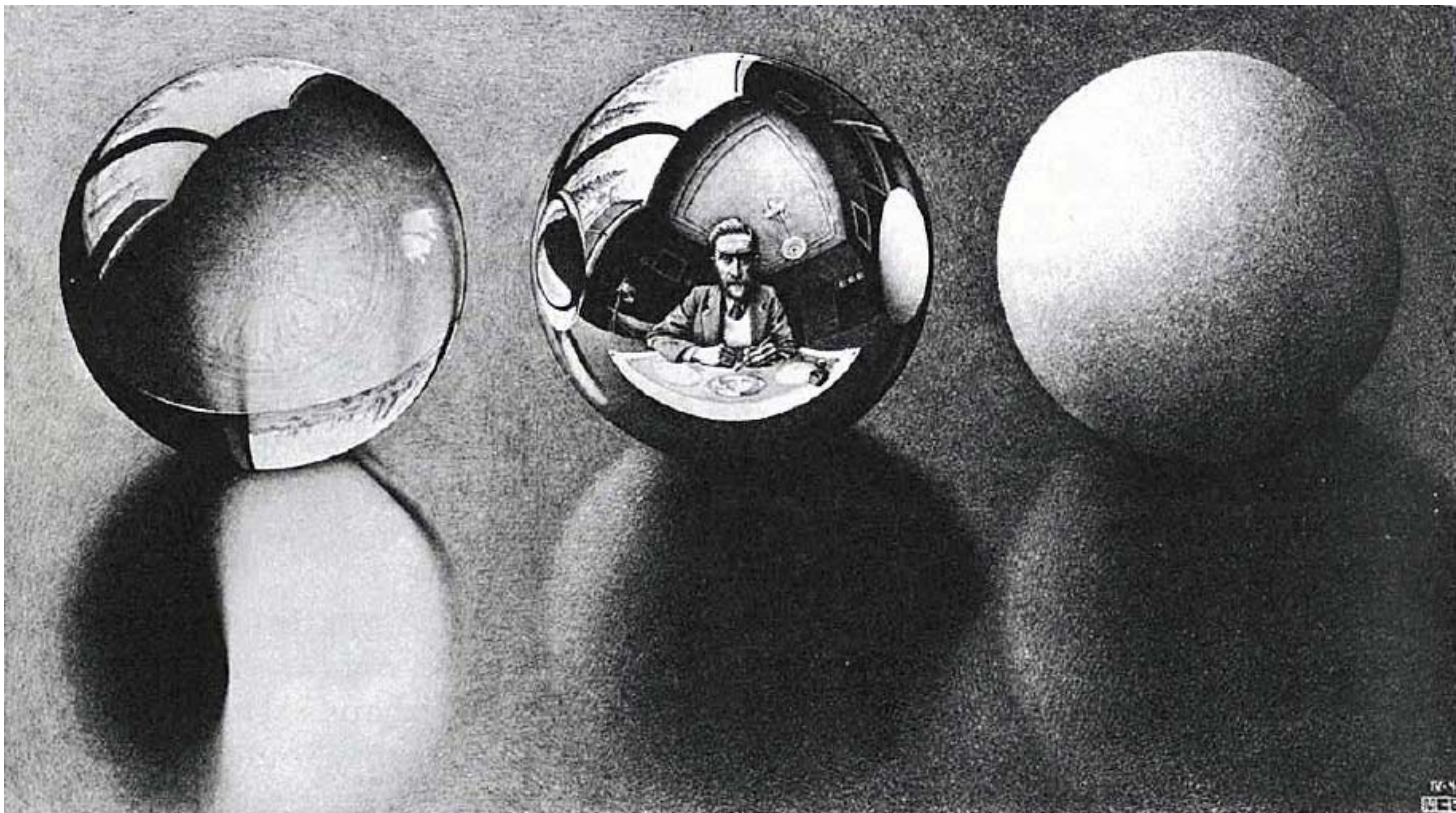


DAYLIGHTING ISSUES

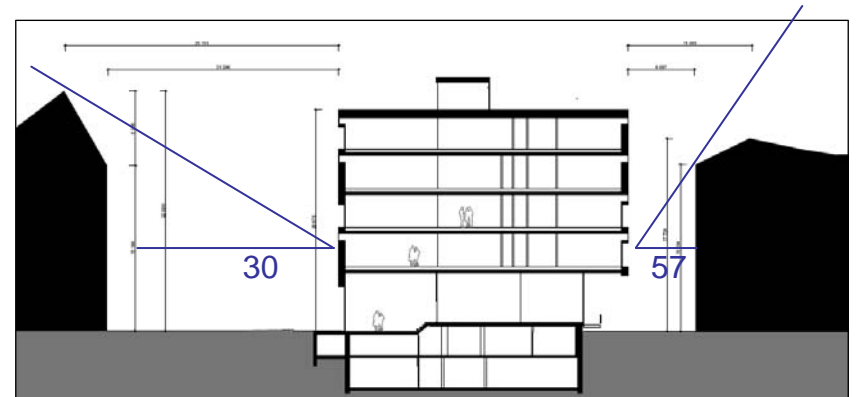
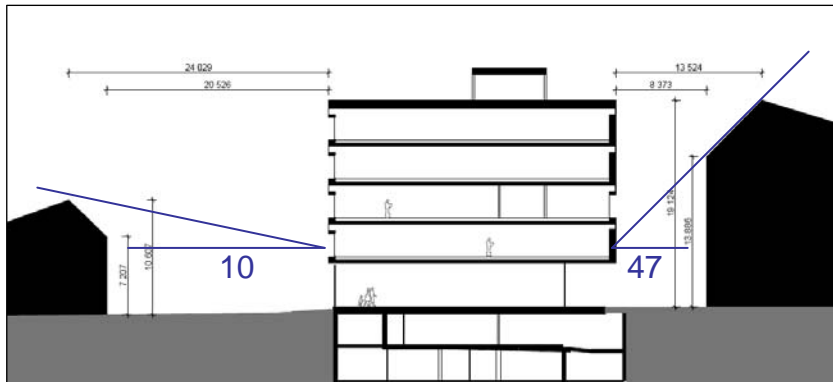
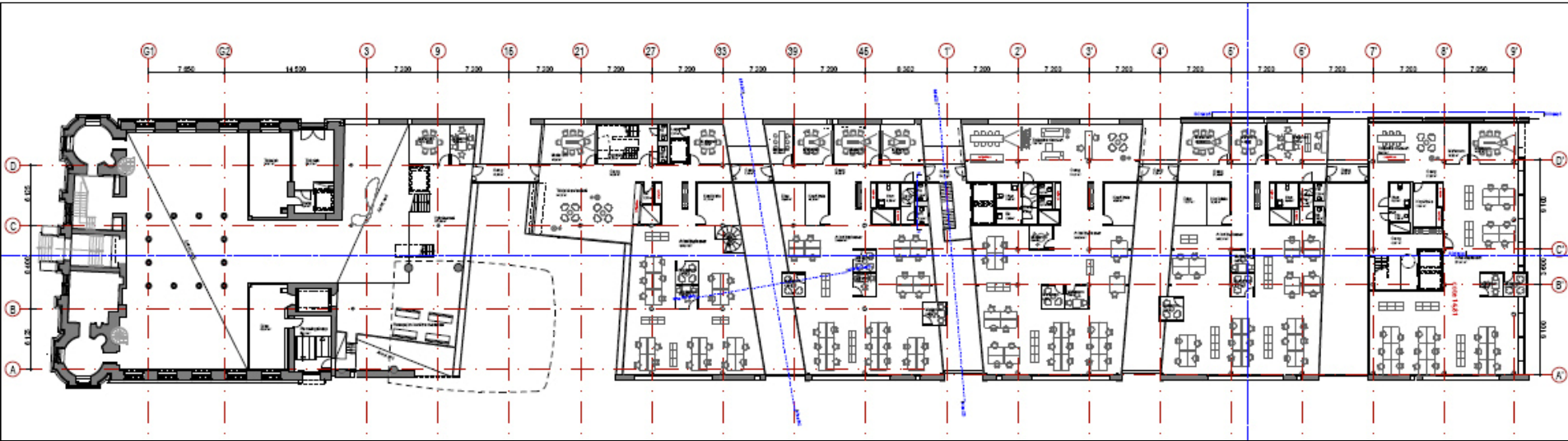
Barbara Matusiak

Department of Architectural Design, Form and Colour Studies



Three Spheres, by Maurits. C. Escher (lithograph, 1946)

Daylighting in the bank building?

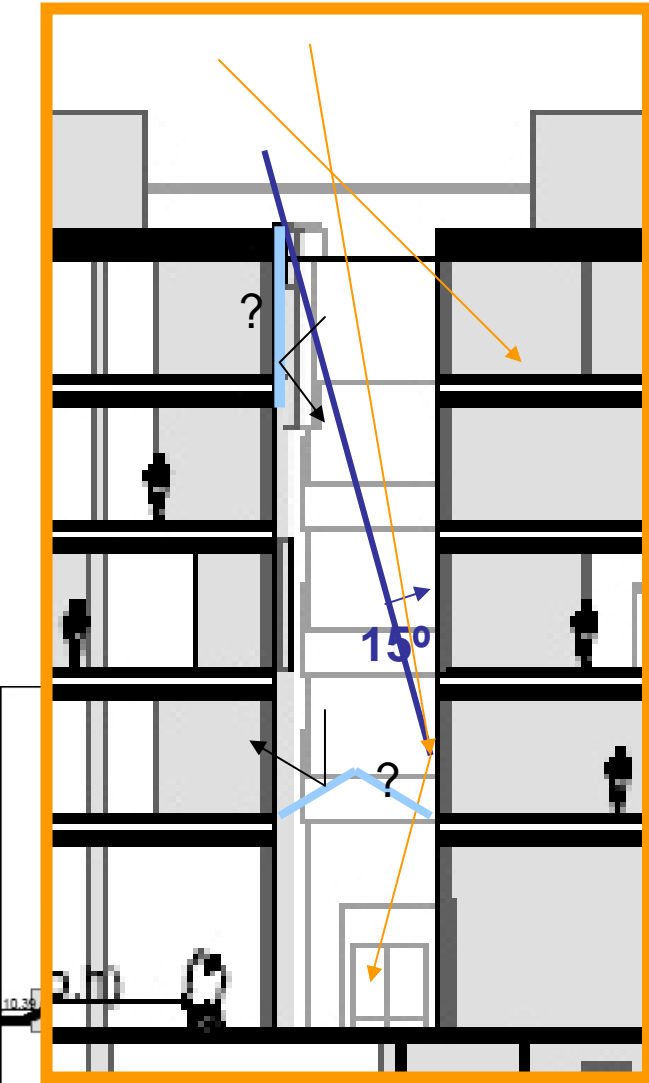


Daylight level in officies

Step 1:

Calculation of daylight level for alternatives:

- BaseCase: 50-50-50-50
- BaseCase: 70-50-30-20
- ALT: 70-50-30-20 + mirror
- ALT: 70-50-30-20 + reflector
- ALT: 70-50-30-20 refl. + mirror



Glass

- Windows:

$$LT_{\text{glass}} = 0,71$$

- Roof in light spaces:

$$LT_{\text{glass}} = 0,70, \quad LT_{\text{roof}} = 0,70 * 0,9 = \underline{0,63}$$

