Appendix D1
Roadway Lighting Column Specification

D1 Overview

Purpose

This document specifies the minimum requirements for the standard design of street lighting columns intended for use in Auckland Council region, under the guidance of Auckland Transport. It should be read in conjunction with the rest of this chapter in the *Transport Design Manual.*

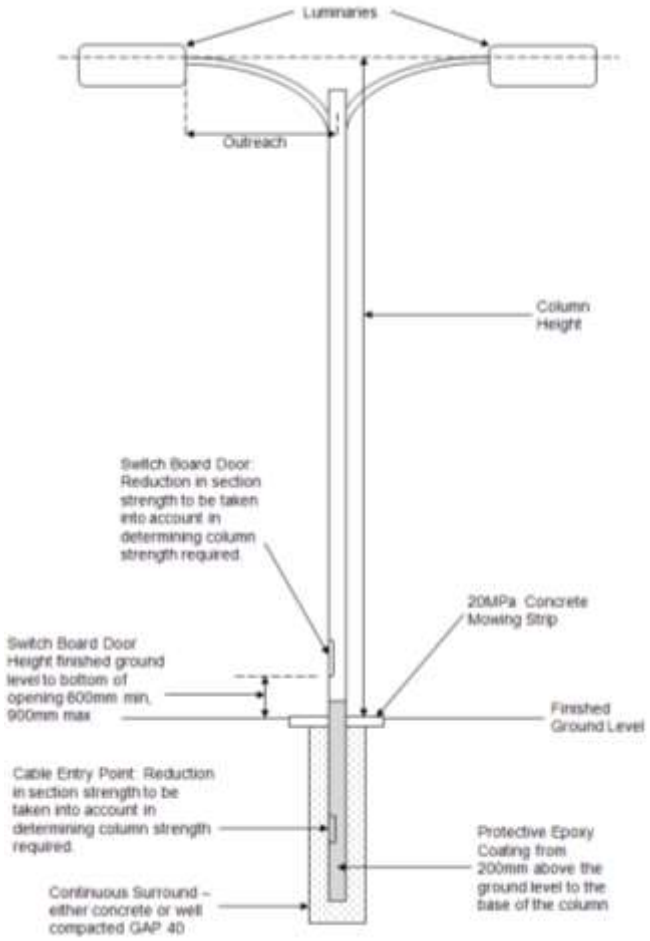

Figure D1: Parts of the lighting column.

D2 Column design

D2.1 Introduction

Design life	All lighting columns must have a minimum 50-year design life.
Design standards	The design must be in accordance with AS/NZS 4676 *Structural Design Requirements for Utility Services Poles* and AS/NZS 4677 *Steel Utility Service Poles*.
Construction standards	All construction must comply with the New Zealand Building Code and the appropriate New Zealand standards.
➔Approved suppliers	All lighting columns must be manufactured by Auckland Transport approved suppliers. See Appendix H for the current list of approved suppliers.

D2.2 Standard columns

All lighting columns must be constructed to a standard length of 4m, 6m, 8m, 10m, 12m or 14m from the ground to the tip of the bracket arm and have a maximum bracket arm outreach length as specified in Table C1 below, unless otherwise approved by Auckland Transport.

Each column must be designed to take the load of a standard luminaire as outlined in Table D1 below.

A column proposed for a luminaire >15kg will require specific structural design to suit.

Table D1: Standard column heights and associated bracket arm lengths, mass and sail areas			
Nominal Column Height (m)	**Maximum Bracket Arm Outreach (m)**	**Luminaire Mass (kg)**	**Luminaire Sail Area (m^2)**
14.0*	4.0	15.0	0.15
12.0	4.0	15.0	0.15
10.0	3.0	13.0	0.12
8.0	2.0	9.0	0.10
6.0*	1.0	8.0	0.10

** Appropriate for single outreach only.*

Bracket arm

Standard columns must have a curved outreach bracket arm with a 5° upward tilt.

Spigot diameter

The minimum spigot diameter must be 42mm.

