Outdoor lighting concepts can form a continuous whole with the indoor lighting designs. Luminaire groups built to high protection mode form the basis for adding dramatic lighting to architecture, cityscapes and vegetation by night.
The effect of rooms, facades, objects and vegetation greatly depends on the type of lighting. This ranges from general lighting through to specific highlighting. Washlighting forms the background for accent lighting for emphasising objects. In terms of orientation lighting, points of light or rows of lights are used to provide orientation in the outdoor area.

<table>
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<th>Types of lighting</th>
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Ambient lighting produced by wide beam light distribution facilitates perception and orientation in the horizontal plane. It contributes to recognising pathways and to save circulation.
Direct and aimed general lighting produces an even illumination on the horizontal working plane. The architecture is visible and it is possible to orientate oneself in the room.

The directed light produces good modelling and brilliance. The uniformity on the working plane increases as the mounting height increases or as the beam angle widens. Directed light enables good appreciation of form and surface texture. The visual comfort increases as the cut-off angle increases. A feature of direct illumination is its highly efficient use of energy.

Downlights cater for an even light distribution on the horizontal plane. They have an inconspicuous design and can be integrated well into the architecture.

Direct, directed general lighting for:
- entrance areas
- arcades
- passages
- atria

Preferred luminaire group
- downlights

Projects:
Repsol petrol station, Spain
Congress Palace, Valencia
Federal Chancellery, Berlin
Coal washery, Zollverein colliery, Essen
Direct, diffuse general lighting designates an even illumination with respect to a horizontal working plane. The architecture is visible and it is possible to orientate oneself in the room.

Direct, diffuse light produces a soft illumination with little shadow and reflection. The limited formation of shadow results in weak modelling capabilities. Shapes and surface textures are only slightly emphasised. One feature of using fluorescent lamps for the general lighting is an efficient use of energy.

Direct, diffuse general lighting for
- entrance areas
- overhanging or cantilevered roofs
- floor lighting on access driveways, paths and public squares

Preferred luminaire groups
- downlights
- wall-mounted downlights

Projects:
Private residence, Ravensburg
Private residence, Ravensburg
Bodegas Vega Sicilia Wine Cellar, Valladolid
Washlighting illuminates larger objects or spatial zones using wide beam light distribution. In contrast to accent light, it conveys a wide impression. Washlighting enables safe movement on pathways and effectively highlights large objects and areas.

The directed light produces good modelling abilities and enables good appreciation of form and surface structure. Washlighting illumination can serve as a background for accent lighting.

Washlighting illumination for:
- wall lighting
- facades
- entrance areas
- cantilever roofs
- trees
- park and garden complexes
- sculptures
- objects

Preferred luminaire group
- floodlights

Projects:
Private residence, Southern Highlands, Australia
ERCO Lightpark, Lüdenscheid
Church, Rörvik
Monastery ruins, Paulinzella
Vertical illuminance defines and structures spatial situations. It makes a significant contribution to the impression of brightness in a space and to a feeling of security.

**Uniform wallwashing**

Uniform vertical illuminance defines the spatial environment. A uniform brightness distribution from upper edge to floor emphasises walls and façades as a whole. This type of lighting with highly uniform wallwashing is ideal for the illumination of façades, open places, entrances and hedges to facilitate orientation and structure outdoor areas.

**Wallwashing with focal emphasis**

Wallwashing with focal emphasis complements the uniform wallwashing by adding a highlight in the lower third of the illuminated wall. This type of lighting is ideal to emphasise the lower section of the façade.
Grazing light wallwashing

Grazing light emphasises the material and surface texture of walls and façades. Positioning the luminaire close to the wall produces a graduation of brightness on the vertical axis. Grazing light impressively brings out the texture of natural stone or wood.

Applications

Washlighting illumination for
- facades
- entrance areas
- passages
- atria
- cantilever roofs
- park and garden complexes

Preferred luminaire groups
- floodlights
- washlights
- wallwashers
- recessed floor luminaires

Projects:
Regional government of Lower Saxony and Schleswig-Holstein in Berlin
Kaufhof media facade, Hamburg
Museo del Teatro de Caesar-augusta, Zaragoza
Porches de la Boqueria, Barcelona
Accent lighting enables good appreciation of form and surface structure. The focused light produces pronounced shadows and good modelling ability, as well as brilliance. A narrow beam and a high brightness contrast to the surroundings give the object particular emphasis.

Conclusion

Accent light emphasises vegetation, individual objects or architectural elements using narrow beams of light. Bright points in dark surroundings attract attention. They separate the important from the unimportant, allowing individual objects to come to the fore.
Accent lighting creates points of interest. Structures and textures of objects are clearly emphasised by the directed light.

Accent lighting for:
- facades
- entrance areas
- arcades
- park and garden complexes
- objects

Preferred luminaire groups
- projectors
- directional downlights
Orientation lighting improves the perception by adding light points and lines, e.g., along pathways and on stairs. The light must function as a signal. Illuminating the surroundings is of secondary importance here.
Low illumination levels are sufficient for orientation purposes. Small luminaires with high luminance clearly set themselves apart from their surroundings.

Applications

Orientation lighting for the identification of:
- architectural lines
- steps and exclusion zones
- entrances
- routes
- emergency exit routes

Preferred luminaire groups:
- floor washlights
- wall-mounted downlights
- recessed floor luminaires
- orientation luminaires

Projects:
Sevens department store, Düsseldorf
Hilton Hotel, Dubai
Czartoryski Square, Krakow
Private residence, Palamos
Luminaires are available in a wide variety of types, each intended to fulfil different lighting requirements. For external applications it is primarily permanently mounted luminaires that are used.
Projectors illuminate a narrowly constrained area. The type of mounting and the orientation are variable. Projectors are offered with different beam emission angles and light distributions.

Criteria for projectors:
- choice of lamp determines light colour, brilliance, functional life, light intensity
- emission angle determines the beam of light and is defined by the reflector and the lamp
- cut-off angle limits glare and increases visual comfort
- rotatable and tiltable

Projectors have narrow-beam light distribution with a rotationally symmetrical beam.

