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A design method for fixed outside solar shading device

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Disposition

- Motivation: the background for the fixed outside solar shading device
- The design method
  - Window design
  - Sky sector for undesired solar radiation
  - Initial design of a shading panel
  - Obstruction of the diffuse light
  - Correction of the initial design
- WONDERWALL project

Motivation

Climate conditions

- Low mean solar altitude angle,
- Sunlight:
  - low luminous intensity
  - low colour temperature
- The sky is overcast in nearly half part of the day hours during a year.
- In windy regions the changes in cloud cover are very fast the shading control systems fail to handle them properly.

Users

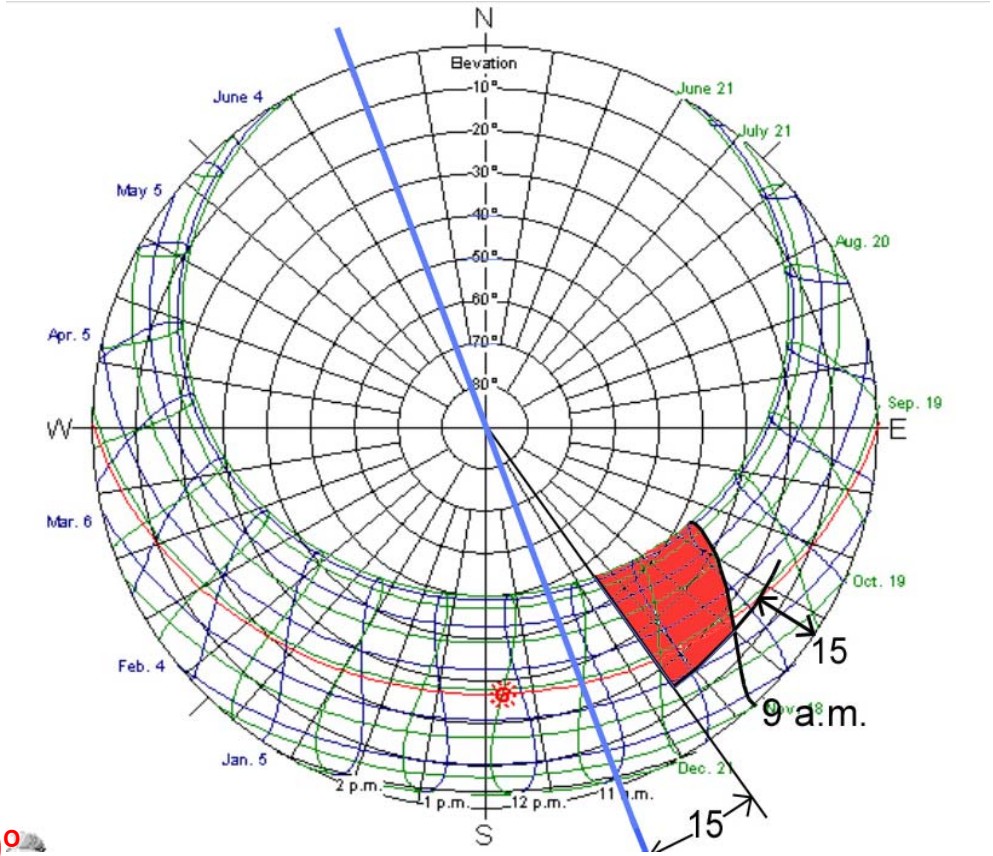
- People love to experience solar heat on the body
- They admire sun patterns, both inside and outside
- Indoor curtains against glare