Structural steel plate

The minimum thickness of steel plate used in any structural column element must be at least 2mm. Special requirements from AS/NZS 4676 apply if the thickness of steel used in any structural elements of the column is less than 3mm**. For the ground section of any column the minimum thickness of the steel plate must be 3mm.**

D2.3 Approved columns

➔Approved columns

A list of the current approved columns can be found in Appendix H. Auckland Transport will consider alternative columns for specific projects on a case-by-case basis.

D2.4 Wind loadings

The column must be designed to an Importance Level of 2 with 50 years design life and must be able to safely sustain the appropriate loads as set out in the current version of AS/NZS 1170.2 *Structural Design Actions - Wind Actions*. See Table D2 below.

Wind loadings are assumed to be non-directional, i.e. the worst orientation of the light column is considered. Specific design considering wind direction, with respect to the orientation of the lighting column, may be warranted in special cases, but this is generally not necessary.

Wind pressures are based on design wind speeds for each wind zone as per Section 5 of AS/NZS 3604 *Wind Bracing Demand* and are calculated in accordance with AS/NZS 1170.2.

The minimum drag coefficient is taken as for a smooth round shape (C_D = 1.2). Other shapes will require modification with the appropriate modification factor in accordance with Table E4 of AS/NZS 4676.

The frontal area of luminaires must be taken from the orientation that results in the greatest wind exposed surface, and the force on these is assumed to act at the top of the column. The frontal area must include all other attachments, motifs etc., which are not part of the main lighting column structure.

Allowance must also be made for the additional forces due to wind on a $1m^2$ fixed sign or, for a single outreach, one 0.9m x 1.8m banner, and for a double outreach, two 0.9m x 1.8m banners, mounted 2.5m above ground level. Columns may be fitted with either a sign or banner(s), but not both.

Auckland Region wind speed design criteria.

The following formula shall be used to calculate the pole loading due to wind speed.

$$V_{\mathrm{sit},\beta} = V_{\mathrm{R}}\, M_{\mathrm{d}}\, (M_{\mathrm{z,cat}}\, M_{\mathrm{s}}\, M_{\mathrm{t}})$$

Table D2: Factors to determine site wind speed		
Description	**Factors**	**AS/NZS 1170.2:2002 Reference Clauses**
Regional gust wind speed, V_R	45 m/s (design life 50 years, Region A)	Table 3.1 – Regional Wind Speeds
Wind directional multipliers, M_d	1.0 (any direction)	Table 3.2 – Wind Direction Multiplier
Terrain/height multiplier, $M_{z,cat}$	Terrain Category 2, site elevation 0m; $M_{z,cat}$	Clause 4.2 – Terrain/Height Multiplier
Shielding multiplier, M_s	1.0	Clause 4.3 – Shielding Multiplier
Topographic multiplier, M_t	1.0	Clause 4.4 – Topographical Multiplier

D2.5 Minimum column strengths

Steel column strengths must be based on the requirements of AS/NZS 3404 *Steel Structures Standard* and AS/NZS 4600 *Cold-Formed Steel Structures*.

Steel section strength requirements apply to the base of the column (at the top of the concrete footing), i.e. not necessarily at the ground surface.

Minimum section modulus requirements must take into account any service opening near the critical location at the base. Locations of openings other than at the base should also be considered.

D2.6 Deflection and vibration

The complete assembly (e.g. column, outreach and luminaire) must be designed to minimise deflection and vibration. To account for fatigue, the lateral liner deflection of the column must not exceed $h_p/15$, where h_p is the height of a column above ground level.

D2.7 Dynamic response check

Translational response	Dynamic response of a light column may subject the structure and fixtures to excessive acceleration and forces. Where structures have natural frequencies less than 1Hz, Section 6 of AS/NZS 1170.2 requires dynamic analysis to be carried out. The dynamic response of a light standard may be in a number of vibrational modes, including fundamental translational (lateral) cross-wind response as well as torsional response, particularly where the fixtures are eccentric and have high mass.
Torsional response	The torsional response may be combined with the translational response. As with the translational response, Section 6 of AS/NZS 1170.2 requires dynamic analysis to be carried out for structures with natural frequencies less than 1Hz.
Wind-sensitive structure	The dynamic analysis of a wind-sensitive structure is outside the scope of this document and specialist design will be required where the structure is deemed to be wind sensitive.