The use of accessories is also typical for projectors:
- lenses: spread lenses or sculpture lenses
- filter: colour filter, UV or IR filter
- glare control: anti-dazzle screen

Accent lighting for:
- façades
- entrance areas
- arcades
- park and garden complexes
- objects

Applications

Projects:
Norwegian Aviation Museum, Bodo
ERCO Lightpark, Lüdenscheid
ERCO Lightpark, Lüdenscheid
ERCO, Lüdenscheid
Floodlights have a wide-beam characteristic. They are offered with an axially symmetrical or asymmetrical light distribution.

Criteria for floodlights:
- choice of lamp determines light colour, functional life, efficiency, light intensity
- uniformity: optimised reflector for even illumination of areas

Floodlights
Floodlights with axially symmetrical light distribution provide even illumination of objects or areas. Light distribution with focal emphasis.

Applications
Washlighting provides an even illumination for:
- wall lighting
- façades
- entrance areas
- overhanging or cantilevered roofs
- park and garden complexes
- sculptures
- objects

Surface-mounted luminaires act as features themselves. Their arrangement should match their surroundings.

Projects:
Private residence, Southern Highlands, Australia
ERCO Lightpark, Lüdenscheid
Centenary Hall, Bochum
Sri Senpaga Vinyagar Temple, Singapore
Wallwashers have a wide-beam characteristic. They are offered with an asymmetric light distribution.

Criteria for wallwashers:
- choice of lamp determines light colour, functional life, efficiency, light intensity
- uniformity: optimised reflector for even illumination of areas
- gradient: soft edges to the beam of light

Wallwashers

Recessed-mounted wallwashers with asymmetric light distribution provide an even illumination of areas.

Wallwasher, tiltable

Recessed-mounted wallwashers with asymmetric light distribution provide an even illumination of areas. Surface-mounted downlights can be mounted on walls, ceilings or floors and in addition can also be tilted.

Applications

Wallwashing is an important component of architectural lighting for adding emphasis to façades. Further applications are:
- entrance areas
- passages
- atria
- overhanging or cantilevered roofs
- park and garden complexes

As recessed luminaires, wallwashers are inconspicuous architectural details. Surface-mounted downlights act as a room feature. They should correspond to the architecture in their arrangement and form.

Projects:
Regional government of Lower Saxony and Schleswig-Holstein, Berlin
Kaufhof Media Facade, Hamburg
ERCO P1, Lüdenscheid
Concentration Camp memorial, Belzec
Ceiling and wall-mounted downlights are defined first and foremost by their type of mounting and not by their light characteristics. They are available with narrow-beam, wide-beam, symmetrical or asymmetric light distribution. Some luminaires can be positioned either on the wall or on the ceiling.

Criteria for ceiling and wall-mounted downlights:
- choice of lamp determines light colour, functional life, efficiency, light intensity
- uniformity: optimised reflector for even illumination of areas

Facade luminaires
Facade luminaires are offered with narrow-beam, wide-beam, symmetrical or asymmetric light distribution. The light can be distributed either via a single-sided or double-sided light aperture.

Wall-mounted downlights
Wall-mounted downlights, with their diffuse beam in the room, provide good visual comfort. They can also be mounted on the ceiling.

Wall-mounted downlights, shielded
Wall-mounted downlights with half-shielded face offer good visual comfort and illuminate the floor area in particular.
Applications

Projects:
Private residence, Ravensburg
Private residence, Ravensburg
Zara, Munich
Cultural Centre and Coastal Museum NORVEG, Rörvik

For illumination of:
- façades
- entrance areas
- overhanging or cantilevered roofs
- floor lighting on access drive-ways, paths and public squares

The position and design of the ceiling and wall-mounted down-lights should be chosen to match the with the architecture. Façade luminaires should be arranged such that the elements to be illuminated are optimally lit and no light shines past the objects.
Bollard luminaires have a wide-beam characteristic. They are offered with an asymmetric light distribution.

Criteria for luminaires for open area and pathway lighting
- choice of lamp determines light colour, functional life, efficiency, light intensity
- uniformity: optimised reflector for even illumination of areas
- gradient: soft edges to beam of light
- cut-off angle increases visual comfort and limits glare and light pollution
- light output ratio is increased by optimised reflector technology

Luminaires for pathway lighting
Pathway lighting luminaires with asymmetric light distribution provide uniform illumination on pathways. The light is spread in its width so that pathways can be evenly illuminated. Their small shape makes these luminaires suitable for lighting steps.

Luminaires for open area lighting
Light for illuminating open spaces is generated by an asymmetric reflector-flood system. A sculpture lens acting as safety glass directs the light deep into the outdoor area.

Facade washlights
Floor washlights with asymmetric light distribution provide an even illumination of buildings.
Bollard luminaires are mainly used for illuminating the following:
- façades
- entrance areas
- arcades
- passages
- floor lighting on access drive ways, paths and public squares
- orientation lighting on pathways, drives, entrances and steps
- park and garden complexes

As recessed luminaires, these are inconspicuous architectural details. Free-standing luminaires act as features in the room. Their arrangement should correspond to the surroundings.
Recessed luminaires emit a beam that is directed downwards at either a perfectly vertical or an adjustable angle. They are usually mounted on the ceiling and illuminate the floor or walls. They are offered with narrow-beam, wide-beam, symmetrical or asymmetrical light distribution. The cut-off angle of narrow-beam downlights means they are largely free of glare. On downlights with Dark-light reflector, the lamp’s cut-off angle is identical to that of the luminaire. This gives a luminaire with the widest beam possible while simultaneously having an optimised light output ratio.

The use of a diffuser reduces the luminance in the luminaire and thereby improves the visual comfort and the evenness.