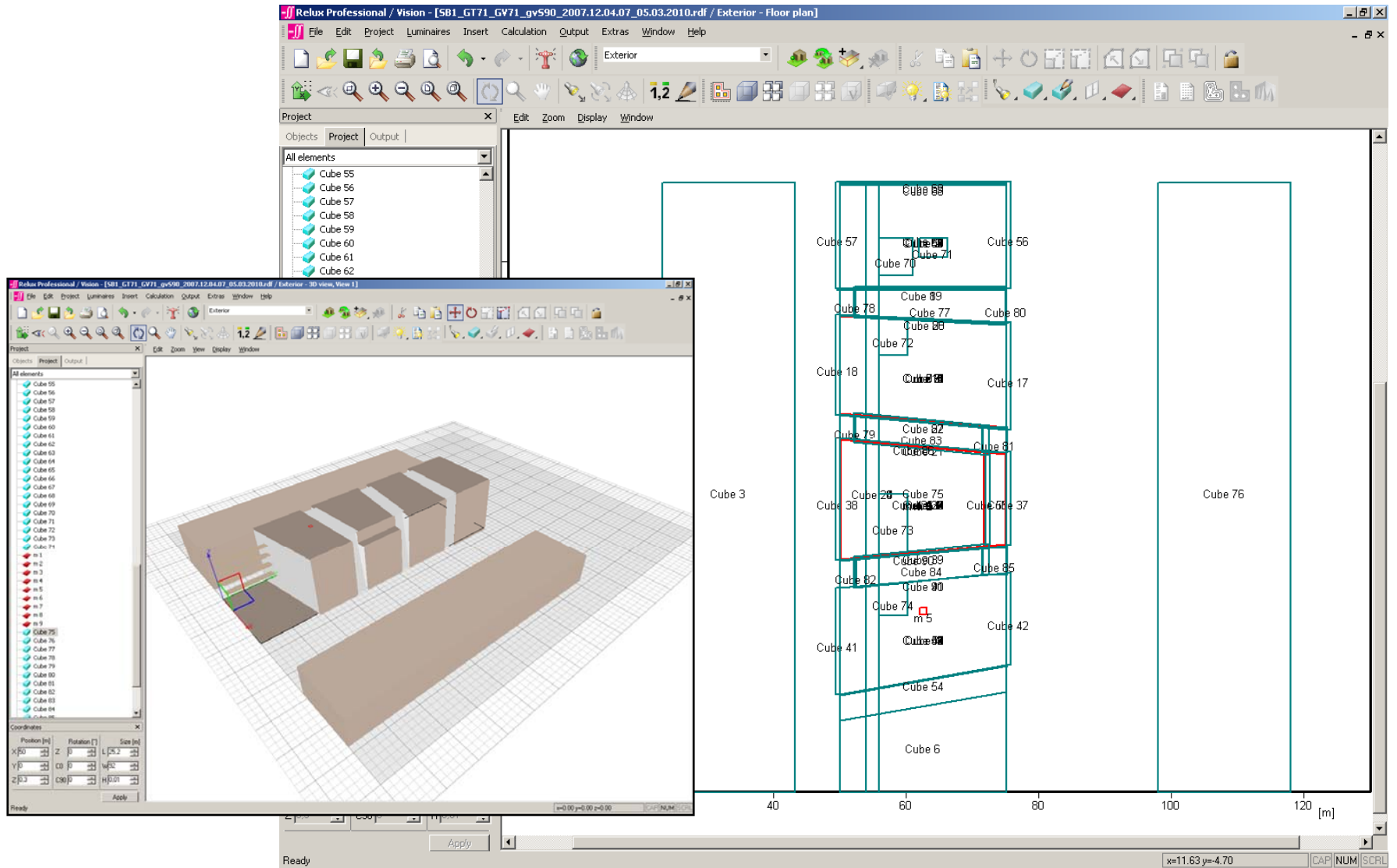
- Outside glazed walls in light spaces:

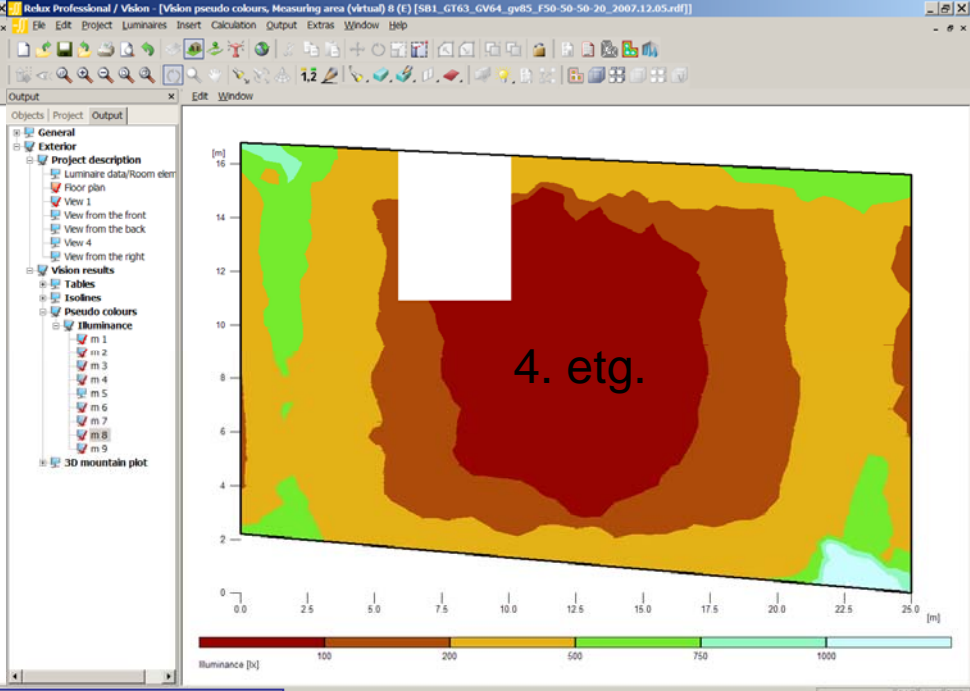
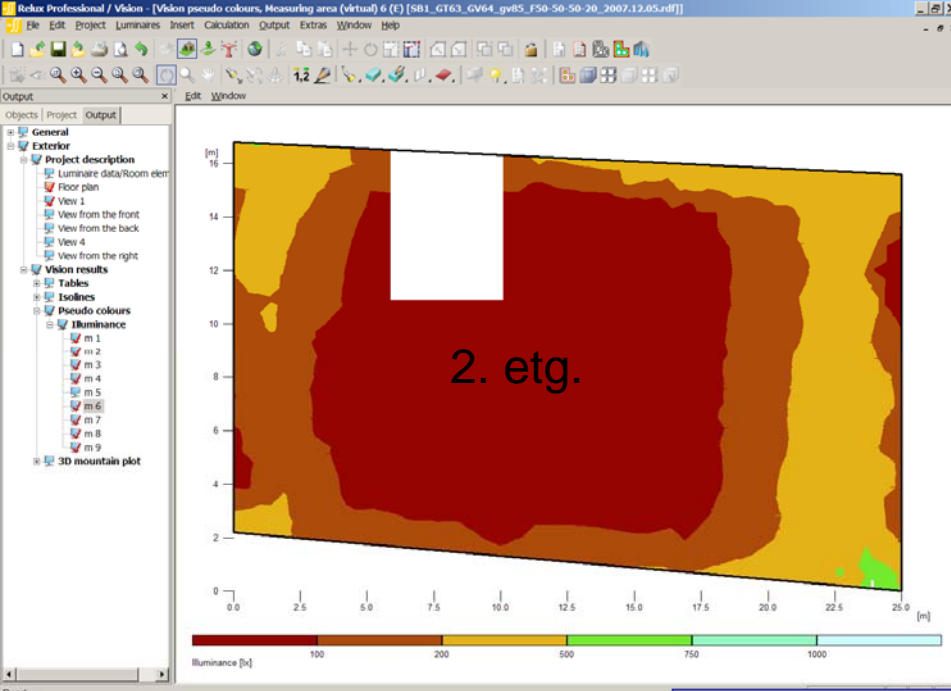
$$LT_{\text{glass}} = 0,71, \quad LT_{\text{wall}} = 0,71 * 0,9 = \underline{0,64}$$

- Glas walls in office areas toward light spaces:

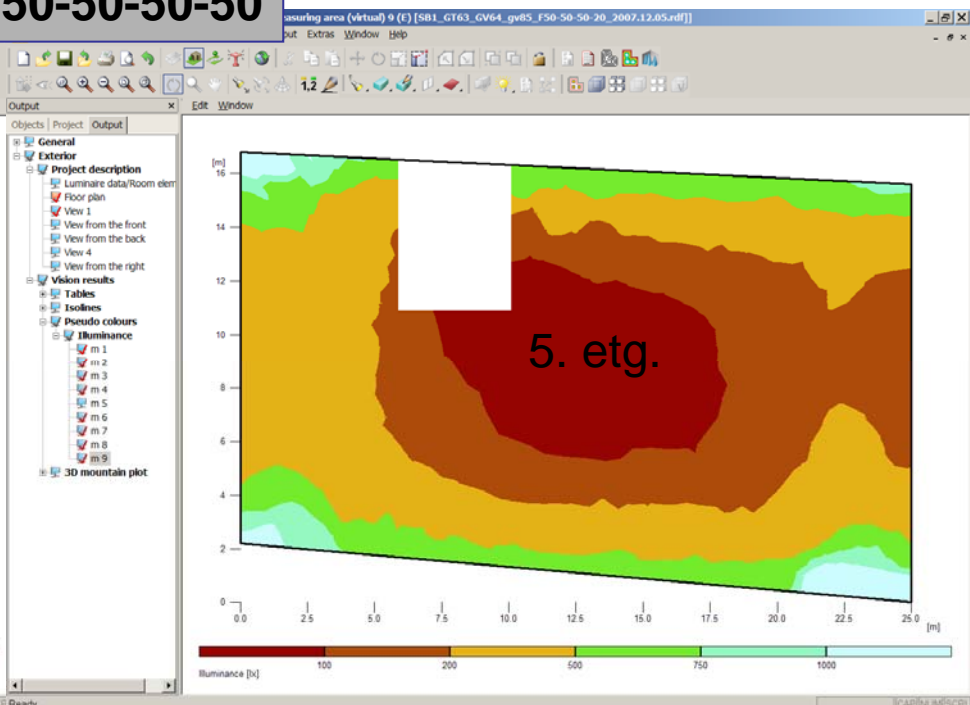
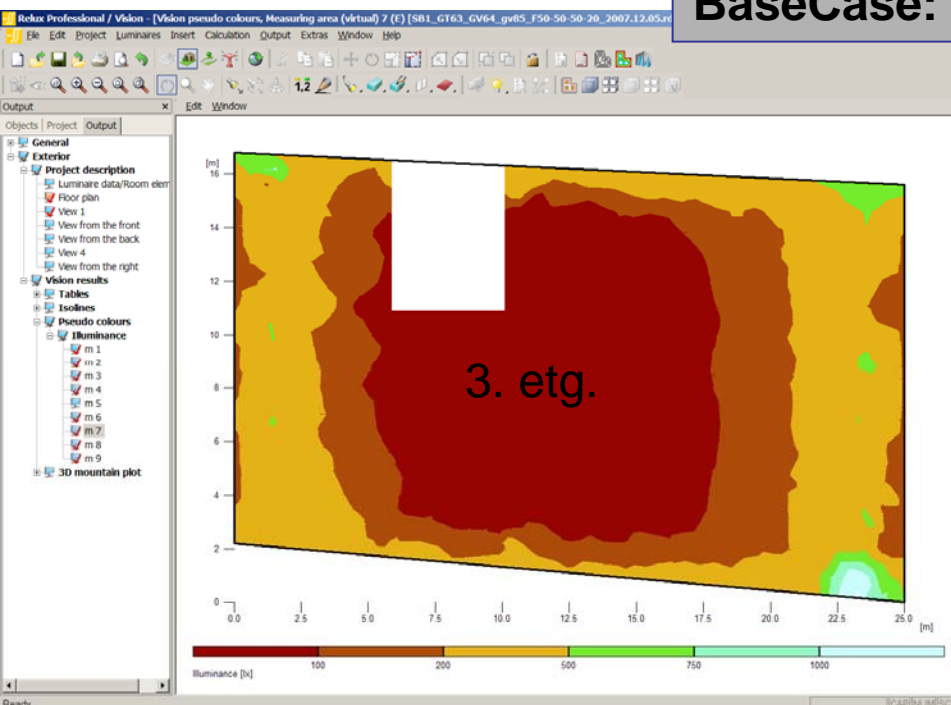
$$LT_{\text{glass}} = 0,9, \quad LT_{\text{wall}} = 0,9 * 0,95 = \underline{0,85}$$

