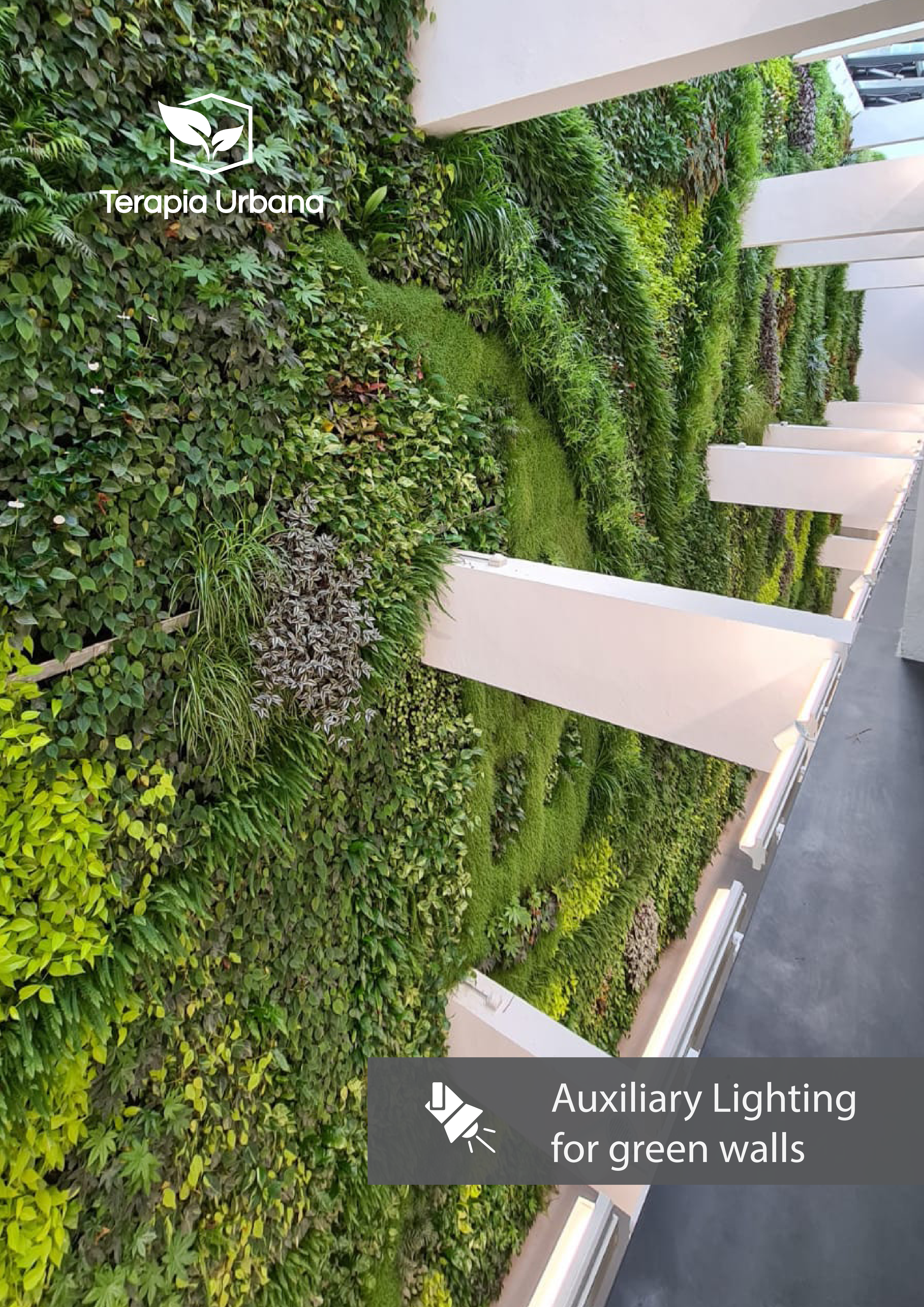
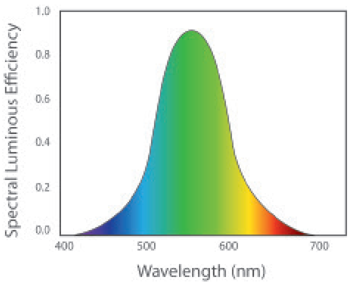