Criteria for recessed luminaires
- choice of lamp determines light colour, functional life, efficiency, light intensity
- emission angle determines the beam of light and is defined by the reflector and the lamp
- cut-off angle limits glare and increases visual comfort
- light output ratio is increased by optimised reflector technology

Downlights
Downlights have a rotationally symmetric beam that is directed vertically downwards.

Wallwashers
Wallwashers have an asymmetrical light distribution that is directed onto vertical surfaces. They provide even illumination for wall or façade surfaces. Special lens systems for lens wallwashers ensure even wall illumination. The light is spread out by the lens and directed onto the wall by wallwasher reflectors. The Darklight reflectors of lens wallwashers are visible from below and are glare-free.

Directional luminaires
Directional luminaires provide highlighting for individual areas or objects with a medium to narrow light distribution.
**Arrangement**

The offset from wall should measure approximately half of the luminaire spacing in order to achieve sufficient brightness on the wall and well proportioned scallops of light. To attain an even illumination on a reference plane, the luminaire spacing should not exceed the mounting height \( h \) by more than 1.5:1. An optimal evenness is achieved when \( a = h \).

**Applications**

Downlights provide general lighting for:
- entrance areas
- arcades
- passages
- atria

Recessed downlights are inconspicuous architectural details, whereas surface-mounted downlights and pendant luminaires act as room features. They should correspond to the architecture in their arrangement and design.

**Projects:**
Repsol petrol station, Spain
Congress Palace, Valencia
Federal Chancellery, Berlin
Intercontinental Resort, Berchtesgaden
Surface-mounted luminaires emit a beam that is directed downwards or to the side. They are usually mounted on the ceiling and illuminate the floor or walls. Surface-mounted luminaires are offered with narrow-beam, wide-beam, symmetrical or asymmetrical light distribution. The cut-off angle of narrow-beam downlights means they are largely free of glare. On downlights with Dark-light reflector, the lamp’s cut-off angle is identical to that of the luminaire. This gives a luminaire with the widest beam possible while simultaneously having an optimised light output ratio. The use of a diffuser reduces the luminance in the luminaire and thereby improves the visual comfort and the evenness.

**Criteria for surface-mounted luminaires**
- choice of lamp determines light colour, functional life, efficiency, light intensity
- emission angle determines the beam of light and is defined by the reflector
- cut-off angle limits glare and increases visual comfort
- light output ratio is increased by optimised reflector technology
Recessed floor luminaires emit their beam upwards. They are offered with narrow-beamed, wide-beamed, symmetric or asymmetric light distribution.

Criteria for recessed floor luminaires:
- choice of lamp determines light colour, functional life, efficiency, light intensity
- uniformity with wallwashers: optimised reflector for even illumination of areas
- range of tilt for directional luminaires with high glare protection

Uplights
Uplights feature an upwards directed beam with symmetrical light distribution. The narrow, rotationally symmetrical beam is used for highlighting objects.

Lens wallwashers
Lens wallwashers feature an upwards directed beam with asymmetrical light distribution. They provide an even illumination of walls.

Directional uplights
Directional luminaires provide highlighting for individual areas or objects with a medium to narrow light distribution. The beam can be tilted.

Uplight, diffuse
Recessed floor luminaires with diffuse light intensity distribution are used for marking paths or emphasising architectural lines.
**Applications**

- Glass pavilion, Glass technical college, Rheinbach
- Brandenburg Gate, Berlin
- Khalil Al-Sayegh, Dubai
- Benrath Castle, Düsseldorf

**Project:**

Accent lighting or floodlighting for:
- facades
- entrance areas
- arcades
- passages
- atria
- overhanging or cantilevered roofs
- park and garden complexes

Recessed floor luminaires are inconspicuous architectural details. They should correspond to the architecture in their arrangement and form.
Orientation luminaires are defined first and foremost by the task of providing orientation. This can be achieved by luminaires that function as sources of illumination or as signals.

Criteria for orientation luminaires
- luminance: noticability of the luminaires in their surroundings

Orientation luminaires
Orientation luminaires with point-form front lens act as a local orientation light.

Floor washlights
Floor washlights form points of light on the wall and serves as an orientation light on the floor surface.
Applications

Projects:
Sevens department store, Düsseldorf
Hilton Hotel, Dubai
Czartoryski Square, Krakow
Private residence, Palamos

For identifying:
- architectural lines
- steps or restricted areas
- entrances
- routes
- emergency exit routes
Illuminating facades by night changes the atmosphere of a city. In urban areas or civic parks, points of interest can be created to enable orientation and to establish spatial reference points. Light in the outdoors also extends one's perception when looking outside from with a building.
Wall and facade lighting at night extends one’s perception and defines spatial limits. Vertical illumination is significant in the visual surroundings for identifying areas in terms of their form, regardless of whether they are facades or walls covered with climbing plants. The objective may be to obtain a uniform wallwashing comparable to that in the indoor area, or to gently illuminate a building against the nocturnal environment. The arrangement of the luminaires is dependent on the desired uniformity and illuminance. In the outdoor area at night, a low brightness is often sufficient for making objects visible and for making contrasts.
Wallwashers are noted for giving an even progression of brightness on the wall.

**Observation**

*Wallwashers, plan view*

*Wallwasher, underside*

*Recessed-mounted washlight*

**Conclusion**

Vertical illumination emphasises the surfaces delineating the room in terms of their physical makeup. The room is made to look bigger by brightening the wall faces. Point-form light sources make the wall surface much more vivid. Wallwashing only achieves a uniform brightness on matt surfaces.

Lighting criteria for walls:
- uniformity of the lighting
- the choice of lamp determines the light colour and colour rendition
Arrangement

The offset from the wall should be at least one third of the wall height. Alternatively, the light's angle of incident should be 20° to the vertical. An optimum evenness is obtained when the luminaire spacing is the same as the offset from the wall, or at least does not exceed it by more than 1.5 times. Wallwashers only develop their optimal evenness as of a minimum number of three luminaires.

