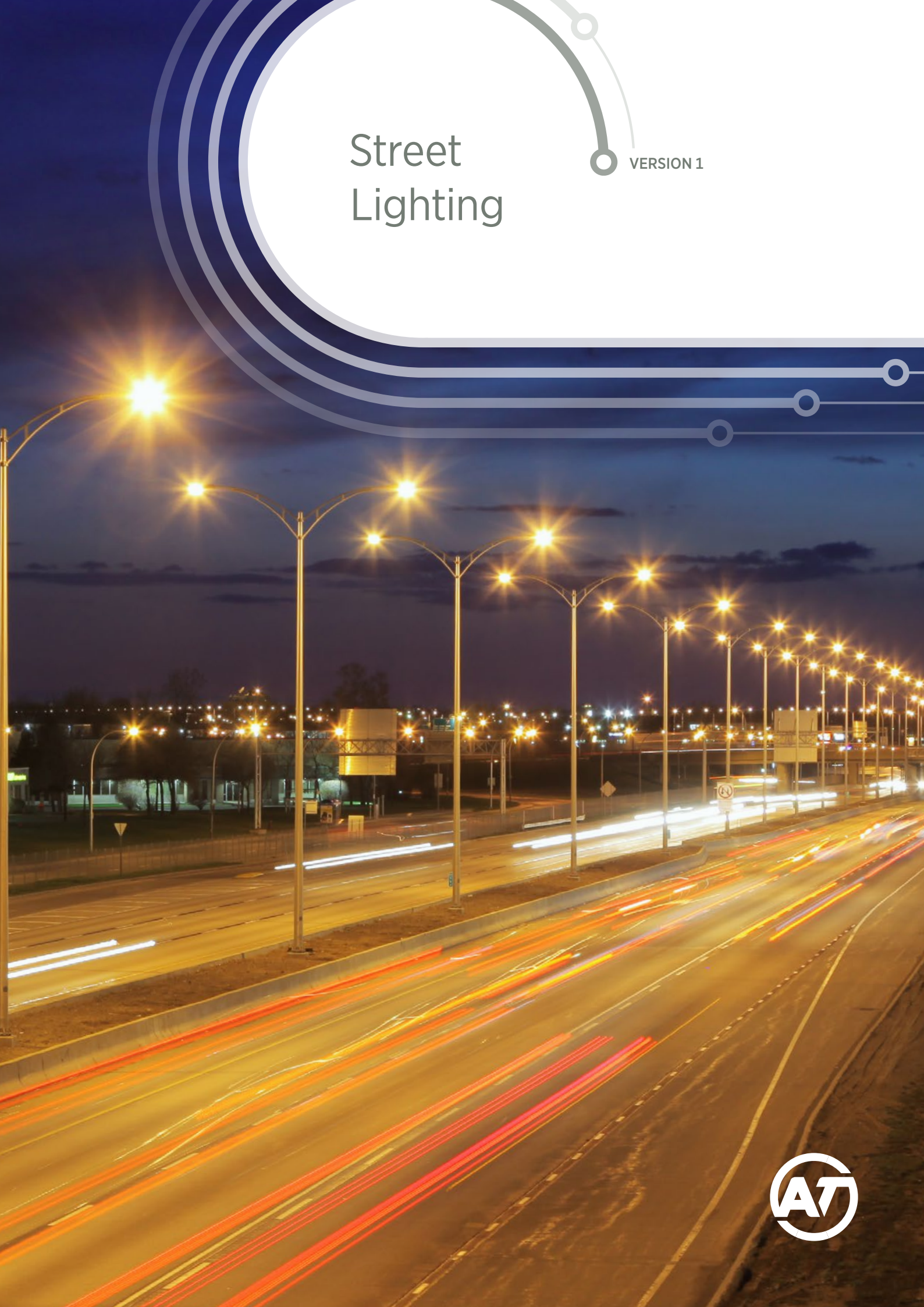
Street Lighting

VERSION 1



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01 Introduction

PURPOSE

This document provides a guide to everyone involved in the management and design of public lighting installations on Auckland Transport (AT) routes or associated infrastructure. Its application will ensure consistent standards are maintained.

DIFFERENCES FROM STANDARDS

Where clauses in this chapter differ from AS/NZS1158, this document takes precedence. See Section 12.9 for a list of differences.

UPDATING

This document will be reviewed and updated from time to time. Please make sure that the most up to date version is used

SCOPE

The scope of the document is outlined below.

TABLE 1 SCOPE

Includes	Excludes
Outdoor carparks, within AT owned and/or managed areas	Building facades
Pedestrian and cycle paths, within the road reserve or within other AT owned and/or managed areas	Building interiors
Pedestrian crossings, within AT owned and/or managed areas	Council parks and reserves
Public precincts, within AT owned and/or managed areas, e.g. plazas and squares	Indoor car parks
Roads and access ways, within AT owned and/or managed areas	Signs
Connecting elements, within AT owned and/or managed areas, e.g. Steps, stairs, ramps, subways and footbridges	Sports fields

PRINCIPLES OF STREET LIGHTING

Part of Auckland Transport's role is to ensure that the public lighting network is attractive, of good quality, easy to maintain, and cost effective. Public lighting is there to provide a safe environment for pedestrians and vehicles and to discourage illegal acts. At the same time, care must be taken to minimise spill light onto neighbouring properties and upward light (sky glow).

OTHER CONSENTS

Note that lighting other than street lighting in a designated public road, may require resource and building consents

APPROVAL PROCESSES

The following approval processes must be followed.

- **LED roadway lighting luminaire approval process**
  Refer Appendix B1 – clause B1
- **LED amenity lighting luminaire approval process**
  Refer Appendix C1 – clause C1
- **Road lighting column approval process**
  Refer Appendix D1 – clause D5

DESIGN APPROVAL

All outdoor lighting that will be vested to Auckland Transport must adhere to the following design approval process:

- Request a lighting design brief from Auckland Transport (direct to lighting@at.govt.nz). Details of the proposed development will be required sufficient for AT to determine the expected use of the roads and ancillary spaces. Where a development is staged, a Master Plan is required to clarify the long term expectation of the road layout within the development and connections beyond.
- AT recommends that the lighting designer engage with the design reviewer as early as possible in the design process.
- A Traffic Impact Assessment and a copy of the Auckland Council Resource Consent decision must be supplied to AT to ensure that the brief is correctly informed. AT recommends that this be supplied prior to the creation of the brief in order to minimise the risk of later changes to the brief.
- **Refer TDM Section 12.8 – Required Information in addition to the AT brief for design requirements**.
- Undertake the lighting design in accordance with the brief and submit to AT for approval.
- The landscape design must be supplied with the lighting design when the lighting design is submitted for approval to demonstrate that the two designs are compatible and result in an efficient lighting design.
- When planning the space, the developer should be mindful that the ideal location for a lighting column is in line with common property boundaries. When they are placed in front of residential properties complaints frequently arise. They must also be placed at least 1m from a driveway, 1m back from the kerb and clear of trees as described in the "New trees" Section of the TDM.
- The number of lighting columns should be kept to a minimum consistent with these requirements, so the developer should allow suitable space for lighting columns at separations close to the maximum spacing calculated by the lighting designer.
- The applicant is encouraged to discuss any concerns in this regard with AT or their appointed agent while developing the subdivision design. It would also be prudent for the developer to obtain the maximum luminaire spacing from their lighting designer prior to detailed design, to assist in the subdivision hard and soft landscape design.
- Construction of the lighting installation may not commence until the design is approved.
- **Current TDM version:** The design shall satisfy the version of the TDM current at the time the brief was written and approved.
- **Sunset Clause:** The approval will remain current for 12 months from the date of approval. If the lighting installation has not been commenced in that time, the design must be updated as necessary to comply with the current TDM, TDM Appendices and Standards and resubmitted for approval. AT recommend that the lighting equipment (luminaires and columns) should not be purchased until it is known that the installation can be completed within the available time.

