



**MANUKAU CITY COUNCIL**

**PUBLIC LIGHTING DESIGN STANDARD**

**SEPTEMBER 2003**

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## 1 COPYRIGHT

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## 2 INTRODUCTION

The intent of this document is to set suitable benchmarks for materials, systems and workmanship for lighting systems intended for use in Manukau City.

This should in turn ensure that these installations are attractive, robust, easy to maintain, cost effective, suitable in relation to performance and minimise obtrusive effects. Good design principles are expected, including:

- Minimising obtrusive effects (to neighbours, traffic and sky glow).
- Designing vehicular route lighting for vehicle and pedestrian safety.
- Designing pedestrian lighting to minimise crime and enhance the environment.
- Designing equipment construction and finishes to retain serviceability and a good standard of appearance for the service life of the equipment.

The document is generally prescriptive, but designed to allow for the wide range of equipment currently available. It also outlines the related procedures required by Manukau City Council (MCC). It applies to all lighting installations that will be designed and constructed by parties other than MCC, but that will be maintained by MCC.

This will *include* but not be limited to:

- Roads.
- Pedestrian Crossings.
- Pedestrian and Cycle Paths.
- Parks and Reserves.
- Public Precincts (eg. Shopping Precincts)
- Outdoor Carparks.
- Steps, Stairs, Ramps, Subways and Footbridges.

It will *exclude*:

- Building Interiors.
- Building Facades.
- Signs.

Where clauses differ from existing standards, the requirements of this document shall apply.

It should also be noted that:

- Street lighting shall be designed in accordance with this standard and all applicable New Zealand Standards including but not restricted to the current AS/NZS 1158 series of standards.
- A street lighting plan is required as part of the engineering plan approval.
- The developer's representative is required to certify that all streetlights have been installed in accordance with the approved plans and specifications.
- The developer's representative shall ensure that a streetlighting audit is undertaken in accordance with Section 12 of AS/NZS1158.1.3:1997. Two copies of the audit report must be submitted to Council – one for the development file and one for the appropriate asset manager.
- Only Luminaires and lighting columns from MANARC approved suppliers shall be used.

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***In using this Document, the category of road shall be determined by the City Traffic Engineer, Manukau City Council according to the Standard(s) for the type of road, applicable at the time.***

The document will be subject to periodic review. Comments from interested parties relating to this document are welcome. Please send comments in writing to:

City Traffic Engineer  
Manukau City Council,  
Private Bag 76917  
DX EP75557  
MANUKAU CITY

## **2.1 THE PROCESS**

The process will typically be as follows:

1. In general, the design classifications applicable to AS/NZS 1158 shall be as follows, subject to confirmation in each case with Manukau City Council:
  - i) Regional Arterial roads - Lighting Category V2.
  - ii) District Arterial Roads - Lighting Category V3.
  - iii) Collector Roads - Lighting Category P3.
  - iv) Predominantly industrial minor roads (Vehicle dominated) - Lighting Category V4.
  - v) Predominantly residential minor roads (Pedestrian dominated) - Lighting Category P4.

Where a road is identified for future extension to a different use (eg. a dead end road that is planned to be continued in the future to become a collector or arterial), the more onerous design condition shall be applied.

Other spaces (eg. cycleways, pathways, carparks, public precincts, transport terminals, subways, etc) shall be classified in accordance with AS/NZS 1158.3.1.

Confirm the exact designation with the Manukau City Council prior to commencing design.

2. Design, prepare **all** details as specified, complete the checklist and review form(s) – submit to MCC.
3. Provide any supplemental information requested by MCC or their representatives to clarify the submission.
4. MCC will advise whether the submission is accepted and if so, under what conditions.
5. If the conditions of acceptance affect the plans as submitted, then modify and resubmit as required until accepted.
6. Fabrication of the equipment may proceed only when final approval of the design is received from MCC (and not before).
7. Provide warranties to MCC, **prior** to installation.
8. Proceed with the installation. Advise MCC when the installation is due to commence so that inspections can be arranged.
9. MCC will inspect the works in progress and on completion. Attend to any remedial works as required by MCC.

10. The developer's representative is required to certify that the streetlights have been installed in accordance with the approved plans.
11. The developer's representative is required to ensure that a streetlighting audit is undertaken in accordance with section 12 of AS/NZS1158.1.3:1997 with two copies of the audit report forwarded to Council – one for the development file and one for the appropriate asset manager.
12. Upon completion, supply as-built drawings & SLIM forms to MCC. This may require amendment & re-submission if incomplete or of unsatisfactory quality.
13. Supply MCC with signed copies of network supplier certificates of electrical compliance (COC).

### 3 GENERAL

#### 3.1 DEFINITIONS

For the purpose of this Standard the definitions listed below apply. The definitions are the same as those used in AS/NZS 1158.

**Arrangement (lighting arrangement)** – the pattern according to which luminaires are sited in plan, e.g. single sided, staggered, opposite or central.

**Average Illuminance ( $E_{ave}$ )** – the mean illuminance in a horizontal plane at ground level over a specified area, derived in a specified manner.

**Azimuth or C-angle** – the angle, in azimuth, between the vertical plane containing the direction of a particular value of intensity and the vertical plane parallel to the axis of the road. See figure 2, AS/NZS1158.0: 1997, for details of the CIE C, angle co-ordinate system, which is used for the photometry of road lighting luminaires.

**Carriageway** – that portion of the road devoted particularly to the use of motor vehicles, inclusive of shoulders and auxiliary lanes.

**Carriageway lighting design width ( $W_k$ )** – The width of carriageway which is used for the calculation or assessment of road lighting performance.

**Disability glare** – glare that impairs the visibility of objects without necessarily causing discomfort.

**Discomfort glare** – glare that causes discomfort without necessarily impairing the visibility of objects.

**Footpath (pathway)** – a public way reserved for the movement of pedestrians and non-motorised vehicles.

**Glare** – condition of vision in which there is discomfort or a reduction in ability to see, or both, caused by an unsuitable distribution or range of luminance, or to extreme contrasts in the field of vision.

**Illumination** – a general expression for the quantity of light arriving at a surface. The physical measure of illumination is illuminance.

**Illuminance (E)** - the luminous flux arriving at a surface divided by the area of the illuminated surface. Unit: lux (lx); 1 lx = 1 lumen/m<sup>2</sup>.

**Illuminance uniformity** - the ratio of the maximum illuminance to the average illuminance within a specified area of the road reserve. Symbol:  $U_E$ .

**Initial light output (of a discharge lamp)** - the total luminous flux emitted by a lamp after 100 hours of operation.

**Intersection** – a place at which two or more roads cross at grade or with grade separation.

**Junction** – a place where two or more roads meet.

**Kerb** – a raised border of rigid material formed at the edge of the carriageway.

**Lamp** – a generic term for a man-made source of light.

**Lighting column** – a vertical structure of any appropriate material, which is designed to support luminaires either directly or by the use of outreach arms or mounting frames.

**Light output** – the total luminous flux emitted by a lamp or luminaire, as appropriate.

**Light output distribution** – the distribution of luminous intensity from a luminaire in various directions in space.

**Luminaire (lantern)** – apparatus which distributes, filters or transforms light transmitted from one or more lamps and which includes, except for the lamps themselves, all the parts necessary for fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electrical supply.

**Luminance (L)** – the physical quantity corresponding to the brightness of a surface (e.g. a lamp, luminaire, sky or reflecting material) in a specified direction. It is the luminous intensity of the surface divided by that area. Unit: candela per square metre ( $\text{cd}/\text{m}^2$ ).

**Luminous flux ( )** – the measure of the quantity of light. For a lamp or luminaire it normally refers to the total light emitted irrespective of the directions in which it is distributed. Unit: lumen (lm). Note: Values of luminous flux in this Standard refer to new lamps, viz. Initial 100-hour values.

**Luminous intensity (I)** – the concentration of luminous flux emitted in a specified direction. Unit: candela (cd).

**Maintenance factor (light loss factor)** – a factor applied to lighting design calculations, to take account of the light losses resulting from the depreciation in the lamp lumen output due to ageing and the accumulation of dirt on the optical surfaces of the luminaire, during the interval between scheduled maintenance of the lighting system.

**Minimum illuminance ( $E_{\min}$ )** – the lowest value of illuminance in a horizontal plane at ground level, within a specified area.

**Mounting height (H)** – the vertical distance between the centre of a luminaire and the surface which is to be illuminated, e.g. the road surface.

**Outreach** – The distance, measured horizontally, from the photometric centre of a luminaire, to-

- a) *for lighting columns with outreach arms* – the centre of the vertical section of the column,
- or
- b) *for bracket arms* – the mounting plate by means of which the bracket arm is secured to the column, wall or other supporting surface.

**Peak intensity** – the highest value of luminous intensity from a given luminaire.

**Property line** – the boundary between a road reserve and the adjacent land.

**Road reserve width (W)** - the width of the entire way, between property lines, devoted to public travel.

**Roundabout** – an intersection where all traffic travels in one direction around a central island.

**Spacing** – the distance between successive luminaires in a road lighting installation measured along the centre-line of the carriageway. This applies irrespective of whether the carriageway is straight or curved. Note: in a staggered installation, the distance is measured along the centre-line of the carriageway, between the luminaire on one side of the carriageway and the next luminaire on the other side of the carriageway.

**Threshold increment (TI)** – the measure of disability glare expressed as the percentage increase in contrast required between an object and its background for it to be seen equally well with the source of glare present.

**Upcast angle; tilt angle** – the angle by which the axis of the fixing spigot entry is tilted above the horizontal when the luminaire is installed.

**Upward waste light ratio (UWLR)** – the proportion of luminous flux emitted by the luminaire above the horizontal, when mounted as installed. Note: For conventional road lighting luminaires-

$$UWLR = ULOR / LOR$$

Where

*ULOR* = upward light output ratio of the luminaire

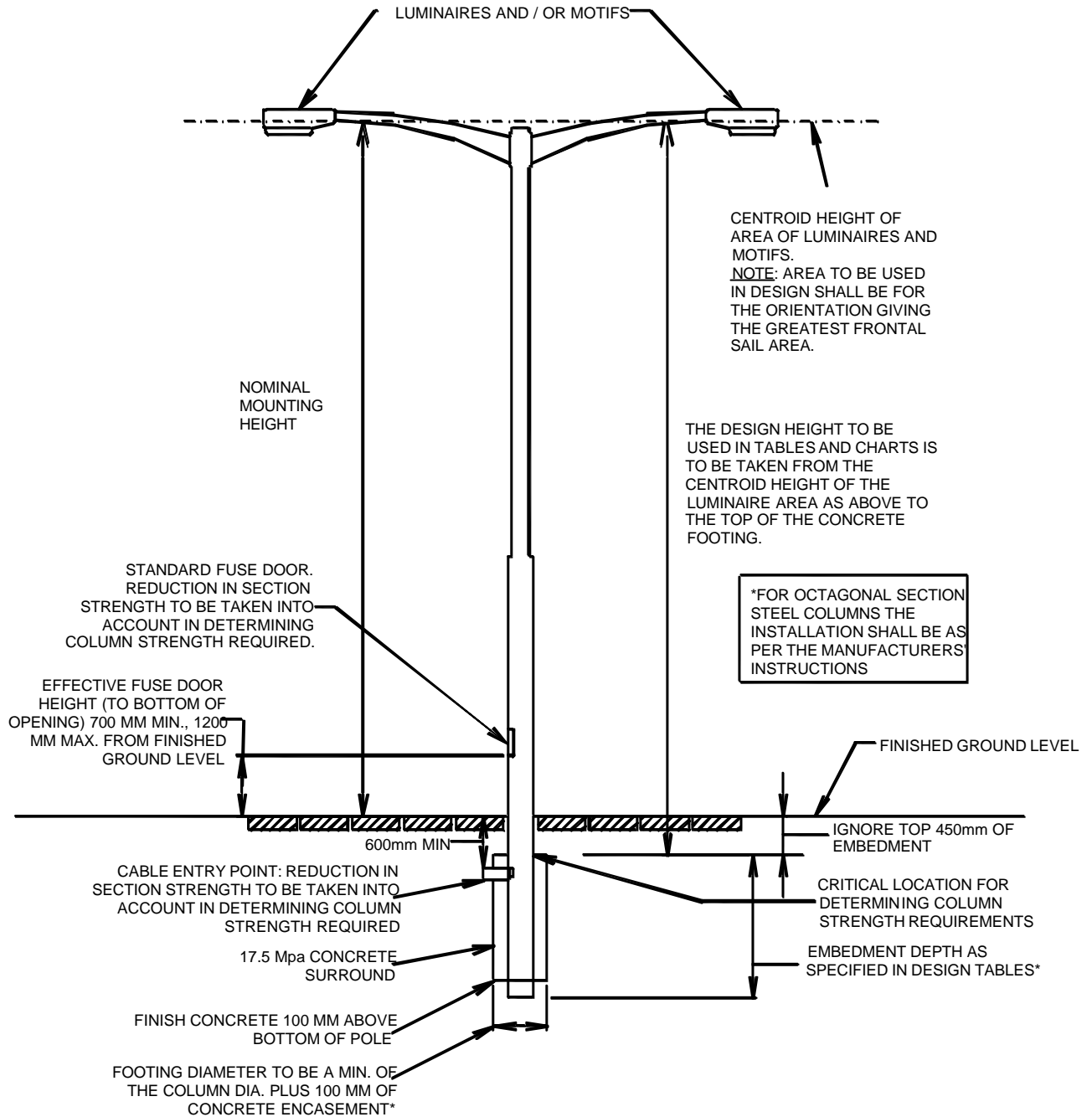
*LOR* = total light output ratio of the luminaire

However the degree of upcast, if any, should be taken into account in assessing compliance with the specified *UWLR*.