Applications

Washlighting illumination for vertical surfaces of:
- wall lighting
- facades
- entrance areas

Preferred luminaire groups
- wallwashers

Projects:
ERCO, Lüdenscheid
Benrath Castle, Düsseldorf
Berliner Tor Center, Hamburg
Concentration Camp memorial, Belzec
Given the same lighting, as the wall height increases the brightness of the wall decreases. Wallwashers are characterised by the even progression of brightness along the wall. Lens wallwashers have special lens reflector systems.

Vertical illumination emphasises the wall faces in terms of their physical makeup. The room is made to look bigger by brightening its walls and ceiling. Directed light makes the wall surface much more vivid. As the wall height increases the distance of the luminaire to the wall must be increased. The reduction of the mean illuminance on the wall can be compensated for by having a higher lamp power and by increasing the number of luminaires.

Lighting criteria for high walls:
- uniformity of lighting
- the choice of lamp determines the light colour and colour rendition

Observation

Wallwashers

Lens wallwashers

Conclusion
Whereas for normal wall heights the luminaire spacing is the same as the offset from the wall, for higher walls it must be reduced to compensate for the otherwise sinking illuminance. The offset from the wall is given where a 20° line projected down from the top of the wall meets the ground.

Washlighting illumination for vertical surfaces of:
- wall lighting
- facades
- entrance areas

Preferred luminaire groups:
- wallwashers
- lens wallwashers

Projects:
Regional government of Lower Saxony and Schleswig-Holstein in Berlin
Georg Schäfer Museum, Schweinfurt
Brandenburg Gate, Berlin
Sacred Heart church, Munich
Wall with texture

**Observation**

Point-form light sources at a short offset from the wall produce their own light pattern that, admittedly, does accentuate the texture, but does not permit an even wallwashing. Grazing light on walls can emphasise any surface irregularities.

**Downlights**

**Wallwashers**

**Lens wallwashers**

**Directional luminaires**

**Conclusion**

Directed grazing light makes surface textures clearly visible.
Applications

Projects:
Rohrmeisterei restaurant, Schwerte
Sri Senpaga Vinayagar Temple
Private residence, Germany
Museu Etnològic, Barcelona

The smaller the offset from the wall, the clearer the surface texture is enhanced. When using grazing light, the evenness of the wall illumination is greatly reduced.

Preferred luminaire groups
- downlights, narrow-beamed
- wallwasher
- recessed floor luminaires (uplights, lens wallwashers, directional luminaires)
With ceiling illumination, either light is shone to illuminate the ceiling in its own right or the ceiling is merely used as a reflector for general lighting. The ceiling is primarily emphasised, when it has an intrinsic communicative value, e.g. due to architectonic structures.
Guide

Outdoor lighting | Lighting applications | Ceiling

Ceiling, plan

Observation
The luminaires for washlighting the ceiling can be mounted on the walls or in the ground.

Uplights

Recessed floor luminaires

Conclusion
Selecting the luminaire type is dependent on the room and its use. For ceiling washlights, a minimum distance to the ceiling is required. To avoid glare, recessed floor spotlights for illuminating ceilings should not be installed in heavily trafficked areas.

Arrangement
The prerequisite for ceiling illumination is a sufficiently high room in order to achieve an even distribution of light. Ceiling washlights should be mounted above eye-level. The distance from the ceiling depends on the level of evenness required and should be at least 0.8m.
Applications

Projects:
- Stansted Airport, London
- Glass pavilion, Glass technical college, Rheinbach
- Jahrhunderthalle, Bochum
- Cosmo petrol station, Tokyo

Washlighting ceiling illumination for:
- entrance areas
- arcades
- passages
- atria
- overhanging or cantilevered roofs

Preferred luminaire groups:
- ceiling washlights
- recessed floor spotlights
Luminaires for lighting support structures can be mounted on the structure itself, on the walls or in the floor. A washlighting illumination adds emphasis to the whole ceiling surface. Narrow-beamed luminaires accentuate the support structure in particular.
**Conclusion**

The selection of the type of luminaire is dependent on the scale and the proportion of the support structure. Spotlights can also be attached directly to components of the support structure. The complete support structure can be illuminated with floodlights. To avoid glare, recessed floor spotlights for lighting the support structure should not be installed in heavily trafficked areas. The arrangement of the luminaires should be oriented around the design of the support structure.

**Applications**

Ceiling lighting for:
- entrance areas
- arcades
- passages
- atria
- overhanging or cantilevered roofs

Preferred luminaire groups
- spotlights
- ceiling washlights
- recessed floor luminaires

Projects:
- Post-Tower, Bonn
- Ciudad de las Artes y las Ciencias, Valencia
- Jahrhunderthalle, Bochum
- Museo del Teatro de Caesar-augusta, Zaragoza
When floor lighting, the floor surface can be illuminated with direct light from downlights or from floodlights positioned on the sides. Floor washlights particularly emphasise the floor surface and its physical make-up.
Floor washlights

Conclusion

Due to their asymmetric light distribution, floor washlights provide grazing light illumination of the floor. They ensure a high degree of visual comfort thanks to their low mounting height. A soft beam gradient reduces the contrast with the surroundings. The elimination of glare from downlights is determined by the cut-off angle.

Applications

Projects:
ERCO, Lüdenscheid
Eberbach monastery, Eltville
Private residence, Berlin
Private residence, Palamos

Floor washlighting for:
- driveways
- pathways
- public squares

Preferred luminaire groups:
- downlights
- floor washlights
- bollard luminaires
- mast luminaires
Objects can be accentuated with great effect to turn them into real eye-catchers. The appearance of objects can be made to look unusual by selecting a strong grazing light. The opposite of such dramatic lighting is a uniform, large area lighting solution.
Objects in the room or area can be illuminated with spotlights or floodlights. When illuminating an object head-on with one spotlight in the direction of vision, the modelling effect is weak. Two spotlights, with sculpture accessories, shining from different directions create a balanced, three-dimensional effect. The brightness contrasts are milder compared to when using just one spotlight. Illuminating from below produces an interesting but mysterious effect since the light is coming from an angle which is unusual for the observer.

