000 Lux

Skylights deflectors



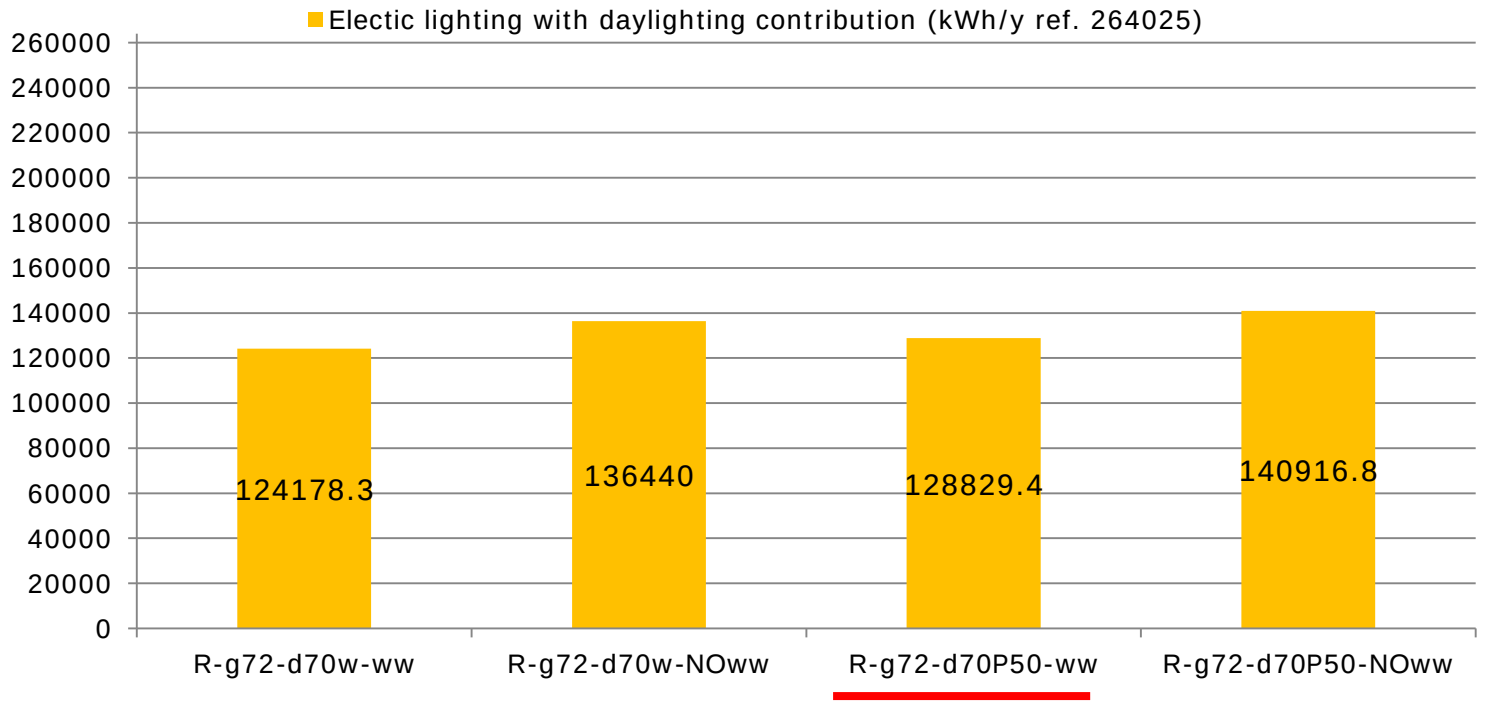


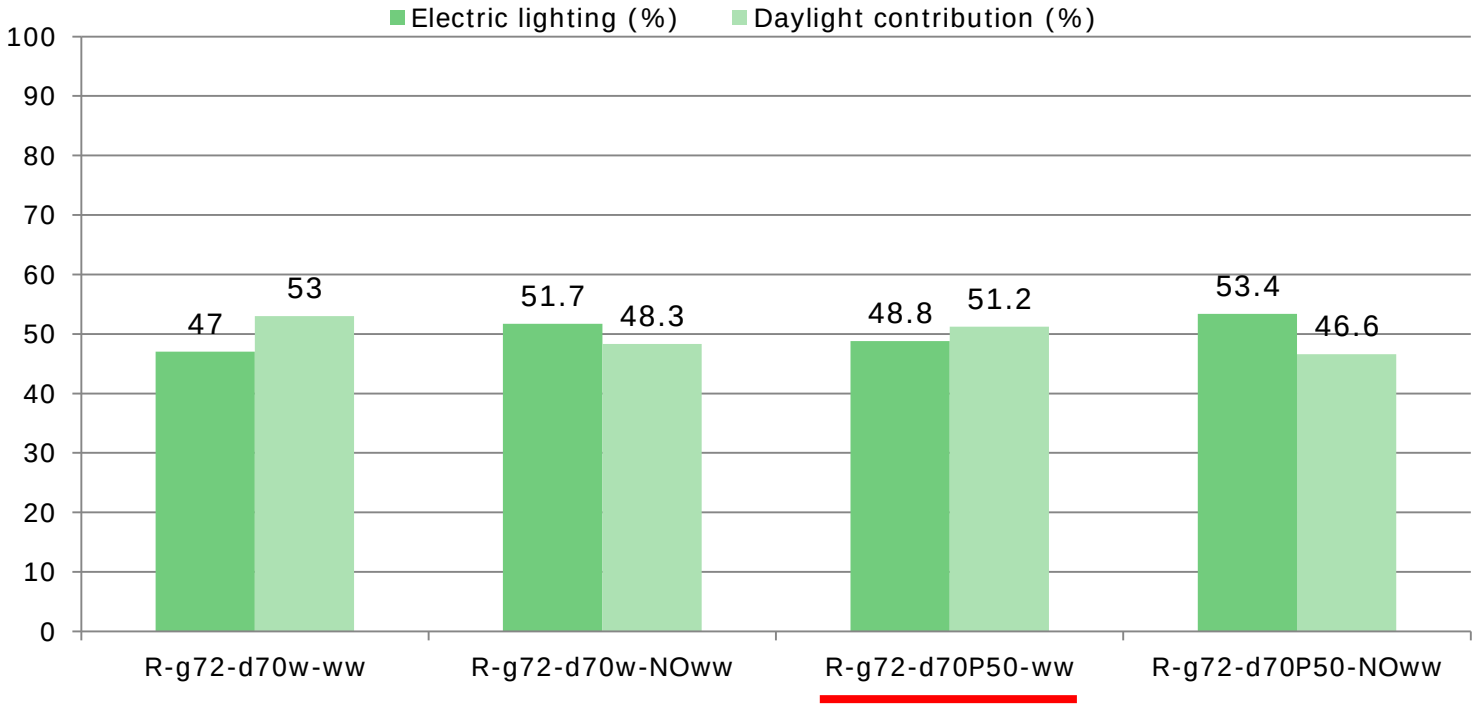
- Opaque white
- Polycarbonate VT 35%



CDA Continuous Daylight Autonomy
UDI>3000 Useful Daylight Illuminance > 3000 Lux

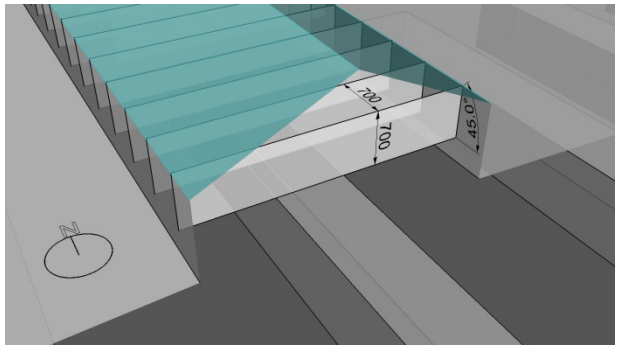
Daylight and electric light contribution