3.2 TYPICAL COLUMN TERMINOLOGY

Schematic only – Do not scale



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### 3.3 PROCEDURE

Four copies of the plans and two copies of isolux plots & written submissions shall be submitted to the appropriate section of Manukau City Council:

Subdivision Engineer or, Senior Roading Engineer or, Parks Manager  
Traffic & Roading

Manukau City Council  
Private Bag 76917  
DX EP75557  
MANUKAU CITY

Allow approximately 3 weeks for processing **fully completed** submissions. To assist in this process, applicants are encouraged to complete the form and checklist contained in Appendix C of this document and forward with their submission. Where data supplied is not complete, additional time will be required to process the submission. All of the time required to review the submission will be charged to the applicant. Hence, it is in the applicant's best interests to provide a fully completed submission in the first instance.

Where the review indicates that design changes are required, adjust the documents and resubmit until approval is obtained.

No installation work shall be carried out until written approval is received from Council.

A representative of the Manukau City Council will undertake a site inspection during the installation to verify compliance. AS/NZS 1158, Part 1.3, Section 12.2 will form the basis of this inspection for streetlights.

*In order for Council to issue a Compliance Certificate, all lighting equipment must be installed and working correctly, and Council in receipt of the developers installation audit, all applicable SLIM forms, written warranties, and the completed as built documentation. Council will not issue a Compliance Certificate for the subdivision until all aspects of the subdivision have been verified for compliance with applicable council standards.*

### 3.4 DOCUMENTATION REQUIRED

1. Where applicable, all documentation required in Appendix C of AS/NZS 1158.1.1, or Appendix C of AS/NZS 1158.3.1 (as appropriate), that is not listed below shall also be provided.
2. Certification confirming that the Embedment Depth, Base Moments and Column Strengths comply with the requirements of the Structural section of this specification.
3. Detailed installation and maintenance instructions for the lantern and column combination including handling, transport and storage instructions as well as minimum foundation details as above.
4. A detailed written warranty, minimum 10 years, stating the extent and any conditions of the warranty and the remedial action proposed in the event of a claim.
5. Copies of photometric test reports for the proposed luminaires, from an accredited Testing Laboratory in hard copy and, on request, in IESNA or CIE electronic format.
6. Relevant Luminance and Illuminance information calculated by approved methods, e.g. computer software, and based on the appropriate photometric information provided above, using the observer position indicated by the current applicable NZ standard.

7. A site plan showing the proposed locations of all luminaires, supporting structures and foundations included in the project. Where the project is a continuation of, or intersects an existing lighting system, the columns affecting or contributing to the proposed system shall also be shown and clearly marked as existing.
8. On completion of commissioning and prior to hand-over to Council, "As-built" drawings of the completed works and completed Streetlighting Inventory Management (SLIM) forms shall be supplied to the Manukau City Council, for approval before acceptance of the hand-over. This includes full working drawings for manufacture made available to the Maintenance department so that replacement installations can be the same as the original.
9. "As-built" drawings, to the Network Supplier's standards, shall be supplied to the Network Supplier for all underground and overhead power supply and pilot cables.

#### **3.4.1 As-built Drawings**

The drawings shall be in accordance with the Manukau City Council Engineering Quality Standards.

#### **3.4.2 SLIM Forms**

Obtain the current version of the master SLIM (Street Light Inventory Maintenance) forms, complete with user guidance notes, from MCC (Asset Management Engineer – Roadings).

Complete sheets for each luminaire and support system and submit for approval.

### **3.5 CODES, REGULATIONS AND STANDARDS**

Only luminaires and lighting columns from MANARC approved suppliers shall be used. The codes, regulations and standards referenced in this document shall be the latest version complete with all amendments.

All works are to be carried out in accordance with all relevant statutes, bylaws, regulations and in particular:

- a) The Electricity Act 1992, Electricity Regulations 1997, the relevant Electrical Codes of Practice (ECP) referred to in this, and relevant Standards referenced in ECP3.
- b) New Zealand Radio Interference Notices 1958 and 1985 and Radio (Television) interference notice 1961.
- c) Health and Safety in Employment Act 1992.
- d) Relevant Statutory Acts, Regulations and Bylaws.
- e) The requirements of Network Supplier's Health and Safety Standards (NHSS)

### **3.6 WORKMANSHIP**

All work shall be performed in accordance with best trade practice utilising good quality new materials.

Specific items:

- Avoid damage to materials during transport and installation.
- Ensure columns are weatherproof.
- Do not use ceramic fuses or fuse holders.

### **3.7 WEATHERPROOFING**

The equipment shall comply with the following parameters in relation to AS 1939 or IEC 529.

<b>ITEM</b>	<b>MOUNTING HEIGHT</b>	<b>MINIMUM IP RATING</b>
Luminaire Optical Chamber	> 3 m	IP54
	< or = 3 m	IP56
Luminaire Control Gear Chamber	> 3 m	IP24
	< or = 3 m	IP56
Column Gear/Fuse Door	-	IP43
Remainder of Column	-	IP24
Switchboard	-	IP56
In-ground equipment	-	IP68

Columns shall be equipped with any necessary drain holes, vent holes, glands and gaskets to comply with the above requirements. Any vent holes shall be arranged to prevent rain entry. Any drain or vent holes shall be arranged to prevent vermin entry. Ensure that the design of the column intrinsically prevents the occurrence of water filling the base of the pole or entering the lantern.

### **3.8 MATERIALS**

The steel materials and fasteners shall be as given in NZS 3404.1 or AS 4100. The minimum thickness of steel plate used in any structural column element shall not be less than 2.0 mm.

Dissimilar metals shall not be used in contact with one another. Where this is unavoidable the components shall be plated with a metal of intermediate potential to prevent any electrochemical reaction. In the case of screw fastenings the fastener is to be captive and the system is to be corrosion resistant for the service life of the equipment, i.e. 20 years.

## **4 LIGHTING COLUMNS**

Only lighting columns from MANARC approved suppliers shall be used.

### **4.1 DESIGN**

#### **4.1.1 Introduction**

The design requirements for columns shall be in accordance with the Australian/New Zealand Standard AS/NZS 4676: "Structural design requirements for utility services poles". In particular, Sections 2, 4.1 & 5.3 and Appendices C & D.

Appendices A & B of this document provide details for calculating minimum requirements for column strength and ground embedment.

Charts that set out basic minimum requirements for the design of street light columns to meet the requirements of the New Zealand Building Code (NZBC) with respect to street light column strength are contained in Appendix A. Also Australian/New Zealand Standard AS/NZS 4676: "Structural design requirements for utility services poles" has been used as a guideline.

Design of components for strength will be subject to specific design by the suppliers.

Interpolation between charts is permitted for intermediate values. Extrapolation outside the scope of the charts is not permitted without further input by a registered engineer.

All construction is to comply with the NZBC and the appropriate New Zealand Standards.

#### 4.1.2 Column Types

The design charts provided are based on constant diameter – uniform wall thickness columns.

Where tapered or variable wall thickness columns are proposed, specific design details and calculations proving that equivalent structural performance will be achieved are to be provided.

#### 4.1.3 Wind loadings

The column shall be designed to safely sustain the appropriate loads as set out in NZS 4203:1992. The wind loading shall be as per the wind zone maps included in Appendix A of this document or by contacting Manukau City Council on Ph: 09 262 8900, unless otherwise instructed by Council in writing.

Wind loadings are assumed to be non-directional. i.e. the worst orientation of the light standard is considered. Specific design considering wind direction, with respect to the orientation of the light standard, may be warranted in special cases, but this is considered not generally necessary. Wind Pressures are based on design wind speeds for each wind zone as per NZS3604 and are calculated in accordance with NZS4203 as tabulated in table A1.1 in Appendix A.

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 determined by the manufacturer.

The frontal area of luminaires shall 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 shall include all other attachments, motifs etc., which are not part of the main street light column structure.

The height of the column used in the charts is to be taken as the height from the centroid of the frontal area of the luminaires and attachments as above, to the top of the concrete foundation. Table A1.1 in Appendix A shows wind zone values in kPa.

#### 4.1.4 Minimum Column Strengths

Concrete column strengths are based on the requirements of NZS3101 for ultimate limit state design. Steel Column Strengths are based on the requirements of NZS3404 (Structural Steel) and AS/NZS4600 (Cold-Formed Steel Structures).

Steel sections 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.

Steel strengths other than G250 and G350 ( $f_y = 250$  MPa and  $f_y = 350$ MPa respectively) will require the required strength to be modified by the ratio of  $F_{y\text{table}}/F_{y\text{used}}$ .

Aluminium section requirements are based on 6061-T5 alloy. Other alloys will require a minimum Z value obtained by multiplying the tabulated value by the ratio of  $F_{y\text{table}}/F_{y\text{used}}$ .

For modification factors for minimum column strengths, refer to Appendix A.

#### 4.1.5 Deflection & Vibration

The complete assembly (eg. column, outreach & luminaire) shall be designed to minimise deflection and vibration. Specific design requirements include:

- The luminaire manufacturer shall, upon request, provide a guarantee that the service life of 20 years for the luminaire and the lamp manufacturer's stated service life for the lamp will not be compromised by the support systems.
- The axis of the main light beam shall remain fixed under the design wind conditions to  $\pm 2^\circ$ .

#### 4.1.6 Dynamic Response Check

##### a. TRANSLATIONAL RESPONSE

Dynamic response of a light standard may subject the structure and fixtures to excessive acceleration and forces. The loadings Standard, NZS 4203:1992; 5.2.2.2 requires a dynamic analysis of wind sensitive structures where the period of the structure is greater than one second.

The dynamic response of a light standard may be in a number of vibrational modes, including fundamental translational (lateral) cross wind and along and response as well as torsional response, particularly where the fixtures are eccentric and have high mass.

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.

We have included a simple check for dynamic response below which should not be taken as a rigorous assessment, however, it can be used to quantitatively assess whether dynamic response might be a problem.

- i. Determine the total mass of the fixtures and other top attachments, including outreach arms etc. and include the mass of the top half of the post =  $M$  (kg).
- ii. The minimum section inertia of the post,  $I_{min}$ , is then obtained from:

$$\begin{aligned} I_{min} &= k_m 65.83 M h^3 \text{ (mm}^4\text{) (for steel posts)} \\ &= k_m 0.006583 M h^3 \text{ (cm}^4\text{)} \end{aligned}$$

where:  $M$  = lumped mass (kg) as above

$h$  = approximate height to centre of lumped mass (m)

$k_m$  = material modification factor

- iii. The post size chosen should meet both the strength ( $Z_{min}$ ) and stiffness ( $I_{min}$ ) criteria to ensure adequate performance.

Example:            for     $M = 100\text{kg}$   
                                        $h = 6\text{m}$   
                           required  $I_{min} = 142 \times 10^4 \text{ m}^4$   
     $= 142\text{cm}^4$         for a steel post.

i.e.: a suitable minimum size would be, say, a 100NB x 3.18 API Line Pipe with  $I = 171\text{cm}^4$  subject to a strength check.

A modification factor for other materials must be applied where applicable by multiplying the required  $l_{min}$  by the following:

material:	Aluminium = $k_m = 2.857$	where $E = 70 \times 10^3$ MPa
	Timber = $k_m = 30.77$	$E = 6.5 \times 10^3$ MPa
	Concrete = $k_m = 7.782$	$E = 25.7 \times 10^3$ MPa ( $f_c = 30$ MPa)

#### b. TORSIONAL RESPONSE

The torsional response is much more difficult to predict and may be combined with the translational response. Included in Appendix E, is a sample spreadsheet calculation that includes a formula for the torsional period.

As with the translational response, a period in excess of one second would indicate a more rigorous dynamic analysis is required.

#### 4.1.7 Control Gear / Fuse – Access Door

The door shall be positioned to permit safe access for maintenance, ie:

- Not facing the street.
- Not facing the property boundary behind the column, unless clearance to the property boundary is greater than 1000mm.
- One metre minimum clear of any fixed obstructions.
- Fixings shall be vandal & child resistant and shall require a tool to open.

The bottom of the door shall be located between 700 and 1200 mm above finished ground level.

It shall be of sufficient size for safe and easy maintenance access.

The door shall be prevented from being opened by unauthorised persons, by the use of fasteners requiring a specific tool to gain access to the fuses and terminations.

#### 4.1.8 Shear base Columns

All shear base type columns shall incorporate a mechanism to ensure that the pole does not become live in the event of vehicle impact or similar event.

### 4.2 CONSTRUCTION

This section details the requirements for finishes and their application, as solutions considered satisfactory by MCC. Alternative products and processes may be submitted for approval for specific projects and / or for future incorporation in this document.

Approved coating systems are listed in Appendix D.

This section relates particularly to columns and column-mounted luminaires. While the spirit of this document shall also apply to other styles of luminaires and supports, proposed finishes and their application details shall be submitted for approval.

Surface preparations, coatings and repairs shall be in accordance with one of the approved systems (refer Appendix D) and be performed by one of the companies approved for that system to meet the minimum warranty period.

Painting is optional. However, columns shall be finished in one of the following forms:

- Hot dipped galvanised mild steel – painted (externally) or unpainted.
- Mild steel – painted (externally & internally).
- Stainless steel (316 grade) – painted (externally) or unpainted.
- Marine grade aluminium – painted (externally).

Surface finishes shall be smooth and free from obvious blemishes.

#### 4.2.1 Standards

The following standards are applicable to this section

AS/NZS 2312	Guide to the Protection of Iron & Steel Against Exterior Atmospheric Corrosion.
SSPC-SP1	Cleaning Using Liquid Solvents & Alkaline Solutions.
SSPC-SP10	Abrasive Blast Cleaning.
SSPC-PA2	Measurement of Dry Paint Thickness with Magnetic Gauges.
AS/NZS 4680	Hot-Dip Galvanised (Zinc) Coatings on Fabricated Ferrous Articles.