**Spotlights**

**Floodlights**

**Directional luminaires**

**Directional uplights**
**Conclusion**

Narrow-beam spotlights place emphasis on the object alone, whereas floodlights show the object in the context of its surroundings. This reduces the modelling effect. Lighting from below can have the effect of making things look very strange.

**Arrangement**

Objects in the room can be illuminated with an angle of incidence of 30° to 45° to the vertical. The steeper the incident light, the stronger the shadows.

**Applications**

Accent lighting for
- park and garden complexes
- sculptures

Preferred luminaire groups
- spotlight
- floodlights

Projects:
Norwegian Aviation Museum, Bodo
ERCO, Lüdenscheid
Rhenish State Museum, Bonn
Let The Dance Begin, Strabane
Objects on the wall can be illuminated with spotlights or floodlights. Spotlights highlight the object and create a decorative effect. Due to their even illumination of the complete wall surface, floodlights accentuate the object less than spotlights.

Spotlights

Floodlight from above

Floodlight from below

Recessed floor and directional luminaire

Lens wallwashers
Conclusion

Narrow-beam spotlights accentuate the object while floodlights show the object in the context of its surroundings.

Arrangement

Objects on the wall can be illuminated with an angle of incidence of 30° to 45° to the vertical. The steeper the incident light, the more three-dimensional the object appears.

Applications

Accent lighting for
- facades
- entrance areas
- park and garden complexes
- sculptures

Preferred luminaire groups
- spotlight
- wallwashers
- uplights

Projects:
ERCO, Lüdenscheid
Vietnam Veterans Memorial, Washington DC
Sinnet Tennis Club, Warsaw
The form of facades is determined not only by their material and shape but also by the light and its direction and colour. The appearance of a facade alters during the course of the day due to the changing direction of light and the varying components of diffuse and direct light. Different light distributions and the use of lighting control systems give facades an appearance of their own at night. Varying illuminances differentiate components or areas of a facade. Grazing light emphasises facade details. Wash-lighting facades allows them to appear in their entirety. Shining any light beyond the facade surfaces, either to the sides or over the top, should be avoided.
Washlighting creates a very uniform light distribution on the facade. A line of light marks out the edge of the building against the night sky. Uplights rhythmically divide up the facade. Under the light of up-downlights, graphic patterns are produced by the definite beams.
Washlighting facades can make them appear flat. Reducing the illuminance as the facade height increases gives a low-contrast transition to the dark night sky. Grazing light emphasises the surface textures of materials. Progressions of light on untextured walls become the dominating feature and are seen as independent patterns in their own right. Large, uniform surfaces can be given structure with patterns.

Conclusion

The facade lighting can be positioned on the ground, on a mast or on the building. Wallwashers offset from the facade at one third to half the facade height avoid long shadows. Luminaires positioned close to the facade produce grazing light with a strong emphasis on the surface textures and structures. Recessed floor luminaires are architecturally discrete. Overgrown vegetation must be prevented. Mast luminaires will appear as additive features in front of the facade. Cantilever arms allow direct mounting to the building. Shining any light beyond the facade surfaces, either to the sides or over the top, should be avoided.

Arrangement

Recessed floor luminaires

Surface-mounted floor luminaires

Upright supporting tube
Guide

Outdoor lighting | Lighting applications | Facade

Solid facade

Mast

Cantilever arm

Facade luminaires

Applications

Projects:
Georg Schäfer Museum, Schweinfurt
ERCO Lightpark, Lüdenscheid
ERCO Lightpark, Lüdenscheid Cultural Centre and Coastal Museum NORVEG, Rörvik
Floodlights produce a uniform illumination on the facade. Washlighting with point-shaped light sources makes the surface texture and structure clearly visible. Accentuating the columns detaches these from the surrounding facade. Uplights positioned on two sides emphasise the volume of the column. Downlights accentuate the column and illuminate the floor area. The combination of uplights and downlights augments the vertical facade division by lighting from above and below.

**Observation**

**Floodlights**

**Uplights**

**Uplights, double-sided layout**

**Downlights**
Downlights and uplights

Narrow beams of light intensify the effect of the vertical division. To avoid shadows at the side, the luminaires should be positioned at right angles, parallel to the facade. Strong contrasts and heavy shadow can be compensated for by washlighting the facade as a form of general lighting. The luminaires should be positioned in a rhythm corresponding to that of the facade divisions.

Conclusion

Applications

Projects:
Brandenburg Gate, Berlin
Municipal works, Lüdenscheid
Ruhr Festival Theatre Congress Centre, Recklinghausen
Faena Hotel, Buenos Aires
Horizontally divided facade

Observation

Floodlights illuminate the entire facade and emphasise the horizontal divisions by casting heavy shadows. Lines of light echo the horizontal structure on the darker facade surface.

Floodlights

Lines of light

Conclusion

Luminaires positioned close to the facade highly emphasise its three-dimensional nature. Long heavy shadows cast by facade divisions can be reduced by increasing the offset of the luminaire from the facade. The steeper angle of incidence for the light in the upper region of the facade casts longer shadows than in the lower area.

Applications

Projects:
Hong Kong and Shanghai Bank, Hong Kong
Palazzo della Borsa, Triest
Kaufhof department store, Mönchengladbach
Facade with projecting or recessed sections

Observation

Wide-beam floodlights set far from the building illuminate the facade evenly. Facades with large protruding sections or insets will feature heavy shadows. Different illuminances or light colours augment the differentiation of the facade. Uplights mark out the internal corners with grazing light.

Floodlights

Spotlights with different illuminances

Spotlights with different light colours

Uplights
Conclusion

Differentiated illuminances, light distributions and light colours add rhythm to the appearance of the facade. Harsh contrasts between accentuated and unlit areas can be compensated for by using washlighting to perform the general lighting. Increasing the luminaire offset from the facade reduces the formation of heavy shadow. The luminaire arrangement should correspond to the pattern of facade division.

