NZ TRANSPORT AGENCY
WAKA KOTAHI

SPECIFICATION FOR LIGHTING COLUMNS

1 SCOPE AND GENERAL

This Specification sets out the technical performance, design, approval, fabrication, testing and installation requirements of lighting columns of the direct ground planted and flange mounted types for use by the NZ Transport Agency (NZTA).

Any aspects relating to aesthetics are in addition to the technical requirements detailed in this specification and are to be agreed separately with the asset owner.

The scope is not limited by the material type or the appearance or shape of the column or outreach bracket. While the majority of lighting columns are of a stepped tubular, round, octagonal or polygonal cross-section, they may be of other forms such as lattice or telescopic.

Minimum levels of performance are specified with respect to:

- Durability
- Strength
- Safety

This Specification **does not** cover the following columns:

- **Columns with provision for the attachment of flags and/or banners unless specifically allowed for by the respective manufacturer**
- High mast lighting (generally over 16m)
- CCTV camera columns
- Lighting columns fed by overhead supply
- Joint use columns for lighting and electricity distribution, telecommunications, traffic signals or tramway services

1.1 Application

This Specification applies to the procurement of all lighting columns used for the lighting of roads and bridges on the State highway network.

1.2 Referenced documents

The documents referred to in this Specification are listed in Annex A of this document.

1.3 Definitions

For the purpose of this Specification, the definitions below apply.

1.3.1 Clear Zone

The clear zone is the desirable unobstructed road side area available for the recovery of errant vehicles that have left the travelled way.

1.3.2 Constant Amplitude Fatigue Limit (CAFL)

A nominal stress range below which a particular fatigue detail can withstand an infinite number of stress cycles without fatigue damage.

1.3.3 Design Load

A load which occurs under abnormal or extreme environmental conditions. This is usually defined as a wind load with a minimum return period of 250 or 500 years.

1.3.4 Durability

The time elapsed before the first major maintenance (recoating or patch repairs) of the column or the column coating system becomes necessary, to arrest corrosion.

1.3.5 Lighting Column

A free standing vertical structure of appropriate material, which is designed to support luminaires either directly or by the use of outreach arms or mounting frames and includes such elements as foundations, column, outreach arms, connections and accessories.

1.3.6 Mounting Height

The mounting height dimension shall be the distance between the centreline of luminaire mounting spigot, and the intended finished ground level for a ground planted column, or the bottom of the base plate for a column with base plate.

1.3.7 Outreach Arm Length

The outreach arm length shall be the horizontal distance from the point of entry to the luminaire, to a vertical line passing through the centre of the column cross section at the finished ground level.

1.3.8 Passively Safe or Frangible Column

A column which is designed to perform such that after a vehicular impact, the occupants are unlikely to suffer injuries. This involves either a breakaway support (e.g. slip base or couplings) or a yielding or progressive material collapse type that does not separate from the base.

1.3.9 Rigid Column

A column designed to withstand vehicular impacts without undue deformation while remaining upright.

1.3.10 Specified Intended Life

The specified intended life is the period of time the lighting column shall meet the performance requirements specified, and includes the effects of normal environmental degradation expected at the site, but excludes accidental or wilful damage and the effects of extreme weather events.

2 GENERAL REQUIREMENTS

2.1 Information to be provided to supplier

The following information shall be provided to the supplier:

(a) Specified intended life of column.
(b) Environmental exposure classifications (durability).
(c) Road safety impact classification.
(d) Column height, outreach distance and other geometrical criteria.
(e) Luminaire connection requirements (spigot diameter and tilt angle).
(f) Access requirements (base compartment and cable access; size, position and orientation).
(g) Foundation materials (if known).
(h) Any specific accessories required (attachments, holes etc).

2.2 Information to be provided by supplier

The following information shall be supplied with the quotation, if requested:

(a) Fully detailed drawings showing a general arrangement, mounting height, outreach arm length, and base plate details, together with material specifications (including protective coating(s) where relevant), welding, fixing details, and construction tolerances.
(b) Method of assembly of the sections and base including lifting and installation procedures.
(c) Installation procedure including torque setting for holding down bolts and the maximum and minimum torque tolerance applicable.
(d) Maintenance requirements for breakaway devices.
(e) Confirmation of specified intended life and details of any recommended maintenance to achieve this.
(f) A suitable compliance certificate, e.g. Producer Statement Design (PS1).

This information may be lighting column type or wind zone specific and cover the general supply of the lighting columns. This generic information must be submitted initially by the supplier to the NZTA.

2.3 Dimensions and tolerances

The preferred dimensions and tolerances are:

2.3.1 Nominal Mounting Height

For lighting columns with outreach arms, the nominal mounting heights should be one of the following:

5.5m, 7.0m, 8.0m, 10.0m, 11.0m, 12.0m, 13.5m, for columns with curved or mitred outreach arms,
and
7.5m, 9.0m, 10.5m, 11.5m, 13.0m, 14.0m, for columns with elliptical outreach arms.

