



Multi-Story Car Park Lighting

V1 2019

The lighting solution in a multi-story car park must support in delivering a bright welcoming environment, safe movement of cars and people as well as reducing crime and the fear of crime for the user of these spaces. This guide has been produced to support the lighting designer in delivering the correct lighting solution, taking into account latest guidelines and best practice design.

Indoor Car Parks

Standards and Guidelines:

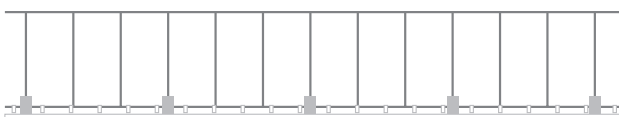
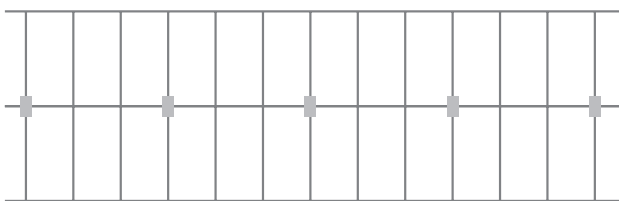
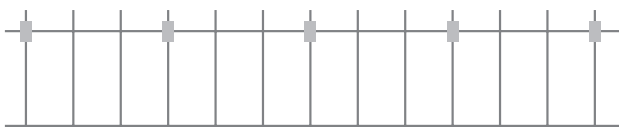
BSEN12464-1:2011, Table 5.34

Area	Em	UGR	Uo	Min Ra	Notes
In/out Ramps (Day)	300	25	0.4	40	Floor Level Safety colours should be recognisable
In/out Ramps (Night)	75				Floor Level Safety colours should be recognisable
Traffic Lanes					Floor Level Safety colours should be recognisable
Parking areas		-			Floor Level Safety colours should be recognisable High vertical illuminance
Ticket Office	300	19	0.6	80	Reflections in windows minimised Glare from outside should be prevented

BS5489-1:2013 Section 7.4.8.2 – as BSEN12464-1:2011

Park Mark Safer Parking (<https://www.britishparking.co.uk/Guidelines-and-Resources>) – as BS5489-1:2013

Room Design Inputs:



- Light surface finishes will deliver a more energy efficient solution as well as support a sense of comfort and safety for the user.
- Reflectance values should be sought from client. Where these values are not given, reflectance values of 50/30/20 could be used.
- Confirmation of whether ceiling is flat or includes drop beams. Due to potential for shadowing and installation considerations, if drop beams, depth and mounting method should be confirmed.
- Ceiling heights to soffit should be requested. Where not given, a ceiling height of 2.5m should be used.
- Column locations should be requested to support design.
- Where not advised, parking bay layouts can be used. Typically there are 3 standard or 2 disabled parking bays between columns.
- An accurate MF value can only be calculated once operational life, cleaning regime and surface finishes are known. Where schemes use a default value of 0.8, confirmation of maintenance calculation should be sought. Please see appendix 1 for further details.

Design Considerations:

Main parking area (See Appendix 2 for suggested layout):

- The lighting solution must provide a balanced bright well lit environment to support comfort and safety for drivers and pedestrians. With this in mind the following design principles should be followed:
 - Target lux and uniformity values are an average across the whole floor area including change in direction and covered ramps.
 - As BS5489-1:2013 7.4.8.4, a 0.5m wall zone can be used
 - The first measuring point should be no further than 0.5m from the wall (including central core areas)
 - Measuring points no greater than 1.5m apart (BSEN13201-3:2015 7.2.9), with a minimum of 36 points (BS5489-1:2013 7.4.8.4).
 - Fitting locations should take into account beam locations (where applicable) and mounting height if fixed to trunking.
 - Orientation of fittings should be such that glare to driver is minimised (BS5489-1:2013 7.4.8.2). Mounting luminaire crossways on roadways should be avoided.
 - Luminaire selection should be robust (Min IK08), with a minimum IP65 rating.

Entrance and Exits (See Appendix 3 for suggested layouts):

- To support the adaptation of the eye between the outdoor and internal levels during the day it is recommended to light the entrance/exits to a higher illumination level. The following rules should be followed:
 - Main entrance/exit – these should be lit to 300lux during the day and 75lux at night.
 - Where area not identified, providing these levels to and from entrance barriers could be proposed.
 - For areas coming down from the open roof area, the higher illumination level should apply to the covered area to a point at which the cars have turned onto the main roadway
 - During hours of darkness, lighting at the entrance/exit should reduce to the same as the main car park levels.