The design method

- Window design

  $DF > DF_{min}$

- HSS sky sector for undesired solar radiation

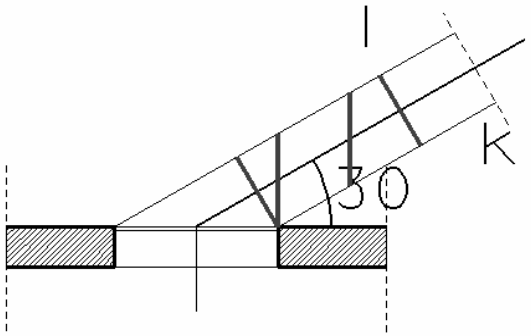


$15 < \alpha < 45$, $\alpha_{mean} = 30°$

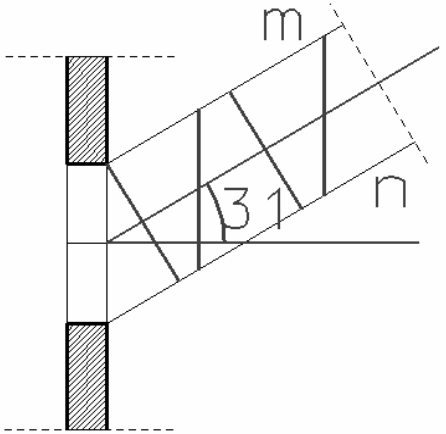
$15 < \beta < 47$ $\beta_{mean} = 31°$

The design method

Initial design of a shading panel



Vertical section, α=30º



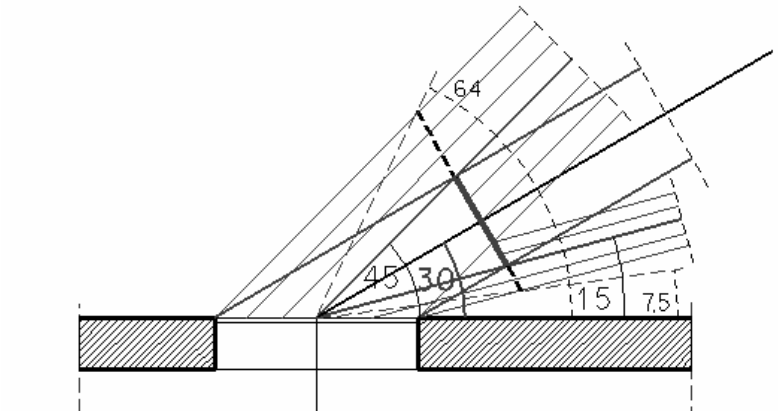
Horizontal section, β=31º

$15 < \alpha < 45, \quad \alpha_{mean} = 30º$