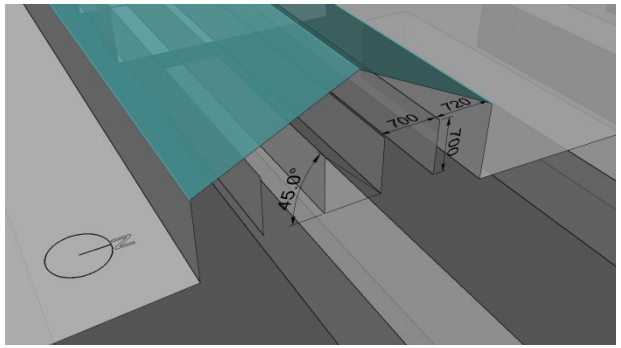


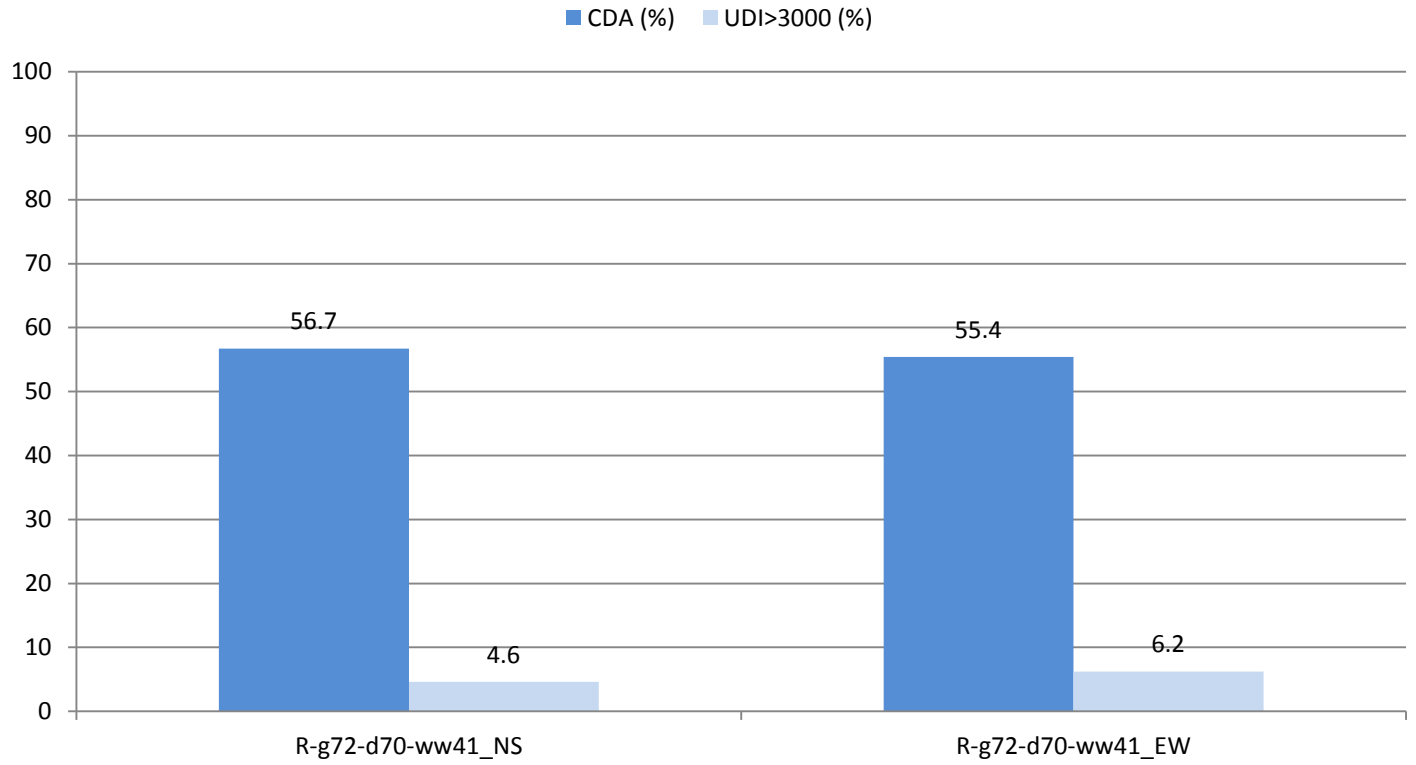


Orientation

Skylights ridge type glass VT 72% deflectors 700mm x 700 mm opaque white oriented toward south