INSTALLATION APPROVAL

All lighting installations must adhere to the following installation approval process:

- The lighting installation must be in accordance with the approved lighting design documents. The roading and landscape installation must match the design that the lighting design is based upon.
- **Lighting Designer Certification:** Once the installation has been completed, the lighting designer must provide a letter to AT certifying that the installation has been installed in accordance with the AT approved design.
- Any defects advised by AT must be remedied to the satisfaction of AT before acceptance of the assets.

02

Applicable standards

DESIGN & INSTALLATION STANDARDS

AT controlled public lighting must be designed and installed in accordance with all applicable standards with all current amendments, including;

- AS/NZS 1158 – Lighting for Roads and Public Spaces
- AS/NZS 3000 – Australia/New Zealand Wiring Rules
- AS/NZS 4282 – Control of the obtrusive effects of outdoor lighting
- AS/NZS 7000 – Overhead Line Design
- Auckland Transport – Transport Design Manual (TDM)
- ESE 406 – Overhead Standard – Structures with street lights
- ECP 34 – New Zealand Code of Practice for Electrical Safe Distances

LEGAL FRAMEWORKS & REGULATORY

All works must be carried out in accordance with all relevant statutes, bylaws and regulations, with all current amendments, including;

- Electrical Codes of Practice (ECP) and standards referenced therein
- New Zealand Radio Interference Notices 1958 and 1985 and Radio (Television) Interference Notice 1961
- Electricity Act 1992
- Electrical (Safety) Regulations 2010
- Health and Safety at Work Act 2015 (in particular – the preparation of a Safety in Design register)
- Relevant Statutory Acts, Regulations and Bylaws
- The requirements of Network Supplier's Health and Safety Standards (NHSS)
- Auckland Unitary Plan (AUP)

03 Lighting design

All new lighting designs or replacement luminaires must be LED.

3.1 Road classification

Lighting requirements are largely determined by the road classification and sub-category. These are specified by Auckland Transport, and may change over time and must be agreed with Auckland Transport before the design process begins.

The AS/NZS 1158.1.1 and AS/NZS 1158.3.1 standards should be used to determine the appropriate lighting classification and sub-category. To assist this process, there are V and P Category Calculator Tools available in Appendix J.

In the case of new subdivisions, the AT lighting design brief will nominate the road classifications.

PEDESTRIAN ACCESS WAYS

Pedestrian access ways must be lit to the appropriate P category as set out in the current version AS/NZS 1158 3.1. Table 2.2 of that document defines the criteria for determining the lighting subcategory. Then use the Auckland Transport P Category Calculator Tool (Appendix J2) to assist with the classification.

The minimum category shall be PP3.

Luminaires must be pole top mounted at a height suitable to allow access by ladder.

The use of 4m high lighting columns is recommended wherever practical within narrow walkways to limit spill light.

VERANDAS/ CANOPIES

Refer to the Auckland Unitary Plan for lighting requirements.

PRIVATE ACCESSWAYS

Refer to the Auckland Unitary Plan Section E27.6.3.7.

OTHER SPACES

Other spaces (e.g. public precincts, transport terminals) will be classified as per AS/NZS 1158.3.1.

Design The design must comply with requirements set out in the Transport

DESIGN

Manual and including, but not limited to, the current version of:

- AS/NZS 1158 – all current parts.
- AS/NZS 4282.
- ECP 34.

The V category road reflectance shall be 0.07 in accordance with AS/NZS 1158.2-2020. Calculations must be in accordance with this. AT can provide a temporary workaround method for calculation. The workaround will be in effect until such time as Perfect Lite is updated to include this parameter.

The design arrangement referenced in Perfectlite as “5S” (i.e. a Staggered arrangement in a dual carriageway road) shall not be used.

AT do not consider a painted median to constitute a dual carriageway.Any such situation shall be treated as a single carriageway.

Within a V category road, where parking areas are defined by solid barriers (i.e. landscaped islands or similar) such that those spaces cannot reasonably be used as driving lanes, the V category calculation shall be undertaken from the road side of the defined parking area. Consideration should be given to ensure that the footpath is adequately lit if the design is not undertaken from kerb to kerb. Otherwise, the design area shall be kerb to kerb.

Parking areas beside roads, whether parallel or angled, shall be considered part of the road reserve. They should not be treated as carparks as defined in AS/NZS 1158.3.1.

The minimum design standard for pedestrian pathways / cycleways shall be PP3. This typically relates to dedicated pedestrian, cycleway and shared use pathways (SUP). Such facilities immediately adjacent to a V category road or within a P category road reserve, will generally not require an additional system of lighting.

SAFETY IN DESIGN

Safety-in-Design, also called Safety-by-Design, health and safety by design (safety-by-design), describes a process that designers use to eliminate or minimise health and safety risks that people might be exposed to during the entire life-cycle of a structure including construction, use and demolition.

Professional designers have a duty of care to those people that will construct, operate and maintain the infrastructure designed and anyone who may interact with it. Designers make things safer for users by designing in safe features – or designing out unsafe elements – before they are constructed and before they are used.

The lighting designer must prepare a Safety in Design (SiD) register and supply as part of the design when presented for review.

The SiD register integrates hazard identification and risk assessment methods in the design process. It must demonstrate how to eliminate, isolate or minimise the risk of death, injury and ill health to those who will construct, operate and maintain.

The Lighting Designer is responsible for these inputs in relation to lighting. Consequently, the SiD register shall be submitted as part of any review process instructed by AT Streetlights and referenced on the design drawings.

Note: This is a legal requirement under the Health and Safety at Work Act 2015. The designer cannot devolve responsibility for this aspect of the submission to a third party.

3.2 Design criteria

EQUIPMENT SELECTION

The luminaires and columns used in the design must be selected from the Auckland Transport approved lists. In addition, the following requirements apply;

1. The luminaire options stated in the Approved List are those that were reviewed at the supplier's request and determined to satisfy the performance requirements for a series of representative test cases. Any optic available for the Approved make and model of luminaire, may be considered for site specific design, provided that all of the applicable performance requirements in the AT Specification and any specific additional requirements of the RCA are satisfied

   The luminaire wattage must not exceed the maximum values stated in the Approved List as the luminaire has not been reviewed for the increased heat that would result from a higher wattage. The design Maintenance Factor* and projected luminaire life could be affected.