Terapia Urbana

Auxiliary Lighting for green walls

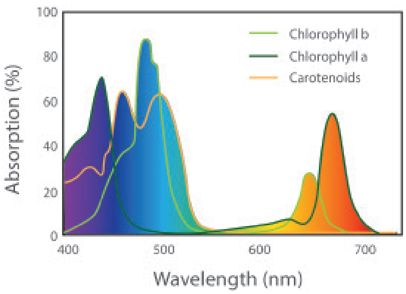
VISUAL AND BIOLOGICALLY EFFECTIVE LIGHTING FOR PLANTS

Integrating plants in interior spaces is becoming more and more frequent in contemporary architecture. As a result, it is necessary to study the lighting levels in the spaces to optimize the positive impact of light on both, plants and users.
It is necessary to find a formula that establishes the appropriate balance for both species, taking into account that you cannot use lux or lumens as units to measure lighting system intensity for plants, the values are different depending on the lamp spectrum. In interior spaces, in order to stimulate the natural processes of plants, the flux density of photosynthetic photons must be measured. In addition, it is necessary to implement light sources that emit an adecuate wavelength.



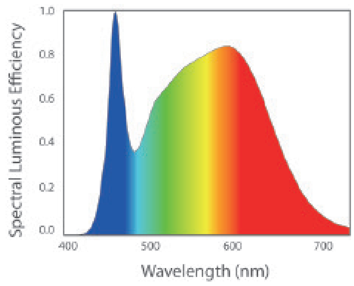
Retail lamps Spectrum

The spectral response of the human eye



Absorption plants spectrum

Plants contain light-absorbing molecules that absorb the energy from light, called pigments.



Specific Lamps spectrum

Light provided by Terapia Urbana (combination of both previous curves)

Parameters for plants

Successful artificial lighting for indoor plant growth must balance quality, intensity and photoperiod.

✓ Light quality

Defines spectral composition of the supplementary light source.

✓ Light intensity

(Quantum flux density-Photosynthetic Photon Flux Density/ PPFD, µmol $m^{-2} s^{-1}$) the amount of photosynthetically active photons received by plants (m^2) per second and used in the process of photosynthesis which decreases with the distance to the source.

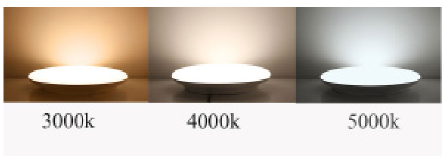
✓ Photoperiod

Duration of plants daily exposure to light, is an important factor for plant growth that influences several development processes, like flowering.

Parameters for human

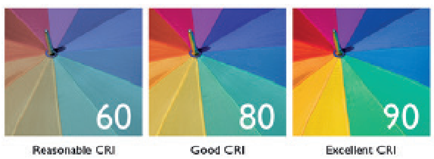
✓ Color temperature

Color temperature (K) is a characteristic of visible light that has important applications in lighting. Warmer light, lower color temperature, promotes relaxation and cooler light, higher color temperature, enhances concentration.



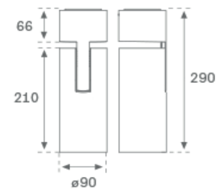
✓ Color Rendering Index (CRI)

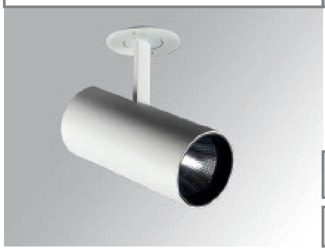
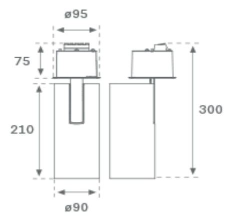
The CRI is a measure of a light source's ability to show object colors "realistically" or "naturally" compared to a familiar reference source, either incandescent light or daylight.