#### 4.2.2 Repair of Damage To Surfaces

*Welded Areas & Inorganic Zinc Surfaces.*

Degrease in accordance with SSPC-SP1 to remove all visible deposits of oil, grease, dirt, dust and other contaminants.

Remove all weld spatter, radius sharp edges and grind weld seams.

Power tool clean welds etc in accordance with SSPC-SP3. Prime the prepared areas by brush within 4 hours, or before rust bloom appears. Lap the primer coat at least 25 mm over the surrounding sound paint.

Prime and paint in accordance with the MCC approved paint manufacturer's system.

*Damaged Top Coat not back to Inorganic Zinc Primer.*

Sand to mechanically roughen the coating at the damaged area to ensure adhesion of the topcoat. Remove all rust and dust particles with compressed air or by vacuuming.

Paint in accordance with the MCC approved paint manufacturer's system.

#### 4.2.3 In-Ground Section of all Columns

All bare metal must be covered in a zinc rich coating which must then be coated with High Build Epoxy of minimum dry film thickness of 150 microns to match the above ground level specification for the type of column used.

Bare, untreated metal is not acceptable. Where the pole base could be electrically separated from earth by a paint or insulation medium a separate buried earth stake shall be provided and connected to the earth terminal provided in clause 7.4.



#### **4.2.4 Alternatives**

Where alternative materials or paint finishes are required to those described above the applicant shall submit full details of the proposed process and materials for review with the submission.

#### **4.2.5 Warranty**

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 to meet or exceed the Standards in section 3.2.1 of this manual. This certification shall be provided before installation of the columns & lanterns.

Materials and paint finishes of columns, and luminaire bodies shall be unconditionally guaranteed against fair wear and tear for a minimum of 10 years, commencing from the date of hand-over of the installation to Council.

#### **4.2.6 Inspection**

The paint manufacturer shall be responsible for inspections as necessary, sufficient to enable the specified warranty to be provided.

#### **4.2.7 Protection**

Immediately after painting and before transporting to the site the columns shall be individually wrapped in polythene "bubble wrap", or similar material, to protect the equipment from damage. The protective wrapping shall remain in place during the delivery and site storage phases.

The column shall be lifted into position with suitable soft surface straps to avoid damage to the finish. Immediately prior to or after erection as appropriate, the column wrapping shall be removed.

Any damage caused prior to the hand-over to the Manukau City Council shall be repaired as new with all warranties remaining intact. Where the damage is considered too severe the contractor shall, upon written instruction from Council, or their representative, replace the damaged equipment with new at no cost to MCC.

## **5 LUMINAIRES**

Only luminaires from MANARC approved suppliers shall be used.

Luminaires shall be manufactured in accordance with AS/NZS 60598.1, tested in accordance with AS/NZS 60598.2 and a Certificate of Compliance from an accredited, independent testing laboratory shall be provided.

The steel materials and fasteners shall be as given in NZS 3404.1 or AS 4100.

Dissimilar metals shall not be used in contact with one another. Where this is unavoidable the components shall be plated with a metal of intermediate potential to prevent any electrochemical reaction. In the case of screw fastenings the fastener shall be captive and the system shall be corrosion resistant for the service life of the equipment, i.e. 20 years.

## **5.1 OPTICAL PERFORMANCE**

The optical performance of the luminaire shall comply with the applicable standard (AS/NZS 1158) with respect to the objectives of the lighting, characteristics of the lanterns and the installation geometry parameters as described.

## **5.2 LIGHTING DESIGN**

The lighting design shall comply with the following standards as well as the additional constraints set out in this section.

- AS/NZS 1158.1 – For predominantly vehicular area (Category V) lighting.
- AS/NZS 1158.3 – For predominantly pedestrian area (Category P) lighting.
- AS 4282 – For control of the obtrusive effects of lighting (Relates to carpark and accent lighting. Accent lighting is lighting provided in addition to the minimum requirement for safety and security).

Category V5 will not be used.

### **5.2.1 Quantities**

Use the least quantity of luminaires that will satisfactorily meet the lighting parameters

### **5.2.2 Obtrusive Light**

Particular attention shall be given to AS 4282 and AS/NZS 1158.3.1, Clause 3.2.3.2, for the assessment of obtrusiveness to adjacent properties, other than public areas (eg. path, reserve or road).

### **5.2.3 Refractors**

In an effort to minimise the glare, luminaires which have optical control dominated by refractor control, or in which the lamp is positioned as to be more than 50% below the natural screened edge of the luminaire canopy (or opaque section), shall not be used in subdivisions containing residential properties.

However, refractors may be accepted for shopping / pedestrian precincts, etc.

### **5.2.4 Light Distribution**

The light distribution pattern for road lighting shall be asymmetric with a forward and sideways throw. Symmetrical patterns shall not be used for road lighting.

### **5.2.5 Rural Areas**

While road lighting in Rural Areas is suitably addressed in AS/NZS 1158, other lighting will need to be addressed on a case-by-case basis.

Primarily, since the ambient light and sky glow in Rural Areas is significantly less than that in built-up areas, the impact of obtrusive light is much greater.

AS 4282 (Control of the Obtrusive Effects of Outdoor Lighting) will be used as a guide in these situations.

The following design guidelines apply:

- Keep road lighting to the minimum applicable standard at intersections and road terminations.
- Minimise lighting beyond these areas (intersections and terminations). Only provide sufficient luminaires such that a pedestrian walking along the road always has a light in view, for orientation and guidance.

**5.2.6 Pedestrian Crossing Lighting**

Pedestrian Crossings shall be lit in accordance with the Traffic Regulations, AS/NZS 1158 and Transit New Zealand standard TR11 as appropriate for the road category. Particular consideration shall be given to the use of “white light” for illumination at pedestrian crossings.

**5.2.7 Roadway Lighting Column Locations**

The minimum column set back from face of kerb to face of column shall be 800mm, unless otherwise directed by MCC in writing. Refer standard road cross-section, drawing R5, section 6 of the MCC Engineering Quality Standards Manual.

Streetlighting columns shall generally be located in line with property boundary separations. Where this is impractical, columns shall be positioned to avoid future driveways. Normally this would mean positioning the column at the middle of a section frontage and avoiding properties with short frontages.

**5.2.8 Energy Efficiency**

The installation shall be designed for economic use of energy, applying the following principles:

- Low loss control gear (as per the table below).
- High power factor (  $\geq 0.95$  lagging, &  $< 1.0$ ).
- High efficacy lamps.

ATCO OM & OG series ballasts for HID lamps and LLEC series ballasts for fluorescent lamps meet the following requirements. Where fixture size or other practical constraints conflict with the following requirements, submit details for approval. Departures will only be considered for small quantities of fittings in any one development.

**Acceptable ballast loss factors for fluorescent lamps:**

Ballasts for fluorescent lamps shall meet the following Minimum Energy Performance Standards (MEPS) in accordance with NZHB 4783.2:

TYPE	ENERGY EFFICIENCY INDEX (EEI)
Ferromagnetic	B1
Electronic	A2
Dimmable electronic	A1

**Acceptable ballast loss factors for HID lamps:**

Mercury Vapour	
Lamp W	Loss W (hot)
80	9.5
125	12
175	15
250	19.5
400	23
700	32
1000	48

Metal Halide	
Lamp W	Loss W (hot)
50	9
70	13.5
100	13.5
150	19
250	20
400	25
1000	50

High Pressure Sodium	
Lamp W	Loss W (hot)
50	10.5
70	12
100	14
150	18
250	25
400	35
600	42
1000	60

**Fluorescent lamp efficacy**

All fluorescent lamps of length 550 mm or greater shall comply with NZHB 4782.2. In particular, they shall meet the requirements of Class R in relation to lamp efficacy.

**5.2.9 Adjacent Access Routes**

Where the primary area to be lit is accessed by a road, path or similar that is also required by the MCC to be lit as part of the development conditions, the accessway shall be lit to the same standard with lighting systems of similar appearance and quality as those in the primary area.

**5.2.10 Alternative Solutions**

Design solutions utilising computer calculations based upon CIE standards are acceptable provided that clear correlation is supplied to prove equivalence with AS/NZS 1158 requirements for the specific project parameters.

**5.3 MAINTENANCE AND SERVICEABILITY**

Lamp and control gear compartments shall be accessible for servicing within 60 seconds of commencement of work, without the requirement for special tools.

The luminaire control gear shall be readily maintainable without the need to dismantle significant portions of the luminaire. Where feasible, a removable gear tray shall be provided.

Removable sections of the lantern, i.e. lenses, visors, cover glass and gear tray assemblies, shall be secured by means of a lanyard or hinge type arrangement for safety and ease of maintenance.

**6 EQUIPMENT & COMPONENTS**

Electrical equipment & components shall be manufactured to comply with the applicable New Zealand, or International Standards and shall be readily available as spare parts. These components shall be incorporated into the lantern or in the column, be protected against the ingress of moisture and be easily accessible for repair or replacement. Warranties on these components shall be the manufacturers' standard warranty, but no less than 12 months, and be applicable from the date of hand-over of the installation to Council.

## 6.1 LAMPS

Standard lamp wattages preferred by MCC are 250 watt, 150 watt, and 70 watt.

For normal street lighting High Pressure Sodium lamps shall be used (Metal-halide may be considered subject to written approval by the MCC). For other areas and tasks, e.g. parks & reserves, either metal-halide or mercury-vapour can be used. Details of these shall be included on the submission drawings.

## 7 ELECTRICAL

### 7.1 PERMITS

Make application to the Network Supplier for permits and approvals as required to complete the work. All work shall be carried out in accordance with the Electricity Regulations 1997 and the applicable Electrical Codes of Practice. **In addition work shall be in accordance with the Network Supplier's Street Lighting Standard with respect to pilot cable installation.**

### 7.2 POWER CHARGES

The Developer shall be responsible for notifying the Power Supplier / Vector / Trust Power etc. of when the new street lights are commissioned and for direct payment to the Power Supplier of all line and energy charges covering the period up until the "Hand-over to Council".

### 7.3 CABLING

#### 7.3.1 Supply to columns

All supply cables shall be underground unless agreed in writing by Manukau City Council.

If any new power supply cable is required to be installed it is to be minimum 16mm<sup>2</sup> two core PVC insulated neutral screened with soft drawn copper conductors, having a heavy grade sheath of radial thickness no less than 3.2mm. The size of neutral screened cable is to be determined by the Contractor taking into account the allowable voltage drop. AS/NZS 3008.2.1 shall be used to determine current, thermal and voltage drop ratings.

Road crossings and sealed areas shall be thrust and ducted.

#### 7.3.2 Cabling within Columns

New wiring within columns and outreaches shall be TPS cable. Cables and flexible cords will be standard conductor type and a minimum size of 1.5mm<sup>2</sup> for cables and 32/0.20mm<sup>2</sup> for flexible cords.

All cabling within the streetlight column will be terminated in a proprietary in-line plug and socket-fuse combination or on an Engineer approved insulated panel, as defined in the "Fuses" section.

Heat resistant wiring shall be used where ends are exposed to temperatures above 75<sup>0</sup> C.

#### 7.3.3 Identification

All cores shall be phase identified with, if necessary, a coloured PVC sleeve firmly attached to the core.

A polythene signal strip as per the utility service provider (bright orange with warning message) will be installed to protect the cable.

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### 7.3.4 Routes

Search on site and on any drawings that are available for evidence of existing underground services, or factors that may affect the installation of cables and/or ducts on the proposed routes. Any services exposed or damaged during trenching shall be reported immediately and any damage caused to existing services during the course of the work shall be made good at no cost to MCC.

### 7.3.5 Spacing

Minimum cable spacing from other services shall be as follows:

HV	300 mm
MV or LV	150 mm
Water or Gas	200 mm
Telephones	200 mm
Fibre Optics	500 mm

### 7.3.6 Fuses

All fuses shall comply with AS/NZS 60269 for HRC cartridge fuses.

The rated breaking capacity of 90 kA/415 Volts AC will apply with Class Q1 general fuse links for industrial purposes unless detailed otherwise.

Provide an HRC fuse and fuse holder, for and at, each luminaire or column.

Within road lighting columns, use a proprietary in-line plug & socket-fuse combination (Tradeline Buchanan in-line kits or equal approved). This shall be located & fixed to the manufacturer's recommendations to ensure the best opportunity for the lower portion to remain intact following a car-column collision. Ensure sufficient slack in the incoming cable to enable the fuse to be pulled up to the gear door for changing.

If an in-line plug and socket fuse combination is not practical, then an approved insulated panel may be used with permission of the engineer. The panel shall be compliant with current electrical regulations and be securely fixed at the base of the pole just inside the cover plate upon which the fuse holder shall be bolted. The supply cable/connection shall be made in an approved insulated terminal block with a PVC insulated conductor from the terminal block into the fuse base. The earth shall be terminated on the body of the pole by drilling and affixing with a suitable galvanised nut and bolt, with a crimped terminal fitting on the earth cable.

Where in-line kits are not used a proven method to restrict condensation and moisture entering the fuse holder shall be provided.

## 7.4 EARTHING

Each column shall be earthed. An appropriate earthing tag shall be provided for this purpose.

The earthing cable is to be a single 10mm<sup>2</sup> stranded copper cable.

The Contractor will ensure that all new steel poles have earths terminating in the body of the pole by drilling and affixing with a suitable galvanised nut and bolt with a crimped terminal fitting on the earthed cable. They are to be securely fixed to the approved insulated panel and all cables are to be continuous between the terminals.