Staircores and Lift Areas

- Staircores should be lit to an average of 150lux with a uniformity of 0.4.
- Lift Areas – 200 lux average should be provided with good vertical illumination on lift wall.
- Fittings should be:
 - Robust (min IK08)
 - Positioned to minimise risk of vandalism and obstructing movement of people
 - Located to create sufficient contrast to the front of steps and change in heights
 - Avoid mounting over treads to simplify maintenance
 - Wall or ceiling mounted fittings on landings is recommended

Emergency Lighting (See Appendix 4 for indicative layouts)

- As with all emergency lighting designs, consultation should take place to identify the emergency lighting strategy and drive the required solution.
- Where possible fire strategy drawings should be sought.
- Part B of the building regulations, Table 9, advises for the provision of emergency lighting in these applications.
- General Lighting:
 - Integral or standalone solutions can be used
 - There are 2 possible ways to implement emergency lighting:
 - Treat whole space to 0.5 lux minimum point with 0.5m wall zone
 - Pedestrian escape routes only to 1 lux minimum point (BS5266-1:2016 5.2.8.7)
 - For staircores and lift lobbies a minimum of 1 lux along the centre should be provided.
 - Min/Max diversity ratio no greater than 1:40
 - Call points and fire safety equipment locations should be requested and illuminated to 5 lux (BS1838:2013 4.1.2 i)
 - Calculations should always be undertaken to ensure compliance is met.
- Exit signage:
 - Exit signage should be clear and unambiguous in the event of a power failure.
 - Sufficient exit signs should be provided to allow for both obstructions and viewing distances.
 - Viewing distance is affected by viewing orientation. Further details can be found in BS5499-4:2013 Annex C.
 - Please note where non-illuminated signs are used, viewing distance is reduced, with a need to light these under general and emergency conditions (BS5499-4:2013, 5.3)
- Unless advised, Whitecroft Lighting will adopt the following design solution:
 - 0.5 lux minimum to whole floor space
 - No emergency lighting will be included on car ramps as assumed 'off limits' to pedestrians
 - The exit signage design will be based on an open space taking into account viewing distances and orientation as outlined in BS5499-4:2013

Lighting Controls

- Any control strategy employed must balance out the needs for energy saving with user comfort and safety. The examples given below will offer varying levels of energy savings, user experience, and cost. These can support the designer in discussions to deliver the appropriate solution:
 - Manual on/off
 - Timeclock
 - Presence detection – full floor, zoned or individual fittings
 - Daylight
 - Set-back – full floor or zoned
 - Individual presence/daylight detection
 - Background Illumination levels
- The designer can also consider the use of wireless controls. These can offer significant savings throughout the build and operation of the car park. At build, savings on installation and commissioning can be realised. For the client, performance diagnostics, including emergency testing and monitoring are available offering the client greater visibility of their buildings performance. Please contact Whitecroft for further details.

Roof Level Car Parks

Standards and Guidelines:

BSEN12464-2:2014, Table 5.9 and BS5489-1:2013, Table 5

Area	Em	Uo	GR	Ra Min
Light Traffic – shops, terraced and apartment houses, cycle parks	5	0.25	55	20
Medium Traffic – department stores, offices, plant, sports, multipurpose complexes	10		50	
Heavy Traffic – Schools, Churches, Major shopping centres, Sports and multipurpose complexes	20			

Park Mark Safer Parking (<https://www.britishparking.co.uk/Guidelines-and-Resources>) – as BS5489-1:2013

Note: Compliance to the ILP Guidance notes for the reduction of obtrusive light should also be considered within any car parking scheme

Design Considerations:

- It is most common to light roof areas to 20lux, although consultation should take place to ensure appropriate light level is selected.
- Target lux and uniformity values are an average across the whole roof area
- As BS5489-1:2013 7.4.8.4, a 1.0m wall zone can be used
- The first measuring point should be no further than 1.0m from the perimeter wall (including central core areas)
- Measuring points no greater than 1.5m apart (BSEN13201-3:2015 7.2.9), with a minimum of 36 points (BS5489-1:2013 7.4.8.4).
- Due to the height of these spaces to the surrounding environment, it is important for the designer to consider light pollution within the solution. The following design principles should be adopted:
 - Confirm environmental zone
 - Where planning does not advise column height, keep as low as practically possible, with a maximum height of 6m
 - Where possible, luminaires should be mounted centrally facing outwards
 - Where fittings are required to be mounted around the perimeter, fittings with a minimal backward light should be used. Baffles/shields can be considered.
 - Luminaires should have 0% upward light (ULR)
 - Maximum colour temperature of 4000K
 - See appendix 1 for further details on maintenance factors
 - If access ramps are not covered, they should be illuminated to the same level in night-time hours as the roof space.