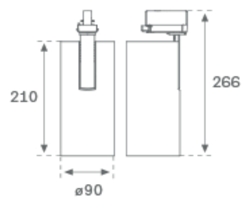


SPECIAL LED LAMPS
Auxiliary Lighting for green walls _ LAMP

HANCE MODEL

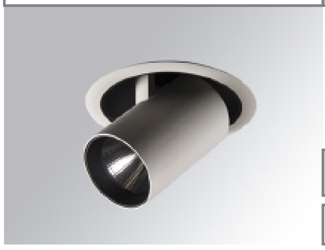
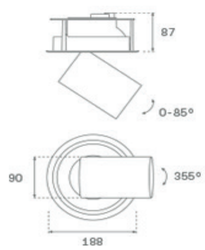
SURFACE	Available power	Light source/aperture	Type of projects	Dimensions
	26 W / 34 W Available color RAL9010 RAL9011	Spot 17º Mediumflood 23º Flood 34º	Medium/large surfaces Distance to green wall 1.20 - 1.80 m No false ceiling available	

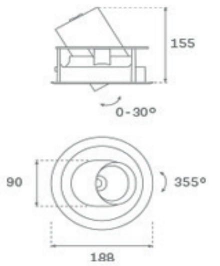
SEMI-RECESSED	Available power	Light source/aperture	Type of projects	Dimensions
	26 W / 34 W Available color RAL9010 RAL9011	Spot 17º Mediumflood 23º Flood 34º	Medium/large surfaces Distance to green wall 1.20 - 1.80 m False ceiling available	

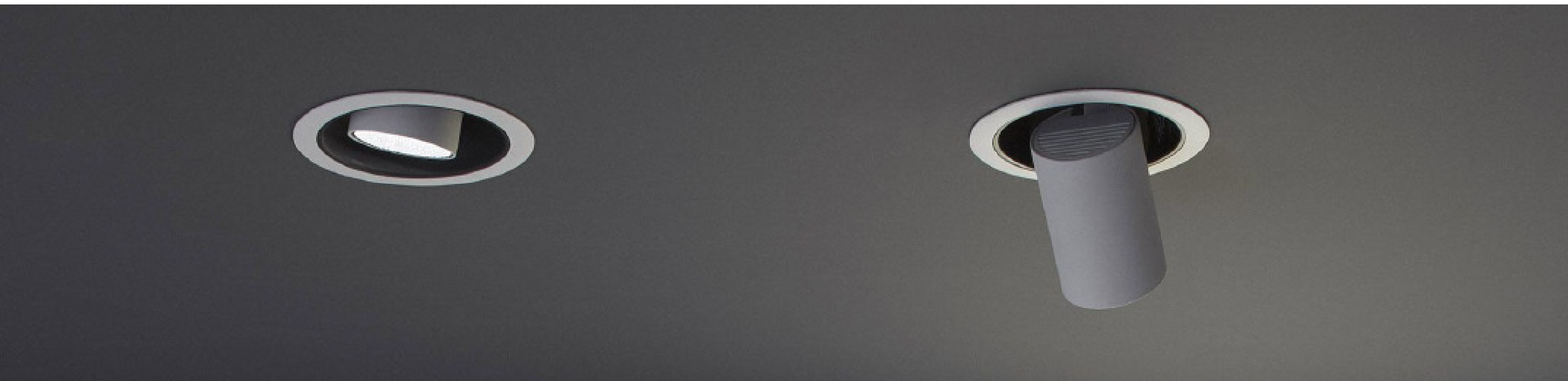
TRACK	Available power	Light source/aperture	Type of projects	Dimensions
	26 W / 34 W Available color RAL9010 RAL9011	Spot 17º Mediumflood 23º Flood 34º	Medium / large surfaces Distance to green wall 1.20 - 1.80 m No false ceiling available	