Inspection covers are to be earthed as above.

---

## 8 INSTALLATION

Installation of streetlights/columns shall be in accordance with AS/NZS 1158.1.3, Section 12 and this document.

On installation of the new light unit a 'first service' inventory of all components is to be carried out and submitted to Council.

All new or upgraded installations will require a Certificate of Electrical Compliance. This certificate will be forwarded to the Engineer prior to payment of any works.

### 8.1 LOCATION

The location of each light/column shall be clearly marked on the drawing(s) submitted to Council for review. Ensure all underground services are located and safe before the commencement of any excavation work. Where underground services obstruct the installation of the light/column, seek the Engineer's approval to relocate the column.

### 8.2 COLUMNS

Roadway lighting columns shall be complete with lantern mounting spigot, base mounted 6 Amp HRC fuse, 2 core 1.5 mm<sup>2</sup> (minimum) PVC/PVC cable to lantern, terminal and control gear space and base shear flange as required with access and underground cable.

Cables shall be connected to proprietary terminals within the chamber. Tee crimp connections shall not be used. The access aperture for the fuse holder shall be no less than 120 mm wide x 240 mm high to enable safe & easy removal of the fuse holder (Structural integrity shall be maintained).

Provide an earth tag within each column and luminaire.

Access facilities for small diameter (low height) columns (eg. for path & area lighting) shall be designed to provide safe and easy maintenance access. Details shall be submitted for approval.

#### 8.2.1 Frangible & Shear Base Columns

Frangible or shear base columns shall be used for all major intersections and appropriate locations as per the guidelines in AS/NZS 1158, Part 1.3, Appendix B.

The selection (frangible vs. shear base), installation, alignment and fixing are critical. These shall be strictly in accordance with AS/NZS 1158, as well as the manufacturers' instructions and recommendations.

Certification shall be provided prior to practical completion that all bolts on shear base poles have been torqued to the settings recommended by the manufacturer.

#### 8.2.2 Erection

The columns shall be erected:

- Vertical to within +/- 2 degrees
- Outreach arms within +/- 2 degrees of normal to the edge of carriageway.
- To ensure the correct roll. Lanterns shall be mounted +/- 2 degrees parallel to the road surface in the driving direction.
- On flange base ground stubs or foundation pads. These shall be neatly back filled with cast in-situ concrete and finished with a neat concrete surround and within 50 mm of final ground level.

Details of embedment depth requirements shall be calculated using the charts and tables contained in Appendix B.



## Appendix A

### Calculating Required Column Strength

## 9 APPENDIX A: CALCULATING REQUIRED COLUMN STRENGTH

### Wind Loadings

Table A1.1: Wind Pressures (kPa)

<b>WIND ZONE</b>	L (Low)	M(Medium)	H(High)	VH(Very High)	SD(Specific Design)
<b>Pressure, qz (kPa)</b>	0.61	0.82	1.16	1.50	2.60

### *MODIFICATION FACTORS FOR MINIMUM COLUMN STRENGTHS*

Table A2.1: Drag Coefficient Modification Factors for Minimum Column Strengths

<b>Section Shape</b>	<b>Modification Factor</b>
Circular	1.00
Square	1.33
Octagonal	1.17
12 Sided Polygon	1.08

Table A2.2 is based on the following:

- Drag coefficients for circular sections of 1.2, square sections of 1.6, Octagon sections of 1.4, and 12 sided polygons of 1.3.
- Modification Factors are the same for all wind zones and soil types.
- Minimum column strengths obtained from the corresponding charts are to be multiplied by the above factors as applicable.

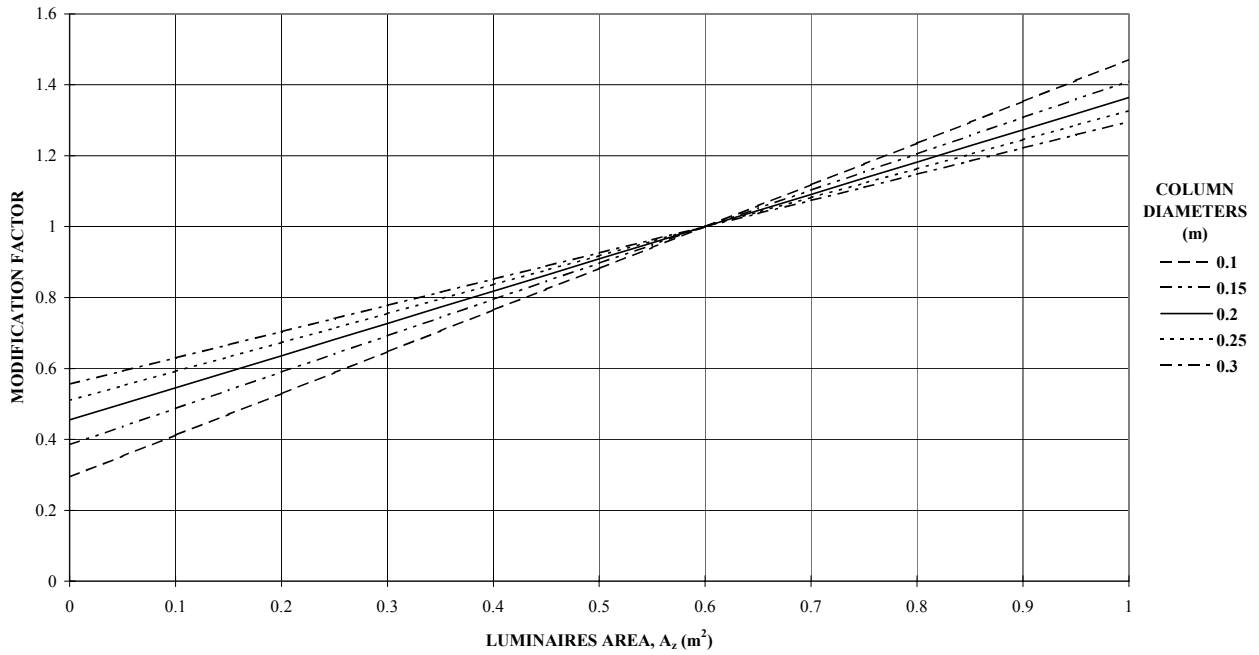
Figures A2.1, A2.2, A2.3, A2.4 and A2.5 are based on the following:

- Circular section with a drag coefficient of 1.2.
- Modification Factors are the same for all wind zones and soil types.
- Minimum column strengths obtained from the corresponding charts are to be multiplied by the above factors as applicable.

**Table A2.2 : Luminaires Area Modification Factors for Minimum Column Strengths**

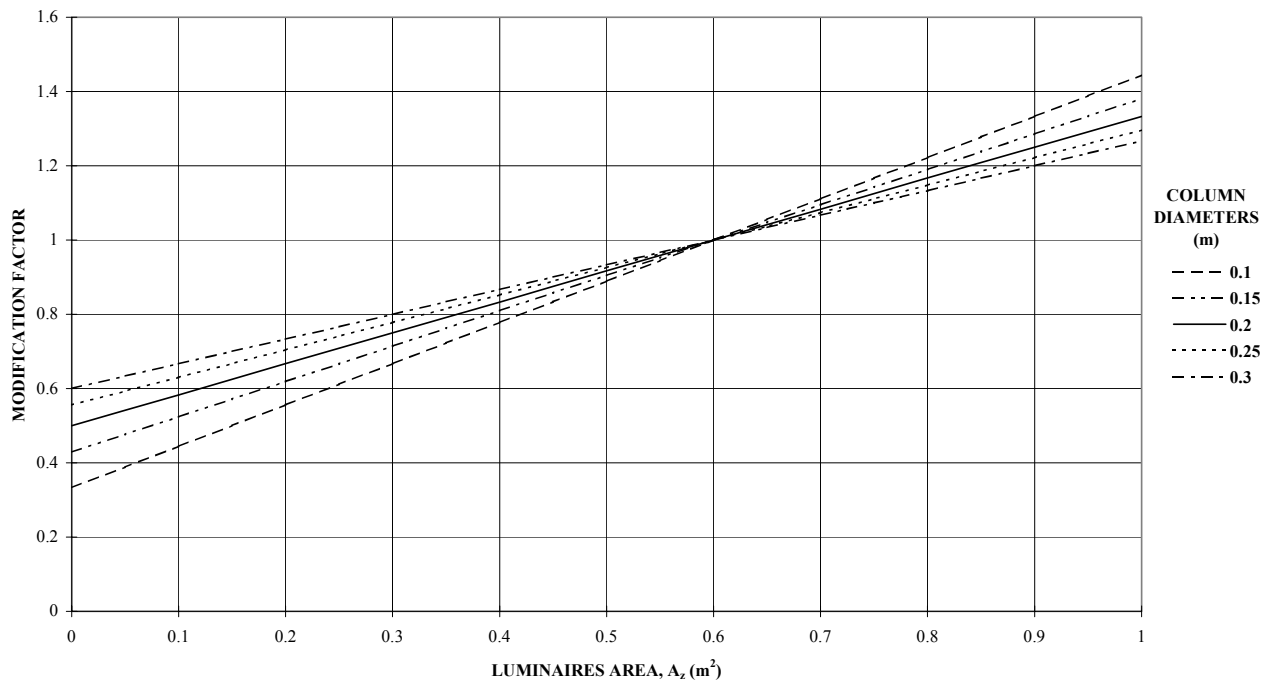
COLUMN HEIGHT (m)	COLUMN DIAMETER (m)	LUMINARIES AREAS, Az (m <sup>2</sup> )										
		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
6.5	0.1	0.294	0.412	0.529	0.647	0.765	0.882	1	1.118	1.235	1.353	1.471
	0.15	0.385	0.487	0.59	0.692	0.795	0.897	1	1.103	1.205	1.308	1.41
	0.2	0.455	0.545	0.636	0.727	0.818	0.909	1	1.091	1.182	1.273	1.364
	0.25	0.51	0.592	0.673	0.755	0.837	0.918	1	1.082	1.163	1.245	1.327
	0.3	0.556	0.63	0.704	0.778	0.852	0.926	1	1.074	1.148	1.222	1.296
7.5	0.1	0.385	0.487	0.59	0.692	0.795	0.897	1	1.103	1.205	1.308	1.41
	0.15	0.484	0.57	0.656	0.742	0.828	0.914	1	1.086	1.172	1.258	1.344
	0.2	0.556	0.63	0.704	0.778	0.852	0.926	1	1.074	1.148	1.222	1.296
	0.25	0.61	0.675	0.74	0.805	0.87	0.935	1	1.065	1.13	1.195	1.26
	0.3	0.652	0.71	0.768	0.826	0.884	0.942	1	1.058	1.116	1.174	1.232
8.5	0.1	0.415	0.512	0.61	0.707	0.805	0.902	1	1.098	1.195	1.293	1.39
	0.15	0.515	0.596	0.677	0.758	0.838	0.919	1	1.081	1.162	1.242	1.323
	0.2	0.586	0.655	0.724	0.793	0.862	0.931	1	1.069	1.138	1.207	1.276
	0.25	0.639	0.699	0.759	0.82	0.88	0.94	1	1.06	1.12	1.18	1.241
	0.3	0.68	0.733	0.787	0.84	0.893	0.947	1	1.053	1.107	1.16	1.213
10	0.1	0.455	0.545	0.636	0.727	0.818	0.909	1	1.091	1.182	1.273	1.364
	0.15	0.556	0.63	0.704	0.778	0.852	0.926	1	1.074	1.148	1.222	1.296
	0.2	0.625	0.688	0.75	0.813	0.875	0.938	1	1.063	1.125	1.188	1.25
	0.25	0.676	0.73	0.784	0.838	0.892	0.946	1	1.054	1.108	1.162	1.216
	0.3	0.714	0.762	0.81	0.857	0.905	0.952	1	1.048	1.095	1.143	1.19
12	0.1	0.5	0.583	0.667	0.75	0.833	0.917	1	1.083	1.167	1.25	1.333
	0.15	0.6	0.667	0.733	0.8	0.867	0.933	1	1.067	1.133	1.2	1.267
	0.2	0.667	0.722	0.778	0.833	0.889	0.944	1	1.056	1.111	1.167	1.222
	0.25	0.714	0.762	0.81	0.857	0.905	0.952	1	1.048	1.095	1.143	1.19
	0.3	0.75	0.792	0.833	0.875	0.917	0.958	1	1.042	1.083	1.125	1.167

**FIGURE A2.1: Luminaires Area Modification Factors For Column Strengths - 6.5m HIGH COLUMNS**



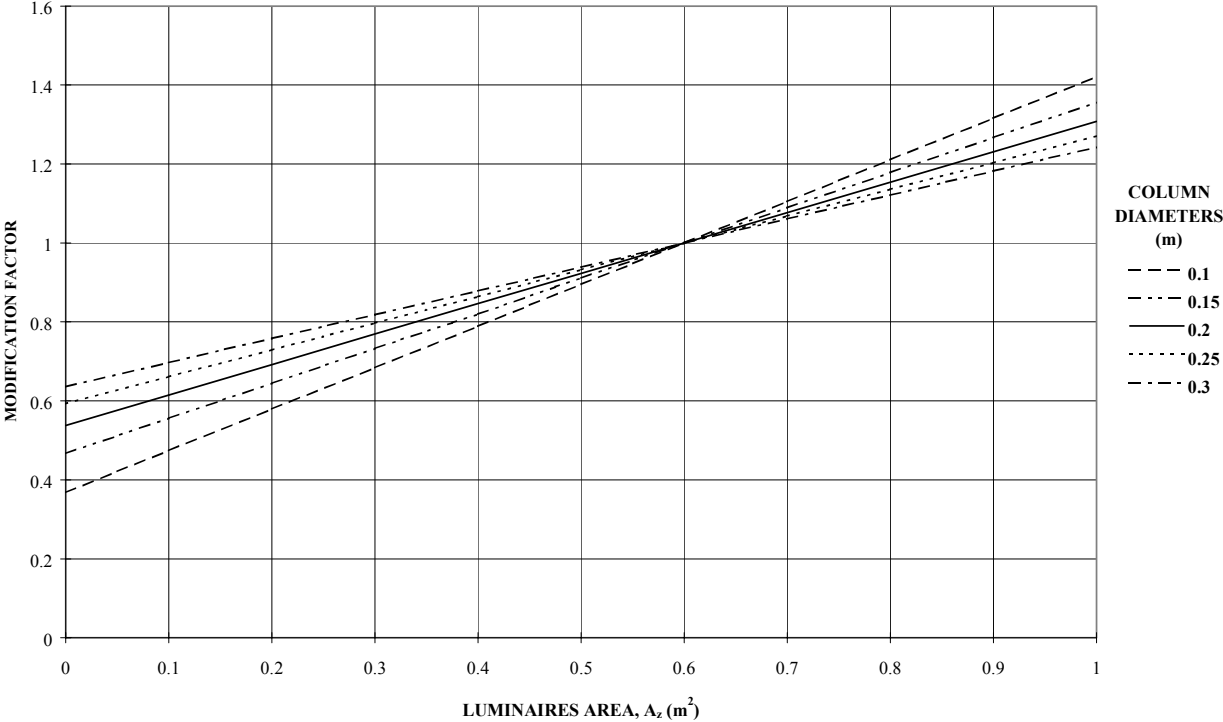
**NB:** Modification Factors are based on a circular section, a drag coefficient factor needs to be applied to other section shapes as well as the above factor. Luminaires Area Modification Factors apply for all wind zones.