$15 < \beta < 47 \quad \beta_{mean} = 31º$

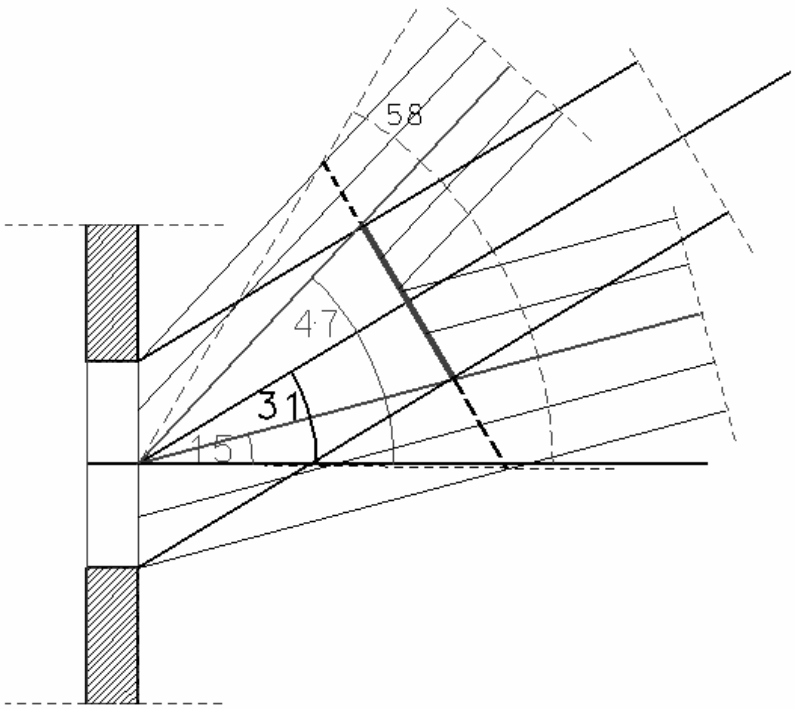
The design method

Initial design of a shading panel



Horizontal section, α_{mean}= 30º

15º < α < 45º

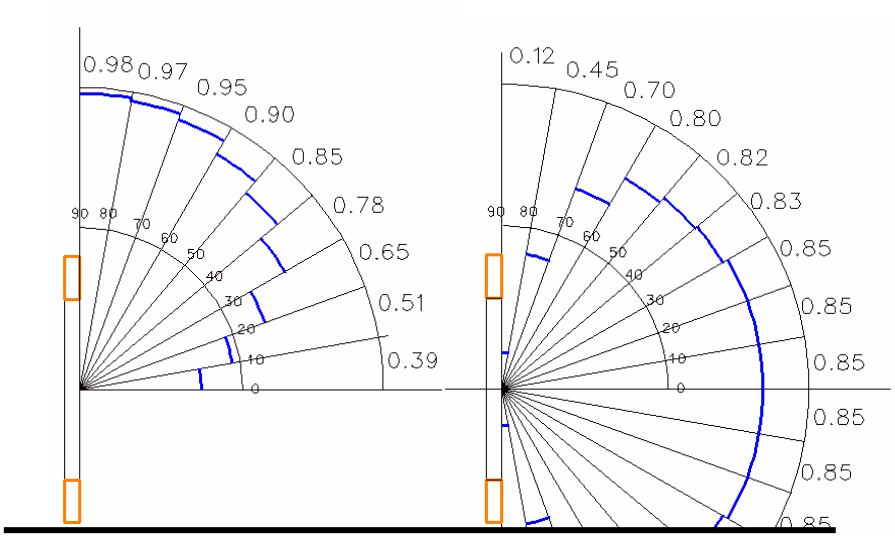


Vertical section, β_{mean}= 31º

15º < β < 47º

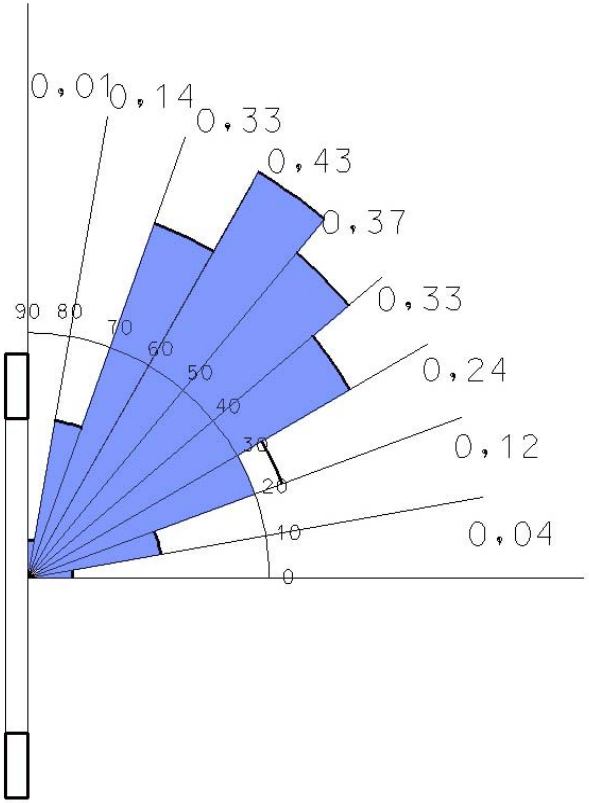
The design method

Obstruction of the diffuse light



the luminance distribution of the standard CIE overcast sky as the percentage of zenith luminance for 10º sky sectors