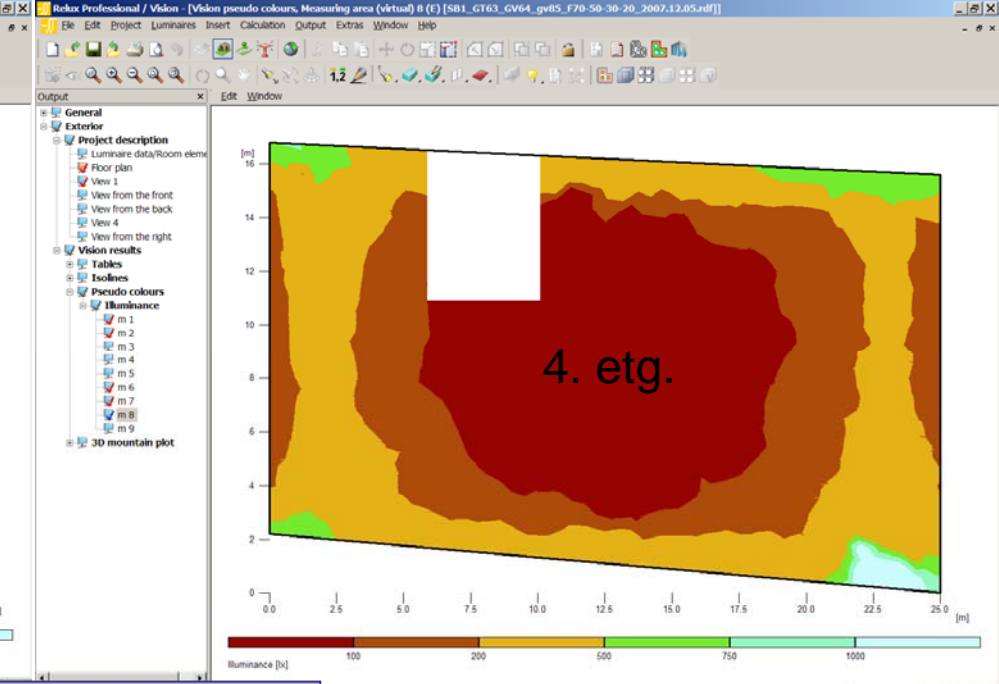
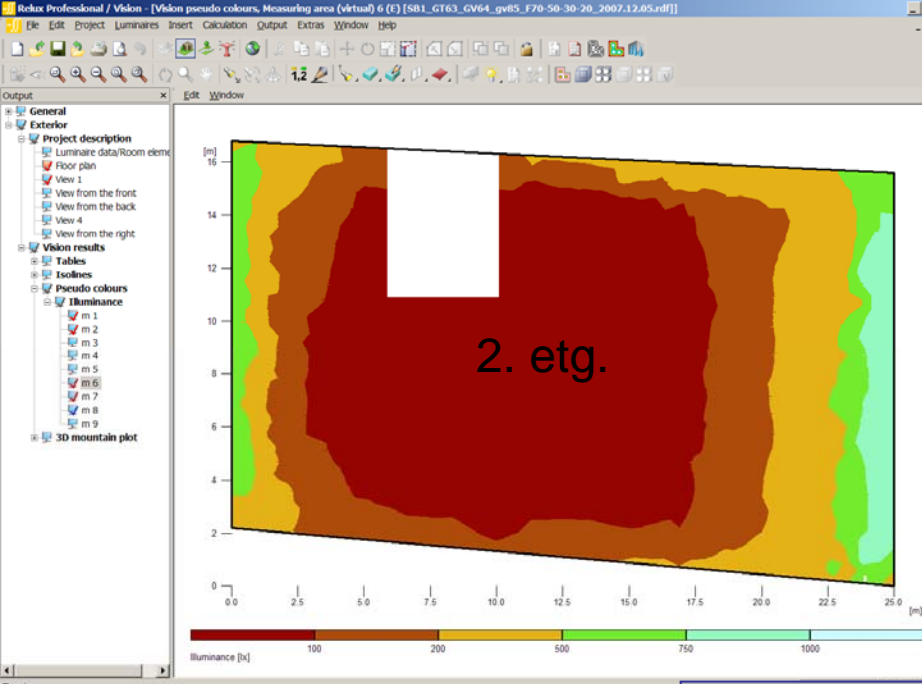
Relux/Radiance model



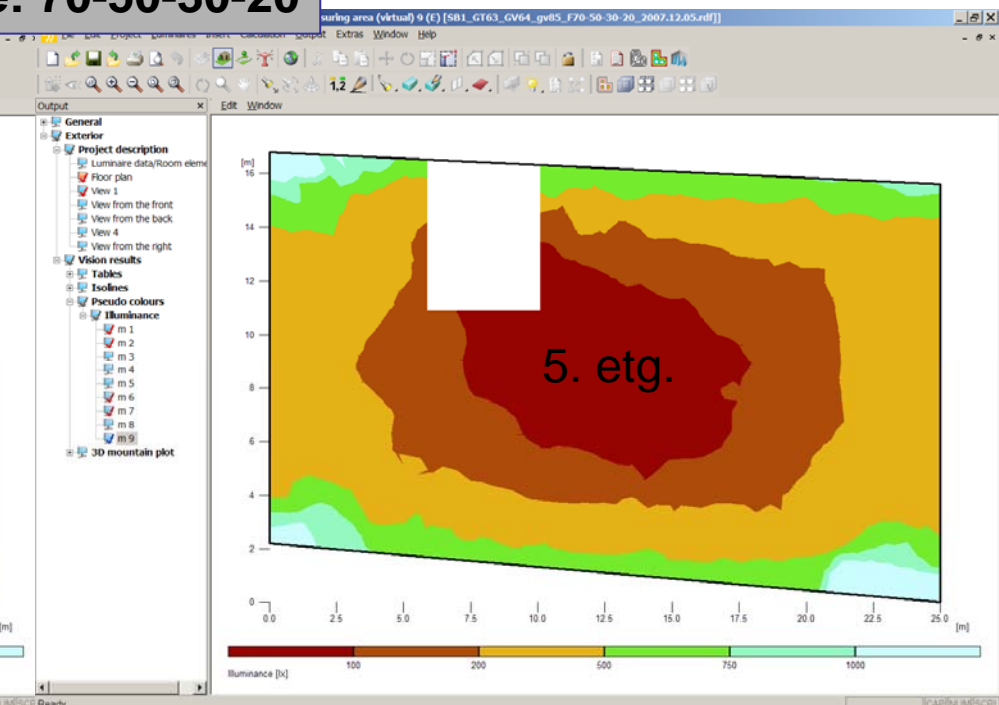
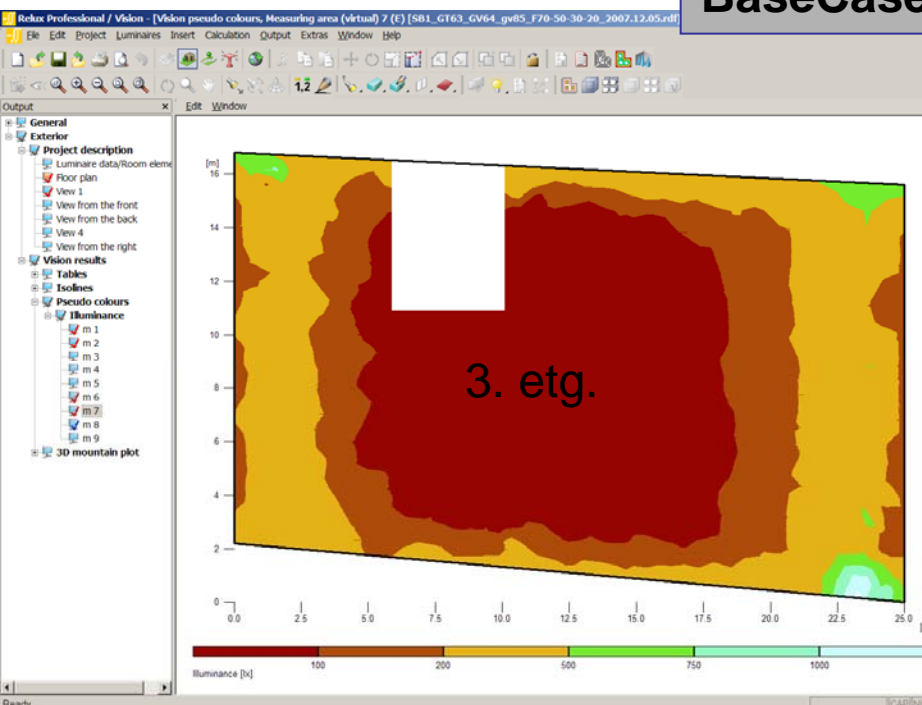


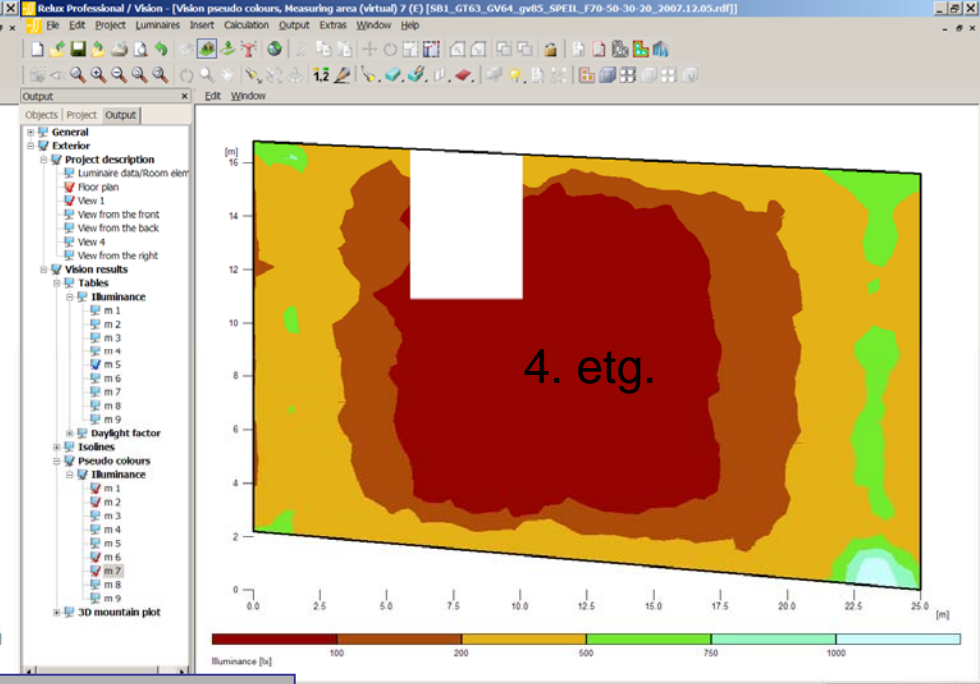
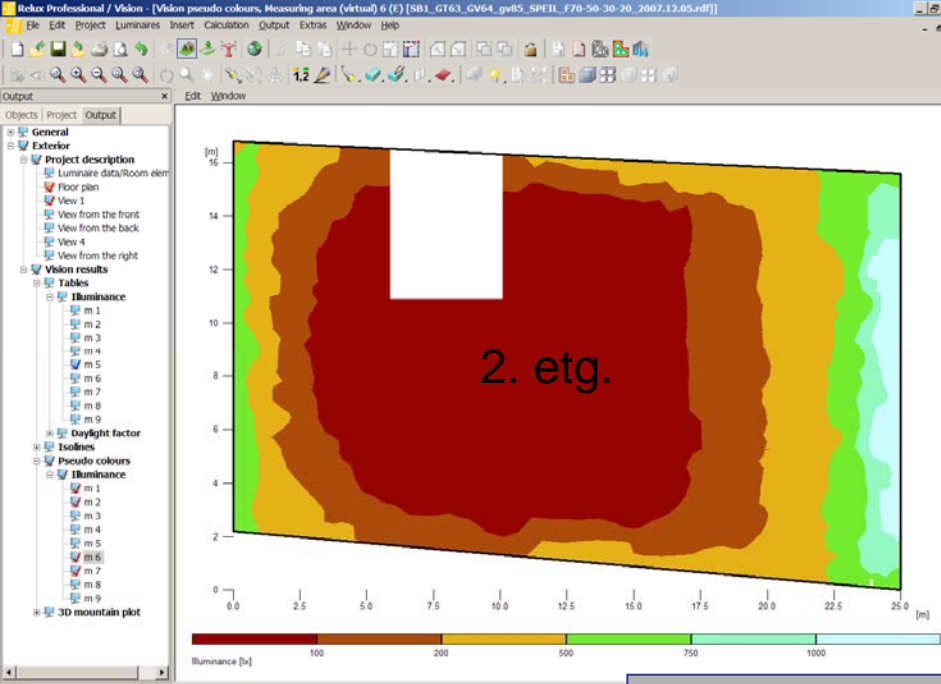
BaseCase: 50-50-50-50