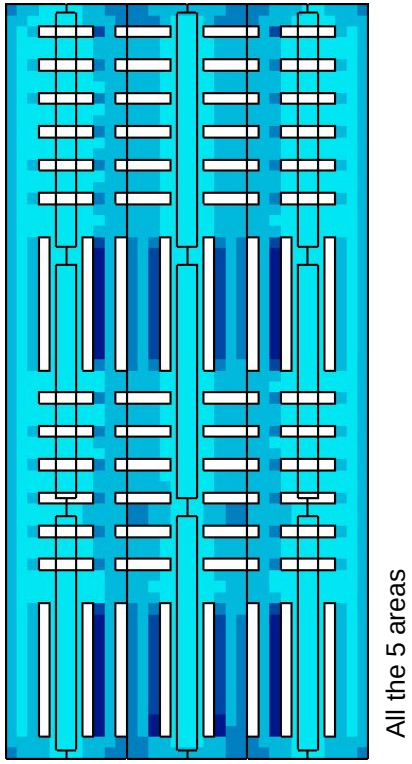


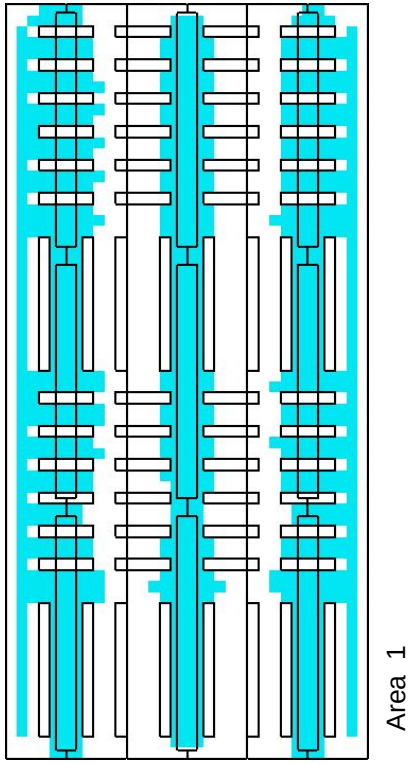


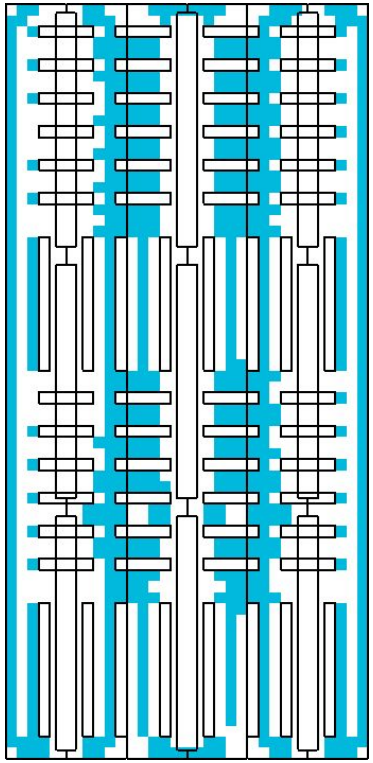
CDA Continuous Daylight Autonomy
UDI>3000 Useful Daylight Illuminance > 3000 Lux