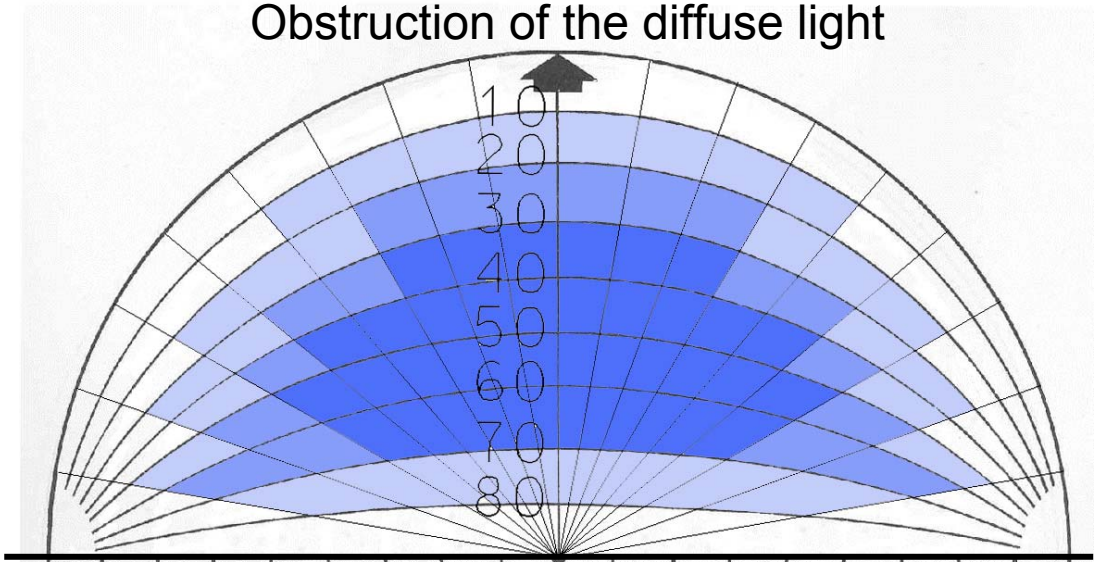
angle dependent light transmittance 2 glass panes, 10º sectors,