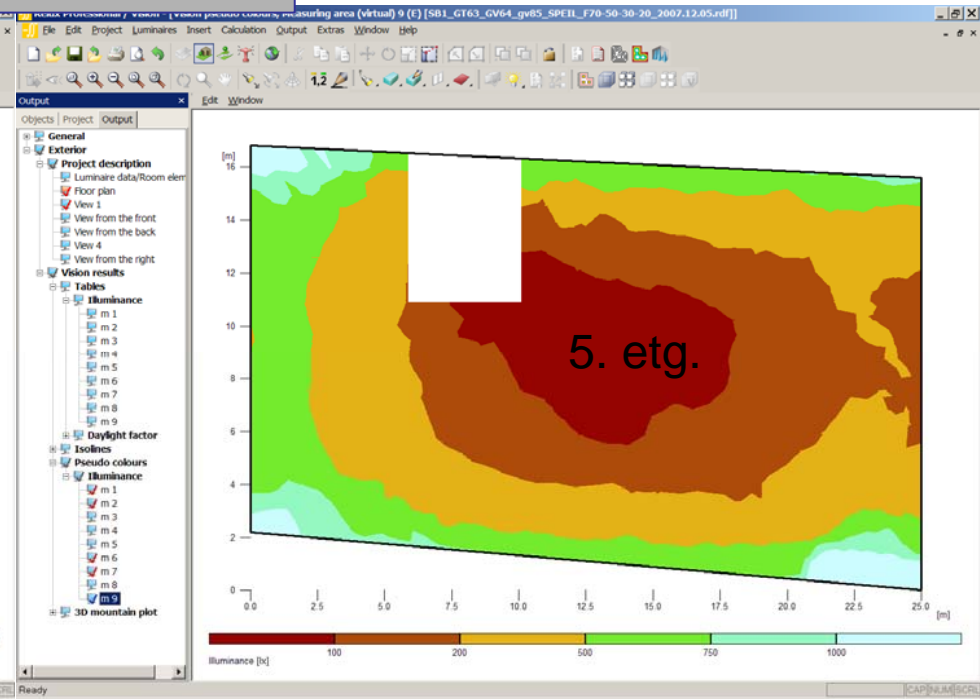
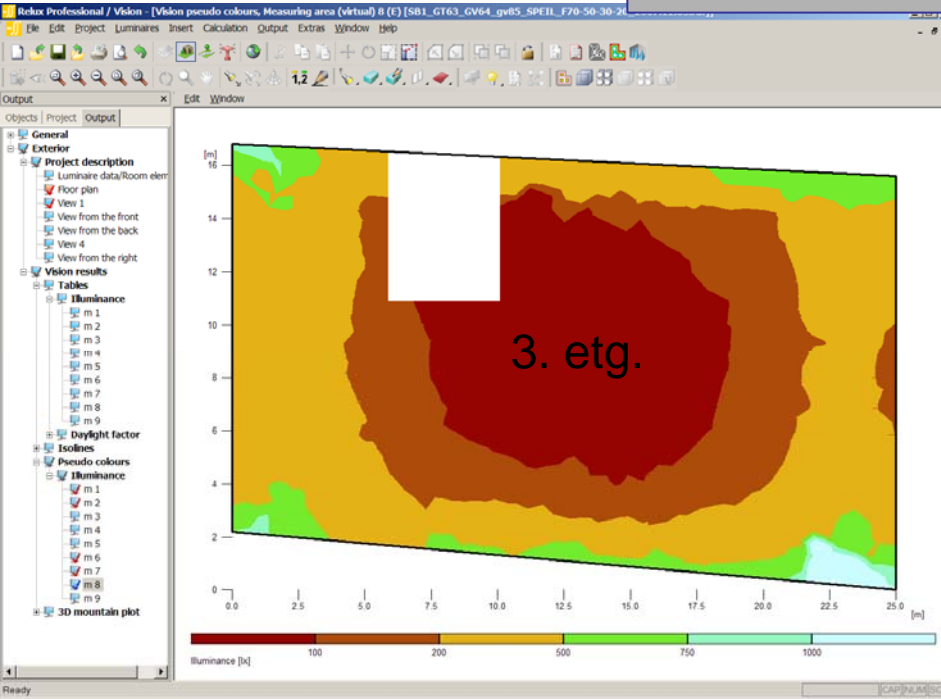


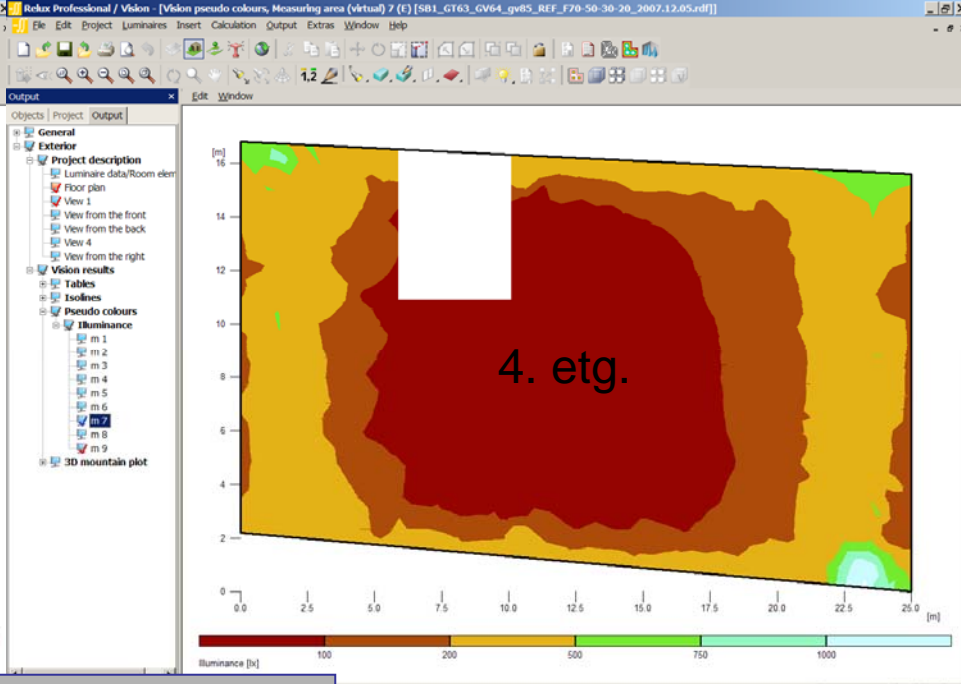
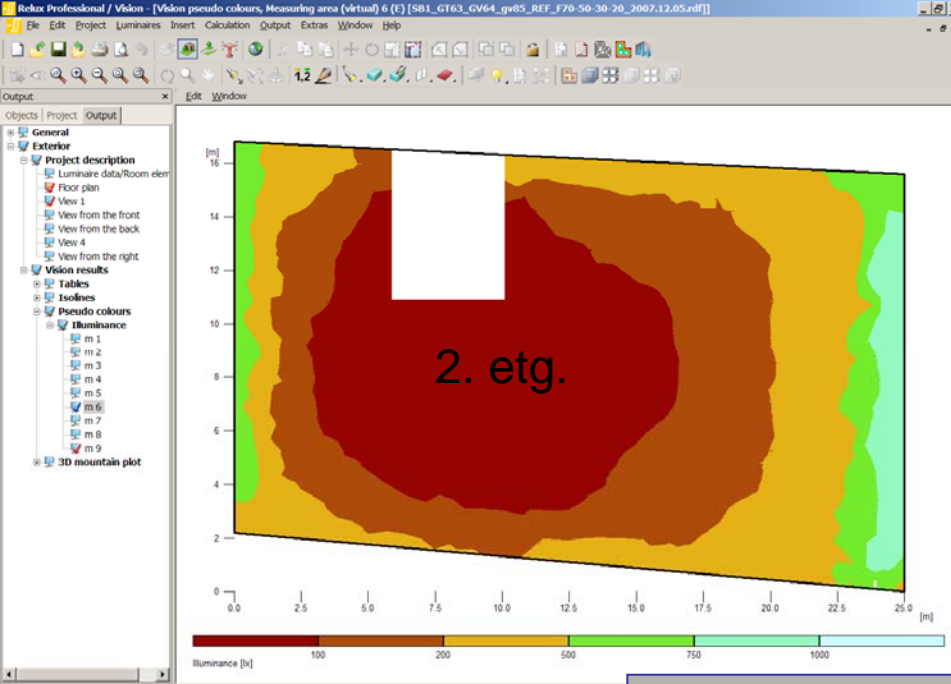
BaseCase: 70-50-30-20