**FIGURE A2.2: Luminaires Area Modification Factors For Column Strengths - 7.5m HIGH COLUMNS**



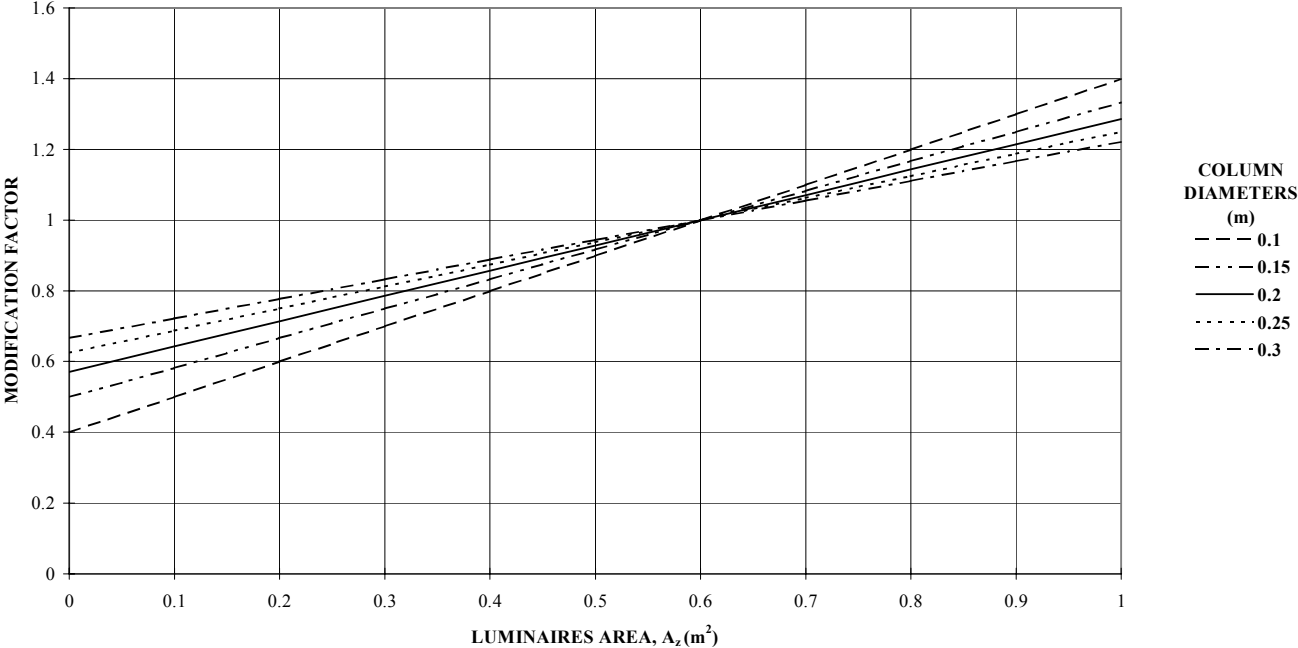
**NB:** Modification Factors are based on a circular section, a drag coefficient factor needs to be applied to other section shapes as well as the area factor. Luminaires Area Modification Factors apply for all wind zones.

**FIGURE A2.3: Luminaires Area Modification Factors For Column Strengths - 8.5m HIGH COLUMNS**



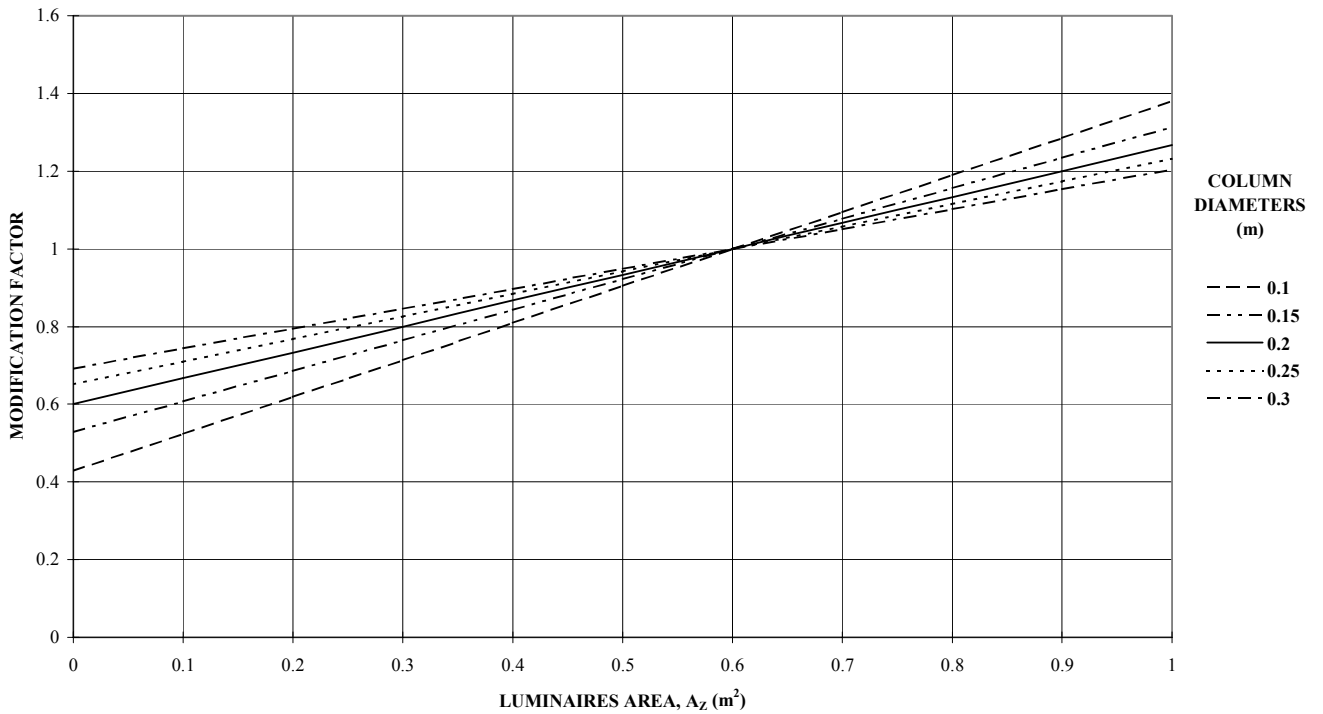
**NB:** Modification Factors are based on a circular section, a drag coefficient factor needs to be applied to other section shapes as well as the above factor. Luminaires Area Modification Factors apply for all wind zones.

**FIGURE A2.4: Luminaires Area Modification Factors For Column Strengths - 10m HIGH COLUMNS**



**NB:** Modification Factors are based on a circular section, a drag coefficient factor needs to be applied to other section shapes as well as the area factor. Luminaires Area Modification Factors apply to all wind zones.

**FIGURE A2.5: Luminaires Area Modification Factors For Column Strengths - 12m HIGH COLUMNS**



**NB:** Modification Factors are based on a circular section, a drag coefficient factor needs to be applied to other section shapes as well as the area factor. Luminaires Area Modification Factors apply to all wind zones.