SF contribution through a two pains of glass from the 10º x 10º sky unit sectors

The design method

Obstruction of the diffuse light



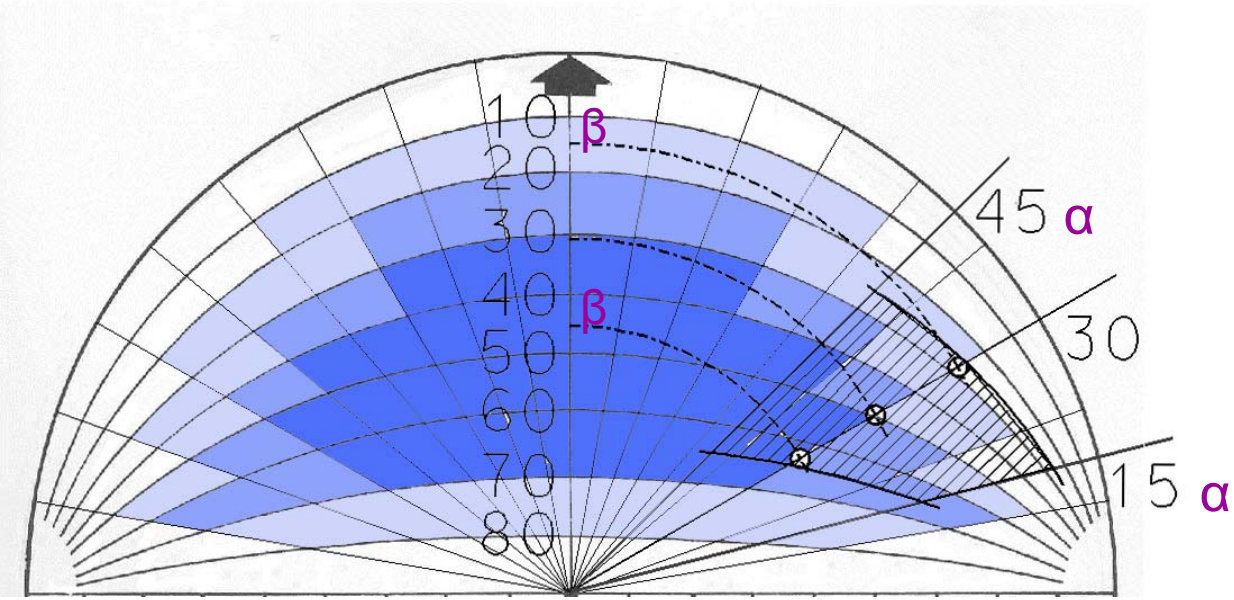
SF sky-unit diagram

SF contribution through a two pains of glass from the 10º x 10º sky unit sectors

VERT. shad. angle	HORIZONTAL shading angle								
	00-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
00-10	0	0	0	0	0	0	0	0	0
10-20	0,15	0,15	0,15	0,15	0	0	0	0	0
20-30	0,25	0,25	0,25	0,15	0,15	0,15	0	0	0
30-40	0,35	0,35	0,35	0,25	0,25	0,15	0,15	0	0