   Proof of compliance for any such alternative proposed shall be provided to the RCA.

   AT recommends that other RCA's should seek independent professional advice to confirm the suitability of any alternative proposals submitted by suppliers.

   ***Note:** The AT Maintenance Factor calculation utilises a different methodology to that outlined in AS/NZS1158.

2. The luminaire must be suitable for the proposed use. If a design is offered with significantly reduced spacing compared with that achievable with another luminaire in the Approved List, AT may reject the luminaire selection and the design

3. AS/NZS1158.4 defines the lighting design requirements for unsignalised pedestrian crossings. The luminaire models on the ATLALL Approved List that may have suitable optics are stated in the introductory notes to the AT-LALL list.

4. Ensure the weight of the luminaire is considered in regard to lighting column design. Standard lighting columns installed prior to 2012 were typically designed for a maximum luminaire weight of 9kg up to 8m high, and 12kg if higher. Current approved columns for new installations are designed for a maximum luminaire weight of 9kg if 4m, 6m or 8m high, 13kg if 10m high and 15kg if 12m or 14m high.

5. Luminaires on the AT-LALL list may be used for Roadway and Amenity lighting applications. Luminaires on the AT-ALAL list may only be used for Amenity lighting applications.

OPTIMISE DESIGN SPACING

The lighting design must optimise the design spacing between luminaire positions by considering the combination of the mounting height, luminaire type, lumen output and luminaire wattage.

Note: Commence with a column height and setback appropriate for the location, then determine the lowest wattage luminaire option that will achieve the agreed design parameters, for the minimum number of lighting column locations.

POWER DENSITY

The straight road theoretical power density for the road reserve (P category) or carriageway (V category), with the proposed luminaire at the proposed mounting height, tilt and location, shall not exceed the following Power Density (PD) limits.

TABLE 2 **POWER DENSITY LIMITS**

Category	Power Density Limit (W/m^2)
PR5	0.034
PR4	0.040
PR3	0.046
V4	0.27
V3	0.30
V2	0.39
V1	0.62

Power Density shall be determined using the maximum theoretical spacing in metres (S) [calculated using SAA STAN software such as Perfect Lite™], the total input power in watts for the luminaire (P) and the road width in metres (W) [Reserve width for P Cat, Carriageway width for V Cat].

Note:

1. This requirement applies to the maximum theoretical spacing only.

2. The V Cat power density limits are based on the revised road reflectance specified in AS/NZS1158.2:2020. Perfectlite calculations must be based on the revised reflectance value.

The Power Density formula is as follows;

- For an 'opposite' arrangement;
  PD = (2*P)/(S*W)
- For all other arrangements;
  PD = P/(S*W)

POWER

Refer to the earlier Section "Equipment Selection".

In the immediate vicinity of an intersection, roundabout, LATM or the like, the luminaire wattage may be increased, from that used for other parts of the road, by a maximum of 25%, only if required in order to achieve compliance.

LIGHT SPILL

The lighting design must minimise glare and light spill on neighbouring properties and the environment. Designs must show horizontal illuminance isolines, including 2 lux and 10 lux lines with the calculation area including the complete road reserve and enough of the neighbouring properties to show the 2 lux line. Vertical illuminance calculations must also be provided as described below.

The spill light limits for residential buildings (building) are stated below. For the purpose of this document, residential buildings include residential dwellings (e.g. house/apartment), commercial accommodation (e.g. motel/hotel) and residential/therapeutic care (e.g. rest home/hospital).

In accordance with AS/NZS 4282:2019 (Control of the obtrusive effects of outdoor lighting), where the locations of building windows are known, the following limits shall apply, measured in the vertical plane at the window. Refer to AS/NZS 4282:2019 for further details.

1. Zone V: On V-Cat roads ..... 4 lux
2. On P-Cat roads
   (where lit to the relevant section of AS/NZS 1158)
   - Zone R1: if boundary >10m from window ..... 1 lux
   - Zone R2: if boundary <10m from window ..... 2 lux
   - Zone R3: as for 'b', but lighting a LATM/ roundabout ..... 4 lux
   - Zone RX: as for 'c', but lighting a pedestrian crossing ..... 4 lux

This must be calculated as a vertical plane at each residence with the measurement perpendicular to the plane and with;

- Minimum height 1.5m
- Maximum height equal to top of highest window (Alternatively, equal to luminaire height where there is no building at present)
- Horizontal and vertical spacing 2m

Note: This can be calculated as a worst case single plane along a complete street or section of street, at a common distance back from the front property boundary, equal to the minimum setback of any house in the street (rather than an individual calculation plane at each house).

Alternatively, **only** where there is no building and the expected location of a possible building is unknown, a limit of 10 lux shall apply, at the boundary, measured in the horizontal plane and at ground level.

AS/NZS 1158 Lighting for Roads and Public Spaces gives requirements on the obtrusive effects of public lighting.

In addition:

- Luminaires must be installed with zero tilt relative to the road surface.
- AT will accept tilt up to 5 degrees on V-Cat roads only, but only if absolutely necessary. Confirm with AT prior to design.
- External screens must not be used.

LUMINOUS INTENSITY (GLARE)

For new P-category designs, Auckland Transport requires the luminous intensity to be no greater than the limits in the following table. This differs from the requirements in AS/NZS1158. The values apply at any horizontal angle. Gamma 80 refers to the luminous intensity at 80 degrees vertical and Gamma 60-80 refers to the peak luminous intensity between 60 and 80 degrees vertical.

This can be relaxed to the AS/NZS1158 requirements at an intersection, roundabout, LATM or the like, but only where it has been proven necessary to increase the luminaire power to achieve the required lighting performance. Refer to Section 12.3.2, sub-section 'Power'.

TABLE 3 **LUMINOUS INTENSITY LIMITS**

Sub-category	Gamma 80 limit (cd)	Gamma 60-80 limit (cd)
PR1-2	Luminous intensity limits as per AS/NZS1158.3.1	
PP1-5		
PR3-6	400	1800
PA1-3	Luminous intensity limits as per AS/NZS1158.3.1	
PE1		
PE2-3	Per chosen sub-category (See AS/NZS1158.3.1 Tables 2.4 & 3.6)	
PC1-3	Luminous intensity limits as per AS/NZS1158.3.1	
PCD		
PCX		

X category Pedestrian Crossings – The following luminous intensity limits shall apply at vertical angles of 70 degrees and above at azimuth angles of 330 to 30 degrees (through 0 degrees) and 150 to 210 degrees (through 180 degrees) for pedestrian crossing luminaires;

- Up to 6,000 lumen output: 2,000 candelas
- Over 6,000 lumen output: 4,000 candelas

THRESHOLD INCREMENT

V category roads–The Threshold Increment (TI) along the road must be no greater than 12%, with the pedestrian traffic lights as well as the adjacent street lights included in the calculation.

3.3 Trees and road lighting column/luminaires

COORDINATE TREES AND PLANTING

There is no simple single solution for roads or streets with existing trees. However, the placement of lighting columns should always be coordinated with the trees to provide an acceptable urban landscape.