Applications

Projects:
Museum of Arts and Crafts, Hamburg
Palacio de la Aljaferia, Zaragoza
**Perforated facade**

**Observation**

Under daylight conditions the window surfaces appear dark. At night, illuminated interiors provide a strong contrast between the dark facade surface and bright windows. Floodlights produce uniform light distribution over the facade. Illuminating the window embrasure accentuates the frame of the facade opening, whereas narrow-beam uplights emphasise the facade's grid pattern.
Indoor users should not be dazzled. Luminaires shining into the interior impair the view out of the building. Lighting control systems can be used to control the light in individual rooms and to create patches of light on the facade.

Projects:
- Humboldt-University, Ehrenhof, Berlin
- Pentacon Tower, Dresden
- Ernst-August-Carree, Hannover
- DZ Bank, Berlin
Observation

Under daylight conditions the strip of windows appears dark. Illuminating the indoor areas at night forms a strong contrast between dark facade surfaces and a bright strip of windows. The lighting on the balustrades augments their horizontal structure.

Daylight

Uplights, indoor

Band of light

Conclusion

The strong contrast between bright indoor lighting and the dark outer surface at night can only be compensated for to a small extent with facade wash-lighting.
Applications

Projects:
- Municipal works, Lüdenscheid
- Astra Administration, Stockholm
- E-Werk event halls/SAP SI offices, Berlin
Under daylight conditions, the transparent facade appears dark and reflects its surroundings. Indoor lighting allows the observer to see into the building. Ceiling washlights in the indoor area emphasise the ceiling surfaces and increase the overall impression of interior brightness at night. The facade construction is silhouetted. Lines of light in the ceiling area of the individual floors underline the horizontal building structure. Uplights emphasise the vertical elements of the facade.
Guide

Outdoor lighting  |  Lighting applications  |  Facade

Transparent facade

Uplights, outdoor

Conclusion

The visual perspective from the ground makes the lighting effect of the indoor area appear larger with uplights than with downlights. Dazzling the users of the indoor area should be avoided. Luminaires shining into the indoor area will impair the view out of the building.

Applications

Projects:
Office building, Basel
Ruhr Festival Theatre Congress Centre, Recklinghausen
Zürich Insurance, Buenos Aires
Biblioteca Foral de Bizkaia, Bilbao
In the field of landscaping, trees are the most important elements for forming areas. The shape and size of the trunk and tree crown vary depending on the type of tree. The most well-known tree forms are rounded, columnar, spreading and flat-crowned (e.g. a palm). The winter scene is characterised by filigree branches, while in the summer the leaves of the crown thicken to form a voluminous mass. In addition to the shape, the appearance of trees is also characterised by blossom and foliage in the course of the seasons.
Floodlights aimed upwards make the tree crown appear three-dimensional. Two floodlights from the front, yet to the side, illuminate the crown evenly as a voluminous mass, while floodlights mounted at the side add greater emphasis to the three-dimensionality. Floodlights arranged around three sides illuminate the crown evenly from all sides and reduce the three-dimensionality of the tree form. Floodlights in the background create back-lighting and make the tree crown into a silhouette. Uplights at the trunk accentuate the trunk as a linear feature and visually connect the crown to the ground. Depending on the season, light from above will either emphasise the contour of the crown or accentuate the shadows of the branch structure on the ground.
Guide

Outdoor lighting | Lighting applications | Vegetation

Trees

Floodlight behind

Uplight

Spotlight from above

Conclusion

Luminaires arranged on several sides give an even illumination of the tree, while one or two luminaires create a greater three-dimensional effect. Narrow-beamed uplights are suitable for highlighting any striking, tall tree trunks. The texture of the bark is brought out stronger when lighting from the front. Positioning the luminaires to the side gives rise to a narrow line of light on the trunk. When illuminating a wall behind a tree, the silhouette of the crown and trunk becomes apparent. Spotlights mounted in atria or on facades can cast the contour of the tree and/or branches as a shadow on the ground.
**Observation**

**Tree growth**

One or two luminaires accentuate trees of small dimensions. Several floodlights produce an even illumination of large, fully grown trees.

**Small tree**

**Large tree**

**Conclusion**

Tree growth and avoiding glare are two points that must be considered when arranging and aiming the luminaires. On large trees, several luminaires may be necessary to achieve an even illumination and to avoid a distorted perception of light and dark parts. Flexible, directable luminaires with ground spikes can be repositioned and re-aimed as the tree grows. Luminaires recessed into the ground blend into the area of landscape better but require more work to reposition however.
Floodlit illumination of the tree crown particularly brings out the beauty of the outermost blossom in the springtime. In the summer, the dense foliage makes the crown appear as a solid mass. Coloured leaves are characteristic for the autumn. In the winter, the lighting effect is reduced to the filigree branch work.

Lamp selection is a factor that influences the colour of light and the colour rendition of the leaves and blossom. Daylight white colours of light emphasise blue-green foliage colours, whereas warm white colours of light accentuate brownish-red leaves.
Applications

Projects:
Ernst-August-Carree, Hannover
ERCO, Lüdenscheid
ERCO, Lüdenscheid
ERCO, Lüdenscheid

Lighting for
- park and garden complexes
- entrance areas
- atria

Preferred luminaire groups
- spotlights
- floodlights
- uplights
Floodlit illumination emphasises the shape of the tree crown as a solid volume. Positioning the luminaires close to the tree underlines with grazing light the texture of the crown and of the trunk. The illumination from below brings out the three-dimensionality of the crown when the foliage is quite open.