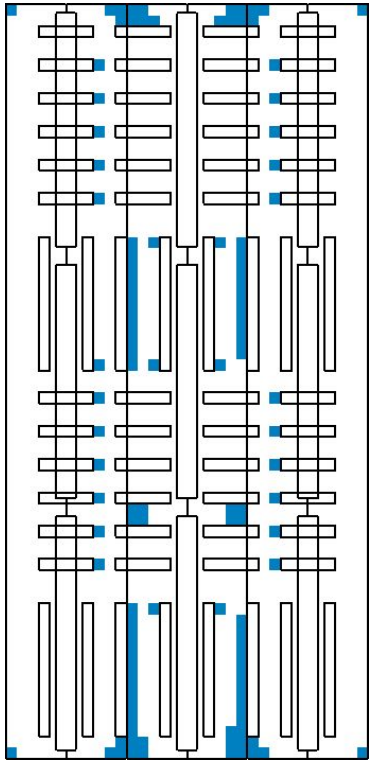
Lighting zones

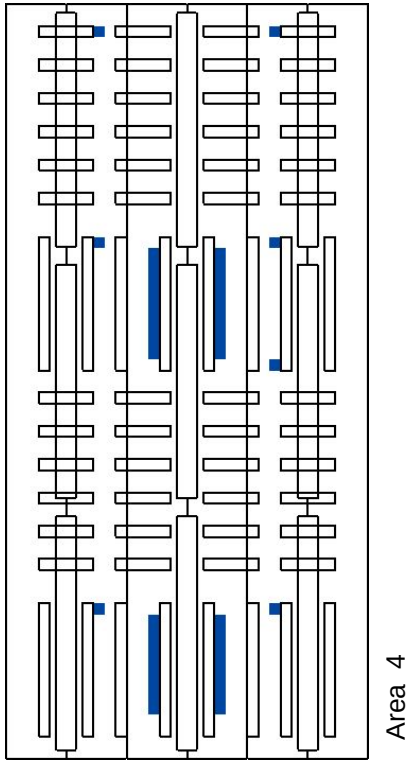
Daylighting uniformity areas (CDA)
(Case R-g72-d70p50-ww)