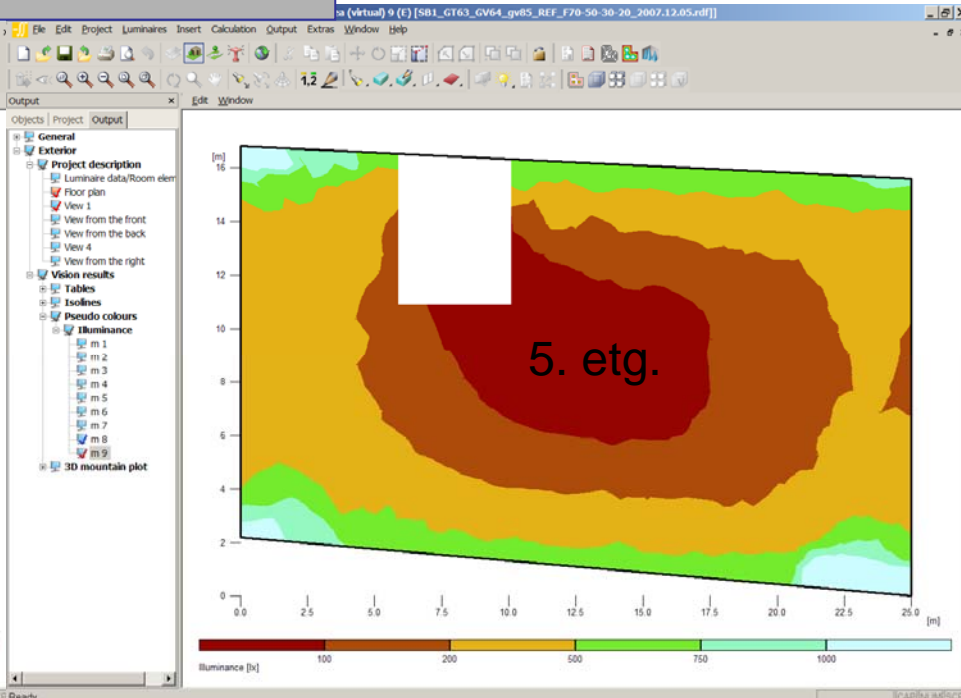
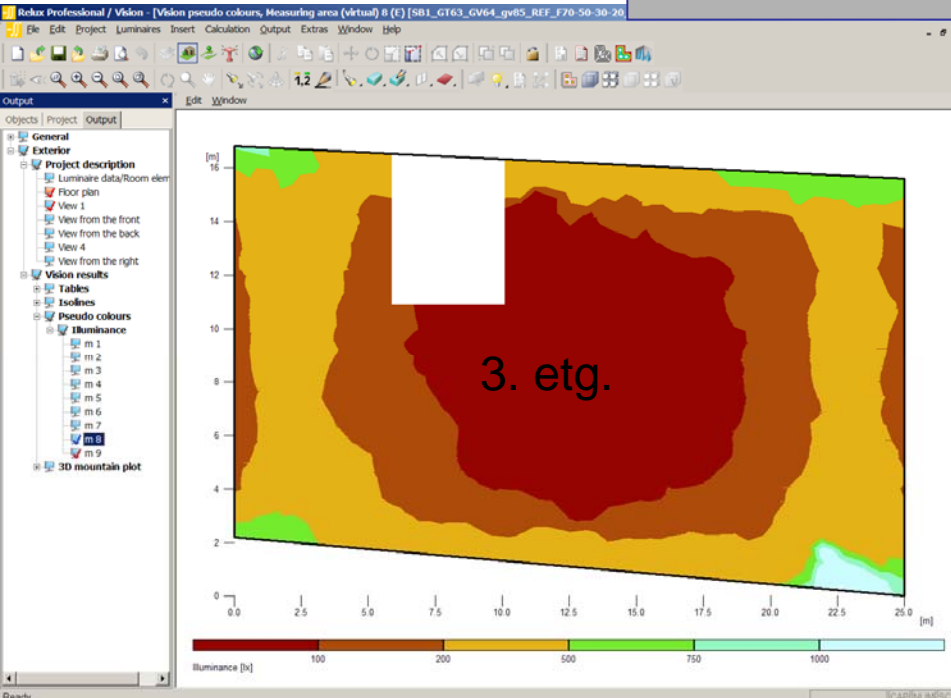


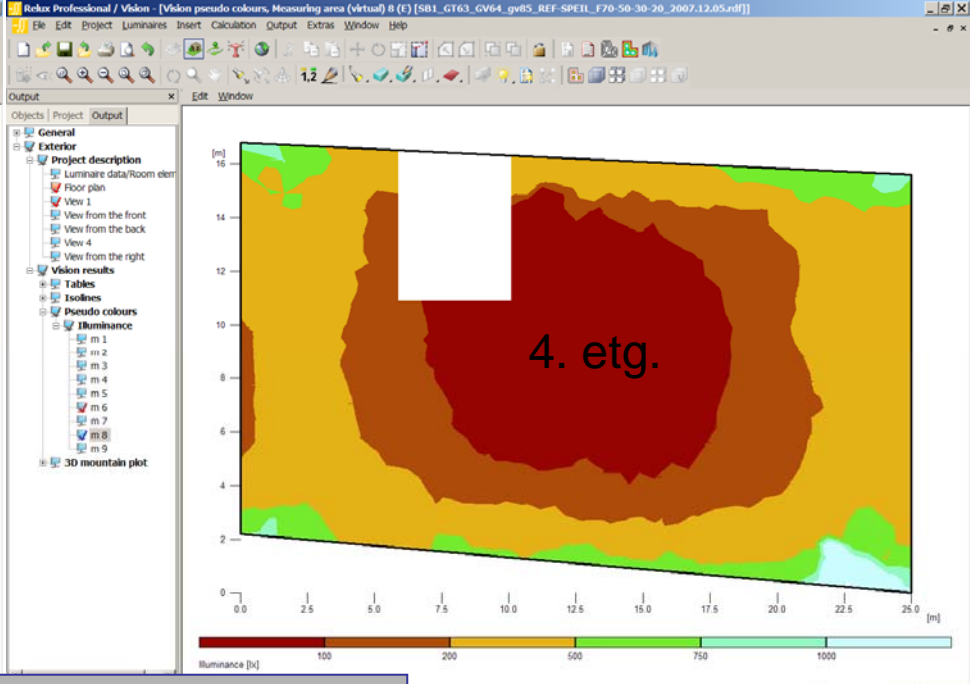
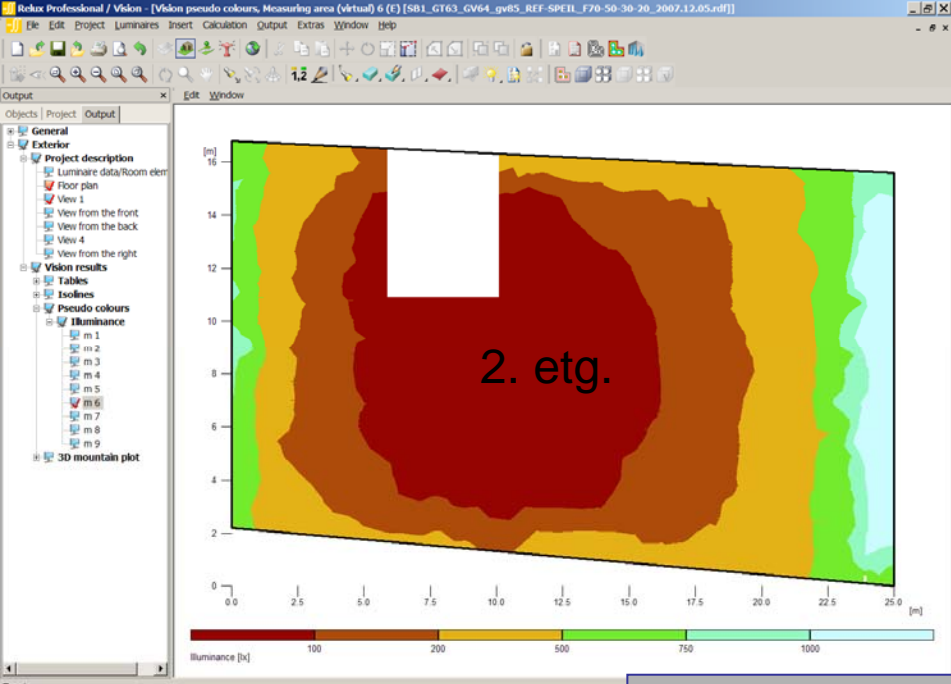
ALT: 70-50-30-20 +mirror



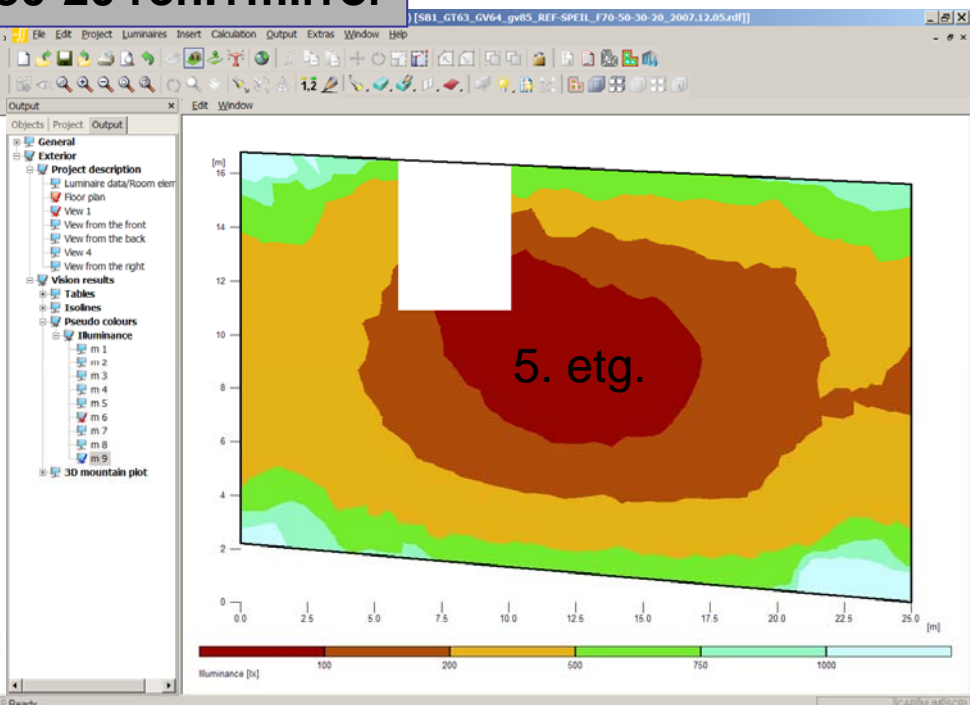
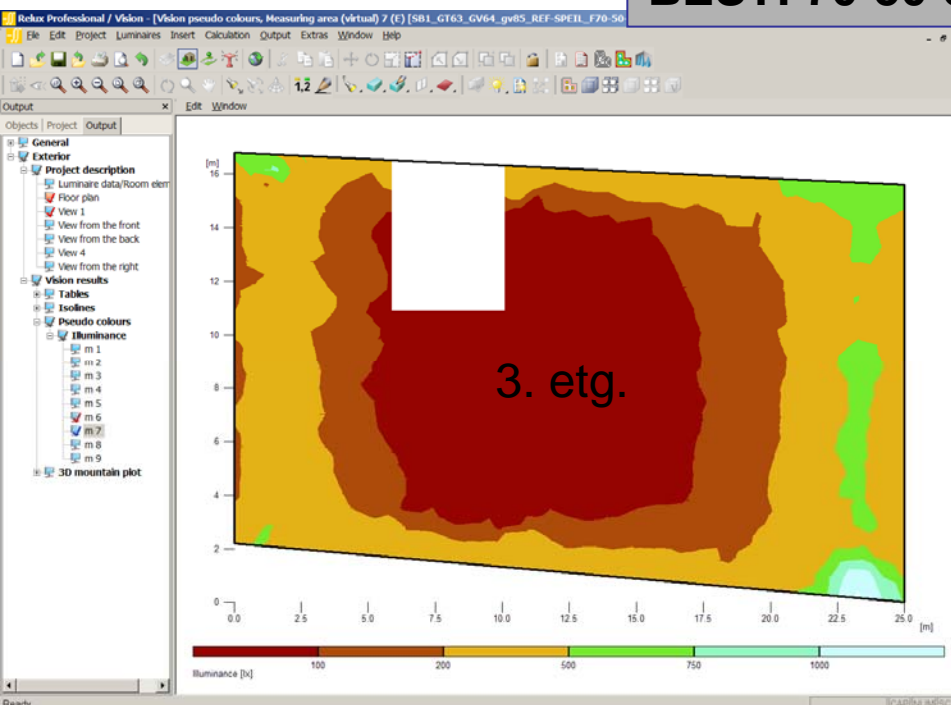