**Tree form: rounded**

Floodlight, front

Floodlight on the right

Floodlights on three sides

Floodlight behind
Guide
Outdoor lighting | Lighting applications | Vegetation
Types of trees

Uplight

Spotlight from above

Tree form: Weeping

Floodlight in front

Floodlight on the right

Floodlights on three sides
Types of trees

Tree form: columnar

Spotlight in front

Spotlight on the right
Guide
Outdoor lighting | Lighting applications | Vegetation
Types of trees

Spotlights on three sides

Spotlight behind

Uplight

Tree form: conical

Floodlight at front

Floodlight on the right
Guide

Outdoor lighting | Lighting applications | Vegetation

Types of trees

Floodlights on three sides

Floodlight behind

Tree form: palm

Spotlight in front

Spotlight on the right

Spotlights on three sides
Rounded, weeping trees with dense, low hanging foliage that cannot be seen through, lend themselves to floodlit illumination and the luminaires are best positioned outside the area under the tree. On spreading trees with thin, see-through foliage, illuminating from within the area under the tree, using uplights allows the whole tree crown to appear aglitter. Illuminating a tree with grazing light requires a flat incident beam at approximately 15 degrees. Spherical trees require a greater distance between luminaire and crown than columnar trees do here. Narrow-beamed uplights are particularly suitable for lighting high palms.

The desired illuminance must be selected to suit the reflectance of the leaves.
**Clusters of trees**

**Observation**

Floodlights located in front illuminate the tree crowns evenly. Floodlights positioned at the sides produce a hard contrast of light and shadow. Luminaires on two sides avoid hard shadows. Uplights at the trunk emphasise the trunk as a vertical linear feature.

**Floodlight at front**

**Floodlights at sides**

**Uplights**
The cluster of trees can be visually differentiated by using different luminaires and differently aimed. Spatial depth is created by adding lighting emphasis in the foreground, middle ground and background. Stronger brightness contrasts support this effect. Narrow-beamed luminaires provide highlighting, while broad-beamed floodlights take on the task of general lighting.

Having several luminaires with high cut-off angles reduces the glare compared to a few broad-beamed luminaires. Narrow-beamed and well-aimed luminaires reduce the superfluous emission of light into the surroundings. The decentralised illumination of trees allows a differentiated lighting of a cluster of trees. Spotlights are suitable for additional highlights. Tree growth and the avoidance of glare are to be considered when positioning and aiming the luminaires.

Lighting for
- park and garden complexes
- entrance areas
- atria

Preferred luminaire groups
- spotlights
- floodlights
- uplights

Projects:
ERCO, Lüdenscheid
ERCO, Lüdenscheid
Bank of China, Beijing
Bank of China, Beijing
Upwardly directed spotlights emphasise the tree canopy. Floodlights with asymmetric light distribution give homogenous light from base to canopy even on tall and broad rows of trees. Narrow-beamed uplights highlight the tree trunk as a vertical, linear feature.

**Observation**

**Tree form: rounded**

**Floodlight**

**Tree form: rounded**

**Uplights**

**Tree form: columnar**

**Spotlights**

**Tree form: columnar**

**Uplights**
Tree form: palm
Spotlights

Tree form: palm
Uplights

Conclusion
The effectiveness of rows of trees
to delineate space depends to a
very large extent on the type of
tree. Thus, depending on the type
of tree, a closely planted row of
trees can appear as a 'wall' or a
'colonnade'. Narrow-beamed and
well-aimed luminaires reduce the
glare and the spill light into the
surroundings. The tree growth
must be considered when posi-
tioning and aiming the lumi-
naires.

Applications

Lighting for
- park and garden complexes
- entrance areas
- pathways

Preferred luminaire groups
- spotlights
- floodlights
- uplights

Projects:
ERCO, Lüdenscheid
Loher Wäldchen park,
Lüdenscheid
**Observation**

Upwardly directed spotlights emphasise the tree crowns. Floodlights with asymmetric light distribution give homogenous lighting from base to canopy even on extensive avenues of tall trees. Narrow-beamed uplights highlight the tree trunk as a vertical, linear feature.

**Tree form: rounded**

- Floodlights

**Tree form: rounded**

- Uplights

**Tree form: columnar**

- Spotlight

**Tree form: columnar**

- Uplights
Tree form: palm
Spotlights

Tree form: palm
Uplights

Conclusion
The spatial profile of tree-lined avenues depends to a very large extent on the type of tree. Thus, depending on the type of trees, an avenue of narrowly spaced trees can act as a wall and segregate a definite area or can appear as a colonnade. Narrow-beamed and well-aimed luminaires reduce the glare and spill light into the surroundings. The tree growth must be considered when positioning and aiming the luminaires.
Observation

Broad, upwardly directed beams of light emphasise the underside of the tree canopy. Narrow-beamed uplights highlight the tree trunk as a vertical, linear feature.

Tree form: weeping
Uplights, narrow-beam

Tree form: weeping
Uplights, wide-beam

Tree form: columnar
Spotlights

Tree form: columnar
Uplights
The tree crowns of narrowly spaced trees combine to take on the effect of a canopy. Having several narrow-beamed luminaires reduces the glare compared to a few broad-beamed luminaires. On pathways and traffic routes, it must be ensured that the luminaires are well shielded to prevent glare.
In this subchapter, application possibilities for outdoor luminaires are shown using design examples. Design variations are presented using simulations.

Entrance area, small  Entrance area, large  Historical facade

Pathway
The entrance area is formed by a negative volume, which is set apart from the outdoor area by a few steps.

Design 1
The wallwashers integrated in the ceiling provide a very homogeneous illumination of the wall. The luminaires are integrated into the architecture.

Design 2
The light intensity distribution of the downlights determines the overall impression of the scene. On the wall, uniform beams of become apparent and become the formative element. The material texture on the back wall is brought out by the light.

Design 3
To meet the functional criteria of an entrance, it is sufficient to illuminate the ground. The overall volume of the entrance recedes into the background.
Guide
Outdoor lighting | Design examples
Entrance area, small

Arrangement

Design 1
The offset of the wallwashers from the wall measures half the wall height. The luminaire spacing is equal to the offset from the wall.

Design 2
To achieve a decorative lighting effect, the downlights are positioned near to the wall.

Design 3
The floor washlights are located at a height of 60cm in order to avoid glare.
The design draft shows a representational entrance area with a canopy roof projecting out a long way. This is supported by evenly arranged struts. The main task is to reinforce the representational character using the lighting.