40-50	0,35	0,35	0,35	0,35	0,35	0,25	0,15	0	0
50-60	0,45	0,45	0,45	0,45	0,35	0,35	0,25	0,15	0
60-70	0,35	0,35	0,35	0,35	0,35	0,35	0,25	0,25	0
70-80	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0
80-90	0	0	0	0	0	0	0	0	0

The design method

Correction of the initial design



obstruction mask at the SF sky-unit diagram

SF reduces from the maximum value of 26.0% to about 23.7%

SF reduction 9%

$15^o < \alpha < 45^o$ $15^o < \beta < 47^o$

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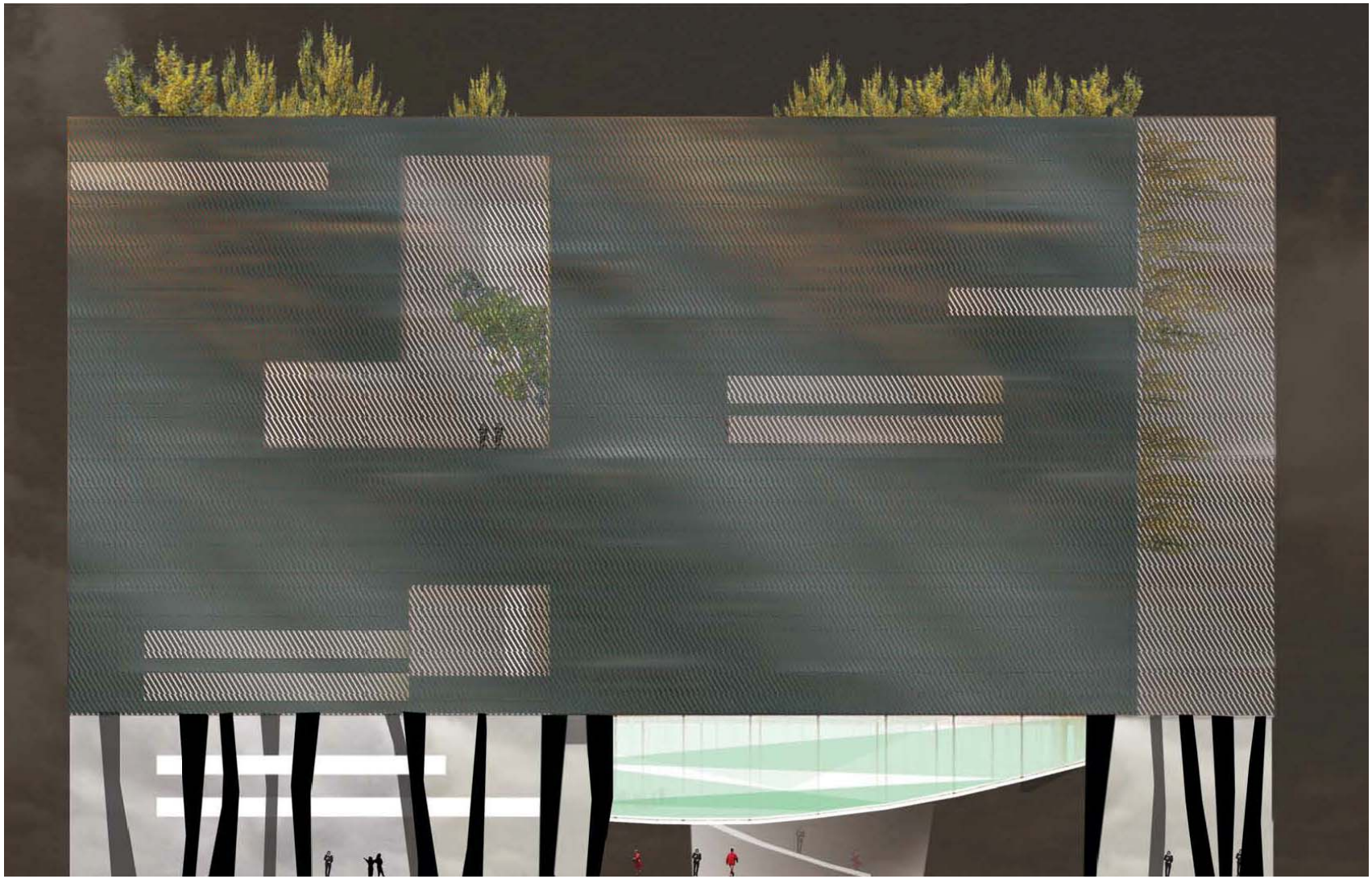
The WONDERWALL project