EXISTING TREES

For mature tree-lined roads with trees on one side, columns should be on the opposite side. If there are trees on both sides, lighting columns on each side may be required, located midway between trees, with long outreach arms to reach out under the canopy. Pruning trees as part of the design is not recommended as this is ongoing and cannot be guaranteed.

Lighting columns should be located outside the dripline. Place street light columns where the tree root structure cannot interfere with underground cabling or other underground services, unless tree pits are used to confine the root structure.

NEW TREES

Where new trees are proposed, lighting columns should be located first to provide the correct lighting levels in accordance with AS/NZS 1158 and this Manual. Only then should trees be located to create the daytime aesthetics.

Trees should be positioned such that the expected future dripline, when the tree is mature, will provide a minimum clearance of 2 metres from the lighting column. The expected future dripline of the trees when mature must be shown on the lighting design layout. Consider the potential impact of shadows from road lighting when the trees are mature.

Also consider the use of 6m columns in treed subdivisions. This will result in additional lights, but will better distribute light onto the road from under the tree canopy and limit spill light.

3.4 Overhead reticulation

If there is overhead reticulation, consult with the power and telecommunications utilities. Consider supplementing the light from the other side of the road. Brackets on Lines Company poles must comply with the ESE 406 joint Vector and AT standard.

Transpower assets require significant horizontal and vertical clearances, because of the long spans between supports.

3.5 Underground services

The design engineer shall obtain existing services plans from B4-U-DIG and ensure that all necessary clearances required by the utilities are maintained.

High pressure gas requires significant clearances.

3.6 Maintenance factor

The design engineer shall use the method set out in the LED Road Lighting Luminaire Maintenance Factor calculator in Appendix E1 to calculate Lumen Depreciation and to calculate the design Maintenance Factor (MF).

The designer shall also obtain the lighting manufacturer's lumen maintenance calculation, based upon their proprietary method of determining lumen depreciation over 85,000 hours (energised time), 25C ambient and LMF of 0.92 for a luminaire with a visor or 0.78 for a luminaire with exposed optics (unless a more stringent factor is applicable), allowing for all electronic and optical degradation factors. The LMF factors provided in BS5489 may be used in lieu of those recommended in AS/NZS1158.

The designer shall use the more conservative of the two maintenance factors for the design.

04 Lighting columns

4.1 Compliance

COMPLIANCE

All street light columns must comply with the Street Lighting Column

APPENDICES D & H

Specification and Assessment Methodology in Appendix D. All columns used in design must be on the Approved List (Appendix H).

NUMBERING

Each column must be individually numbered at time of installation, together with the month and year of manufacture. In addition to the unique column number, a QR code must be attached for easy on-site data access. These labels must be positioned above the gear door at a height of 2m above ground.

4.2 Lighting column location within the road reserve

MINIMUM SET BACK

Consider the standard proposed street cross sections shown in the Street Furniture Section. The preferred location for columns is in the front grass berm. Where this does not exist, locate the column immediately behind the nominal 1.8m wide concrete footpath.

Unless otherwise agreed with AT, the minimum column set back must be 1m (from kerb face to the face of the column). This shall apply equally to both V and P category roads and all parts of the kerb (e.g. including side and end clearances in parking bays).

Columns must be placed at least 1m from the side of a driveway.

Exception: Where the location is on the boundary and protected by a structure, it may be located between the two driveways with less than 1.0m clearance.

EXISTING AREAS

Where replacement columns are proposed as part of an upgrade to an existing arrangement, the locations shall be in the same place as far as practical, but with the AT minimum setback wherever possible. Where new locations are necessary, they must be located as per the 'new subdivisions' requirements. Any location changes and additions proposed must be agreed with AT.

When undertaking lighting design for Overhead to Underground (OHUG) projects, the following requirements apply;

- Locate new lighting columns in locations as close as practical to the existing power pole positions [to minimise potential concerns for neighbours]
- Where additional lighting column locations are required, proceed as for 'new subdivisions' (e.g. The first column in a side street must be located within 15m of the corner).

TOLERANCES

The following column placement and luminaire height tolerances may be applied to suit services and other obstructions discovered on site.

However, unless the installer can prove the necessity for such adjustments, the location must be as per the approved design.

Tolerances;

- Along the road: ±1.0m
- Kerb setback: ±0.5m (but no less than 0.7m [1m preferred] unless agreed with AT)
- Luminaire height: ±0.2m

Any modifications beyond these tolerances must be agreed with the lighting designer and AT.

All of the other placement requirements in the TDM must also be satisfied unless otherwise agreed with AT.

MOWING STRIP

A mowing strip complying with the requirements stated in section D4.9 of Appendix D to the TDM, shall be provided at every column that will be located in grass

GENERAL REQUIREMENTS

Columns must be placed fully within and with the luminaire perpendicular to the main street alignment. Corner locations or the like with luminaires aimed at other angles are not permitted unless otherwise agreed with AT.

NEW SUBDIVISIONS

In new subdivisions, for P-category roads, lighting columns must be located:

a. Either at the common boundary between adjacent property lots, or

b. On the build-line, i.e. the corner of a building within the property lot.

This is also preferred on V-category roads, but may vary if necessary and agreed with AT. This will generally be identified in the design brief.

The first column in a side street must be located within 10m of the corner. Measure from the property boundary facing the street that vehicle has turned from. The column should be on the driver's left side unless locating on the other side would avoid a boundary spill light exceedance.

Note: If a lighting column is positioned in front of a property that is Commercial, Open Space, or similar (i.e. not residential), then these requirements do not apply.

FOOTPATHS

Street lighting columns should be clear of footpaths. Where this is not possible, place them towards the back edge of the footpath. Maintain a clear 1.5m minimum footpath space.

BUS STOPS

When a bus turns into or out of a bus stop, the bus may overhang the kerb.

A lighting column shall be located on the approach side of the bus stop, within 10m of the start of the bus stop marking. The purpose is to improve visibility for the bus driver of people that may be near the kerb and within the bus turn-in area.

Wherever practical, lighting columns must not be placed anywhere from the beginning of the bus stop marking until at least 4m after the end of the bus stop marking ("no-go zone").

This is to minimise the risk of bus rear-end vs column conflict when turning out of the bus stop.

Where there is an extended bus stop or closely spaced series of stops that necessitate lighting within the no-go zone, then any such columns must be at least 2m from the kerb. If this cannot be achieved, the minimum setback shall be maximised and in no case less than 1m.

Lighting columns shall not be located within 2m of a bus shelter in order to limit potential public roof top access.

UNDER OVERHEAD POWER LINES

The installation of street light poles under Lines Company overhead lines should be avoided and alternative design solutions considered. They are expensive to install and there are often ongoing maintenance costs for both the Lines Company and AT maintaining clearances.

Electrical Code of Practice 34 (ECP34) sets out the clearances between overhead lines and poles both during installation and the final clearance from the structure to the overhead line. The AT Design Manual requires that the final clearance between the overhead line and the pole is a minimum of 1 metre.