Emergency Lighting

- As part of the emergency strategy, whether emergency lighting is required on the roof level of a multi-story car park should form part of the risk assessment undertaken by the relevant parties. To support decision, below is a brief outline of supporting standards and guidance documents:
 - Escape Lighting:
 - Part B of the building regulations Table 9 note 1 states emergency lighting is required for 'external escape routes'.
 - BS5489-1:2013, section 7.4.8.2 states: 'Note 2: Emergency Lighting on the open roof level is not needed as long as means of egress via stairways are visible'
 - Where required, method of emergency lighting likely to match that defined for the covered car park areas.
 - Exit Signage:
 - Should be sufficient to ensure exits are clearly identified, taking into account viewing distance and consideration for viewing orientation (BS5499-4:2013 Annex C).
 - This may require additional column mounted exit signs.
 - Please note where non-illuminated signs are used, viewing distance is reduced, with a need to light these under general and emergency conditions (BS5499-4:2013, 5.3)
- Unless advised, Whitecroft will provide the following emergency coverage for roof level car parks:
 - General emergency provision will not be provided
 - No emergency lighting will be included on car ramps as assumed 'off limits to pedestrians'
 - Exit signs will be included above each exit point
 - Where additional exit signs may be required to ensure clear wayfinding, these will be located at column locations.
- Where risk assessment defines emergency lighting as being required:
 - The correct solution (open area or escapes routes) will need to be identified.
 - Utilisation of the existing luminaires on a central battery system is recommended.
 - Please contact the Technical Sales Manager to discuss further requirements and correct design of the Whitecroft Powerbase solution (www.whitecroflighting.com/powerbase)

Appendix 1: Maintenance Factors

Any lighting scheme must deliver the required lighting levels throughout the life of an installation, and in the case of an LED solution this typically means to 'end of life'. Car Park lighting is no different. Prior to any lighting design, projected life of the installation in operational hours per annum and number of years is required. Once this information is known the maintenance factor(MF) can be calculated.

Indoor

There are 4 main factors that need to be considered for calculating a maintenance factor:

1. RSMF (Room Surface) – SLL Code for lighting can be used
2. LMF (Luminaire) – Where no evidence, SLL provides an LMF value for an IP5X (type E) luminaire. Based on real life testing, Whitecroft are able to demonstrate the use of a higher LMF value for multi-story car parks.
3. LLMF (Lamp Lumen) – the LLMF value for LED luminaires is reported as the 'L' value. For example L90 = 0.9LLMF. To undertake a MF calculation, the LED luminaire manufacturer should provide the 'L' value alongside the number of hours to this output. With these values, it is possible to calculate the LLMF at the point of replacement.
4. LSF (Lamp Survival Factor) – within the MF calculation, it is generally assumed a spot replacement takes place at identification of fault.

Sample MF calculations:

Example 1

Normal environment, 50/30/20 reflectance values, 3 year room and luminaire clean, 50,000 hour operational life:
RSMF & LMF – as SLL, LLMF – L90@50,000K Hours.

RSMF	LMF	LLMF	LSF	MF
0.95	0.84	0.93	1	0.72

Example 2

Normal environment, 50/30/20 reflectance's, 3 year room and luminaire clean, 50,000 hour operational life:
RSMF & LMF – as SLL, LLMF – L70@50,000K Hours.

RSMF	LMF	LLMF	LSF	MF
0.95	0.84	0.70	1	0.56

Whitecroft ACL Industry (IP66): ACH34K/ACH44K

Normal environment, 50/30/20 reflectance's, 3 year room and luminaire clean, 84,000 hour operational life:
RSMF – as SLL, LMF – WLL Recommendation,
LLMF – L90@84,000 Hours.