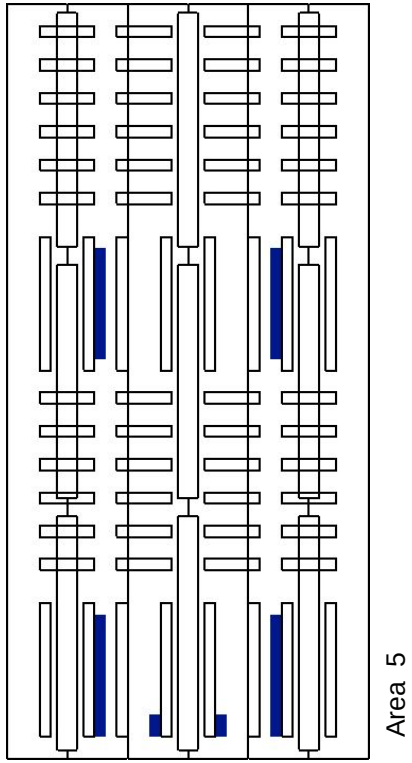

All the 5 areas


Area 1


Area 2


Area 3

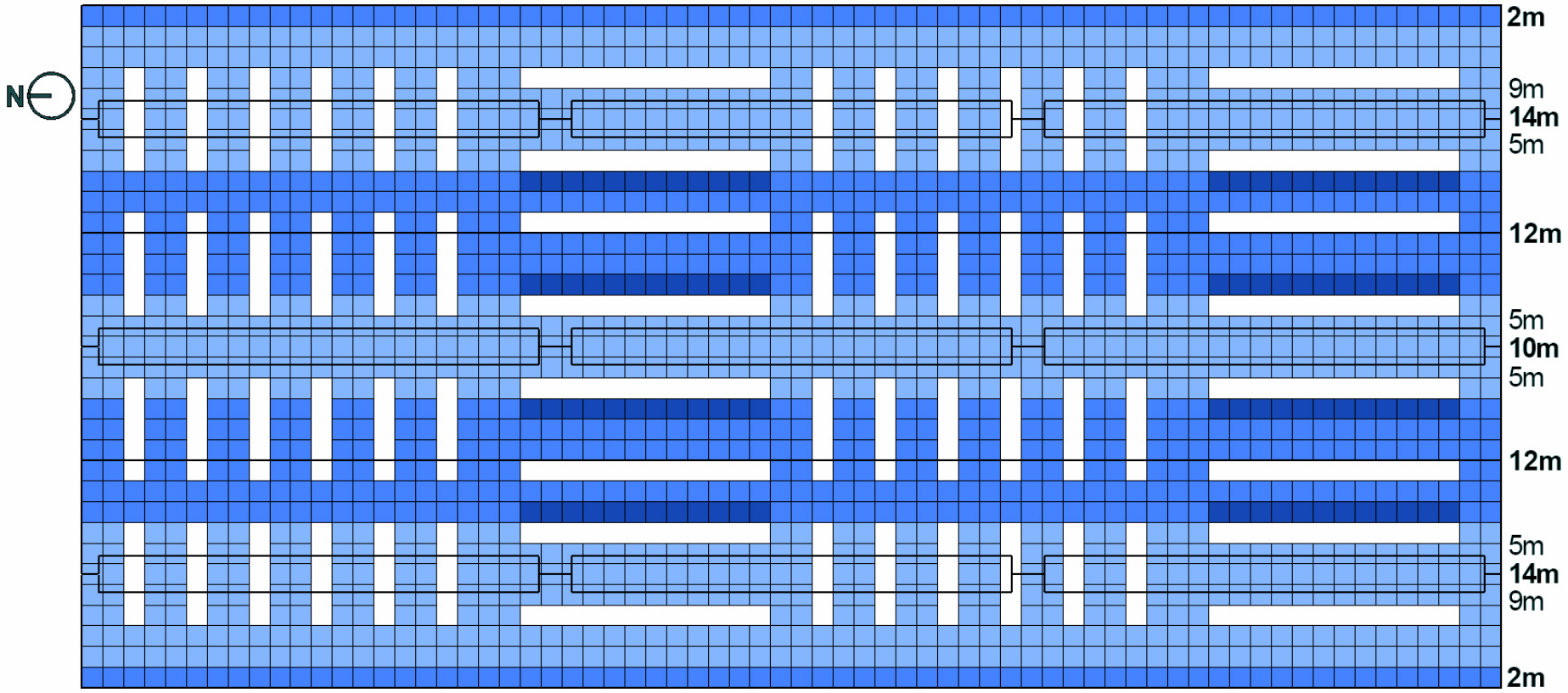

Area 4


Area 5

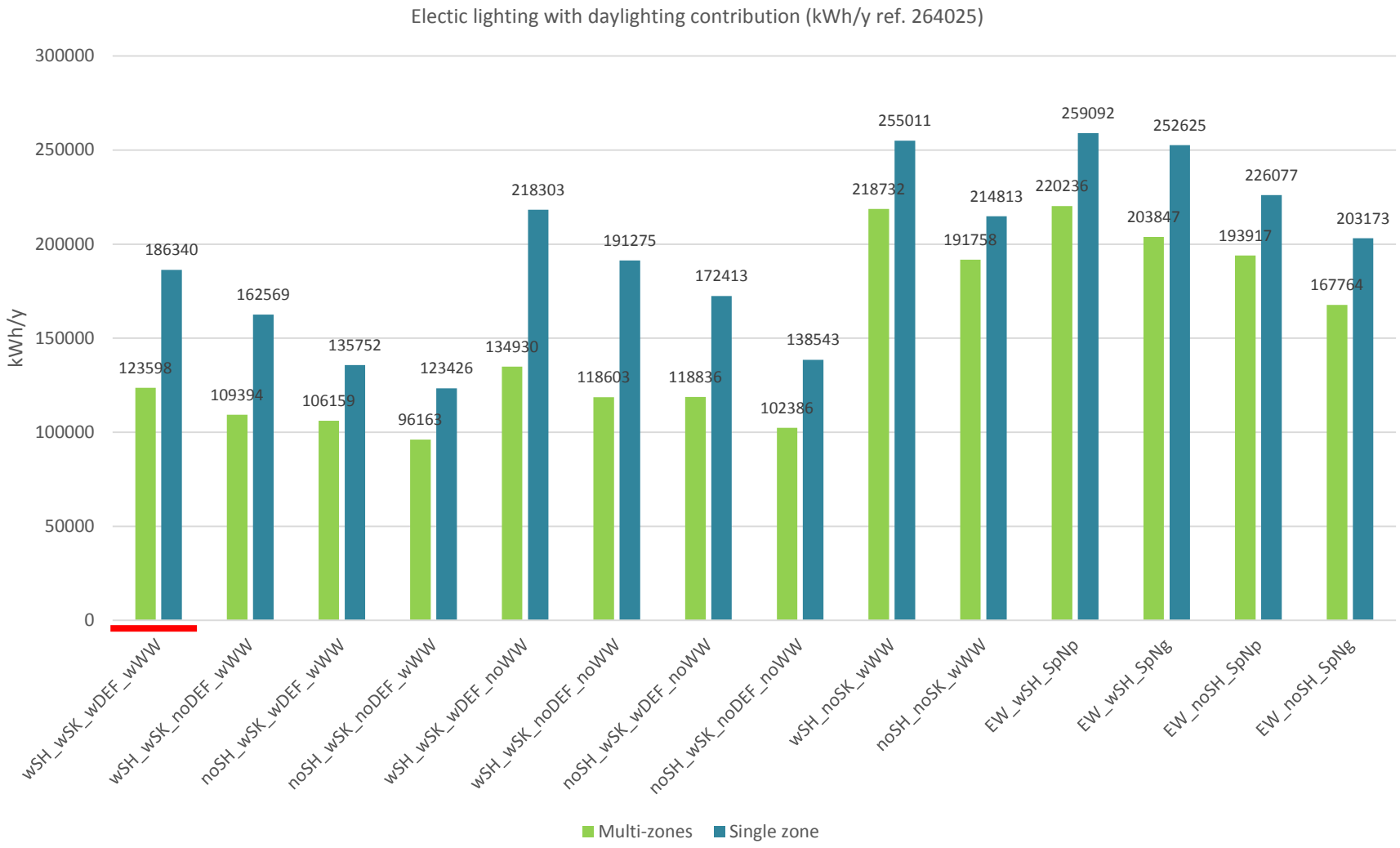
Lighting zones

- Lighting zone with best potential (Zone 1) – Light blue color.
- Lighting zone with intermediate potential (Zone 2) – Medium blue color.
- Lighting zone with least potential (Zone 3) – Dark blue color

(Case R-g72-d70p50-ww North-South)



Lighting zones



Comparision of electric light contribution for building cases with single zone and multi-zones, using the control *always on during operating hours dimmable with light.*

Key aspects and benefits

- Annual dynamic daylight simulations for electric light contribution calculations.
- More than 50% of the necessary illuminance can be provided by daylight using a combination of glass skylights and traslucent wall windows (studies done for Helsinki).
- Necessity of deflectors to decrease contrast and excessive natural illuminance. If well designed the deflectors can reduce the unwanted excessive illuminance of 38% while the reduction of Continuous Daylight Autonomy is just about 7% (mean values).
- Using deflectors (in the glass skylights) and traslucent wall windows the daylight performance of the building are not depenent on the orientation.
- For best performances is necessary to use multiple lighting zones in the building. The electric light consumption of a multi-zones light control can be up to 62% (among the cases studied) of the same commercial building with a single lighting zone.

Thank you.

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