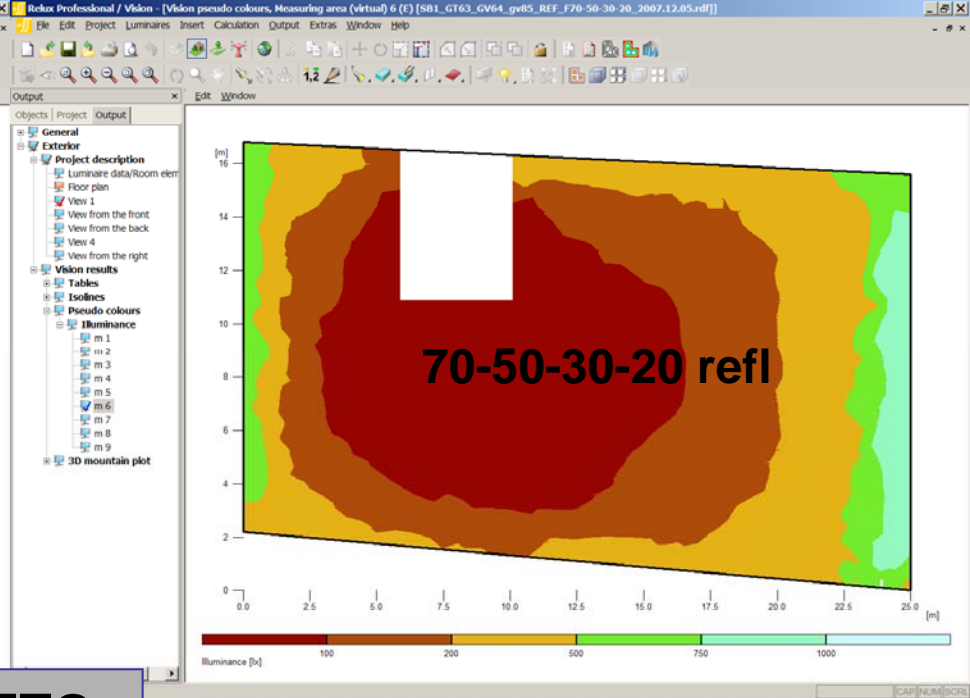
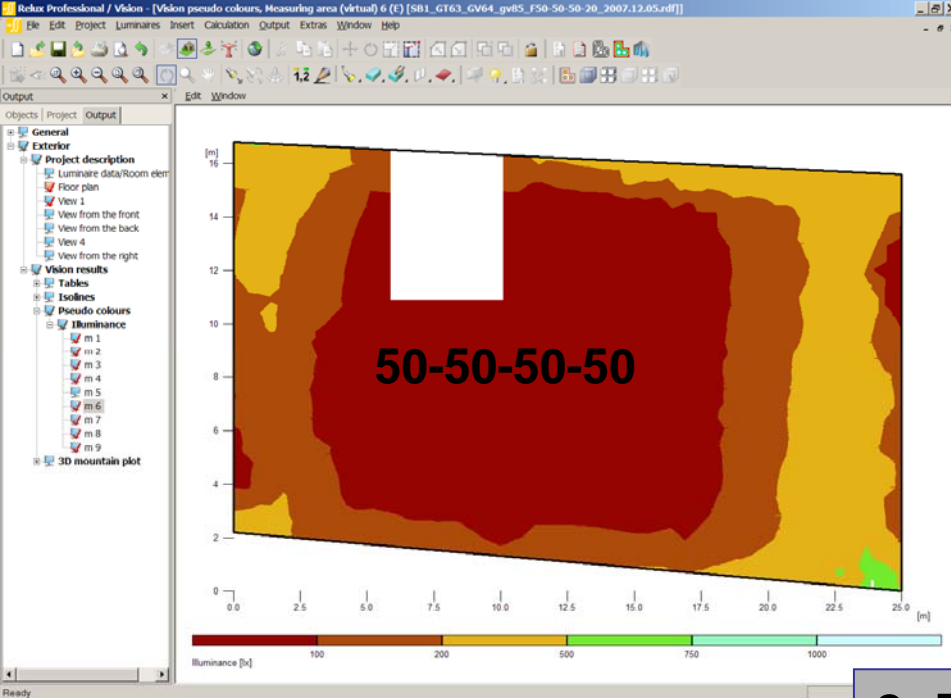
ALT: 70-50-30-20 +reflector



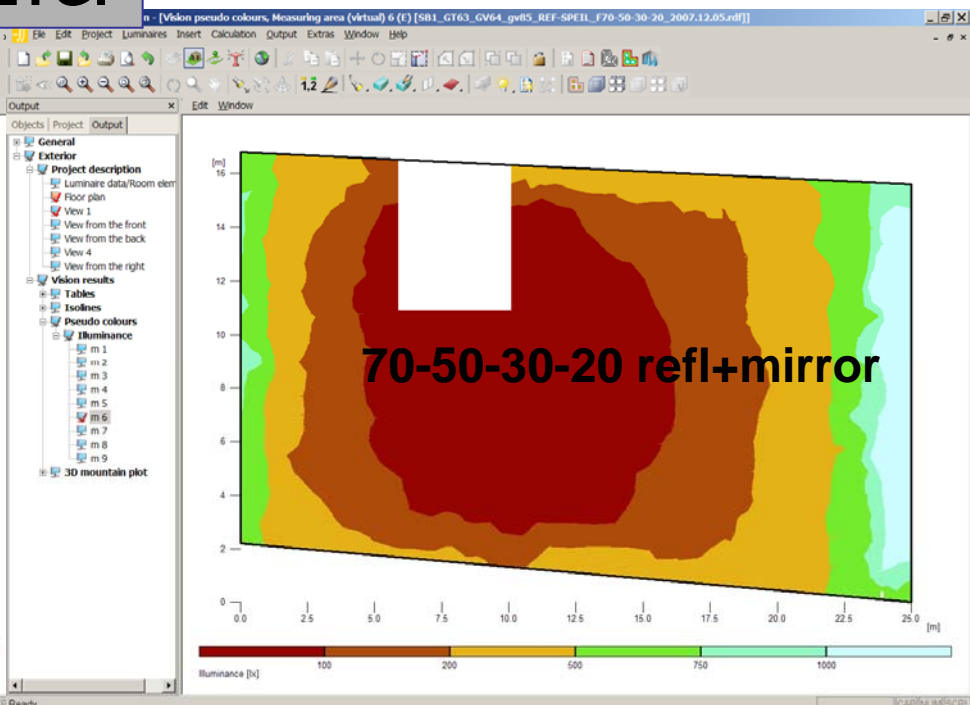
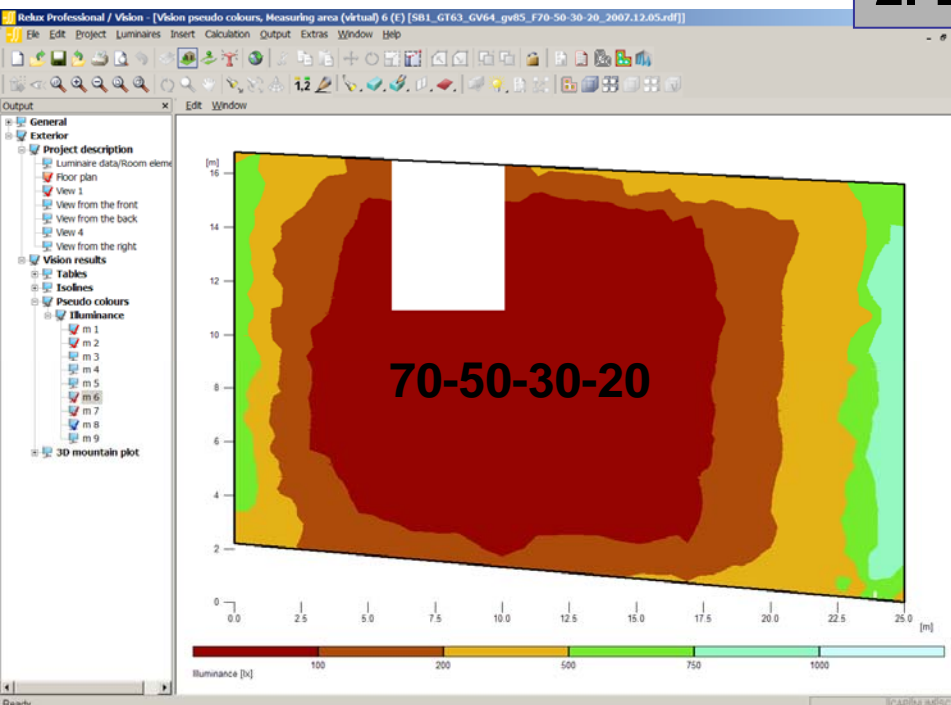


BEST: 70-50-30-20 refl.+mirror





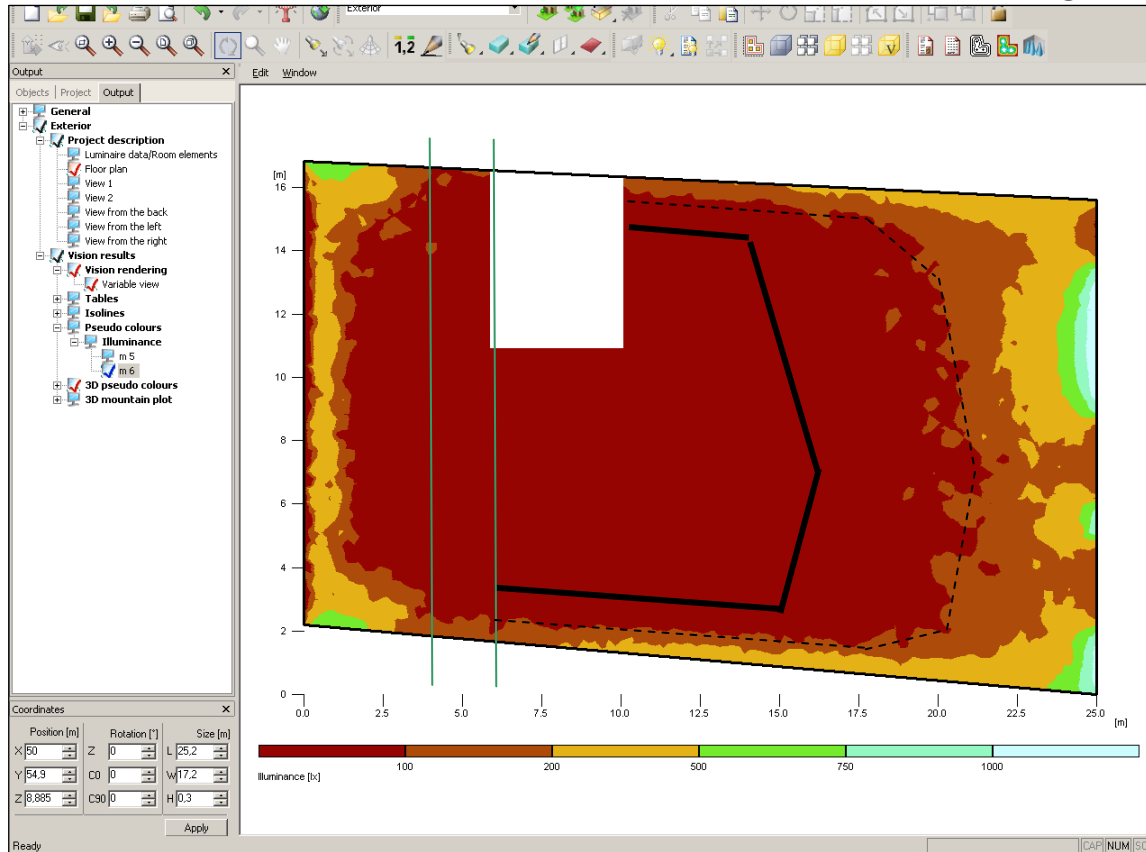
2. ETG.