D2.8 Switchboard – Door cavity opening

Position	The door cavity opening must be positioned to permit safe access for maintenance, e.g.: • Not facing the street • Note: door cavity opening must be accessible at all times
Size	The door cavity opening must be a standard size of 300mm x 100mm. At the absolute discretion of Auckland Transport, a smaller opening may be accepted, provided that; • It is agreed in writing prior to construction, • An opening is provided, large enough to enable earthing of the column and door, and • Alternative provision is made for circuit protection (e.g. a TUDS pit or similar beside the column).
Height	The base of the door cavity opening must be located between 600mm and 900mm above finished ground level, to provide safe and easy access for maintenance.
Opening	The door cavity opening must be prevented from being opened by unauthorised persons, by the use of fasteners requiring a specific tool to gain access to the switchboard.

D2.9 Shear base columns

Shear base columns are only to be installed in speed zones of 70km/h or greater. All other speed zones must utilize flange base or ground planted columns.

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

Refer to the *Transport Design Manual – Typical Shear Base Detail* (Appendix K4) for further information.

D3 Foundation design

Two groups

Footings for lighting columns may be classified into two broad groups:

- direct planted footings
- pad footings

Direct planted footing

A direct planted footing is simply an extension of the pole. It relies primarily on varying the length of the extension (i.e. the embedment depth) and its projected area, to engage the required resistance of the foundation to overturning and sliding. This type is widely used for foundations with a bearing strength between 100kPa and 240kPa.

The embedment depth of directly planted poles must be calculated in accordance AS/NZS 4676, taking due account of the mechanical properties of the particular foundation materials. The embedment depth should not be less than 500mm in any soil. The top 500mm of any pile foundation must be ignored when determining capacity.

Pad footings

Pad footings are usually constructed from concrete and rely primarily on their mass and the distribution of this mass to provide the required stability. For this type of footing, the embedment depth is not as critical a factor in the overturning resistance of the pole, but may be a major consideration in generating resistance to sliding.

Base fixing bolts must be designed in accordance with AS/NZS 4676 and must be arranged so that cable access through the base plate hole is not impaired.

D4 Surface Coatings

This section details the requirements for finishes and their application. Alternative products and processes may be submitted for approval for specific projects and/or for future incorporation into this document.

Surface preparations, coatings and repairs must be in accordance with AS/NZS 2312 *Guide to the Protection of Structural Steel against Atmospheric Corrosion by the use of Protective Coatings* and be performed by one of the companies approved for that system, to meet the minimum warranty period.

Surface finishes must be smooth and free from obvious blemishes. Final coating is optional. However, all columns, complete with mitred and curved outreach arms, must be finished, both internally and externally, in one of the following forms:

- Hot dipped galvanised mild steel – painted or unpainted
- Stainless steel (316 grade) – painted or unpainted.

Contact Auckland Transport regarding other clear acrylic coatings.

D4.1 Standards

The following standards apply to this section:

- AS/NZS 2312 *Guide to the Protection of Structural Steel against Atmospheric Corrosion by the Use of Protective Coatings.*
- AS/NZS 4680 *Hot-Dip Galvanised (Zinc) Coatings on Fabricated Ferrous Articles*.
- AS/NZS 3750.9 *Paints for steel structures - Organic zinc-rich primer*.
- AS/NZS 3750.15 *Paints for steel structures - Inorganic zinc silicate paint*.
- AS/NZS 1554.1 S*tructural Steel Welding - Part 1: Welding of Steel Structures*.

D4.2 Repair of damage to surfaces

Corrosion protection that has been damaged by welding, erection or other causes must be rectified before the column is put into use. The damaged area must be prepared and must be dry and clean, free from dirt, grease, loose or heavy scale of rust before the corrosion protection is applied.

The corrosion protection must be applied as soon as practicable and before noticeable oxidation of the cleaned surfaces occurs. Damaged zinc coating must be restored by application of an equivalent thickness of a suitable zinc paint conforming to AS/NZS 4680, AS/NZS 3750.9 or AS/NZS 3750.15 or with thermal zinc spray.