**FIGURE A2.6: Minimum Section Modulus for G250 CIRCULAR STEEL SECTIONS**

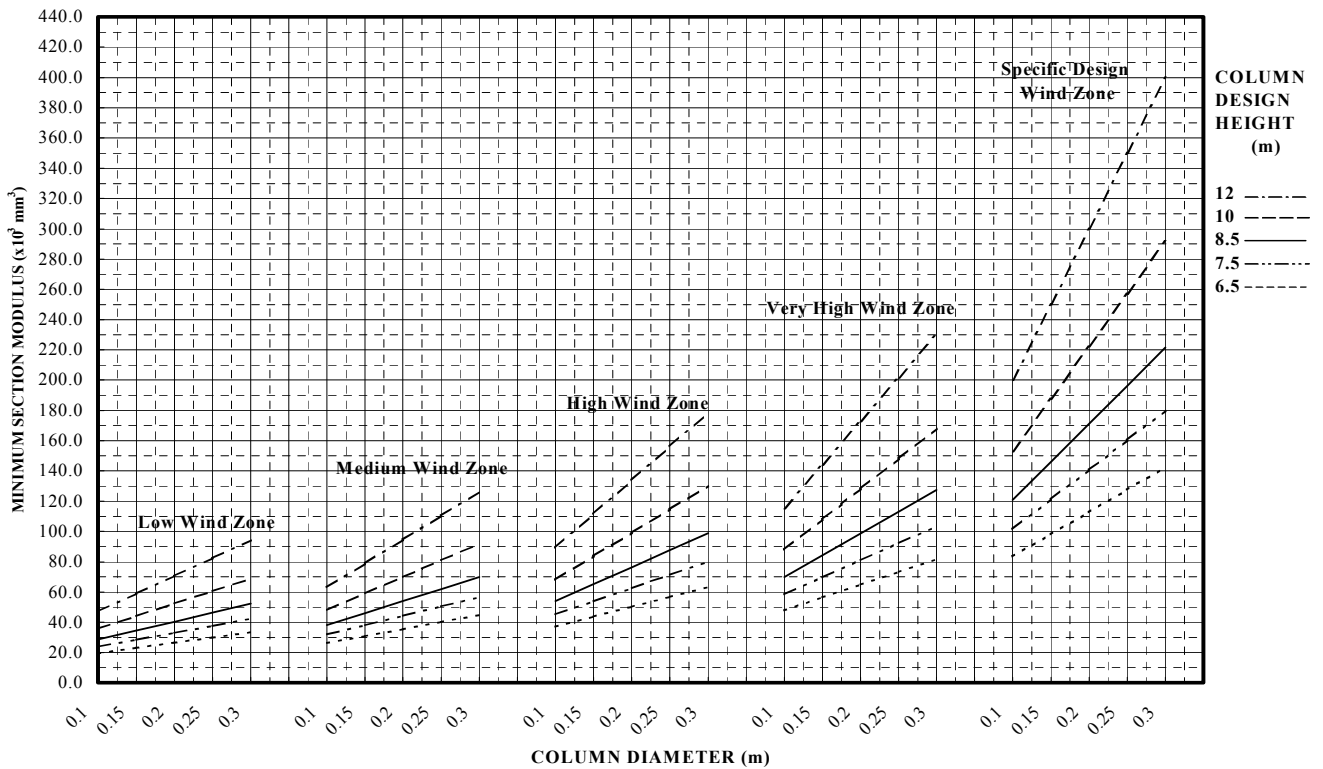


FIGURE A2.7: Minimum Lighting Column Strength for G350 CIRCULAR STEEL SECTIONS

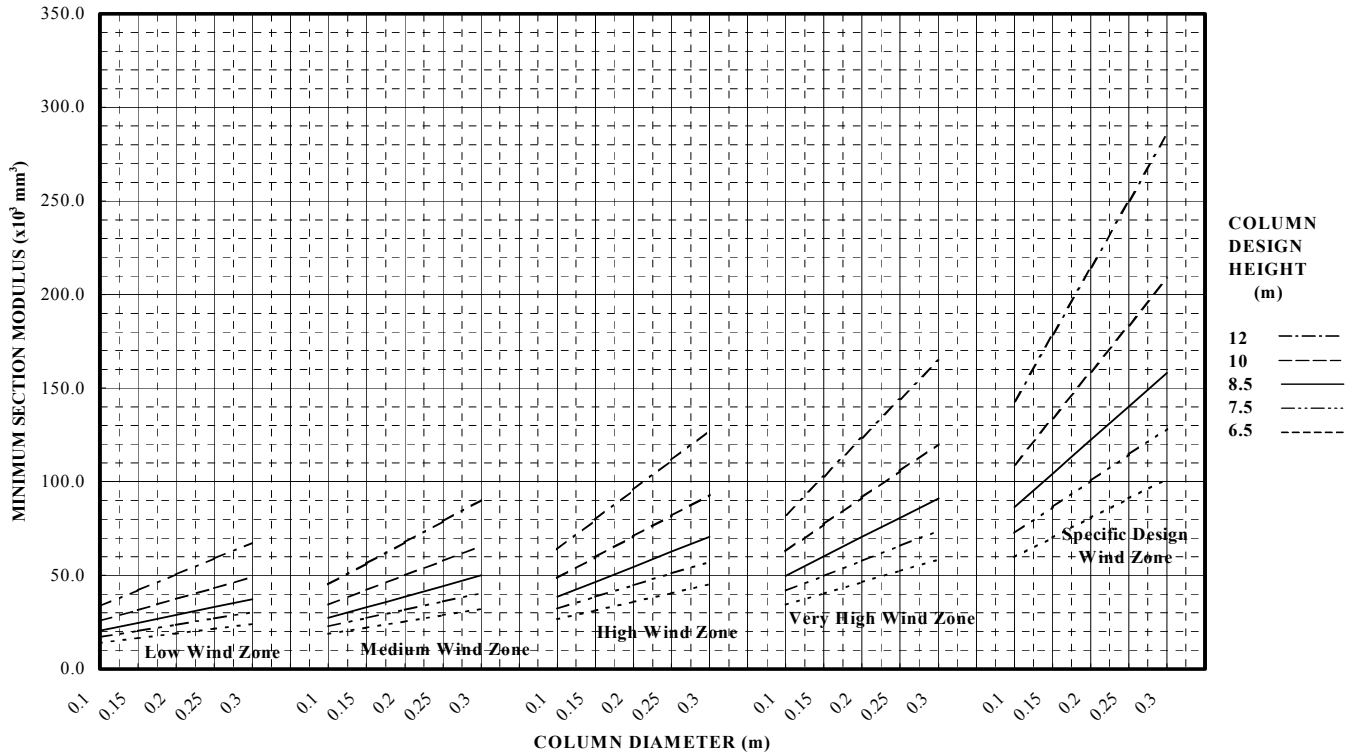
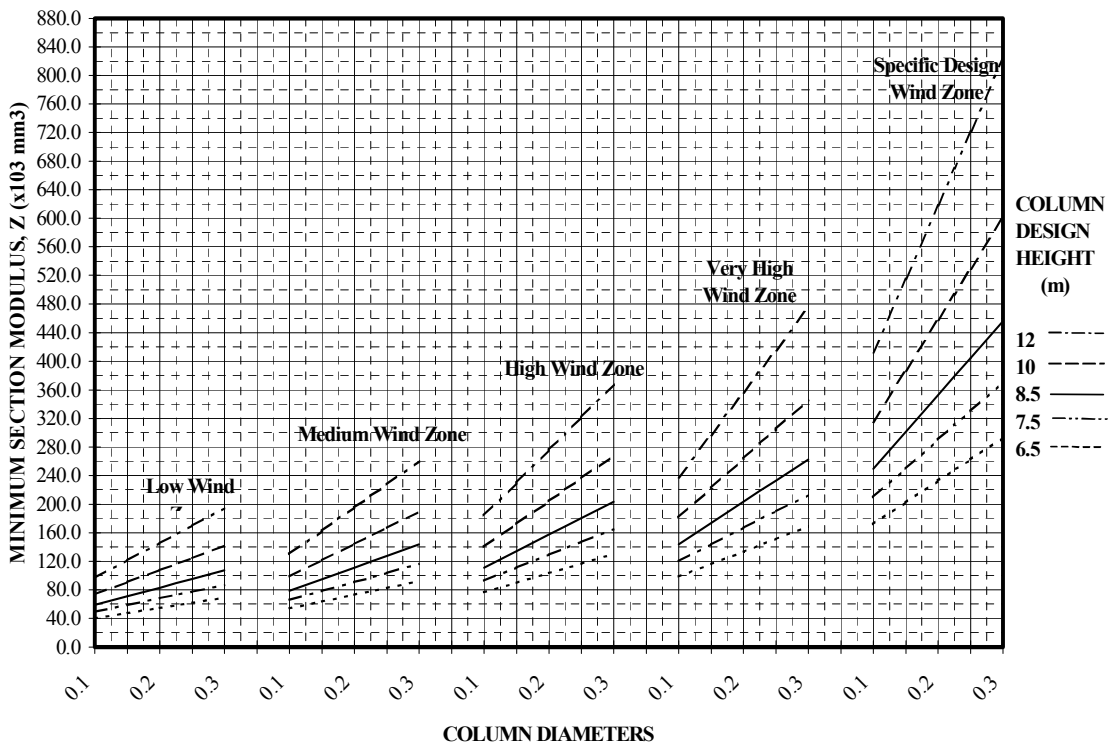


FIGURE A2.8: Minimum Section Modulus, Z, for 6061-T5 ALUMINIUM SECTIONS





**Legend**

- Low
- Medium
- High
- Very High
- Specific Design



**MANUKAU CITY COUNCIL  
CORPORATE STANDARDS FOR  
STREET LIGHTS IN SUBDIVISIONS**

**WIND ZONES**  
Sheet 1 of 3

File No: **7046/7**

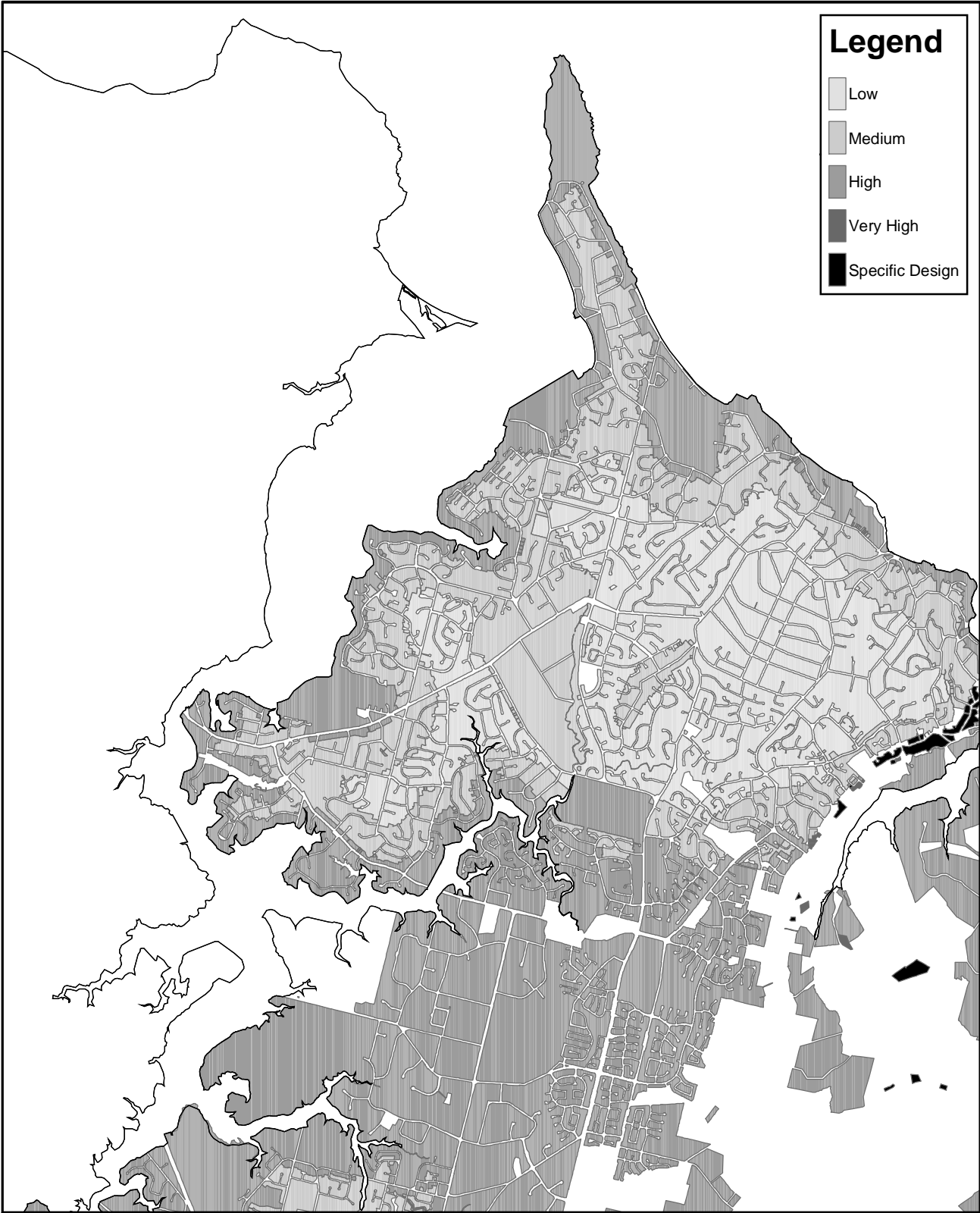
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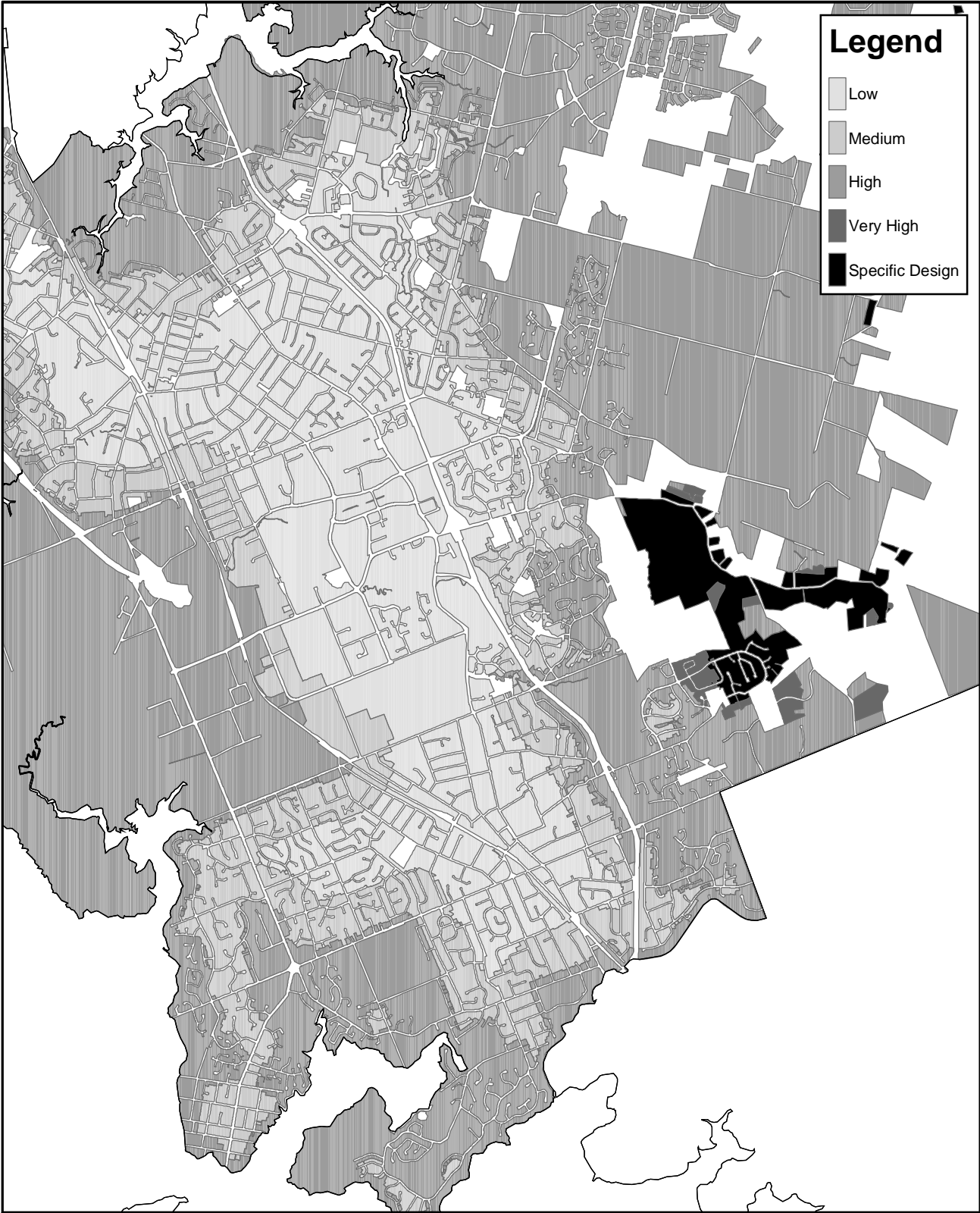




**Legend**

- Low
- Medium
- High
- Very High
- Specific Design

 <small>Te Kaitiaki o MANUKAU City Council</small>	<p><b>MANUKAU CITY COUNCIL CORPORATE STANDARDS FOR STREET LIGHTS IN SUBDIVISIONS</b></p>	<b>WIND ZONES</b>	SCALE 1:60,000	 <b>N</b>
		Sheet 2 of 3	DISCLAIMER	
		File No: <b>7046/7</b>	<small>This plan is supplied for information only. The council accepts no liability for any error whatsoever. Copyright (c) 2003 Manukau City Council</small>	



**Legend**

- Low
- Medium
- High
- Very High
- Specific Design

 <small>Te Kaunthara o <b>MANUKAU</b> City Council</small>	<p><b>MANUKAU CITY COUNCIL CORPORATE STANDARDS FOR STREET LIGHTS IN SUBDIVISIONS</b></p>	<p><b>WIND ZONES</b> Sheet 3 of 3</p>	<p>SCALE 1:60,000</p>	 <p>N</p>
		<p>File No: <b>7046/7</b></p>	<p><b>DISCLAIMER</b> This plan is supplied for information only. The council accepts no liability for any error whatsoever. Copyright (c) 2003 Manukau City Council</p>	

## Appendix B

# Calculating Foundation Requirements

## 10 APPENDIX B: CALCULATING FOUNDATION REQUIREMENTS

### Embedment

Soil types as per table B.1 are based on the following qualitative assessment in the field:

Table B.1: Soil Type Classification

	Soil Type	Description	$S_u$ (kPa)*
1	Topsoil	Friable containing organic matter	20
2	Soft Clays	Readily squeezed through fingers	35
3	Medium Clays	Can be deformed with some effort	50
4	Hard Clays, Tuff, Rock	Difficult to deform by hand	75

#### Note:

- $S_u$  is the assumed undrained shear strength used in embedment calculations.
- Soil testing may be required if any doubt exists as to the correct category to be used.
- \*Embedment depths are to be taken from the top to the bottom of the concrete pile.
- Pile diameters are assumed to be the street light column diameter plus 100mm minimum. Larger diameters may utilise smaller embedments.
- Minimum concrete strength for piles is to be 17.5 MPa @ 28 days.
- Cover to unprotected steel to be not less than 75mm.