2.3.2 Nominal Outreach Arms

For lighting columns with outreach arms, the arm projection should be one of the following:

(a) 1.0m, 2.0m, 3.0m or 4.0m for curved or mitred outreach arms; or

(b) 2.5m or 4.0m for elliptical outreach arms.

2.3.3 Tolerances

Unless otherwise specified, the individual column elements shall be manufactured and erected within the following dimensional tolerances:

(a)	Straightness	≤ 3 mm per metre
(b)	Nominated diameter	± 2.0 mm
(c)	Out of round	≤ 0.06 x nominated diameter

2.3.4 Overlap Length

Where joints in segmental construction rely on overlapping of the upper segment over the lower segment, they shall be detailed and fabricated to give a lap length of approximately 1.5, but not less than 1.4, times the joint internal diameter when assembled tight.

2.3.5 Column Shape

The cross-sectional dimensions of the column shall not increase with increase in column height, i.e. all lighting columns shall be parallel-sided (no change in cross-section with height) or tapered (reducing cross-section with increasing height).

2.4 Identification Marking

All lighting columns and outreach arms shall be clearly and durably marked with the following information:

- Name, identifying mark or symbol of the manufacturer
- Year of manufacture (or at least the last two digits of the year in which the marking was affixed)
- Manufacturers model number or identification reference
- Impact classification and performance class (F if passively safe/frangible, blank otherwise).

The form of marking may be either with a plate setting out in full the information above; a plate with a decipherable single key provided by the manufacturer; a securely fixed label; or a bar code formed either in the material or by painting or by hard stamping. The identification plate, label or marking shall be of the same durability as the intended life of the lighting column. The identification marking and accompanying information shall be placed on the product itself (not on base compartment door) and be recorded in the accompanying documentation.

Where segmented columns are used, each segment shall be appropriately marked to enable replacement parts to be identified and ordered if damaged.

2.5 Mounting Types

Specific column designs are required for the following types (as illustrated in Figure 2-1 below):

(a) Ground planted (direct buried):
Ground planted lighting columns shall be designed for planting in the ground a sufficient depth to resist the design loading, taking into consideration local soil conditions.

The buried section shall have a minimum wall thickness of 2mm for hot-dip galvanized steel and 4 mm for aluminium.

(b) Flange or base plate mounted (including slip/shear base):
These columns will be attached to either a concrete foundation or ground planted stub using a bolted connection.

Flange mounted lighting columns shall be supplied with a base plate not less than 16mm thick (20mm minimum thickness for aluminium columns) and of adequate strength to take the design loading. For flange mounted columns, the base plate shall be provided with a minimum of four holes at equally spaced centres for attachment of holding down bolts.

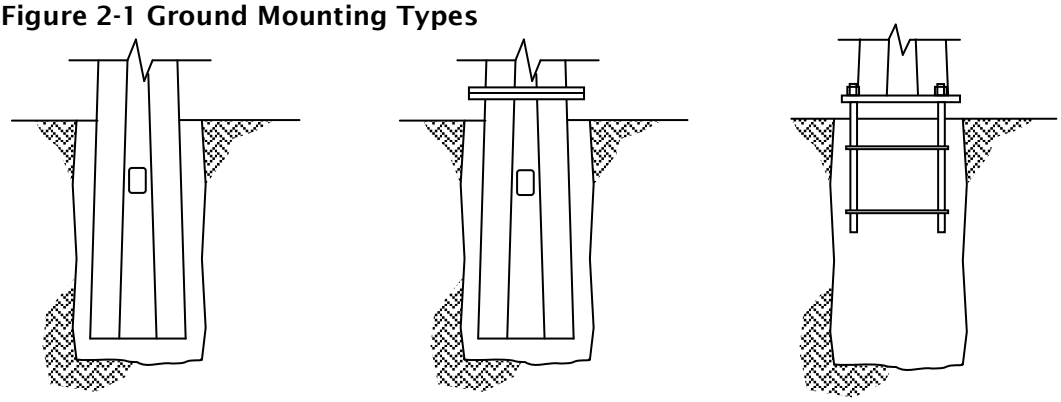
A hole with minimum diameter of 100mm shall be provided through the centre of the base plate for cable access.

Where a ground planted stub is to be used as part of a passively safe column's slip/shear base, the wall thickness of the stub shall be a minimum of 6mm to prevent or minimize damage from impact and reduce the need for replacement.

Concrete foundations shall be designed to resist the design loads including the effect of impact.

Preferred dimensions for base plates for different mounting heights are given in Table 2-1 below (see also Figure 2-2).