SPECIAL LED LAMPS
Auxiliary Lighting for green walls _ LAMP

HANCE DOWNLIGHT MODEL

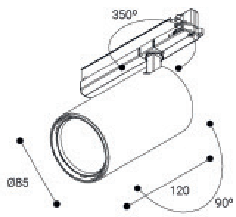
SEMI-RECESSED	Available power	Light source/aperture	Type of projects	Dimensions
	25 W / 34 W Available color RAL9010 RAL9011	Spot 17º Mediumflood 23º Flood 34º	Small/medium surfaces Distance to green wall 1.00 - 1.50 m False ceiling available	

RECESSED	Available power	Light source/aperture	Type of projects	Dimensions
	25 W / 34 W Available color RAL9010 RAL9011	Spot 16º Mediumflood 23º Flood 32º	Small / medium surfaces Distance to green wall 1.00 - 1.50 m False ceiling available	



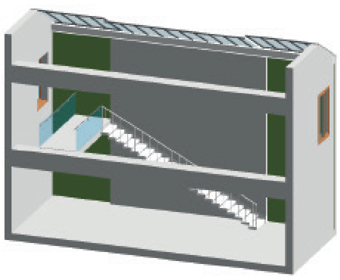
SPECIAL LED LAMPS
Auxiliary Lighting for green walls _ NORMALIT

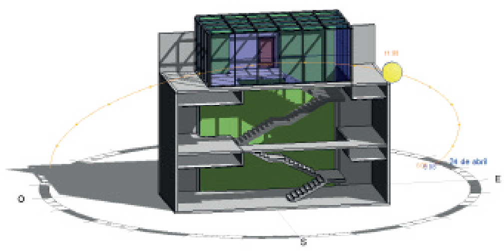
NORMALIT SILK TU MODEL

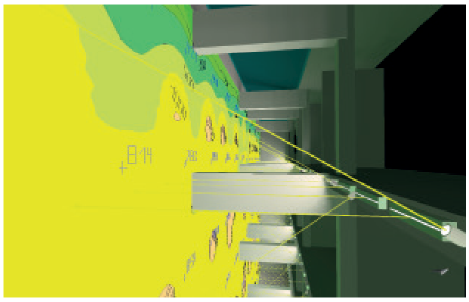
TRACK	Available power	Light source/aperture	Type of projects	Dimensions
	25 W / 34 W **Available color** RAL9010 RAL9011	Intensive15º Medium 24º Extensive 36º Very extensive 55º	Small/medium surfaces Distance to green wall 1.00 - 1.50 m No false ceiling available	

AUXILIARY LIGHTING STUDY

1. DESIGN AND SPACE REQUIREMENTS
2. SOLAR ANALYSIS
3. LIGHTING ANALYSIS
4. ASSEMBLING DETAILED PLANS







1 DESIGN & SPACE REQUIREMENTS

Landscape design requirements, type of species and solar needs

Analysis of direct and indirect natural light in the space

Analysis of the surroundings (adjoining buildings, shadow elements,...)

Analysis of the space (height, aesthetics, distances,...)

Type of lamps selection

Create a 3D Model with REVIT

2 SOLAR ANALYSIS

Analysis of PPFD levels due to natural lighting, to determine auxiliary lighting requirements.

Orientation.

Areas with direct and indirect sunlight.

Hours of natural light throughout a full year (at the different seasons).

* Solar analysis will be done only when the natural sunlight is enough to take it into account for auxiliary lighting design.

3 LIGHTING ANALYSIS

Analysis of PPFD levels due to natural lighting and plant species requirements, to determine auxiliary lighting needs.

LED Lamps location and distribution.

LED Lamps orientation.

Check for a uniform distribution of PPFD levels.