Overcast sky

Step 2:

Calculation of daylight level at 2. floor after the architects drawing to find out the area suitable for permanent working places



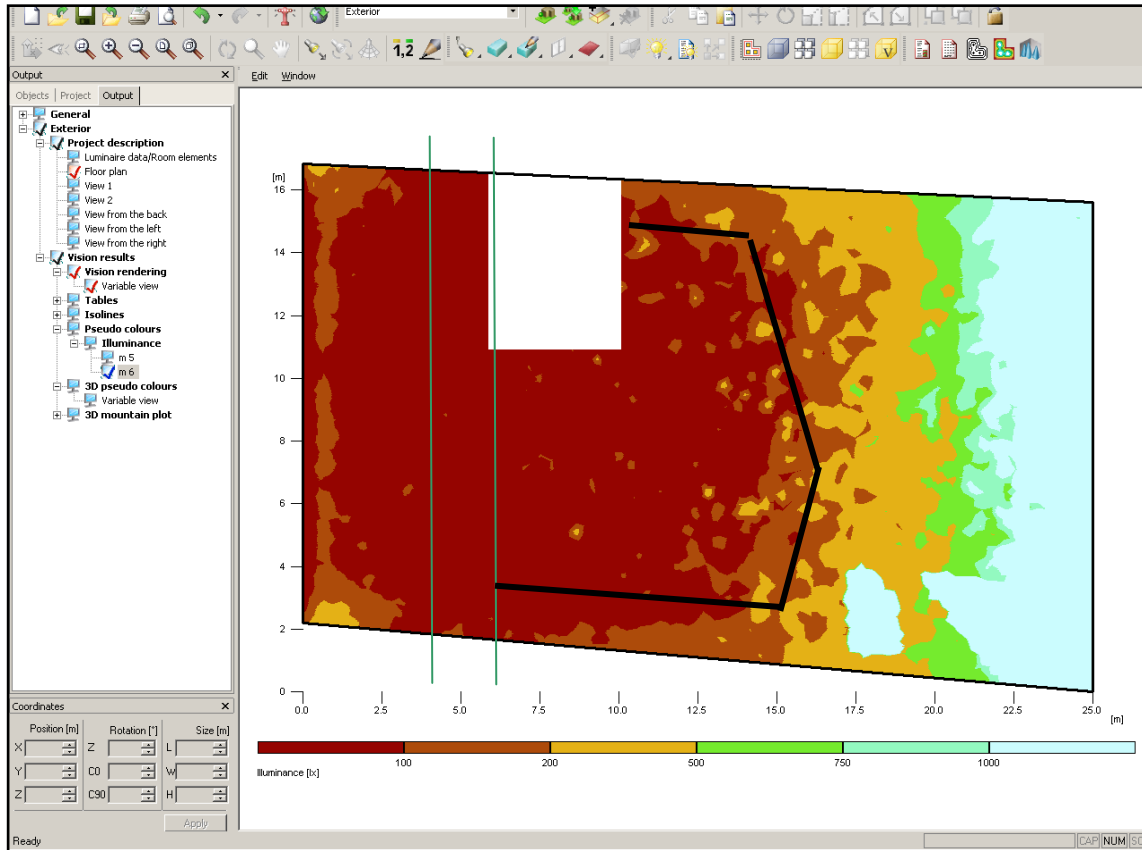
The illuminance (lux) at a hor. plane 80 cm over the floor.

Overcast sky. 28 mars. at 12:00. The illuminance at a hor. non obstructed plane outside is 10.000 lux.

Clear sky

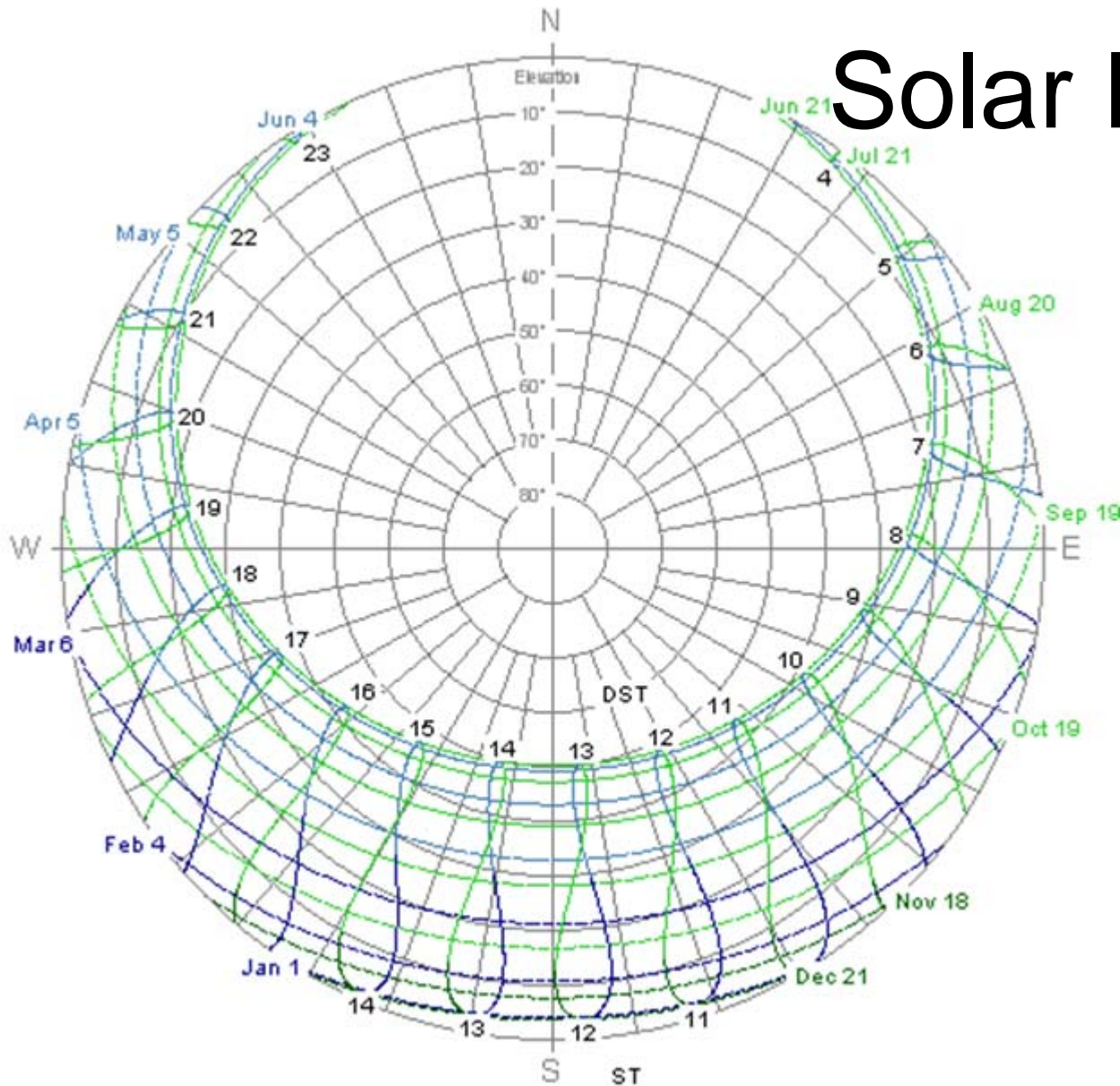
Step 3:

Calculation of daylight level at 2. floor after the architects drawing, sunshading



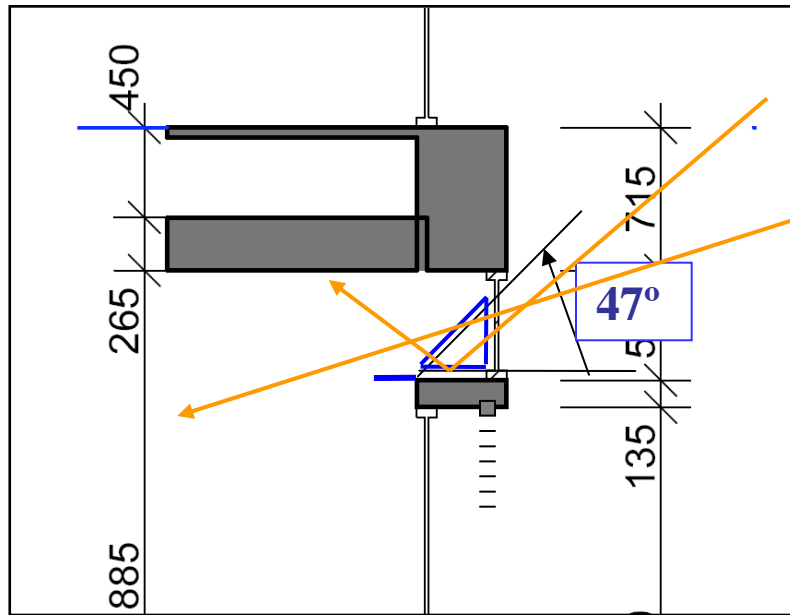
Clear sky. 28 mars. at 11:00.

Solar Diagram

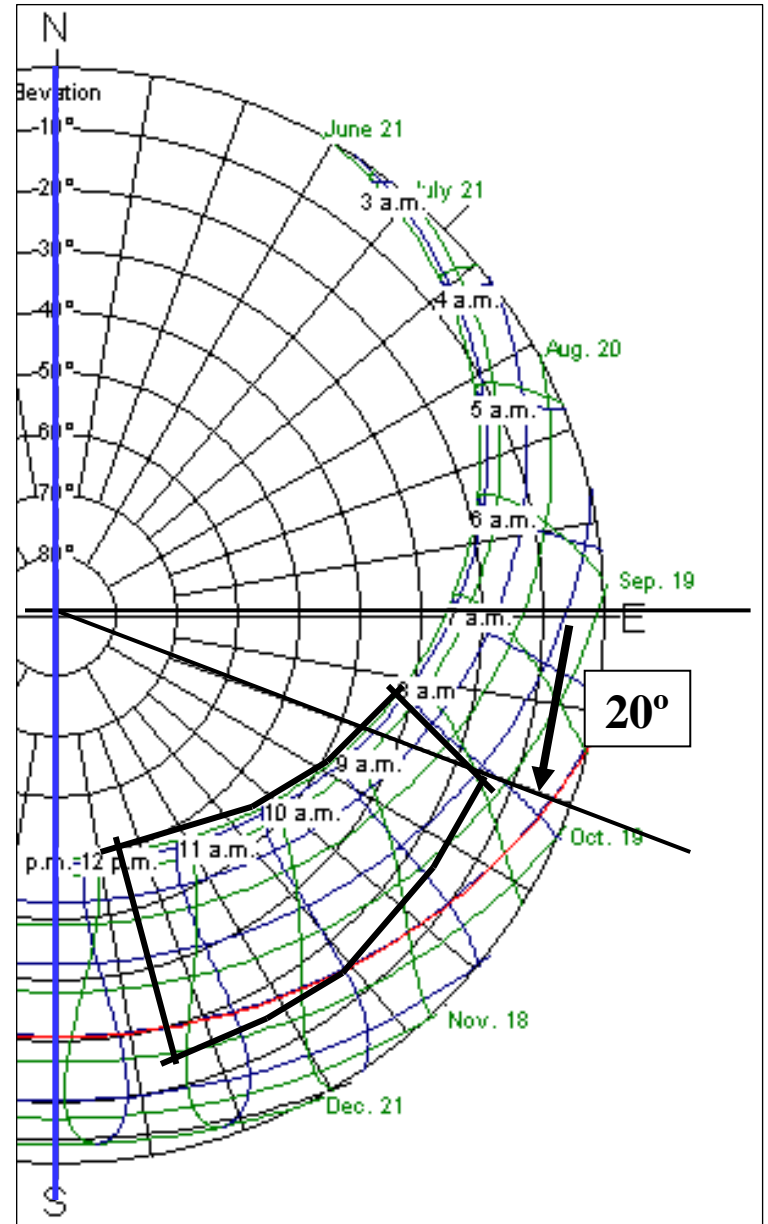


Trondheim (Nor)
coordinates: 63° 26' 24" N 10° 24' 0" E
timezone: UTC+1 ST, UTC+2 DST

Solar shading?