Figure 2-1 Ground Mounting Types



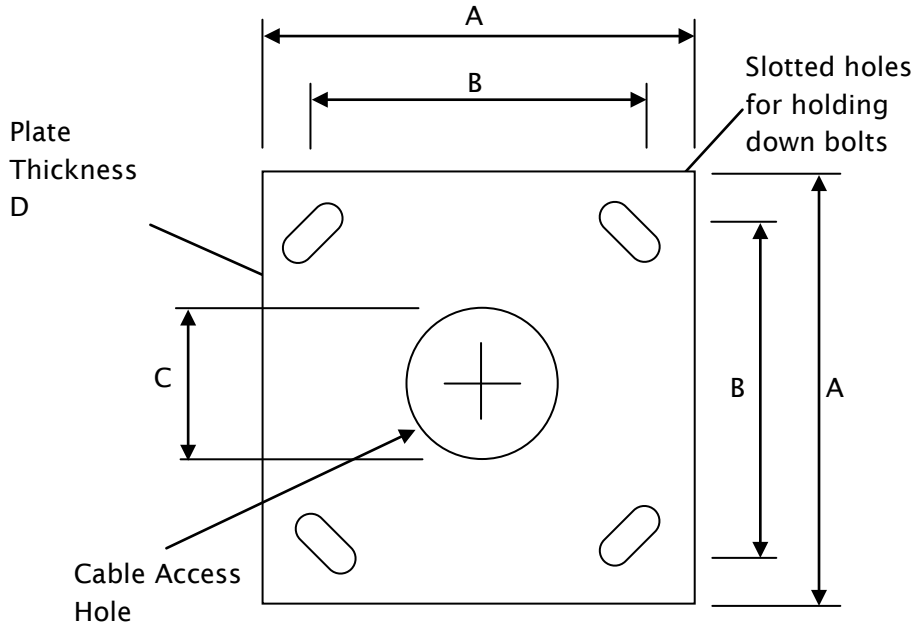
Ground Planted (Direct Buried) | **Flange Mounted (Ground Stub)** | **Flange Mounted (Concrete Foundation)**

Table 2-1 Preferred Base Plate Dimensions

Dimensions (Note 1)					
Mounting Height (m)	Base Plate Size (mm) A	Hole Centres (mm) B	Internal Diameter (mm) C (Note 2)	Holding Down Bolt	
				Required Number	Metric Size Designation (Note 2)
up to 7.4	300 x 300	220	120	4	M16
7.4 to 11.6	375 x 375	260	190	4	M20
greater than 11.6 (Note 3)	450 x 450	320	190	4	M24

Note 1: Dimensions are indicated in Figure 2-2.
Note 2: Minimum values listed only; values adopted in any application shall be justified by design or testing.
Note 3: Columns exceeding 16m require specific consideration.
Note 4: The base plate thickness shall be considered in the design. The thickness of an unstiffened base plate should be equal to or greater than the diameter of the holding down bolt.

Figure 2-2 Base Plate Dimensions



2.6 Base Compartment and Cable Access

When a base compartment is supplied, it shall include a weather resistant door, made to the same material specifications as the column, and shall be attached in such a manner as to resist unauthorised access and damage by vandals, e.g. use secure fasteners which require a specialised tool to open. The door must be of sufficient size to allow easy maintenance access and (unless specified otherwise) face away from the roadway, but with a maximum size of 150mm wide by 300mm high.

The door opening should be located at least 600mm (and not less than 200mm) above finished ground level for direct buried lighting columns, and at least 75mm above the flange for flange mounted types. The door opening corner radius shall be a minimum of 20mm, up to a maximum of half the door width.

Where a metal part is used, it shall be of corrosion resistant material or be protected against corrosion.

Cable access slot shall be aligned vertically below the door opening (unless specified otherwise) and with the bottom at least 500mm below the ground surface and shall have a preferred size of 75mm wide by 150mm, to a maximum of 250mm high. The cable access slot corner radius shall be a minimum of 20mm, up to a maximum of half the slot width. The cable access slot shall be smooth and free from obstruction and present no sharp edges or features which might cause damage to the cables.

The cable access slot may be widened up to 95mm, with supporting structural calculations provided by the manufacturer for the generic columns.

2.7 Luminaire Fixing

A tubular spigot of hot-dip galvanized mild steel to suit the intended luminaire is to be fitted to and shall project 150mm beyond the end of the outreach arm.

3 STRUCTURAL DESIGN REQUIREMENTS

3.1 General

This section provides the basis and general principles for the structural design of the lighting columns and their foundations. The general principles are based on the limit state concept used in conjunction with load and material strength reduction factors appropriate to the design limit state.

3.2 Analysis

The calculations used in the design shall be based on limit state principles, with the ultimate limit state related to the load-carrying capacity of the lighting columns, and the serviceability limit state that relates to the deflection of the lighting column in service. Structural design actions should be determined from AS/NZS 1170.

No matter what material is chosen for the lighting column, the structural design calculations must allow for:

- the effects of local buckling in the column wall
- the effects of openings made in the column wall
- the effects of holding down details
- fatigue at welds, particularly at mitred knee joints and column base plates
- prying forces specific to the joints specified
- P-delta effects
- natural frequency
- torsion effects.