Poles erected under overhead lines must be installed on a flange base. This is to allow the pole to be slid into position in a controlled way to avoid the arc while standing the pole up.

In the case of lighting for pedestrian crossings, there are a number of checks that the design engineer must make as part of the design process:

1. Is it possible to locate the pedestrian crossing adjacent to an existing power pole so the pole can support the light? Low cost option.
2. AS/NZS1158 standard allows crossings "not to be lit". For example, a pedestrian crossing installed for school use during day time hours may not need lighting. AT, as the Road Controlling Authority will need to agree that the pedestrian crossing does not need to be lit.
3. If the pedestrian crossing must be lit, then the design engineer must investigate all options to light it without installing a pole under an overhead line (for example–lighting the crossing from one side only, or installing a pole on a centre island and lighting from that position).
4. The design engineer is responsible for investigating the proposed pole position under a line and specifying the pole height and position from the kerb and crossing. The pole height is usually limited to 4 metres under an LV line.

Under ECP 34 the Lines Company (as owner of the overhead line) is the only organisation that can approve the installation of a pole under their line. Vector have a number of approved Engineers who are authorised to do this assessment. The approval to install

the pole and the installation of the pole is part of the installation process. It is not part of the design process, although it does come under the Safety in Design register.

For installations where a pole is required under an overhead line the contract should allow a PC sum of $12,000 for the approval and installation of the pole and light. The final costs should be based on actual costs.

SWALES

A lighting column may be located within a swale, provided that it;

- Is flange mounted
- Has a concrete base with a minimum height of 70mm above the bottom of the swale
- Is located in the batter as far as practical from the lowest point in the swale

JOINT USE COLUMNS

At signalised intersections, joint use columns are preferred to minimise clutter. These may be either a Joint Use Mast Arm (JUMA) [i.e. a traffic signal column where the traffic signal lights (i.e. 'aspects') are partially or totally on extended outreach mast arms], or a Joint Use Service Pole (JUSP) [i.e. a traffic signal column where there are no traffic signal outreach mast arms].

Where a JUMA or JUSP is proposed, liaise with Auckland Transport. AT should also be consulted to confirm the method of power connection.

The most common form of connection is shown in Appendix K3.

SHEAR BASE COLUMNS

Except as noted below, shear base columns shall only be used where the posted speed limit is ≥ 70 kph, unless the column is located behind a barrier, beyond the deflection zone.

AS/NZS 1158.1.2 Appendix B provides additional guidance. Shear base columns must not be used in high pedestrian activity areas. They are not permitted within 1m from either the kerb or the edge of an unkerbed road, unless located behind guard fencing.

Ensure that the column is installed in strict adherence with the supplier's recommendations to ensure safe and proper operation (e.g. base height, base orientation, slip bolt torque settings, slip washers, etc).

Do not use shear base coumns in the centre of a dual carriageway (They are designed to work for traffic in one direction only).

05 Luminaires

5.1 Requirements

STANDARDS

Luminaires must be manufactured and tested in accordance with SA/SNZ TS 1158.6 and AS/NZS 60598.2.3.

APPROVED LUMINAIRES

All roadway luminaires must comply with Auckland Transport LED Road Lighting Specification (Appendix B) and be included on the approved list (appendix F).

Auckland Transport requires all new luminaires to be LED type. The approval process for roadway LED luminaires is set out in Appendix B.

APPROVED LIST

All new lighting designs must use luminaires from the appropriate approved list.

APPENDICES F & G

The current approved lists are shown in:

- Appendix F, Road Lighting LED Approved Luminaire List (AT-LALL)
- Appendix G, Amenity Lighting LED Approved Luminaire List (AT-ALAL)

NEMA RECEPTACLE

Roadway luminaires must be fitted with either a 5 or 7 contact NEMA receptacle, compliant with ANSI C136.41:2013.

LED DRIVER

The driver shall be DALI dimmable constant current driver.

In-ground up-lights In-ground up-lights must not present a tripping or slip hazard. Internal anti-glare attachments must be positioned to limit the upward light. In addition, these lights must:

- meet AS/NZS 60598.1
- have impact resistance of IK10
- have ingress protection of IP67 or IP68 (preferred)
- have anti-slip glass where used in areas accessible by pedestrians
- have a concrete foundation (with a mowing collar in grassed locations)

BOLLARD LUMINAIRES

The use of bollard luminaires must be pre-approved by Auckland Transport. The construction and finishes of bollard luminaires must be consistent with the requirements for columns and luminaires. In addition, these lights must;

- have maximum luminous intensity in any normal viewing direction not exceeding 500cd
- have an optic to control the light distribution
- have a concrete foundation to the manufacturer's recommendations

IN-FILL LUMINAIRES

In-fill luminaires must be LED type unless specifically agreed otherwise with Auckland Transport.

LABELLING

Labelling must be in accordance with the AT LED Roadway Lighting – Luminaire Labelling System (Refer to Appendix B5 and B6).

5.2 Light source

LED ROAD & AMENITY LIGHTING

For road lighting; only LED luminaires meeting the LED Road Lighting Luminaire Specification (Appendix B) and included on the Auckland Transport approved list (Appendix F) may be used.

For amenity lighting; only LED luminaires meeting the LED Amenity Lighting Luminaire Specification (Appendix C) and included on the Auckland Transport approved list (Appendix G) may be used.

All new or replacement luminaires must be LED luminaires.

LAMP REPLACEMENTS

HID lamp replacements must utilise the minimum rated lumens defined in Appendix A, HID Road Lighting Specification.

06 Road lighting in specific areas

6.1 Rural road lighting

STANDARDS

Road lighting in rural areas is addressed in AS/NZS 1158.1.1 clause 3.5. Since the ambient light and sky glow in rural areas is significantly less than in built-up areas, take special care to limit spill light and glare.

The Waitakere Ranges Regional Park (WRRP), located within the Waitakere Ranges Heritage Area (WRHA), is a rural area. Lighting within the WRRP shall be avoided wherever practical. Where it is considered necessary for safety, any proposed lighting must be agreed with AT.

Within the WRHA but outside the WRRP should also be minimised and agreed with AT. However, there are built-up areas within this space that do require lighting for safety.

Other rural areas should be discussed with AT to clarify the need for lighting and the nature of the lighting.

In addition:

- Keep road lighting to the minimum applicable standard at intersections and road terminations.
- Minimise lighting beyond these areas. Only provide sufficient lights so that a pedestrian walking along the road always has a light in view.
- Give priority to roads that are designated for traffic detours from main highways.

6.2 Safety and security lighting

A principle of Crime Prevention Through Environmental Design (CPTED), is that lighting can reduce the risk of crime and improve safety levels on local roads and public spaces. See also AS/NZS 1158.3.1.

6.3 Pedestrian crossing lighting

STANDARDS

Where a pedestrian crossing is lit, it must be in accordance with the current version of AS/NZS 1158.4. Pedestrian crossings must be lit unless otherwise agreed with AT. Luminaires shall have a photometric distribution specifically designed to suit pedestrian crossings utilising LED luminaires.

UNSIGNALISED

The design criteria in AS/NZS 1158.4 shall apply at unsignalised crossings.