RSMF	LMF	LLMF	LSF	MF
0.95	0.93	0.90	1	0.80

Outdoor

An outdoor maintenance factor calculation must take into account the following 3 elements:

1. LMF (Luminaire) – BS5489-1:2013 Annex B provides details of the luminaire depreciation factors to use based on luminaire mounting height, cleaning regime and environmental zone. The values at >6m can be used for all fittings as these will be significantly higher than this above the ground floor level.
2. LLMF (Lamp Lumen) – the LLMF value for LED luminaires is reported as the 'L' value. For example L90 = 0.9LLMF. To undertake a MF calculation, the LED luminaire manufacturer should provide the 'L' value alongside the number of hours to this output. With these values, it is possible to calculate the LLMF at the point of replacement.
2. LSF (Lamp Survival Factor) – within the MF calculation, it is generally assumed a spot replacement takes place at identification of fault.

Sample MF calculations:

Example 1

Environmental Zone E3, 3 year luminaire clean, 50,000 hour operational life:
LMF – as BS5489-1:2013, LLMF – L90@50,000K Hours.

LMF	LLMF	LSF	MF
0.95	0.9	1	0.85

Example 2

Environmental Zone E3, 3 year luminaire clean, 50,000 hour operational life:
LMF – as BS5489-1:2013, LLMF – L70@50,000K Hours.

LMF	LLMF	LSF	MF
0.95	0.70	1	0.66

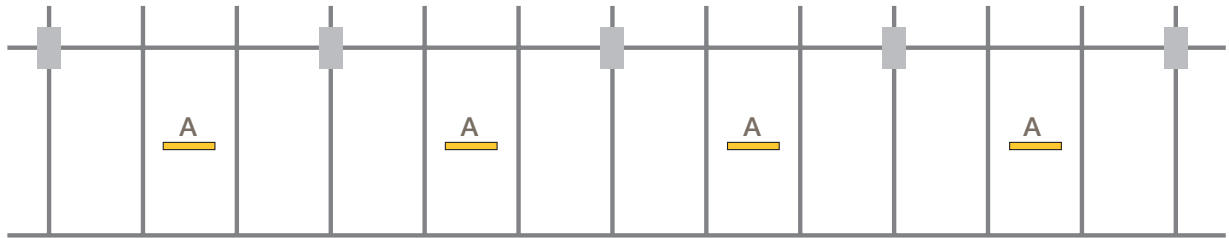
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Environmental Zone E3, 3 year luminaire clean, 50,000 hour operational life:
LMF – as BS5489-1:2013,
LLMF – L90@70,000K Hours.

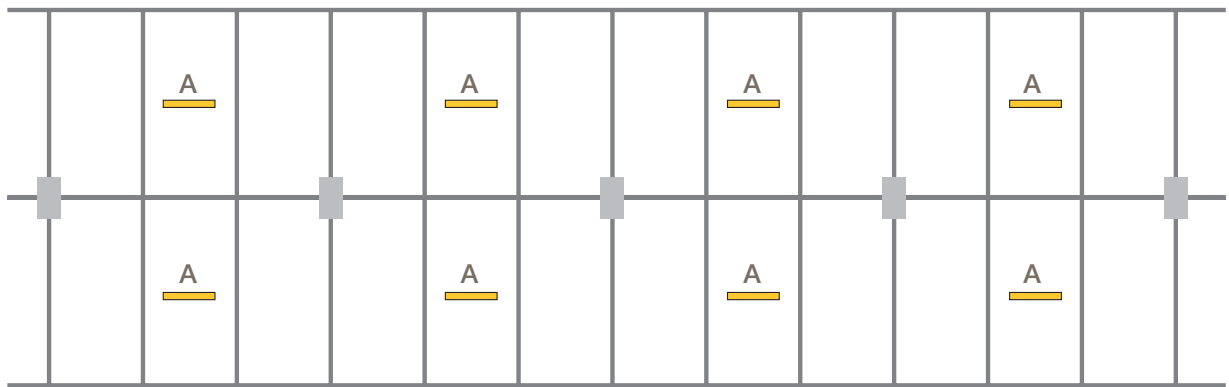
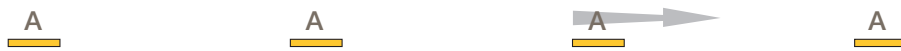
LMF	LLMF	LSF	MF
0.95	0.93	1	0.88