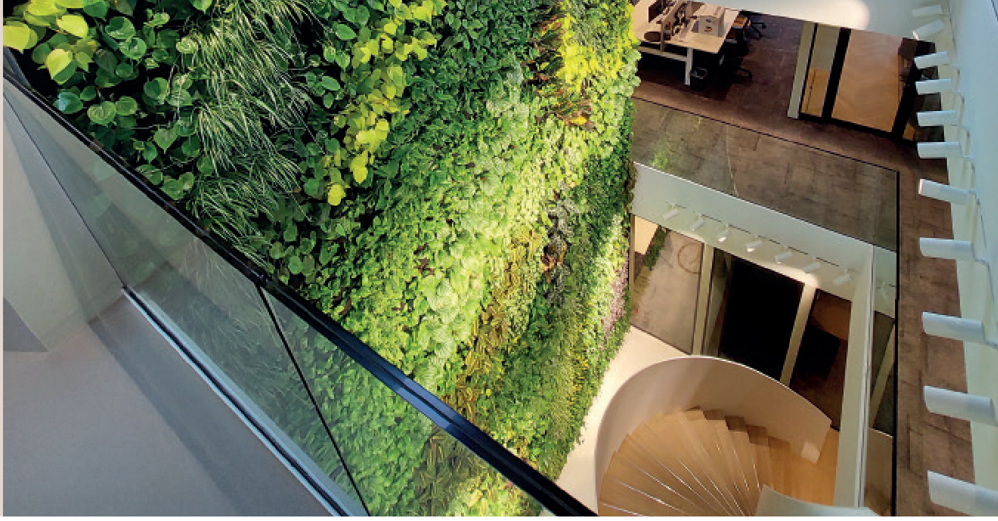
Technical project with final lamp number, distribution and location.

1 DESIGN & SPACE REQUIREMENTS

A previous study of the space and external conditions, such as indirect sunlight, type of ceiling or space height is made, using a 3D model.
With this 3D model a lighting analysis is made using Dialux.

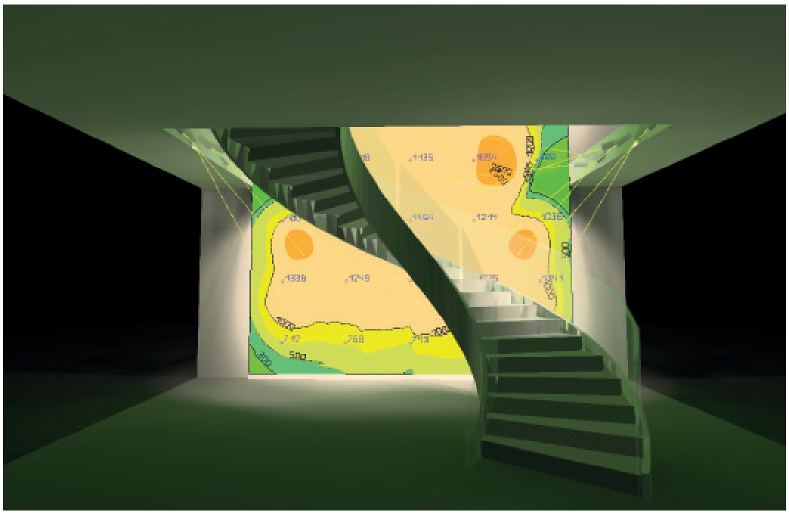
2 SOLAR ANALYSIS

Natural sunlight not relevant in this case.