3.3 Design Strength

To cover the choice of various materials for lighting columns, the design strength requirements should be calculated in accordance with, and as appropriate, the following material design standards:

- NZS3404 Steel structures
- NZS3101 Concrete structures
- AS/NZS 1664 Aluminium structures
- AS/NZS 1594 Hot rolled steel flat
- AS/NZS 3678 Hot rolled steel plate
- BS EN 40-7 Fibre reinforced polymer lighting columns

3.4 Design Working Life

The design working life is the assumed period during which the lighting column should be expected to be used for its intended purpose with anticipated maintenance but without substantial repairs being necessary.

3.4.1 50 year design life

The specified design life for lighting columns on bridges and critical motorway junctions shall be a minimum of 50 years when defined as such in the project specification.

3.4.2 25 year design life

Unless stated otherwise in the project specification, the specified design life for all other lighting columns shall be a minimum of 25 years.

3.5 Importance Level

The consequences of failure for lighting columns is defined as Ordinary, as set out in Table 3.1 of AS/NZS 1170.0, giving an Importance Level of 2.

3.6 Wind Return Periods for Design Working Life

The design loads or wind actions are to be determined based on AS/NZS 1170.2, using the ultimate limit state wind return periods for the relevant design working life given in Table 3-1 below.

Table 3-1 Wind Return Periods for Design Working Life

Design Working Life (years)	Minimum Design Return Period – All Wind Regions
25	250
50	500

3.7 Design Loading

The lighting columns shall be designed for loads which simulate the effect of wind loads and dead loads on the column, outreach arm and luminaire.

The design loads shall be calculated in accordance with AS/NZS 1170 assuming the following:

- non directional wind speed
- minimum terrain category 2
- the effects of shielding shall be ignored
- minimum importance level 2
- topographical multiplier $M_t = 1.0$

The site design wind speed shall not be less than 45m/s.

All lighting columns shall be designed to support the specified luminaires, but in no case less than a minimum mass of 12kg and a minimum wind area of 0.12m². The area of the luminaire shall be taken from the orientation which gives the greatest wind exposure surface and the resultant wind load applied at the top of the column.

3.8 Serviceability Limits

The column and arm deflections may control the column design. For the serviceability limit state, AS/NZS 1170 requires a minimum wind return period of 25 years. This Specification requires a minimum site wind loading of 500Pa to be used under the serviceability state (see clause 3.11 for fatigue ultimate limit state considerations).

The column horizontal deflection limit (at the luminaire) is:

- ***0.04 x (H + W)***
  where: H = the nominal column height
  W = the outreach arm length

The outreach arms vertical deflection limit is:

- ***.025 x W***

The column and outreach arm torsional rotations are to be limited to an angle of 2 degrees.

3.9 Dynamic Response

Lighting columns should be stiff enough to avoid affecting the required illumination or induce fatigue in the column components (see clause 3.11) under dynamic responses caused by wind gusts.

3.10 Durability Requirements

Protection provided by both the column materials and the coating systems, may be shorter than the specified intended life of the lighting column, and due consideration should be given to the maintenance programme or renewal requirements at the planning and design stage.

Durability is expressed in terms of the material or coating life to the first major maintenance. The specified intended life is dependent on both the atmospheric and foundation soil corrosivity classification for the local micro environment.

The durability of a lighting standard in its environmental exposure shall be such that it remains fit for purpose during the design working life given the appropriate level of maintenance. As given in clause 3.4, the design working life is to be specified and the appropriate durability protection needs to be selected.

Specific additional requirements are set out in the particular column material sections in clause 6.3.

3.11 Fatigue Requirements

Cantilever structures can suffer large amplitude vibrations which can lead to the development of fatigue failure particularly at the base connections for steel and aluminium lighting columns. The risk of fatigue failures is minimised by ensuring that critical connections are designed to resist fatigue effects.

The fatigue limit state design shall be in accordance with either;

- A recognised design methodology (using National Standards), or
- A special study, (both subject to final acceptance by NZTA), or
- The current edition of the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, except as modified below.

For the fatigue serviceability state, the lighting columns and their holding down assembly shall be designed to resist an equivalent static natural wind gust pressure of:

$P_{NW} = 0.25(V_Y/5)^2 C_d I_F$

where V_Y = Yearly mean wind speed

= 6.5m/s for Wind Region W, (refer AS/NZS 1170.2) (i.e. Wellington, Marlborough Sounds)

= 5m/s for Regions A6 and A7 (i.e. rest of country)

C_d = Drag coefficient

Cylindrical member	=	1.10
Square	=	1.25
Octagonal	=	1.20
Dodecagonal	=	1.20
Hexagonal	=	1.10

I_F = Fatigue importance factor

50 year design life	=	0.75
25 year design life	=	0.50

The calculated stresses due to this calculated static natural wind gust pressure shall be limited to satisfy the respective detail categories within the constant amplitude fatigue limits (CAFL). These limiting stresses are given in Table 3-1 below.