Awarded with a purchase in the international architectural competition "The most energy efficient building in Europe" in Bjørvika, Oslo, 2005.



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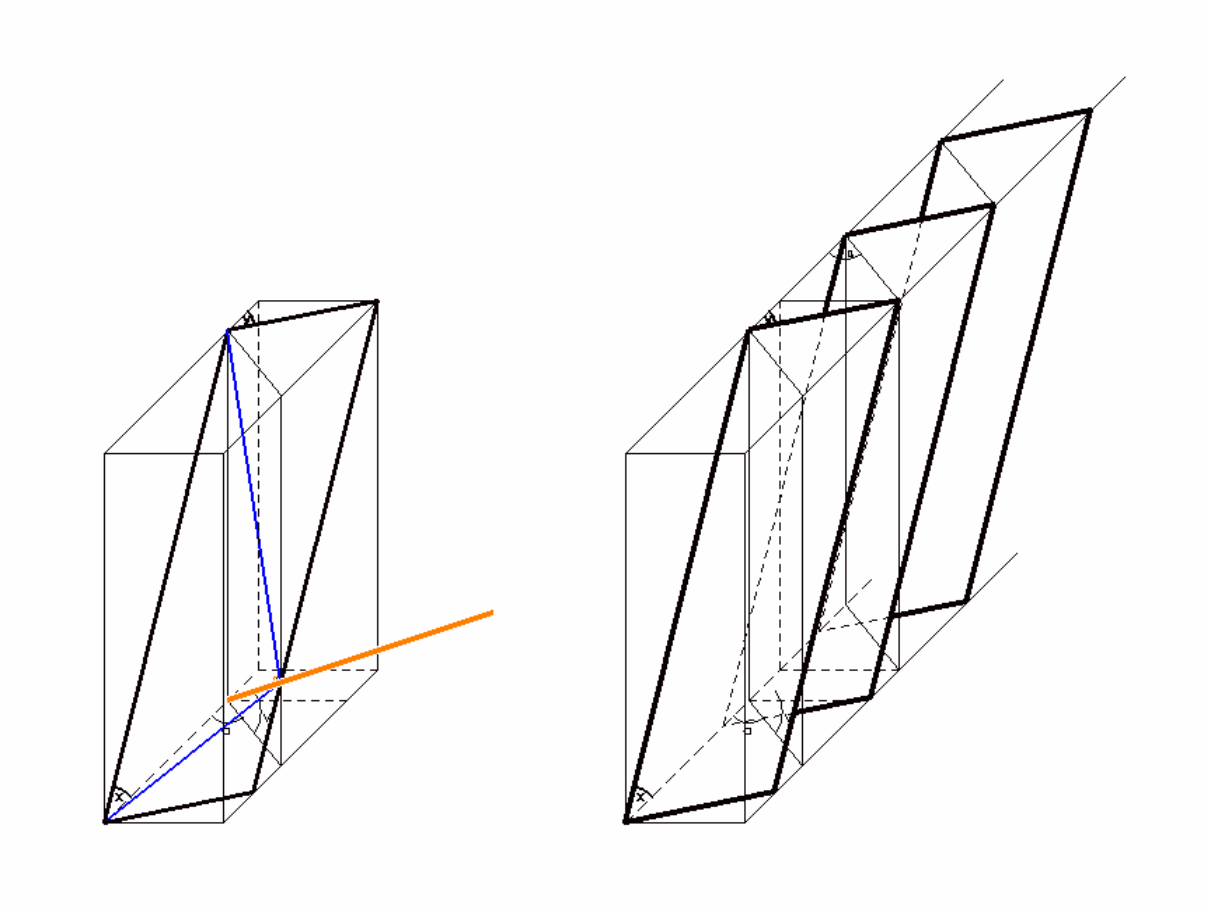
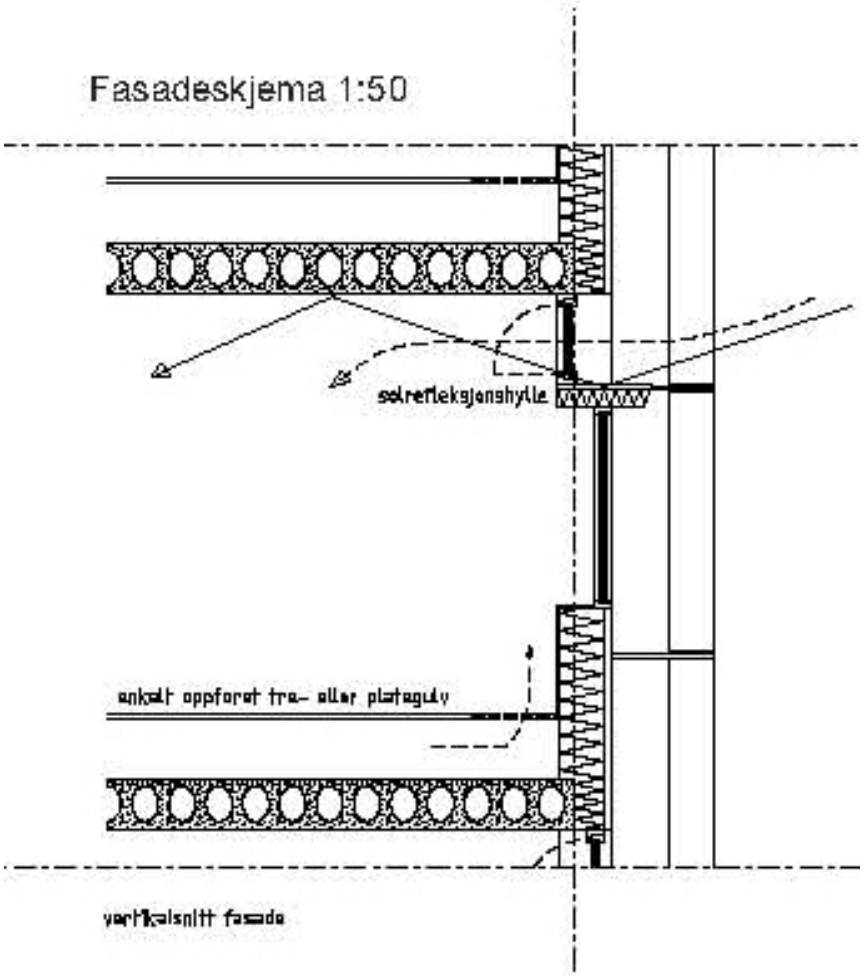
WONDERWALL