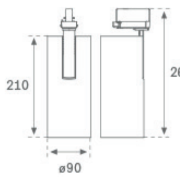


3 DIALUX LIGHTING ANALYSIS

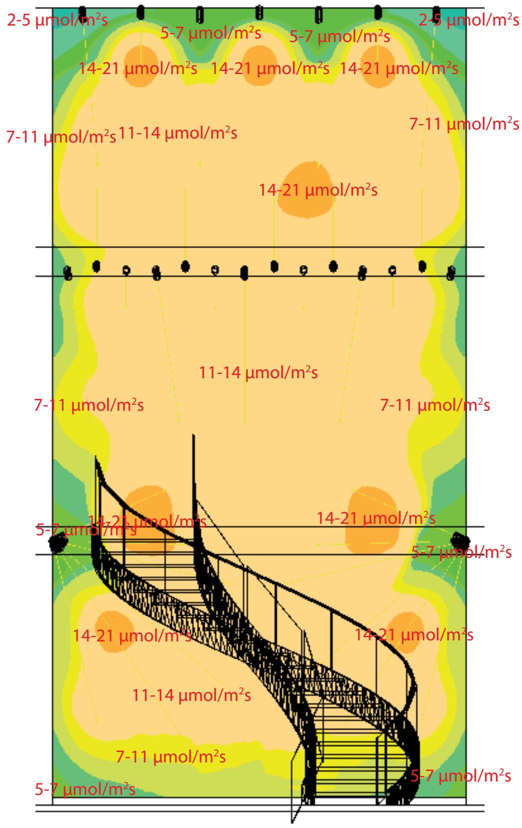
With the 3D model, the lighting analysis is made using Dialux.



3D VIEW - PPFD DISTRIBUTION

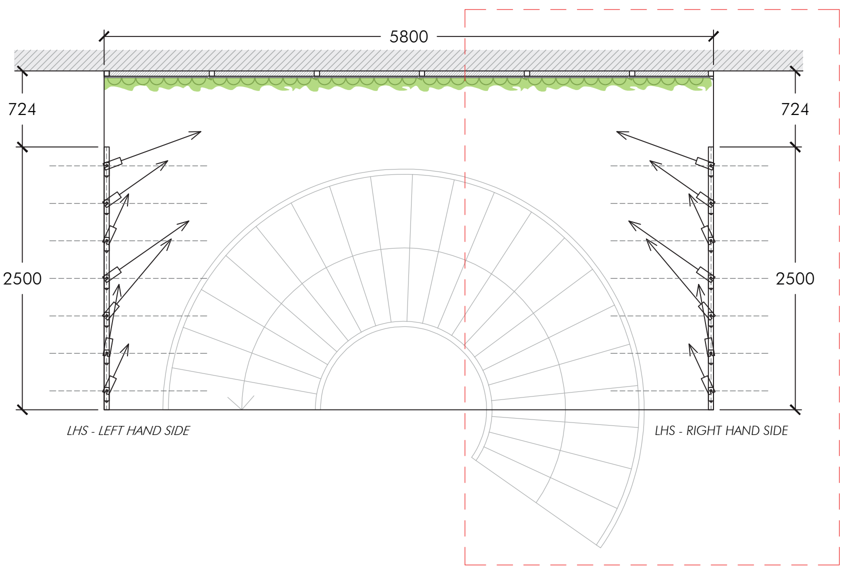


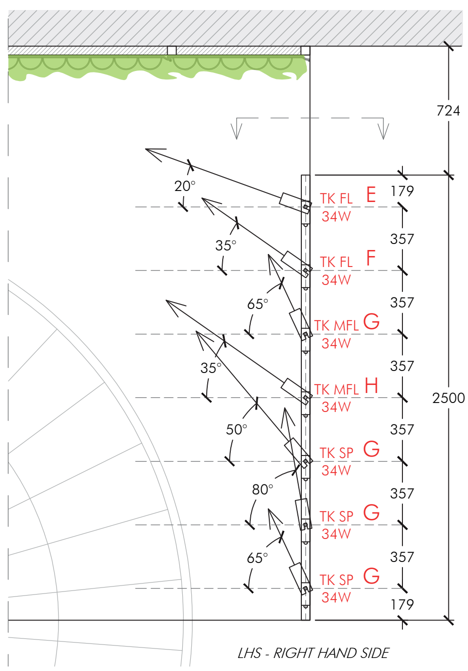
- 2-5 µmol/m2s
- 5-7 µmol/m2s
- 7-11 µmol/m2s
- 11-14 µmol/m2s
- 14-21 µmol/m2s



Based on the Dialux study, the lamps are situated in the space.

4 ASSEMBLING DETAILED PLANS





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