Table 3-1 Constant Amplitude Fatigue Limits

Detail Stress Category	Steel (MPa)	Aluminium (MPa)
A	165	10.2
B	110	6.0
B'	83	4.6
C	69	4.0
D	48	2.5
E	31	1.9
E'	18	1.0
ET	8	0.44
K_2	7	0.38

The typical weld details and categories are given in the AASHTO specification and are also shown in the Notes to M26, Annex A.

3.12 Foundation Design

3.12.1 General

Foundations shall be designed in accordance with accepted principles of soil mechanics, taking into account the soil properties of the foundation material and due account of the water table and sloping ground.

The foundations shall provide sufficient resistance to overturning moments due to dead loads of the column plus wind loads. The foundation must also be able to withstand the impact from a column being struck. For breakaway lighting columns, the foundation must be rigid enough to allow the breakaway device to function, while not becoming a hazard itself.

In the foundation design, the strength reduction factor used for wind and impact loading shall not exceed 0.60, and in cohesionless soils be not greater than 0.5.

Where not specifically designed, the minimum column planting depth shall be one-fifth of the mounting height, but not less than 1.2m.

The top surface of concrete foundations on footways should not be higher than the adjacent ground level, and elsewhere should not be higher than 50mm above ground level.

3.12.2 Passively Safe or Frangible Lighting Columns

For passively safe (frangible) lighting columns to perform, the foundations must be able withstand without deformation the breakaway force or impact loading.

The base details shall not protrude more than 100mm above finished ground level to prevent forming a hazard to the underside of the vehicle, as shown in Figure 7.27 in the NZTA State Highway Geometric Design Manual.

4 LIGHTING COLUMN IMPACT PERFORMANCE

4.1 General

The lighting column's impact performance or energy absorption capability governs the appropriate column type and location to be specified and installed. There are two main classes of lighting columns in terms of their performance with respect to vehicle impact; rigid, and passively safe (or frangible). Passively safe lighting columns have sub categories based on their energy absorption capability. Road safety considerations including column type positions and setbacks are given in Section 7 of AS/NZS 1158.1.2.

4.2 Rigid Lighting Columns

Rigid lighting columns are not designed to deform to absorb an impacting vehicle's energy, and would normally be stiff enough to remain upright. Rigid lighting columns should be limited to locations with sufficient offset from traffic or be protected by guard rails or barriers.

4.3 Passively Safe (Frangible) Lighting Columns

Passively Safe (Frangible) lighting columns shall be specially designed to either break away or otherwise yield or deform in a controlled manner when impacted by a vehicle, to the extent that the decelerations on the vehicle occupants are low enough to avoid serious injury. These passively safe (frangible) lighting columns are referred to as either slip base or energy absorbing lighting columns.

4.3.1 Slip Base Lighting Columns

Slip base lighting columns can be either ground set mounted or plate set mounted. The design shall allow the column stem to break away from its foundation with little retardation of an impacting vehicle. These must not be installed in locations where pedestrians are normally likely to be present.

4.3.2 Energy Absorbing Lighting Columns

Energy absorbing lighting columns can be either ground set mounted or plate set mounted. Energy absorbing lighting columns must:

- deform progressively to decelerate an impacting vehicle at a controlled rate;
- collapse on vehicle impact in a predictable and acceptable manner, and;
- have full structural strength in its undamaged condition.

4.4 Energy Absorption Categories of Passively Safe (Frangible) Lighting Columns

This Specification recognises three categories of energy absorption for the safety evaluation of passively safe (frangible) lighting columns:

4.4.1 High energy absorbing (HE):

Where a vehicle impacts the lighting column causing the column to bend (yield) in front of and under the impacting vehicle, and may sometimes wrap around the vehicle. The impact vehicle is either stopped or allowed to pass at a substantially reduced speed. The lighting columns may straighten out somewhat as the impact event proceeds.

4.4.2 Low energy absorbing (LE):

Where a vehicle impacts the lighting column, initially causing the column to bend (yield), followed by the column failing, yielding in front of and under the impacting vehicle before shearing or detaching towards the end of the impact event allowing the vehicle to pass by but at reduced speed.

4.4.3 Non-energy absorbing (NE):

Where a vehicle impacts the lighting column, causing the column to almost instantaneously fail and detach at the base, allowing the vehicle to pass by with a low loss of speed. Lighting columns will normally fall back over the impacting vehicle, falling approximately in the original position.

These energy absorption categories are to apply to the situations as given in Table 4-1 below.