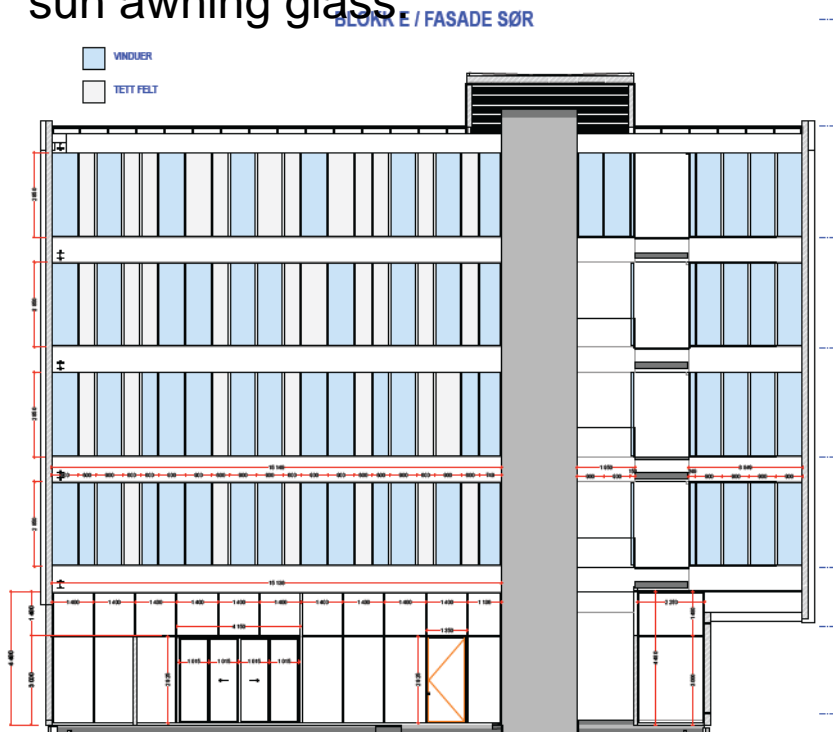
Low windows: outside solar shading
High windows: permanent supply of daylight.

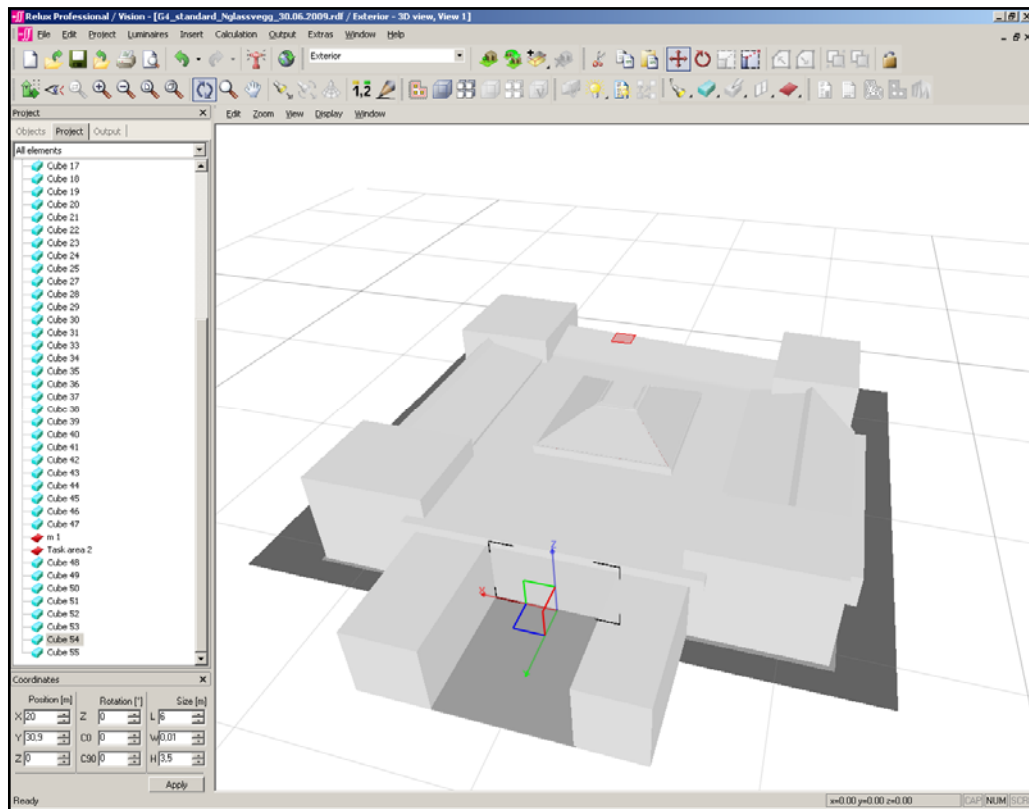


Facades toward light spaces

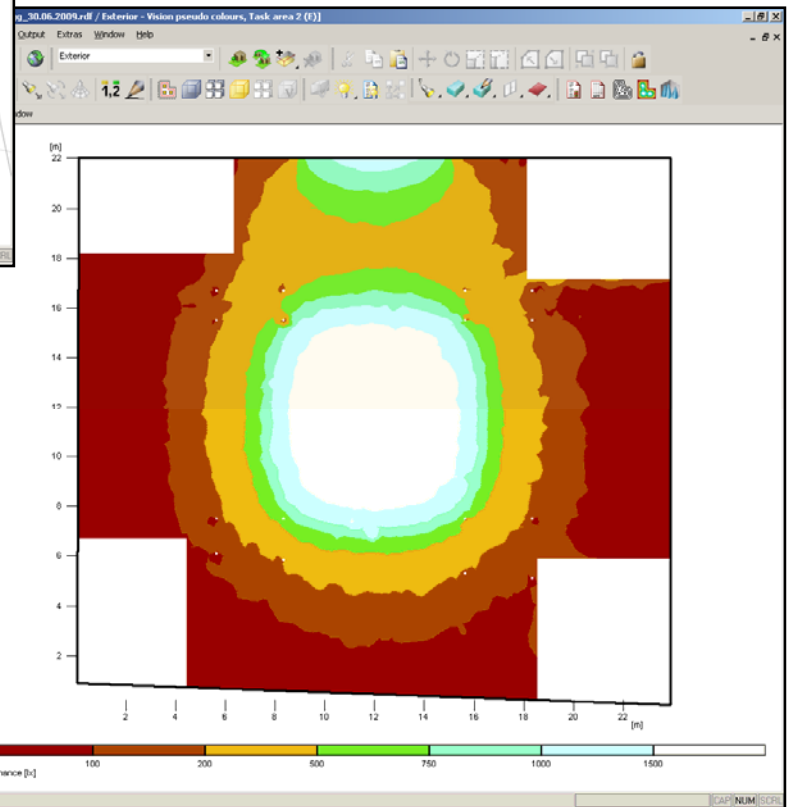
Step 4:

Calculation of daylight level at 2-5 floors to find out the optimal design of facades toward light spaces: combination of opaque parts, clear glass and sun awning glass





Daylighting at the attic storey in the old bank building

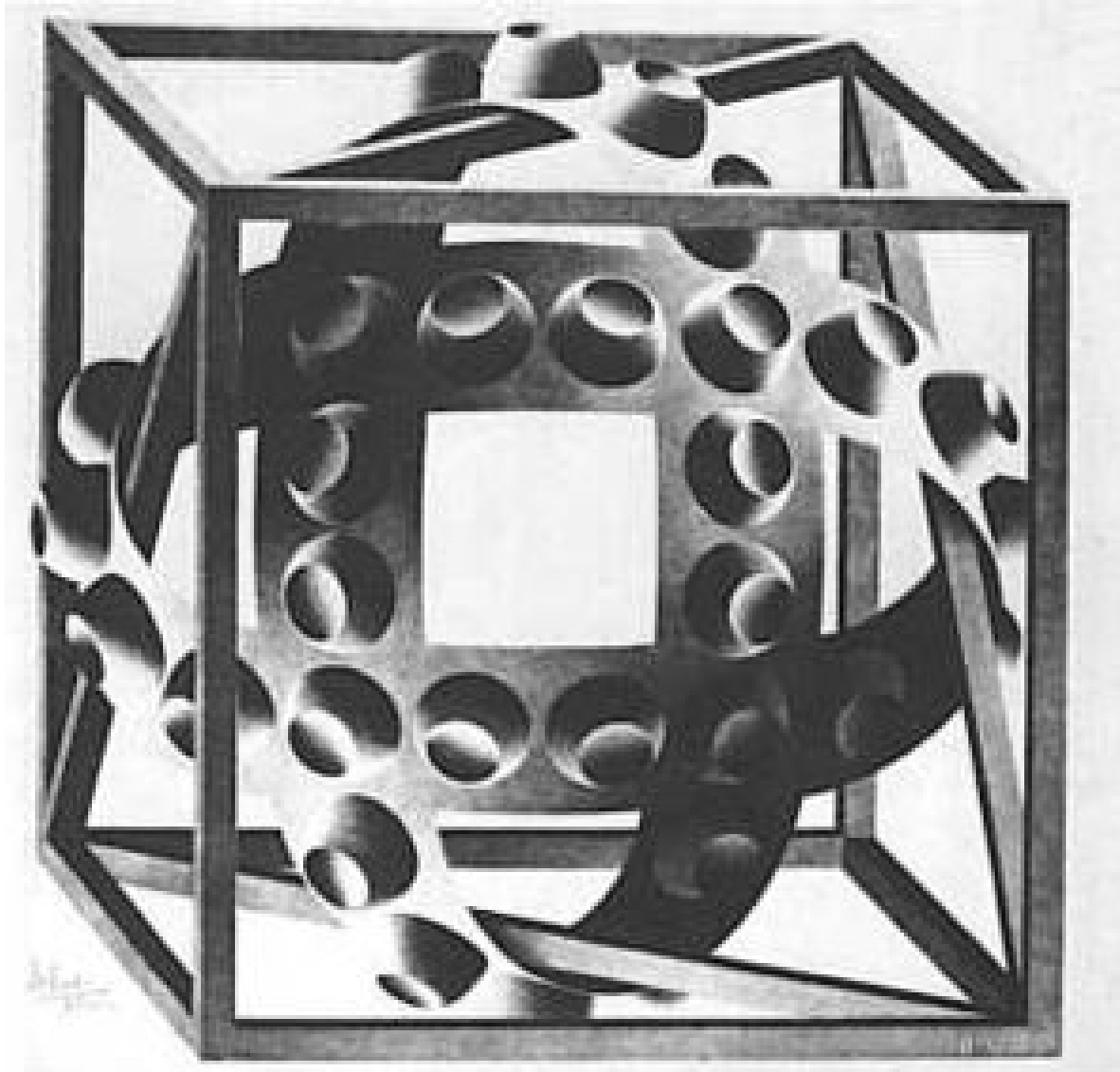


Step 5:
Calculation of daylight level at the attic storey. Enclosure?

Conclusions

- Very high degree of transparency:
 - good visual contact with both streets (light spaces and low sitting windows)
 - and with other parts of the building (through light spaces)
- Very easy to orientate oneself in a large and complex building
- Comfortable daylighting
 - Outside solar shading in windows
 - Constant supply of daylight through the highly sitting window stripes, also when sunshine, it may contribute to the visual environment of high quality: with variation but without glare
 - Possibility for development of green oasis's in light spaces, high amenity value
 - Enough daylight level DF at permanent working places

Maurits Cornelis Escher



two
interlocking
bands
wrapped
around the
frame of a
cube