### MODIFICATION FACTORS FOR EMBEDMENT DEPTHS

#### a) Shape Modification Factors For Embedment Depths

Table B.2: Drag Coefficient Modification Factors for EMBEDMENT DEPTHS

Section Shape	Modification Factor
Circular	1.00
Square	1.18
Octagonal	1.09
12 Sided Polygon	1.05

Table B.2 is based on the following:

- Drag coefficients for circular sections of 1.2, square sections of 1.6, Octagon sections of 1.4, and 12 sided polygons of 1.3.
- Modification Factors are the same for all wind zones and soil types.
- Embedment depths obtained from the corresponding charts are to be multiplied by the above factors as applicable.

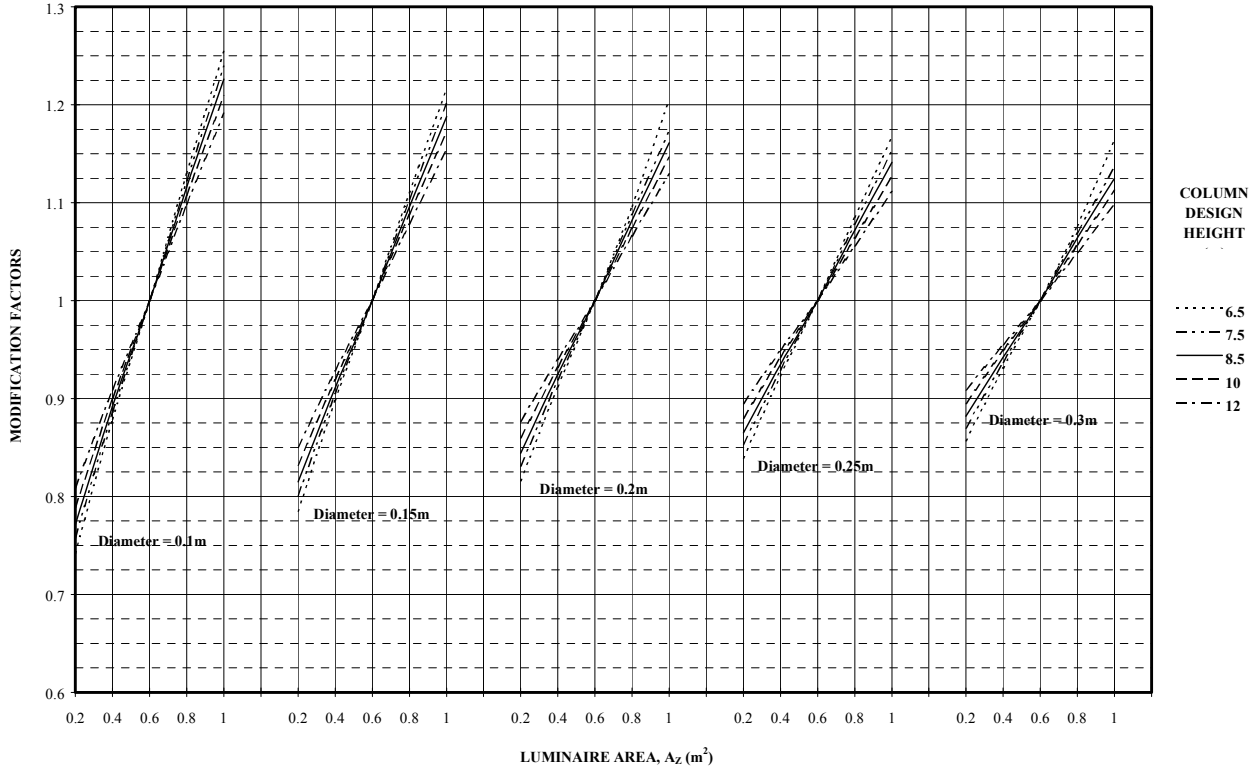
#### b) Luminaires Area Modification Factors for EMBEDMENT DEPTHS

Figure B1.1 shall be used to obtain a modification factor for varying frontal areas.

Figure B1.1 is based on a circular section with a drag coefficient of 1.2

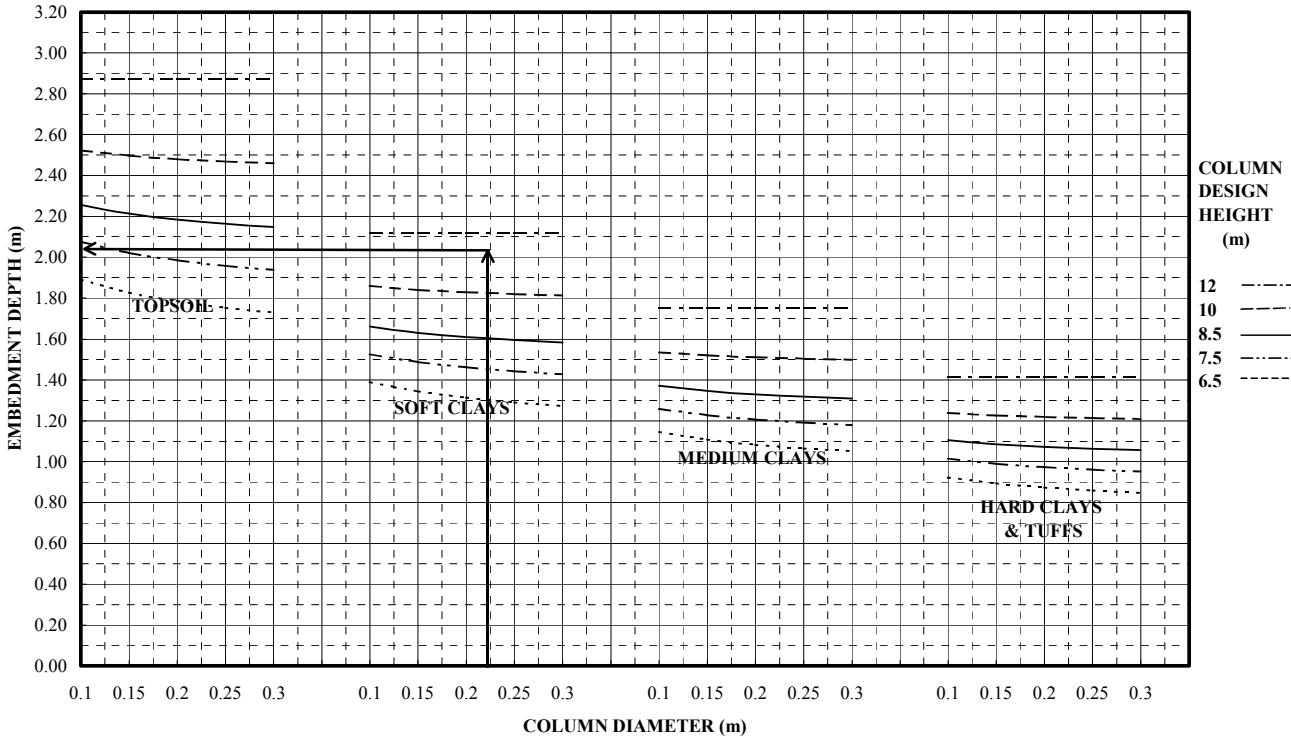
Modification Factors apply for all wind zones.

**FIGURE B1.1: Luminaires Area Modification Factors For Column Embedment Depths**

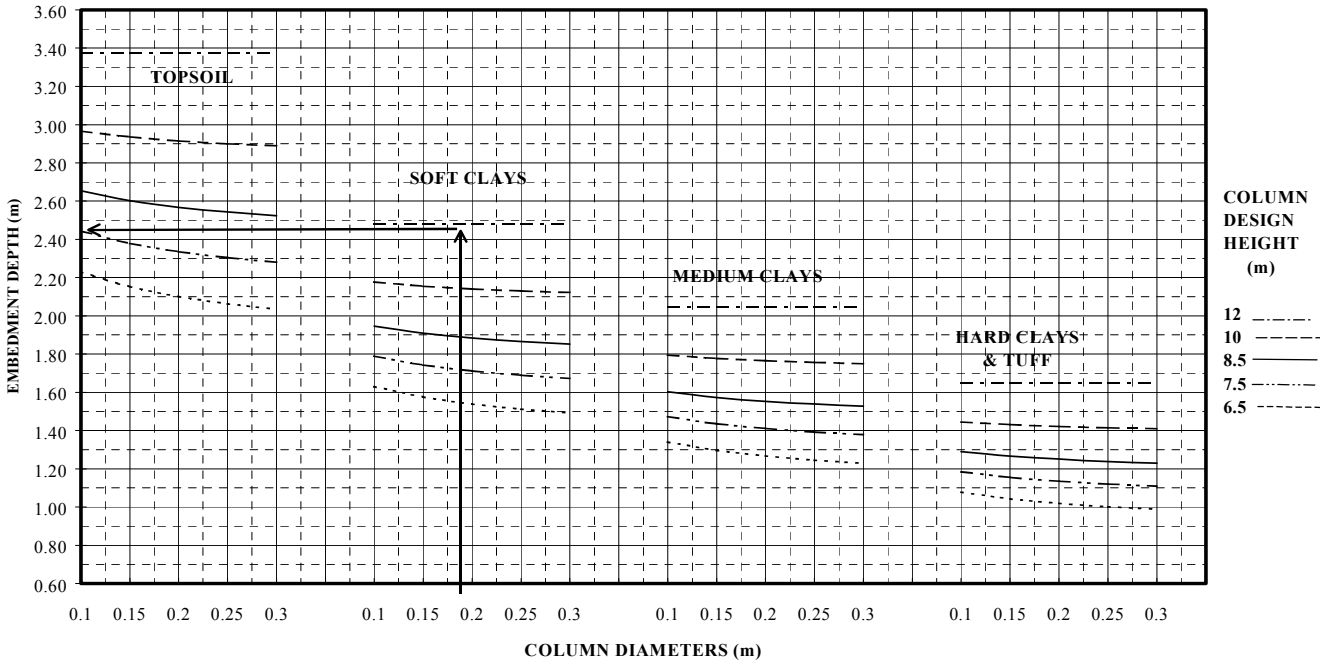


**NB:** Modification Factors are based on a circular section, a shape factor needs to be applied for other section shapes.  
Luminaires Area Modification Factors apply to all wind zones.

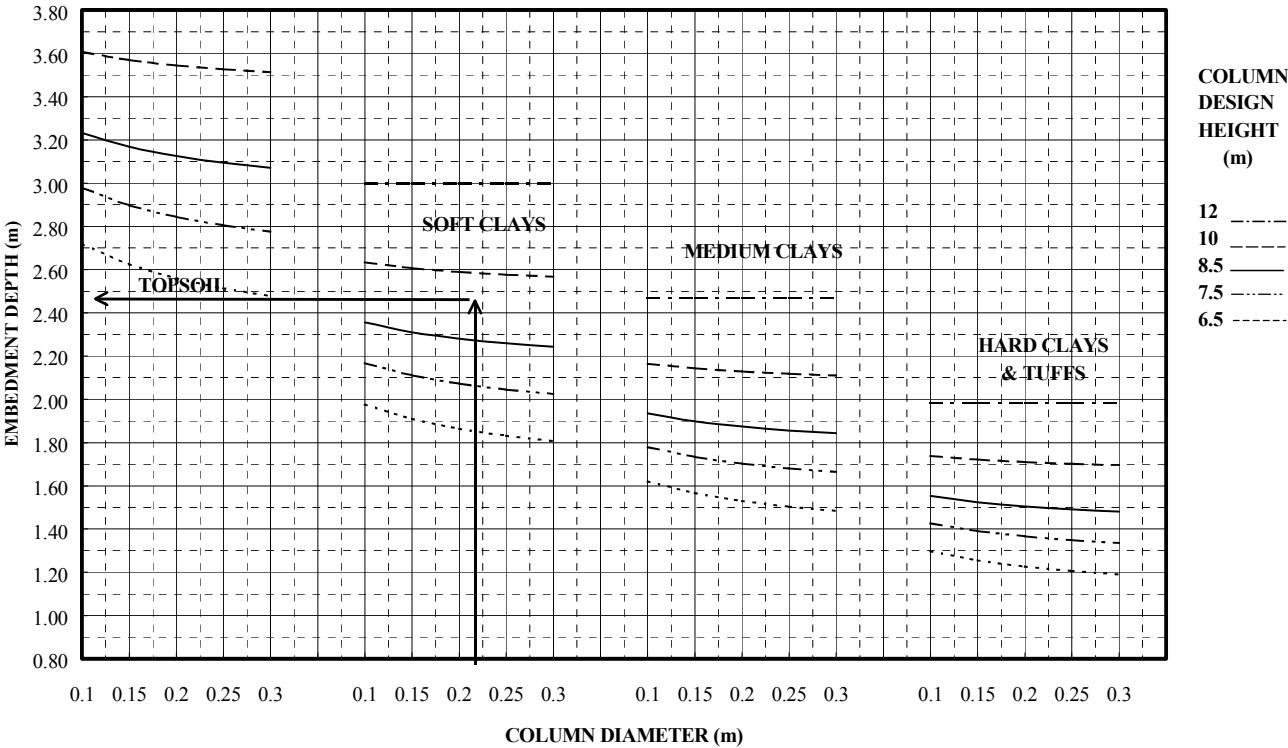
**FIGURE B1.2: Embedment Depths of Columns for LOW WIND ZONES**