Table 4-1 Energy absorption category and performance class

Situation of use		Energy absorption category	Performance class (Impact tested at km/h)
Non-built up all-purpose roads and motorways with speed limits >70km/h	Generally in verges of motorways, dual carriageways and single carriageway roads	**NE**	100:NE
	Locations with significant volume of non-motorized users	**LE / HE**	100:LE or 100:HE
	Locations where major risk of lighting columns falling on either carriageway	**LE / HE**	100:LE or 100:HE
Built up roads and other roads with speed limits ≤ 70 km/h	All other locations with separate facility for pedestrians or cyclists	**LE / HE**	70:LE or 70:HE
Built up roads and other roads with speed limits > 70 km/h	Lighting columns located with presence of frequent pedestrians or cyclists	**HE**	100:HE
Built up roads and other roads with speed limits ≤ 70 km/h		**HE / LE**	100:HE, 70:HE or 70:LE

4.5 Safety Evaluation Standards for Passively Safe (Frangible) Lighting Columns

The acceptable standards or procedures to establish the safety evaluations for the passively safe (frangible) column types under this Specification are as follows:

- AASHTO Manual for Assessing Safety Hardware (MASH)
- European Standard BS EN 12767
- State of Victoria VicRoads Specification TCS 014-3.1
- US National Cooperative Highway Research Program (NCHRP) Report 350

5 LIGHTING COLUMN TYPE APPROVAL PROCESS

5.1 General

To supply new types of lighting columns to NZTA projects, the suppliers' lighting columns must be Type Approved.

Applications for type approval shall be submitted to the National Manager Traffic & Safety, NZTA National Office. To obtain type approval, the supplier must clearly demonstrate that the lighting column conforms to this Specification, and submit the information as detailed in clause 5.2 of this Specification.

The cost of type approval testing and reporting shall not be borne by the NZTA.

5.2 Information to be submitted

The supplier shall submit the following information in sufficient detail in addition to the details required by clause 2.2 when applying for Type Approval:

(a) Column Design:
Confirmation that the structural design and environmental loads will satisfy Section 3 requirements.

(b) Impact Performance (for Passively Safe Lighting columns only):
Test results from an appropriately qualified and recognised body, to prove that the lighting columns will perform as a passively safe (frangible) column as set out in Section 4 of this Specification, based on the evaluation standards of clause 4.5.

The test levels and energy absorbing categories are to be stated.

(c) Prototype Testing:
Results of prototype testing may be accepted at the discretion of the NZTA. Evidence to support the satisfactory performance under load testing to evaluate the serviceability and strength performances. The maximum elastic deflection of the column tip under the serviceability limit state test load shall not exceed 4% of the luminaire mounting height. On removal of the strength limit state test load, the permanent deformation of the column shall not exceed 1% of the nominal column height.

5.3 Review

A review of the information submitted by the supplier will be carried out by the NZTA to determine whether the lighting column will be Type Approved.

Columns that qualify for type approval under this specification will be listed in M26 Appendix A.

Should the NZ Transport Agency discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the column being marketed differs significantly from that which was type approved, it reserves the right to modify or revoke its type approval

6 FABRICATION

6.1 General

Fabrication shall be carried out subject to the limitations of the relevant material supply Standard, unless otherwise shown on the drawings.

Fabricated members shall be free from twists, bends, or other deformations, and shall have their ends square. If straightening is necessary to remove dents, twist, kinks, or other distortions from members, it shall be carried out by methods that will not injure the material.

All burrs and sharp arises, visible or not, shall be removed by grinding before any surface protection is applied. The finish of cut surfaces shall be dressed to a neat, smooth finish, free from defects and distortion.

The location of vent and drainage holes shall be located in such a way to prevent ingress of rainwater inside the lighting columns.

To prevent bimetallic corrosion, dissimilar metals shall not be used. Where fasteners/screws are used, these shall be of a similar durability to the columns.

6.2 Welding

All welds shall be sealed.

The fabricator shall employ an independent Third Party Inspector (TPI) from an ISO 9002 accredited company to carry out audit inspections and review workmanship. The inspector shall hold a CBIP Welding Inspector Certificate or other qualifications listed in Clauses 7.2 of AS/NZS 1554.1 or AS/NZS 1665, to certify that welding procedures, welder qualifications, completed welds, and repairs comply with this Specification.

The fabricator shall arrange, at their own expense, for the programme of inspection and testing required to be undertaken and for the complete documentation of all inspection and testing. This documentation shall be provided when requested.

Where applicable, welding shall be carried out in accordance with the following specified Standards (or NZTA approved ISO equivalents), for the following materials:

(a) Steel:
All welding shall be in accordance with AS/NZS 1554.1. Welding to flanged base plates and mitred joints on outreach arms (i.e. joints subject to fatigue loading) shall comply with AS/NZS 1554.5

Welds shall be de-slagged prior to inspection and galvanizing.

(b) Aluminium:
All welding shall be in accordance with AS/NZS 1665.

6.3 Corrosion Protection

The column materials must comply with the relevant design standards for durability and shall have a life expectancy greater than the specified intended life.

Where applicable, corrosion protection shall be carried out in accordance with the appropriate standards, for the following lighting column materials:

(a) Steel:
All lighting columns and outreach arms shall be hot dipped galvanized in accordance with AS/NZS 4680. The average coating mass shall not be less than 390 g/m², (equivalent to a nominal coating thickness of 55 microns).