Appendix 2: Typical General Lighting Layout

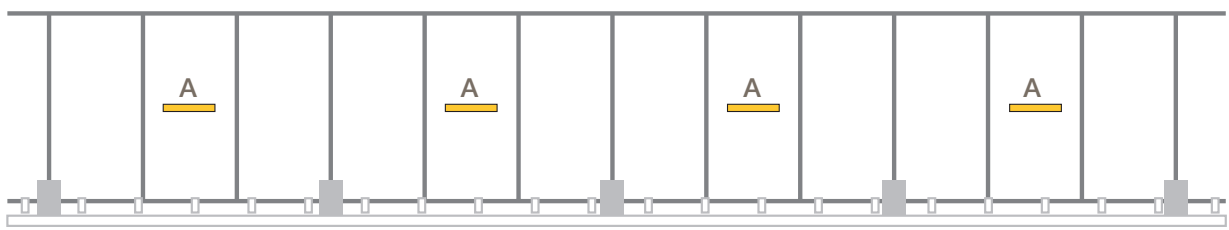
Below shows best practice lighting layout solution that can be applied to all car parks:



Fittings centred in bays and between columns. Typically 7.2m-7.5m centre to centre



Fittings mounted centrally in roadway, lengthways to minimise glare



Product Recommendation – ACL Industry. Typically ACH34K or ACH44K

The above scheme provides:

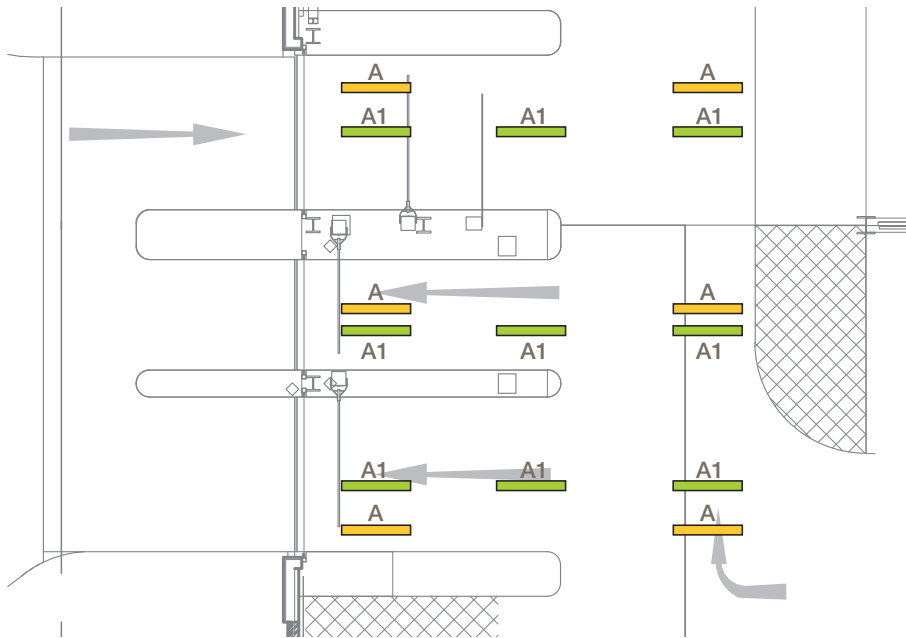
- Good Vertical illumination to support visual comfort and safety of users
- Good levels of modelling to improve facial recognition
- Good uniformity across bays and roadways
- Minimise impact of high sided vehicles parking in bays
- Reduce impact of glare through correct output and improved surface illumination
- Reduced shadowing from drop structural elements.

Alternative layouts could be considered and appropriate.