**Situation**

[Image of the entrance area with a canopy roof]

**Planning**

**Design 1**
Downlights follow the form of the cantilever roof along the struts. The circles of light made by the beams on the floor emphasise the dynamics of the circular facade. The wall adjoining onto the glass facade is delicately brightened by recessed ceiling wallwashers.

**Design 2**
Light is projected onto the cantilever roof via ceiling washlights. The roof reflects the light onto the floor. The indirect lighting casts evenly diffused light onto the ground. Additional illumination of the wall can be dispensed with since the wall is also given sufficient light by the reflection from the roof. The luminaires appear as independent architectural elements.

**Design 3**
Each strut is highlighted by four surface-mounted downlights. The physical makeup of the struts is emphasised.
The arrangement of the narrow-beam recessed downlights follows the circular course of the roof edge. To achieve a relation between wall and luminaires, the offset of recessed ceiling wallwashers from the wall measures only a quarter of the wall height.

Design 2
The ceiling washlights are mounted at two thirds of the strut height.

Design 3
The offset of the recessed ceiling wallwashers from the wall measures a quarter of the wall height. The surface-mounted downlights are placed in a circular arrangement around the struts at a short distance away.
Historical facades require lighting concepts that are in harmony with the architectural features. For classical facades, the following features are to be given consideration in the lighting concept:

- columns
- porticoes
- friezes
- facade division into three areas: portal and two side wings

In all the examples listed a faint general lighting of the facade is ensured via lens wallwashers. The lighting should not be incident too steeply, since otherwise irritating heavy shadows could be cast in the area of the friezes.

### Planning

**Design 1**
The columns are silhouetted against the entrance area, which is illuminated by surface-mounted downlights. The three-dimensional impression of the portico is greatly reduced by the columns that now appear almost flat. The front elevation of the building is clearly divided into three because of the emphasis given to the facade’s central section.

**Design 2**
The columns are illuminated with narrow-beam uplights. The tympanum is illuminated separately. The fact that the entrance area is set forward from the facade becomes much more pronounced. The view is attracted to the central section of the building.

**Design 3**
The facade is clearly given a horizontal division by illuminating the frieze. The overall breadth of the facade becomes more significant. The columns were illuminated as in design 2, but with reduced light intensity so as not to overly emphasise the entrance. Overall, this differentiated lighting concept lends the historical facade a most magnificent character.
Arrangement

The starting point of all three design examples is the homogenous general lighting of the facade with lens wallwashers mounted as recessed floor luminaires. These are arranged in a line at a distance of one third of the building height in front of the right and left sections of the facade.

Design 1
One surface-mounted downlight with a wide light intensity distribution is positioned behind each and every column.

Design 2
The columns are emphasised by narrow-beam uplights arranged circularly around the columns.

Design 3
Directional luminaires for highlighting the frieze are located at a distance of one tenth of the wall height in front of the two side sections of the facade. The spacing between the directional luminaires themselves is relatively small so that an even illumination of the frieze is obtained. Narrow-beam uplights in the semicircle around the four columns add brightness.
Situation

Orientation along pathways can be provided either by primary lighting of the path surface or by emphasising certain reference points in the area.

Planning

Design 1
Orientation is provided here on the one hand by linearly arranged points of light from floor washlights and on the other by marking points of interest. In this example, a low illumination of the pathway by floor washlights is sufficient because illuminating the row of trees provides orientation.

Design 2
The path surface is well lit with wide-beam floor washlights. The evenly arranged floor washlights guide one's view. The adjacent trees are silhouetted against the evenly illuminated wall behind them. The spatial limits are emphasised and this gives the viewer an indication about the volume of the area.
**Design 1**
The uplights are arranged to the right and left of the trees. A row of floor washlights runs parallel to this.

**Design 2**
The lens wallwashers for illuminating the wall are recessed in the floor at an offset from the wall of a third of the wall height.
The development in architecture towards transparency transforms buildings at night into effigies shining from the inside out. Light has advanced to become a marketing topic for a number of cities. A sensitive treatment of light in the outdoor area is crucial for achieving a clear view of the night sky.
Dark Sky stands for a lighting design in the outdoor area whereby the lighting concentrates on what is actually essential. Any kind of light pollution is avoided and observation of the night sky is enabled. This approach combines a lasting design concept with a luminaire technology tailored to suit. The cooperative teamwork of lighting designers, architects, landscape gardeners, building sponsors, electrical fitters and luminaire manufacturers forms the basis for a successful implementation of the Dark Sky concept.

Light pollution

The term “light pollution” refers to that spill light which, due to its illuminance, its direction or its spectrum, causes interference in the context in question. Spill light and glare reduce the visual comfort and the desired content of information cannot be conveyed. The ecological consequences include the waste of energy and the negative effects on flora and fauna.

Graphic: Artificial Night Sky Brightness in Europe

Luminaires suitable for Dark Sky applications feature precise light control and a defined cut-off for optimum visual comfort. Having no emission of light above the horizontal plane is a decisive criterion for open area and pathway luminaires. A low luminance at the light aperture avoids excessive contrasts in luminance levels in the outdoor area.

The first design task for a Dark Sky concept is to ascertain for what purpose and with what quality the particular areas are to be illuminated. The following is decisive for a lasting lighting concept:
- adequate illuminance
- avoidance of spill light above the horizontal plane
- correct alignment of luminaires
- reduce or switch off the lighting when no longer needed

The luminaires should be arranged such that the elements to be illuminated are optimally lit and no light shines past the objects. This avoids dazzling the observers.

With the Dark Sky concept the lighting control takes on special significance for regulating the intensity and duration of the lighting for individual zones, thus regulating the overall light emission. The lighting control allows switching and dimming for individual areas. Predefined light scenes can be recalled dependent on the time of day and season via time sensors and motion sensors. Function-dependent lighting scenes for the twilight, evening and night can be controlled dependent on sensors.