Fasteners shall be galvanized as specified in AS 1214.

All galvanizing vent holes/drainage holes shall be sealed where they could allow ingress of rainwater.

Within the salt spray zone (ISO 9223 Category C4), the AS/NZS 2312 galvanizing designation of HDG390 will not provide sufficient protection. For these columns, the lives to first major maintenance must be extended by application of suitable organic barrier coatings as recommended in Tables 5.2 and 5.3 of AS/NZS 2312.

The underside of flanged bases bolted to concrete foundations also require additional protection against crevice corrosion and the galvanizing should also be epoxy coated to a minimum thickness of 150 μm.

The outer surfaces of galvanized ground planted lighting columns and stub bases shall be further protected to 100 mm above finished surface level (ground or concrete) and to the base of the column, with a

continuous self-priming non-conductive barrier coating (epoxy-mastic or similar) at least 350 μm thick.

Proprietary 100% volume solids polyurethane and polyurea coatings for ground planted columns and stub bases are available that will extend the life even further, and an NZTA approved system should be applied where the specified service life is greater than 25 years.

Repairs to any damaged surface protection of the steelwork shall be carried out in accordance with Section 8 of AS/NZS 4680 for damaged galvanizing, except that the maximum permitted damaged or uncoated area shall not exceed 40 mm^2. Repairs to damaged organic barrier coatings shall be by reinstatement of the system.

Application and repair of all organic barrier coatings shall be in accordance with the written instructions to be provided by the manufacturer of the coating(s). Surface preparation prior to coating shall be by sweep blasting as specified in Appendix I of AS/NZS 4680, unless not required by the coating manufacturer (e.g. when using an etch primer over degreased new galvanizing).

(b) Aluminium:
Aluminium lighting columns require no specific corrosion protection other than the application for ground planted columns of a non-porous, electrically insulating bitumen-containing coating with a minimum layer of 250 μm, or the required thickness of any other material (e.g. helically wound polymer or petrolatum tape) that provides the same degree of protection. The coating should only be applied after degreasing and an appropriate treatment to ensure adhesion.

This coating should be applied to external surfaces of the embedded column section extending to a level 100 mm to 150 mm above finished ground level. Internal surfaces below ground level may be filled with clean free draining material e.g. river sand.

Aluminium in contact with concrete shall be similarly protected where moisture is present and corrodents may be trapped between the surfaces.

Non-conductive materials such as elastomeric spacers shall be used to keep aluminium alloy parts from direct contact with steel or other dissimilar metals in the presence of moisture to avoid galvanic corrosion.

(c) Fibre Reinforced Polymer Composite:
Fibre reinforced polymer composite lighting columns require no specific corrosion protection under this Specification, other than the sealing of all cut edges through the application of the parent resin or a suitable

alternative, and shall be completed prior to the application of any external coatings.

There shall be an application of either polyurethane or other UV resistant coating to the exterior surface to at least 50 mm below the finished ground level or the use of chemical UV stabilizers in the matrix, to minimise degradation of the structural properties of the column due to UV radiation.

Polyurethane or acrylic coating can be applied to the column section below finished ground level extending to a level 100 mm above ground level, both externally and internally, to prevent or delay ingress of aggressive ground chemicals when necessary. The coatings should only be applied after an appropriate preliminary treatment to ensure adhesion.

Lighting columns as fabricated shall not show evidence of exposed fibres, cracks, crazing, or checks on the column surface.

(d) Concrete:
Concrete lighting columns designed to meet NZS 3101 and constructed to NZS 3109 with the required depth of cover to prestressing tendons or reinforcing steel should achieve a long life, longer than the design life required under this Specification, even within coastal areas.

Additional requirements may be specified for columns in a highly corrosive environment, and these include the use of special concrete additives, coatings, epoxy-coated strand, stainless steel reinforcement or increase in concrete cover.

7 ELECTRICAL REQUIREMENTS

7.1 General

The electrical works design should be based on AS/NZS 1158.1.2, with reference to AS/NZS 3000 for connections and earthing. Reference should also be made to the local electrical network or territorial authority requirements.

7.2 Earthing Terminals

Where lighting columns are to be earthed by means of an earthing terminal on the columns or baseboard, the following requirements shall apply:

- Earthing terminal shall not corrode
- It shall have substantial contact surfaces for the attachment of an earthing conductor
- It shall be readily visible and accessible
- It shall be a lug or stud attached to the pole to allow either a crimped terminal connection of a bolted connection for the earth wire.

There shall be reliable electrical contact between all exposed metal parts of the columns and the earthing terminal.

The attachment of the fixed part of the terminal shall be installed so as to prevent it from being rotated when the clamping part is moved. The clamping part should be designed so as to avoid any damage to the earth conductor or its insulation during tightening or loosening.

The earthing terminal, or the column or baseboard adjacent to the terminal, shall be visibly and durably marked with the symbol ⏚.