Please contact Whitecroft to discuss in more detail

Appendix 3: Entrance/Exit

Option 1



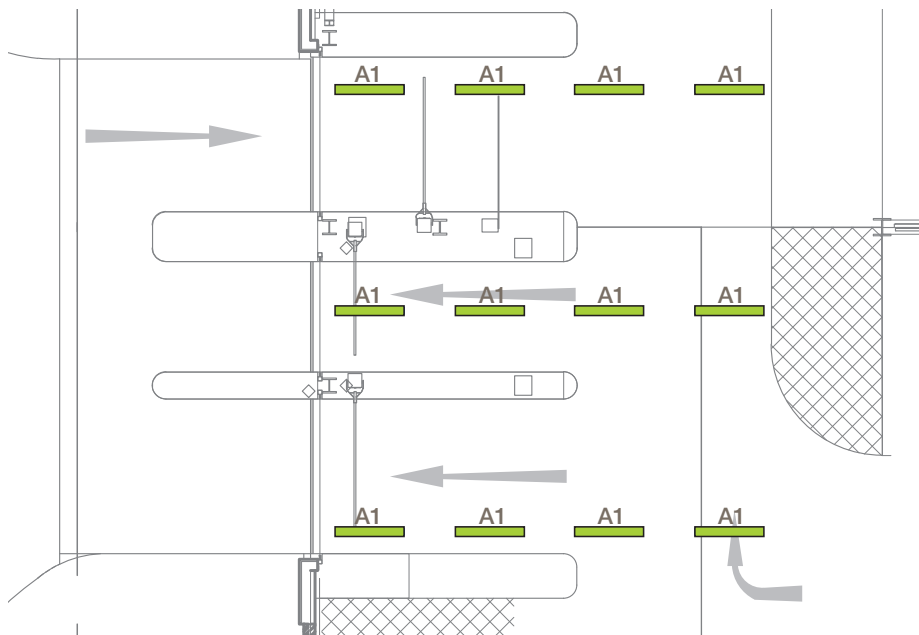
Daytime

combination of Type A and A1 fittings to deliver 300 lux

Night-time

Type A1 fittings turned off through manual or timeclock control. Type A fittings remain on to provide uniform light level across whole parking area

Option 2



Daytime

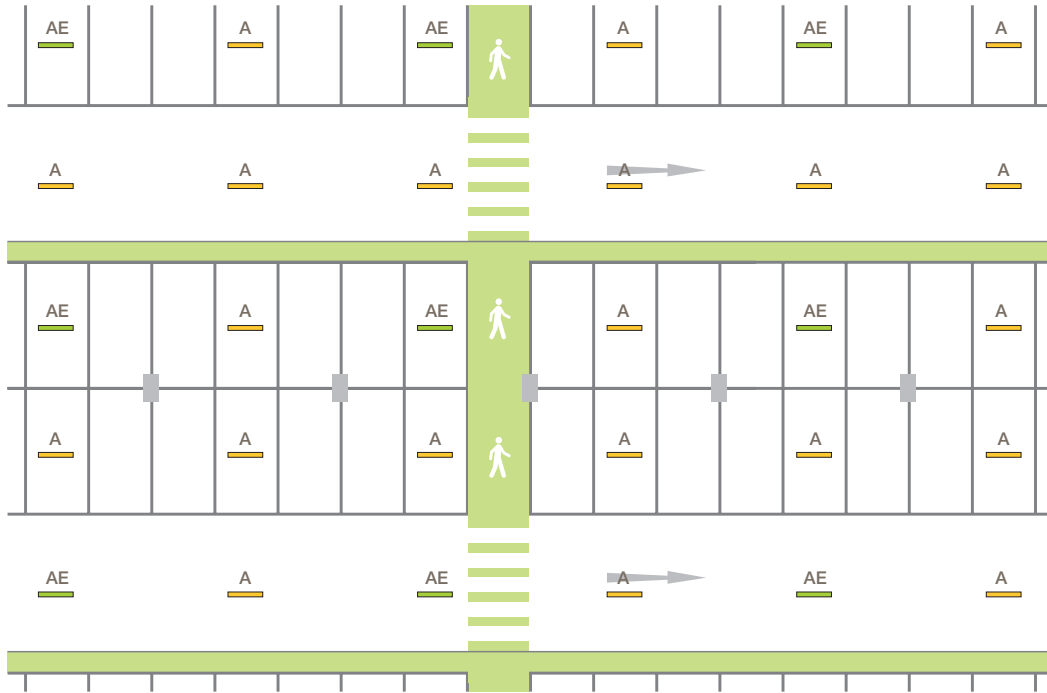
Type A1 fittings provide 300 lux daytime lighting requirements

Night-time

Control solution will have to be set-up to turn off some luminaires. Remaining luminaires will have to be dimmed to ensure higher levels are not achieved at the entrance and affect night-time levels and uniformity.

Appendix 4: Typical Emergency Scheme (Covered Car Park areas)

Option 1: Open Area to 0.5 lux minimum



*Please note indicative only. Actual design may change subject to ceiling height and bay layout.

Option 2: Escape routes only to 1 lux minimum



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