An LED Belisha Beacon shall be installed on each new pedestrian lighting column. The column shall include alternating 300mm wide back and white bands up to the height of the Beacon. The Beacon and column features shall be in accordance with AS/NZS1158.4 clause 3.3. AT do not require the beacons on either side of the road to be synchronised.

The Belisha Beacon shall include integral controls to flash the beacon on and off repeatedly in accordance with AS/NZS 1158.4.

Where pedestrian crossing luminaires are required on a channelization island in addition to those on each side of the road, then the road side columns shall have Belisha Beacons and the island columns shall have Belisha discs. Where physical site restrictions necessitate columns only on the island, then Belisha Beacons are required on the island columns.

Design clarifications;

1. As per AS/NZS1158.4 (Table 3.5), pedestrian crossing lighting shall be calculated ignoring the contribution from road lighting
2. Uniformity requirements for other areas (e.g. LATM's for P & V- cat roads or the full road reserve for P-cat roads) may be calculated without the contribution of the pedestrian crossing lights, where such contribution would otherwise indicate non- compliance

SIGNALISED

No specific requirements.

6.4 Railway level crossing lighting

At railway level crossings, illuminate the crossing to pedestrian crossing standard category X1 (horizontal illuminance requirements only) as a minimum. Striped columns and belisha beacons or disks are not required.

6.5 Local area traffic management

At local area traffic management (LATM) devices, including roundabouts, speed tables, speed humps, pedestrian refuges, etc intended to:

- Slow traffic on category P roads: Use 3.5 lux horizontal point illuminance in accordance with AS/NZS1158.3.1. This is not additional to road lighting.

- Deter traffic on category P roads: Install reflective devices as per the Manual of Traffic Signs and Markings. (MOTSAM)
- Slow traffic on V roads: For an LATM such as a speed hump or speed table, the illuminance design requirements for the specific road lighting design category in AS/NZS 1158.1.1 Table 2.2 Columns 8 and 9 shall apply. The design area shall be the full road width for the length of the LATM including ramps plus a further 5m in each direction along the road.

Refer to AS/NZS 1158.1.1 for lighting of traffic management devices on V category roads.

6.6 Adjacent access routes

Where the primary area to be lit is accessed by a road or path that also has to be lit, the access way must be lit to the same standard with lighting systems of similar appearance as those in the primary area.

6.7 V to P Intersection with signalised crossing

Where a V category road and P category road intersect, if a signalised crossing is present, the intersection shall be treated as V to V category intersection for the purpose of calculation.

6.8 Roundabouts

Lighting columns must not be located in roundabout islands.

07

ELECTRICAL DESIGN

Electrical

The electrical design shall be undertaken by a suitably qualified and experienced person.

AT will be the asset owner of the consumer main downstream of the Lines Company point of connection for all new connections.

The Electrical Design Engineer shall work closely with the Lines Company.

Unless otherwise agreed with AT, run circuits in HD UPVC or HDPE conduit underground with minimum 600mm cover.

All amenity lighting must be supplied from a distribution cabinet and be metered.

Control:

- Each luminare will be individually controlled by a Light Point Controller (LPC) mounted on a NEMA socket, integral to the luminaire. If the luminaire is unable to accept a NEMA socket, the socket shall be mounted in a separate column-mounted proprietary bracket.
- Amenity lighting control shall be located within the source distribution cabinet and agreed with AT. Typically such control would either be an Astronomic Clock (preferred) or a combination of Time Switch plus Daylight Switch.

Road lighting (unmetered) in existing areas:

- An existing underground switched lighting circuit can be re-used, but arrange with the Lines Company to change the circuit from switched to un-switched (i.e. 24/7). [Note: Confirm the status of the circuit with the PLC as the AT maintenance contractors change the circuits to 24/7 as part of the LED retrofit program].
- New circuits shall be 1core 10mm2 (minimum) Cu NS PVC/XLPE cable
- AT prefer lights to be connected to the nearest Lines Company Point of Connection (i.e. pillar/TUD).
- Typically one luminaire per connection/circuit and up to two connections/circuits per Point of Connection (e.g. where it is more cost effective to run one circuit up the street and one down the street to minimise/eliminate driveway/pathway/etc crossings).
- Where there is a second or third luminaire close to another (e.g. pedestrian crossing lights near a street light), then up to 3 luminaires can be looped off one connection.

Road lighting (unmetered) in greenfield areas:

- Circuits shall be 10mm2 (minimum) Cu NS PVC/XLPE cable.
- Ideally, there shall be one light on each Point of Connection from the Lines Company.
- In some sections of road, it may be more cost effective to connect more than one light to a single Point of Connection. The number of lights connected to a single circuit shall be limited to ensure that the load is no more than 50% of the circuit protection rating and with no greater than 2.5% voltage drop from the point of connection to the network, at the furthest luminaire. Cables shall be looped in and out of each light column. Breach joints are not allowed on a new design where single core cable is used.

Dedicated pathway lighting (metered):

- Pathway lighting could comprise column mounted and/or bollard lighting (where approved by AT).
- On long pathways the Lines Company will often not have an LV network nearby. Therefore it is necessary to take supply from the Lines Company at two or more points along the pathway (Typically one at each end and if possible [depending on the length of the path] one in the centre).
- Design a cable configuration along the pathway to fit the number and location of supply points.
- At each supply point establish a switchboard cabinet with a meter.

This is the MEN point.

- The number of lights connected to a single circuit shall be limited to ensure that the load is no more than 50% of the circuit protection rating and with no greater than 2.5% voltage drop from the point of connection to the network, at the furthest luminaire.
- Preferably, run a three phase 4core 10mm2 (minimum) Cu NS PVC/XLPE, with luminaires connected in alternating sequence to phase A, B or C.
- The design should have an objective of providing a cost effective outcome with the least number of supply points along the route.

Amenity lighting (metered):

- Amenity lighting comprises lighting other than functional (i.e. roadway, path, etc), such as decorative strip lights, marker lights, handrail lights, uplights, under water lights, artwork lights, etc.
- Always meter amenity power.
- In the case of 230V luminaires, use round 2core+ECC 2.5mm2 (minimum) Cu PVC/PVC cable in conduit in accordance with AS/NZS 3000. IP68 joint and tail down as required at each light (to suit the available cable entry and termination space for the luminaire).
- In the case of extra low voltage [ELV] luminaires, run 2core 1.5mm2 (minimum) Cu PVC/PVC cable in conduit.

EQUIPMENT & COMPONENTS

Electrical equipment and components must be manufactured to comply with the applicable New Zealand or international standards and must be readily available as spare parts. These components must be incorporated into the luminaire or column, be protected against the ingress of dust and moisture to the appropriate ingress protection (IP) level and be easily accessible for repair or replacement.

Warranties on these components must be the manufacturers' standard warranty and be applicable from the date of handover of the installation to Auckland Transport for at least another 10 years.

ENERGY EFFICIENCY

The installation must be designed for economic use of energy.