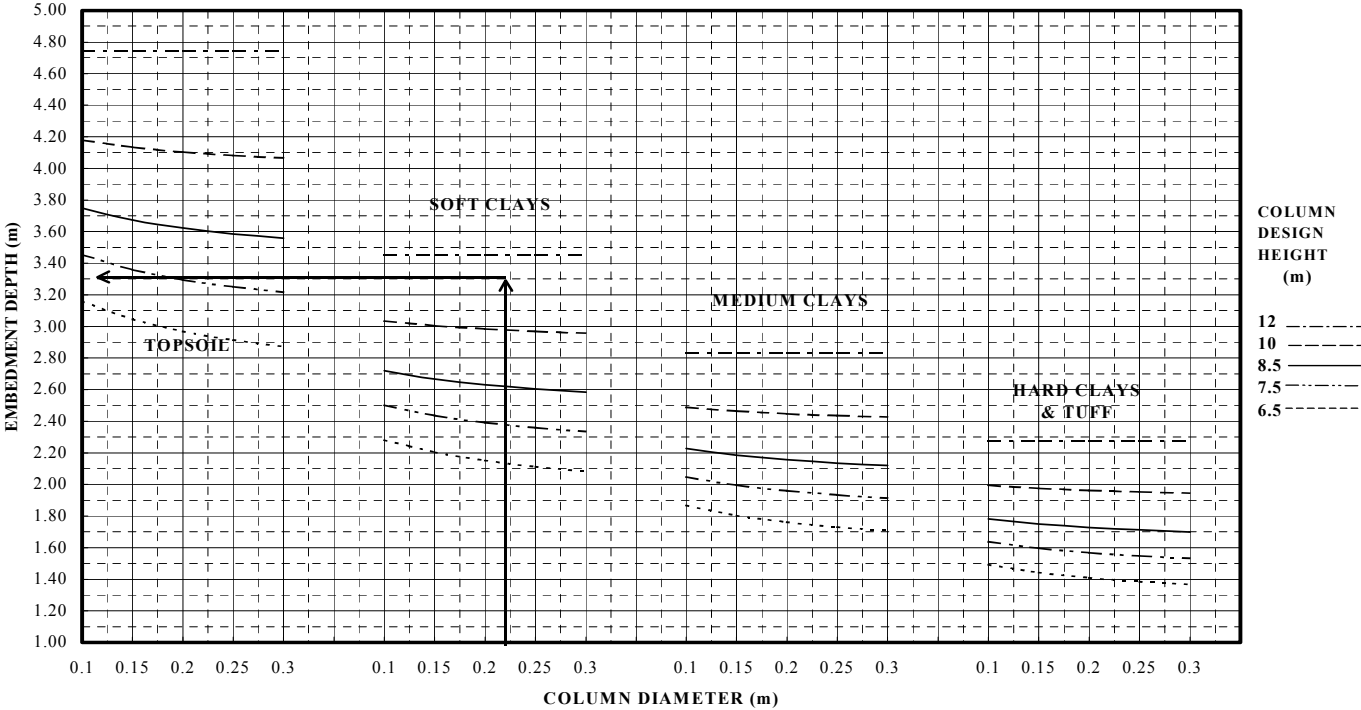
**FIGURE B1.3: Embedment Depths of Columns for MEDIUM WIND ZONES**



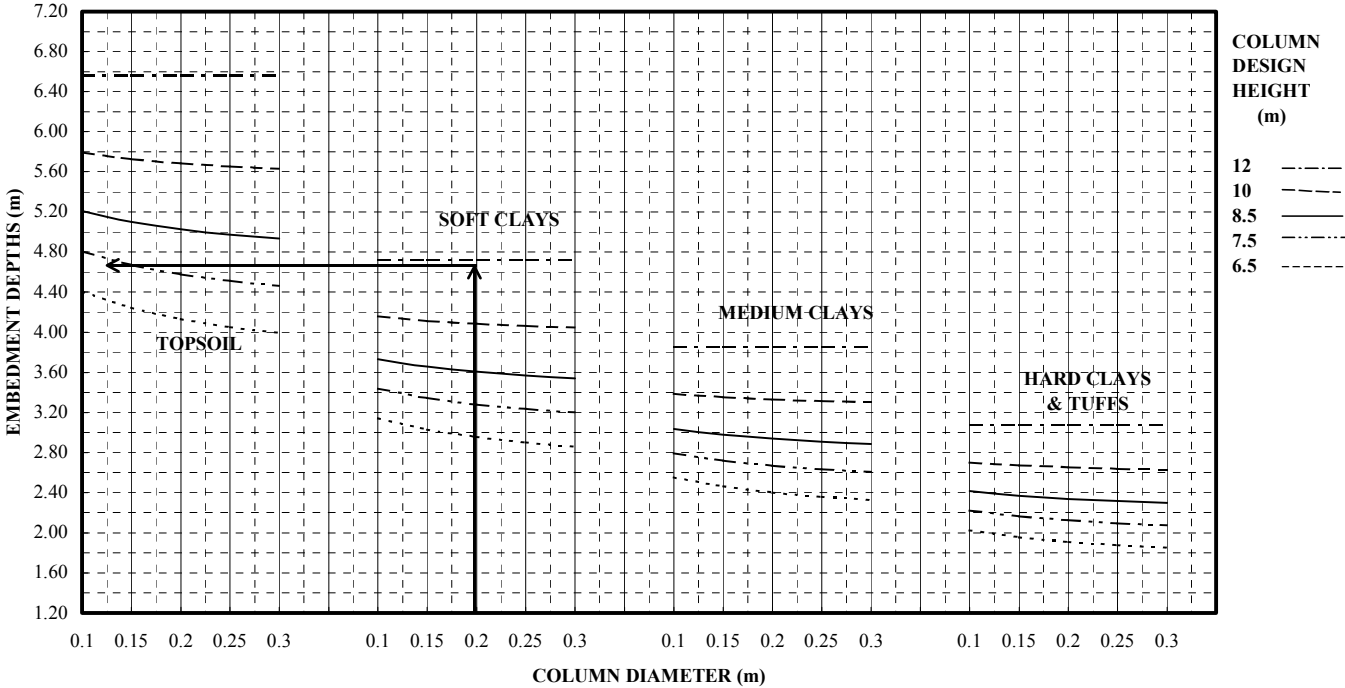
**FIGURE B1.4: Embedment Depths of Columns for HIGH WIND ZONES**



**FIGURE B1.5: Embedment Depth of Columns for VERY HIGH WIND ZONES**



**FIGURE B1.6: Embedment Depths of Columns for SPECIFIC DESIGN WIND ZONES**



## Appendix C

### Guide To Application and Checklist



## **11 APPENDIX C: GUIDE TO APPLICATION AND CHECKLIST**

All Review Forms and the Application Checklist shall be completed and attached with each submission. Use a separate Review Form for each section of road if required.

**MANUKAU CITY COUNCIL SUB-DIVISION STREETLIGHTING REVIEW FORM**

	<i>Please enter the required information below:</i>
<b>Names and Lighting Categories (e.g. V1 - V4, P1 – P12) of roads / areas involved</b>	
<b>Name of the MCC roading engineer who supplied the categories of the roads / areas involved</b>	
<p><b><i>Luminaire details</i></b></p> <p>Manufacturer and product name</p> <p>Lamp type and rating</p> <p>Luminous flux</p> <p>Origin of the photometric data</p>	
<p><b><i>Computer Design assumptions</i></b></p> <p>Name and source of the computer program</p> <p>Road surface reflectance used</p> <p>Maintenance factor used</p>	
<p><b><i>Design result – for straight or curved roads</i></b></p> <p>Min. average carriageway luminance</p> <p>Min. overall luminance uniformity</p> <p>Min. longitudinal luminance uniformity</p> <p>Max. threshold increment</p> <p>Min. surround illuminance ratio</p> <p>Max. upward waste light ratio</p>	
<p><b><i>Design result – for intersections, junctions, and other specified locations</i></b> (Isolux plots shall be provided)</p> <p>Min. illuminance</p> <p>Max. illuminance uniformity</p> <p>Max. upward waste light ratio</p>	

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## APPLICATION CHECKLIST

The following items have been included with this submission:

Tick here:

1. A covering letter identifying the project, listing the enclosures and providing full contact details (contact name, company, phone, fax & e-mail).
2. A site plan showing:
  - the proposed locations of all columns included in the project.
  - the Mounting height, Overhang, and Upcast angle of each luminaire.
  - the existing columns & luminaires affecting or contributing to the proposed system clearly marked as existing.
3. An isolux diagram for each intersection or junction involved in the submission.
4. Copies of photometric test reports for the proposed luminaires, from an accredited testing laboratory in hard copy, where not MANARC approved.
5. Copies of reports generated by the Computer Design program declared on the Manukau City Council Lighting Review Form showing relevant luminance and illuminance information.
6. Certification confirming that the Embedment Depth, Base Moment and Column Strength complies with the requirements of the Structural section (Appendices A and B) of the MCC Corporate Design Manual.
7. The following details are available on request:
  - installation instructions for the luminaire and column combination including handling, transport and storage instructions.
  - maintenance instructions for the luminaire and column combination e.g. instruction and anatomy of the lantern for the purpose of maintenance and replacement.
8. A recommended maintenance schedule (Cleaning, lamp replacement, etc) is available on request.
9. A detailed written warranty, minimum 10 years for the column and luminaire combination (excluding the lamp or control gear), stating:
  - the extent and any conditions of the warranty.
  - the remedial action proposed in the event of a claim.
10. A copy of the coating applicator's certification that the galvanising and / or paint has been applied in accordance with the coating manufacturer's specifications.

### NOTE:

- **The information required herein shall be provided to enable completion of the review. Failure to provide the required information in full may result in a delay in processing the review.**
- **If in doubt about what is required for any of the above, please contact Manukau City Council**

## Appendix D

### List of Approved Coating Systems

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## 12 APPENDIX D: LIST OF APPROVED COATING SYSTEMS

The following list contains coating systems approved for use by MCC for painting lighting columns, enclosures and luminaires. The list is current as at the date indicated in the footer of this document but is subject to change at the total discretion of the MCC.

If further systems are submitted in the future and deemed satisfactory then MCC may choose to include them on this list.

Similarly, if MCC consider that a previously approved system is no longer satisfactory, then MCC may choose to remove them from this list.

<b>Manufacturer</b>	<b>Reference</b>
– Azko Nobel Coatings	– Specifications dated 19/07/00.
– Altex	– Specifications dated 06/05/00.
– Ameron	– Specifications dated 05/05/00.
– Dulux	– Specifications dated 19/11/00.
– Resene	– Specifications dated 03/99

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## Appendix E

### Dynamic Response Spreadsheets

### 13 APPENDIX E: DYNAMIC RESPONSE SPREADSHEETS

#### Torsional and translational period calculations:

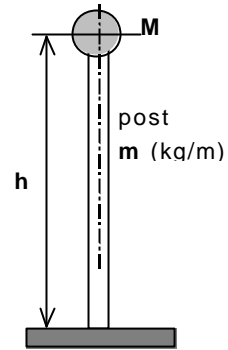
##### a) Translational: Lumped mass on top of uniform mass post

$$\text{Translational Period, } T_l = 2 \sqrt{1.732 \frac{(M h^3 + 0.236 m h^4)}{(E I)}}$$

<b>M</b> =	118.9	lumped mass (kg)
<b>m</b> =	1.0	uniform mass per m of post (kg/m)
<b>h</b> =	6.0	height to lumped mass (m)
<b>E</b> =	200.0	modulus of elasticity (GPa)
<b>I</b> =	171.00	bending inertia of post (x10 <sup>4</sup> mm <sup>4</sup> )
<b>post</b> =	100NB x 3.18 API line pipe	

Translational Period,  $T_l =$  **1.00** second

Note: Lumped mass includes all fixtures and top half of post mass.



##### b) Torsional: Lumped mass(es) eccentric to top of post

$$\text{Torsional Period, } T_t = 2 \sqrt{\frac{M ((h e^2)/(I_p G) + e^3 / (3 E I))}{}}$$

<b>M</b> =	29.9	total lumped mass (kg)
<b>e</b> =	1.0	eccentricity of lumped mass(es) from rotational ctr. (m)
<b>h</b> =	5.0	height to lumped mass (m)
<b>E</b> =	200.0	modulus of elasticity of arm (GPa)
<b>G</b> =	80.0	shear modulus of post (GPa)
<b>I<sub>p</sub></b> =	3.45	polar inertia of post = J (x10 <sup>6</sup> mm <sup>4</sup> )
<b>I</b> =	16.33	bending inertia of arm (x10 <sup>4</sup> mm <sup>4</sup> )
<b>post</b> =	100NB x 3.18 API line pipe	
<b>arm</b> =	40 NB light PE BS 1387	

Torsional Period,  $T_t =$  **1.00** second

Note: Lumped mass includes all fixtures and arms (both sides if applicable) but ignores post mass.