D4.3 In-ground section of all columns

Structural steel sections should not make direct contact with the ground. All sections must be embedded in, or bear on, concrete, or be otherwise protected. Concrete poured around steel structures must be continuous and not cast in sections.

All lighting columns must, on top of the all-over galvanisation, be covered in an extra epoxy protective coating from 200mm above the ground level to the base of the column. Bare, untreated metal is not acceptable.

D4.4 Alternatives

Where alternative materials or paint finishes are required, the applicant must submit full details of the proposed process and materials for review, with the submission.

D4.5 Warranty

Certified applicator

If the coating applicator has been certified by a paint supplier who is an approved provider of the proposed coating system, provide a copy of the coating applicator's certification that the galvanising and/or paint has been applied in accordance with the coating manufacturer's specification. This must happen before installation of the columns.

Non-certified applicator

If the applicator does not possess the necessary certified applicator status, the paint supplier must monitor the work and provide the required certification.

10-year guarantee

Materials and paint finishes of columns and luminaire bodies must be unconditionally guaranteed against fair wear and tear for a minimum of 10 years, commencing from the date of handover to Auckland Transport.

D4.6 Quality control

Standards

All welds and welding processes must comply with the current standards outlined in AS/NZS 1554.

Inspector

Auckland Transport may nominate an inspector to ensure the quality of the lighting column including, but not limited to: the quality of steel, welds, and protective coating. Upon request by Auckland Transport, the manufacturer must supply Auckland Transport with any certificates to ensure the quality of the column.

D4.7 Protection

Transport	Structural members must be adequately protected during handling and transport, to minimise damage to the corrosion protection. The columns must be individually wrapped in heavy duty polythene, or similar method of protection, to protect them from damage. The protective wrapping must not remain in place for any extended period of time, e.g. during site storage, as damage to the paint finish is likely to occur.
Separable	Components that are transported in nested bundles should be separable without damage to other components or their coatings. Consider the use of lifting beams with appropriately spaced lifting points and slings, or lifting with properly spaced fork-lift tines.
Wrapping	The column wrapping must be applied while the column is installed and stood upright in the excavation, and the wrapping must be removed upon completion of installation.
Repair damage	Any damage caused before the handover to Auckland Transport must be repaired as new, with all warranties remaining intact. Where the damage is considered too severe, the contractor must, upon written instruction from Auckland Transport or our representative, replace the damaged equipment with a new item at no cost to Auckland Transport.

D4.8 Excavation and backfill

All excavation and backfilling must be carried out in accordance with the contract specification.

D4.9 Mowing strip

A smooth concrete mowing strip must be provided around the base of lighting columns where appropriate. The concrete must be 25MPa strength with a minimum width of 200mm on all sides and depth of 150mm. The concrete must be boxed, finished level with the surrounding ground level and have a smooth trowel finish, slightly graded away from the column, to eliminate water collecting next to the column.

D5 Checklists

D5.1 Initial evaluation checklist

Initial evaluation checklist

Refer to the *Transport Design Manual – Street Lighting – Column – Submission Checklist* (Appendix D2).

This checklist lists the essential criteria for this assessment that must be met for each new column design that is submitted to Auckland Transport. Lighting columns that satisfy all the requirements of this part may then be considered for a detailed assessment carried out by an independent consultant selected by Auckland Transport.

D5.2 Detailed independent assessment

Verify initial evaluation

Refer to the *Transport Design Manual – Column – Evaluation Checklist* (Appendix D3).

This checklist will be used to record the results of the column's structural performance analysis. This assessment must verify that the initial evaluation is accurate and that the column has no major design issues in relation to the specification outlined above.

Revision Table

Version	Date	Changes
1	11/11/16	Original
2	19/05/17	Replacement for Web
3	14/07/17	Formal Issued Set
4	13/10/17	Rev table added
5	03/05/18	D2.2 (4m column) & D2.8 (door opening) amended
6	26/08/18	Title and footer adjusted. Switchboard opening size adjusted
7	17/12/18	Drawings and checklist removed and replaced by references to other appendices.
8	05/06/19	D2.2 amended re >15kg light