ADAPTIVE LIGHTING

Auckland Transport will be installing adaptive lighting in selected areas. This reduces spill light and sky glow, as well as energy consumption at times of reduced traffic volumes. The Central Management System (CMS) can be further extended through traffic sensors to be fully interactive, adjusting the light levels. In addition, allowance can be made for weather conditions. Each luminaire must be supplied with either a 5 or 7-contact NEMA receptacle, compliant with ANSI C136.41.

INSTALLATION

Each street light position is an "installation" as defined in AS/NZS 3000. All work must be carried out in accordance with this standard, as well as Electricity (Safety) Regulations 2010 and the applicable electrical codes of practice. Refer Appendix K1 – Street Lighting Electrical Connections.

CONNECTION

Each street light must be connected directly to the Lines Company network, providing continuous supply. In some sections of road, it may be cost effective to connect more than one light to a single connection from the low-voltage network.

The number of lights connected to a single circuit should be limited to four in any one direction from the supply point. Where more than one light is fed from a single Lines Company connection, a 10mm2 N/S single core cable must be looped in and out of each column. Breach joints are not allowed as part of a new design.

The boundary between the network company and the street light network is the load side of the fuse connected to the common LV network.

NO NETWORK

Where there is no established Lines Company network and many lights have to be supplied from a single network connection, install two separate cables, with each cable looping into every second street light column. This means that, if a circuit fault occurs, only every second light will be out. This system is most used along long cycle routes. Please agree details of the cabling configuration with Auckland Transport before design begins.

ISOLATION

At the base of each column, between 600 and 900mm above ground level, a fuse board must be installed inside the column to meet the requirements of AS/NZS 3000, with a neutral and earth bar to comply with the requirements of an installation. A 6 amp type C HRC fuse link must connect the light to the incoming supply. Miniature circuit breakers (MCBs) are not permitted. Refer Appendix K1 – Street Lighting Electrical Connections.

SLIM COLUMNS

Slim columns approved for use on the network may use Transnet Amerace 65U in line fuse connectors (IP68) or equivalent. The neutral and earth bar arrangement must still comply with AS/NZS3000.

SHEAR BASE COLUMNS

All shear base type columns must incorporate IP68 plug and socket connections to ensure that the column disconnects from the live supply in the event of vehicle impact or similar occurrence (Transnet Amerace 65U or equivalent).

LUMINAIRES ON LINES COMPANY POLES

In areas where a Lines Company's network is overhead and Auckland Transport has installed luminaires on Lines Company poles, each luminaire must be connected directly to the Lines Company supply using an HRC fuse in the live conductor. The fuse carrier must be a 20 amp Michaud K223. The HRC fuse link must be 6 amps with fusing characteristic type C. Each luminaire along the street must be connected to alternate phases to keep the load on the low-voltage network balanced.

Luminaires attached to Vector poles must comply with the Vector standard ESE406.

The boundary between the street light network and the network company is the load side of the fuse.

LUMINAIRE CONTROL

Auckland Transport is in the process of changing the control of all road lights to a Central Management System (CMS). During the changeover, a mix of several controls will co-exist. Auckland Transport will advise the control type to be used in any particular area at time of briefing.

INTERNAL WIRING

The cable from the fuse board at the base of the column to the luminaire must be 2 core 2.5mm2 neutral screen. The screen must be earthed.

Where the luminaire is supplied with a Wieland flex and plug, the internal column wiring shall instead be 3 core x 1.5 mm2 copper Wieland H05VV- F heavy duty cable – round black sheath, complete with a Wieland socket to match the luminaire plug.

EARTHING

Each column must be earthed by means of 10mm2 copper insulated wire, exothermically welded, or connected by shear-lock clamp, to a driven earth electrode (16mm diameter copper-bonded steel earth rod), located 300mm from the column base. The connection must be buried 300mm below the pavement surface. AS/NZS 3000 applies. Refer Appendix K2 – Street Lighting Earthing Details.

Where it is not possible to install a driven earth electrode due to rock for example, the following horizontal earth electrode is acceptable;

A 7.5m length of 35 mm2 (19/16) bare (uninsulated) copper conductor buried to a depth of 600mm below the surface. The conductor must be embedded in Bentonite slurry or Ground Enhancement Material (GEM). The buried conductor should be placed with 3m either side of the lighting column. The horizontal earth electrode to column connection shall be the same as described above for the driven earth electrode.

CONNECTION AT TRAFFIC CONTROL CABINETS

For connection at traffic control cabinets, refer Appendix K3 – Traffic Signal/Street Light Combination Electrical Schematic.

THIRD PARTY CONNECTIONS

Third party connections to street light circuits is at the sole discretion of Auckland Transport. The street light pole is not suitable for many connections to other devices. Please contact the team leader street lights for further details.

Open private networks

Private networks, that allow embedded customers (embedded network) to purchase energy on the open market, must comply with the following:

- The AT owned street lights will be Time of Use (TOU) metered on dedicated circuits. The cabling and connections to be in accordance with Section 12.7.1 of this document.
- The cables, columns and luminaires must be installed by an approved AT contractor to work on the street light network. Cabling must be in accordance with AT requirements. Refer Appendix L – Electrical Cable Specification.
- AT will own and maintain the cables from the fuse connecting the cables to the private network.
- The network owner will use the same rates (for network charges) as published by the neighbouring Lines Company. These charges will be invoiced to the nominated Electricity Retailer supplying AT.
- Columns and luminaires must be on the appropriate AT Approved List.

CLOSED PRIVATE NETWORKS

Private networks, who's customers are captured behind the bulk meter (customer network), must comply with the following:

- The AT owned street lights will be directly connected to the Lines Company network in accordance with the AT Design Manual section 12.7.1
- Details of the connection to the Lines Company network must be agreed with Auckland Transport and the Lines Company prior to installation.
- Cabling must be in accordance with AT requirements. Refer Appendix L –Electrical Cable Specification.
- The cables, columns and luminaires must be installed by an AT contractor approved to work on the street light network.
- Columns and luminaires must be on the appropriate AT Approved List.

UNDERGROUND CABLE SPECIFICATION

Cabling must be in accordance with AT requirements. Refer Appendix L –Electrical Cable Specification.

These specifications must be used when installing cables that will be owned by AT in public roads.

They must also be used when installing cables that will be owned by a party other than AT (e.g. within private subdivisions).

OVERHEAD CABLE CONNECTION

If neutral screen cable is used between the luminaire and the overhead line point of connection, where the cable sheath is stripped back to expose the 2 insulated conductors, a custom heat shrink sleeve designed to individually seal around each of the two conductors shall be used to ensure a water tight seal, such that water cannot track within the outer sheath into the luminaire.

SAFE WORKING DISTANCES

Safe distance from electric lines and cables must be maintained at all times. ECP 34 and the Safety Manual parts 2 and 3 – Electrical Industry (SM-EI) set out the minimum approach distances for approved qualified staff with current Work Type Competencies (WTC).

PERSONAL PROTECTIVE EQUIPMENT

All personnel working on the Auckland Transport lighting network must wear the appropriate PPE on all sites at all times.