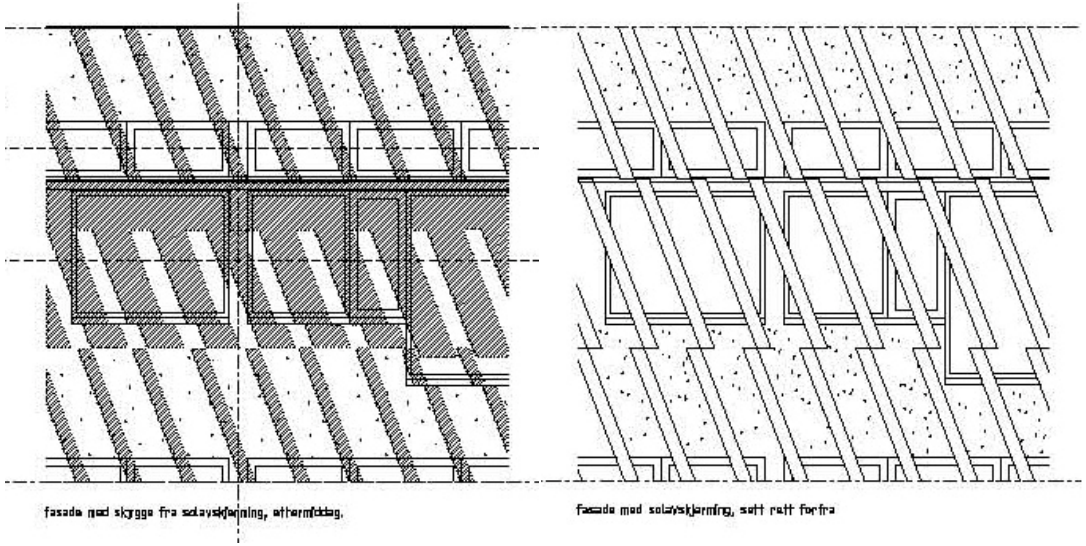
Axonometric perspective of the shading panels in the lower part of the east façade.

The WONDERWALL project

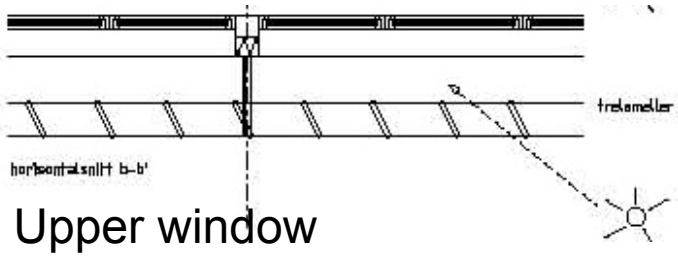
Vertical section



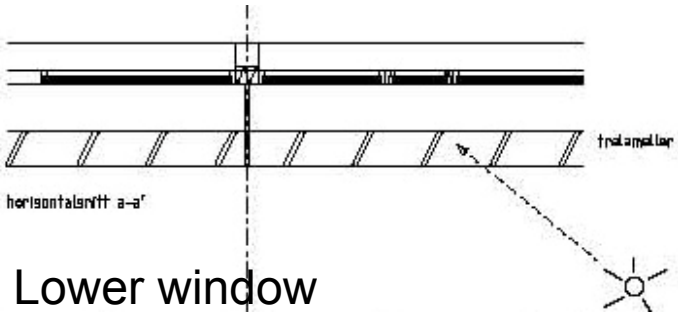
WONDERWALL



Facade west: with and without sunlight



Upper window



Lower window