7.3 Base Compartments and Cable Access

The compartment shall be provided with means of attaching electrical equipment. Where a metal tray is used, it should be given the same degree of corrosion protection as that provided by metal compartment doors. Where a baseboard is used, it shall be manufactured from a material that is substantially non-hygroscopic and rot resistant.

Cableways from the base compartment to the luminaire connection shall have a containing diameter of not less than 18mm.

Cableways from the cable access slot to the base compartment shall have a containing diameter of not less than 50mm.

All cableways should be smooth and free from obstruction with no sharp edges, flashes or burrs which might cause abrasion to the cables.

7.4 Disconnection / Isolation of Supply

For passively safe (frangible) lighting columns, either energy absorbing or breakaway, there will be implications for safety aspects arising from:

- Risk of electrical shock
- Difficulties with electrical maintenance.

The electrical safety of the installation shall be maintained at all times and under all conditions. This includes instances when a vehicle has impacted the column. If the disconnection is at or below ground level, the design should be such to ensure that the column will not be tethered in any way by the cable during an impact, the disconnection system shall physically isolate the impacted object and the risk of any exposed broken live cables is mitigated.

These requirements can be achieved by either the use of:

- Pull-out plug (or equivalent) near the base of the column
- High Rupture Capacity (HRC) fuse to limit the fault current and provide a means of isolation / protection.
- An alternative, or an addition to the circuit breaker, is to use an impact sensor, e.g. tilt switch or inertia sensor.

The method to be employed depends on the column type, its material and whether the device is designed to breakaway on impact.

Any components of disconnection systems that are below ground level shall have a minimum protection rating of IP67 in accordance with AS/NZS 3000 Appendix G.

AS/NZS 3000 details the requirements for design, construction and verification of the electrical installation. Clause 5.7 details the requirements for earth fault loop impedance such that:

- Protective devices will operate within the specified time limits, and
- Touch voltages will be limited

8 SUPPLY

8.1 General

The lighting columns shall be manufactured and supplied in accordance with the details submitted under clause 2.2 of this Specification.

Each finished lighting column shall be handled and individually packed in such a manner to prevent any damage to the column or to the protective coating during storage, handling and transport.

9 ERECTION AND MAINTENANCE REQUIREMENTS

9.1 General

Installation and maintenance procedures, as supplied under clause 2.2 of this Specification, shall be followed.

Maintenance programmes shall include the inspection, testing, repair and monitoring the condition of the lighting columns, outreach brackets, switchboards and wiring systems, in accordance with regulatory requirements and sound maintenance practices.

When a baseboard is used to seat the column at the base of the excavation, it shall be manufactured from material which is substantially non-hygroscopic and rot resistant.

Following the column embedment, the finished ground surface shall be a minimum of 100mm below the top of the column base protective coating.

All cables should enter the lighting column with protection provided by conduits or sleeves.

Annex A

REFERENCED STANDARDS AND OTHER DOCUMENTS

The following documents are referenced in this Specification. All references are undated and the latest edition at the time of purchase, of the publication referred to applies.

AS

1110	ISO metric hexagon precision bolts and screws
1111	ISO metric hexagon commercial bolts and screws
1112	ISO metric hexagon nuts, including thin nuts, slotted nuts and castle nuts
1214	Hot-dip galvanized coatings on threaded fasteners
1798	Lighting columns and bracket arms – Preferred dimensions

AS/NZS

1158.1.2	Lighting for roads and public spaces Part 1.2: Vehicular traffic (Category V) lighting – Guide to design, installation, operation and maintenance.
1170.0	Structural design actions Part 0: General Principles
1170.2	Structural design actions Part 2: Wind actions
1554.1	Structural steel welding - Welding of steel structures
1554.5	Structural steel welding - Welding of steel structures subject to high levels of fatigue loading
1664.1	Aluminium Structures, Part 1 – Limit state design
1665	Welding of Aluminium Structures
2312	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
3000	Electrical installations (Australian/New Zealand Wiring Rules)
3678	Hot-rolled structural steel plates, floor plates and slabs
4600	Cold formed steel structures
4677	Steel utility services poles
4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

BS EN

40-7	Part 7: Requirements for fibre reinforced polymer composite lighting columns
12767	Passive safety of support structures for road equipment – Requirements, classification and test methods

ISO

9223	Corrosion of metals and alloys – Corrosivity of atmospheres - Classification

NZS

3101	Concrete structures standard, Part 1 – The design of concrete structures
3109	Concrete construction
3404	Steel structures standard
6701	Code of practice for road lighting

OTHER

AASHTO	Manual for Assessing Safety Hardware (MASH-1)
AASHTO	Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals
NCHRP	Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features (NCHRP 350)
VicRoads	Specification for the Supply of Frangible Lighting Poles, TCS 014-3.
VicRoads	Design of Steel Cantilever and Portal Sign Structures and High-Mast Light Poles, (BTN 2010/001)