WORK ON OR NEAR LINES COMPANY NETWORK

All work on or near a lines company network must be carried out in accordance with health and safety requirements set out in ECP 34 and the Safety Manual – Electrical Industry (SM-EI). All workers must have the appropriate Work Type Competency (WTC). All aspects of the contract Health and Safety Management Plan must be adhered to at all times.

08 Approvals

APPROVAL NEEDED

All proposed changes or additions to the public lighting network must be approved before construction. All designs will undergo a peer review by an AT approved reviewer.

Refer also Section 12.1 – "Approval processes". The following elements require approval;

- Roadway lighting luminaires
- Amenity lighting luminaires
- Roadway lighting columns
- Lighting design
- Lighting installation As stated in section 12.1;
- **Designer Certification:** Once the installation has been completed, the lighting designer must visit the site, audit the installation and provide a letter to AT certifying that the installation has been installed in accordance with the AT approved design. Use the template supplied in Appendix E2.

REQUIRED INFORMATION

The following information is required for the review (in PDF format unless otherwise stated):

- A covering letter briefly describing the physical extent of the design area, listing all of the documents included in the submission. If there are any unusual features that need to be clarified they should be included in the letter.
- A copy of the AT design brief for the site.
- A Safety in Design register, specific to the proposed design, in accordance with the NZ Health and Safety at Work Act 2015
- A complete copy of the Auckland Council Resource Consent decision.
- Make, model, optic, total luminaire output lumens and total luminaire input wattage for each type of luminaire – Must be on AT-LALL (road) or AT-ALAL (amenity) as applicable.
- Make, model, height and outreach for each type of column – must be on AT-LCAL.
- Maintenance factor calculations (Refer Appendix E1).
- **Initial Lumen Output Calculations (in both PDF & AGI/ DWG format)**
  - Provide a separate spill light calculation plan(s) at a recognised scale (no less than 1:500), with all luminaires set to a Maintenance Factor of 1.0. Include 2 lux and 10 lux horizontal illuminance isolux lines for the complete road reserve plus a further nominal 10m into the adjacent properties for both P & V category designs.
  - Include vertical illuminance calculations at residential windows – refer Section 12.3.1 – 'Light Spill'.
- **Maintained Lumen Output Calculations (in both PDF & AGI/ DWG format)**
  - Lighting design plan(s) at a recognised scale and no less than 1:500 at A3).
  - The lighting design layout shall include all relevant information – property boundaries, driveway crossovers, kerb line, footpath, landscaping, overhead power lines, road names, linear scale, lighting column locations, luminaire labels, detailed luminaire and column legend and any other elements relevant to lighting design constraints.
  - All critical dimensions shall be shown – distance between adjacent luminaires to nearest 0.1m and locating dimensions for each luminaire group (e.g. from the beginning crossroad kerb/boundary).
  - Show the closest existing luminaires beyond the design area (unless >100m away) with estimated height and luminaire details.
  - Show any lighting equipment proposed to be removed.
  - Documentation in accordance with the relevant part(s) of AS/NZS1158 to show compliance.
  - Lighting sub-categories used in the design, e.g. V2, PR3, etc. These must be recorded on each lighting plan.
  - For category V roads: Luminance calculations from Perfectlite together with Isolux plots from AGI32, illustrating relevant contours for the lighting sub-category with illuminance and point illuminance values necessary to demonstrate compliance.
  - For Category P roads: Illuminance diagrams from AGI32 illustrating relevant contours for the lighting sub-category with illuminance and point illuminance values necessary to demonstrate compliance.
  - Information as required by AS/NZS 1158 per tables 5 and 6 below.
  - Include an isolux line for each of the minimum required horizontal illuminance values for each of the categories present in the design as per AS/NZS 1158 (Refer to Table 4).

Note: Compliance is required throughout the design area

TABLE 4 MINIMUM MAINTAINED ILLUMINANCE ISOLINE

ROADS		PUBLIC AREAS	
PR1	2 lux	PA1	7 lux
PR2	0.7 lux	PA2	4 lux
PR3	0.3 lux	PA3	2 lux
PR4	0.22 lux		
PR5	0.14 lux	**CONNECTING ELEMENTS**	
PR6	0.07 lux	PE1	17.5 lux
P Cat LATM	3.5 lux	PE2	(refer standard)
V1 specified locations	15 lux	PE3	(refer standard)
V2 specified locations	10 lux		
V3 specified locations	7.5 lux	**CAR PARKS**	
V4 specified locations	5 lux	PC1	3 lux
		PC2	1.5 lux
PATHWAYS		PC3	0.7 lux
PP1	2 lux	PCD	(refer standard)
PP2	1 lux	PCX	5 lux
PP3	0.5 lux		
PP4	0.25 lux		
PP5	0.14 lux		

TABLE 5 INFORMATION REQUIREMENTS FOR CATEGORY V ROADS

Parameter	Symbol	Notes
Average carriageway luminance	L	Straight sections
Overall uniformity	U_o	Straight sections
Longitudinal uniformity	U_L	Straight sections
Threshold increment %	TI	Straight sections
Surround (verge) illumination ratio	E_s	Straight sections
Perfectlite maximum spacing		Straight sections
Maximum spacing at bends		Bends – Summarise reduced spacing values, showing the bend radius (m), reduction factor and reduced spacing (m).
Point illuminance	E_{ph}	Intersections, pedestrian crossings, pedestrian refuges and defined pedestrian crossing routes at signalised crossing
Illuminance (horizontal) uniformity	U_{E1}	Intersections and pedestrian refuges only
Vertical illuminance	E_{PV}	Pedestrian crossing

TABLE 6 INFORMATION REQUIREMENTS FOR CATEGORY P ROADS

Parameter	Symbol	Notes
Average horizontal illuminance	Eh	
Point horizontal illuminance	Eph	
Illuminance (horizontal) uniformity	UE2	
Point vertical illuminance	Epv	
Luminous intensity at Gamma 80	IG80	For maximum luminaire watts in the design
Peak luminous intensity	IPEAK	For maximum luminaire watts in the design
Perfectlite maximum spacing		Straight sections

09

TRANSPORT DESIGN MANUAL TAKES PRECEDENCE

Differences between the Transport Design Manual and AS/NZS 1158

Where there are differences between the Transport Design Manual and AS/NZS 1158, this manual takes precedence. The following are instances where Auckland Transport's requirements vary from the standards:

1. The maximum tilt for a luminaire must be zero degrees for P Category and 5° for V Category (zero preferred) from the horizontal unless otherwise approved by Auckland Transport. See Section 12.3.2.
2. The Threshold Increment (TI) along the road must not be greater than 12%. See Section 12.3.2.
3. Category P roads: Illuminance diagrams from AGI32 illustrating relevant contours for the lighting sub-category with illuminance and point illuminance values are necessary to demonstrate compliance. See Section 12.8.
4. Category P roads: Record maximum luminous intensity at Gamma 80 on the drawings. It should not exceed 400cd. See Section 12.3.2. Similarly, the peak luminous intensity should not exceed 1800cd.
5. Specific power density limits apply.
6. Different pedestrian crossing luminaire luminous intensity limits.
7. Different maintenance factor calculation method.
8. No columns in roundabout islands.

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