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SPECIFICATION FOR
CONCRETE LIGHTING COLUMNS

BUREAU OF CEYLON STANDARDS

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SLS 429 : 1977

Gr. 6

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Sri Lanka.

Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This Standard does not purport to include all the necessary provisions of a contract.

SRI LANKA STANDARD

SPECIFICATION FOR CONCRETE LIGHTING COLUMNS

FOREWORD

This Sri Lanka Standard has been prepared by the Drafting Committee on Concrete Poles. It was approved by the Civil Engineering Divisional Committee of the Bureau of Ceylon Standards and was authorised for adoption and publication by the Council of the Bureau on 1977-11-02.

The scope of this issue covers reinforced concrete columns and prestressed concrete columns and is divided into three sections:

Section 1, contains general clauses applicable to all concrete street lighting columns conforming to the requirements of this standard.

Section 2, relates to reinforced concrete columns.

Section 3, relates to prestressed concrete columns.

The standard does not control detailed design but lays down requirements for quality and performance. Columns for carrying overhead wires are not covered as those should be specially designed for that purpose.

Planting depths have not been included in this specification because for given ground conditions the depth will vary with the shape of the column and the loads for which it was designed.

All quantities and dimensions in this standard have been given in the International System of Units.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, shall be rounded off in accordance with CS 102*. The number of figures to be retained in the rounded off values shall be the same as that of the specified value in this standard.

In the preparation of this standard, the assistance derived from the publications of the British Standards Institution is gratefully acknowledged.

1 GENERAL

1.1 Scope

Section 1 of this standard applies to both reinforced concrete and prestressed concrete lighting columns and should be read in conjuction with Section 2 or Section 3 as may be appropriate.

Section 2 applies to reinforced concrete columns and Section 3 applies to prestressed concrete columns with pretensioned steel. Columns either reinforced or prestressed could have brackets either prestressed or reinforced. Whichever is used it should comply with the requirement and tests specified in the respective Section for the material concerned.

Both Sections 2 and 3 provide for columns giving a range of nominal mounting heights of 12, 10, 8, 6 and 4 m.

*CS 102 *Presentation of numerical values*.

1.2 Definitions

For the purpose of this standard the following definitions shall apply:

1.2.1 mounting height: The approximate vertical distance between the centre of the lantern and the surface of the carriageway.

1.2.2 column height: For columns with brackets, column height is the vertical distance between the ground-line and a horizontal line at the highest level of the bracket arm centre line.

NOTE - To determine the mounting height for columns with brackets, it is assumed that the centre of the lantern is 200 mm below this point.

For columns without brackets, column height is the vertical distance between the ground-line and the top of the column.

1.2.3 ground line: The position on the column at a distance from the butt end equal to the manufacturer's stated planting depth.

1.2.4 bracket projection : The horizontal distance between the centre line of the column and the concrete at the end of the bracket arm.

1.2.5 test position: For columns with brackets, the position 50 mm below the connection of the bracket to the column. For columns without brackets, the position 50 mm below the top of the column.

1.2.6 special roots: A special root is used where a lighting column has to be placed in a position where there are underground obstructions, which prevent a standard root being used. These special roots take various forms, such as tapered roots, reduced section roots specially reinforced and bolt-on roots.

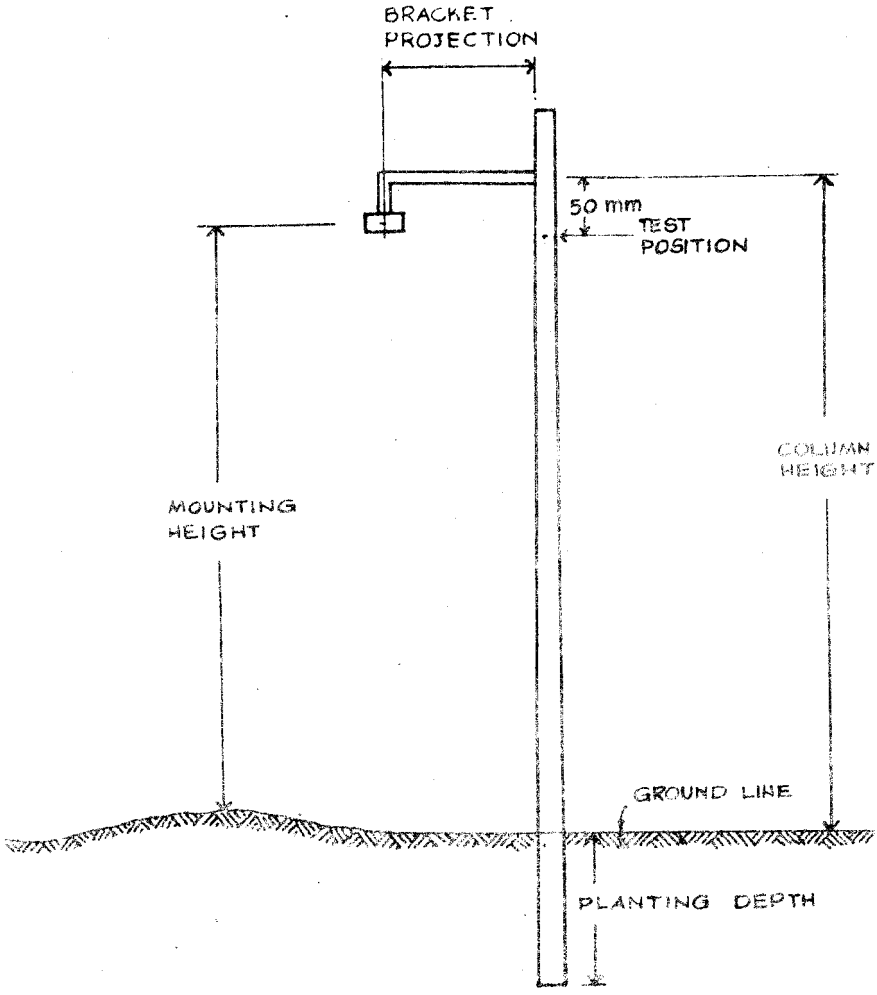

FIGURE 1

Diagram illustrating the terms given in 1.2

1.3 Cement

The cement used in the manufacture of the column and fittings shall comply with the requirements of CS 107*.

1.4 Aggregates

The coarse and fine aggregates shall comply with the requirements of SLS ...** and the maximum size of the aggregates shall not exceed 20 mm.

1.5 Concrete

The concrete shall be made with cement and aggregates specified herein together with clean water which shall be free from harmful amounts of deleterious matter, either in suspension or in solution. Attention is drawn to SLS ...†

The concrete shall be thoroughly mixed and the mix shall be so proportioned as to ensure that the columns and brackets satisfy all the requirements of this standard. Each mould shall be filled with concrete in one continuous operation and shall be fully compacted.

When using Portland type cements the temperature of the mixed concrete shall not exceed 30 ^{o}C except where special care is taken to avoid the possibility of premature stiffening of the fresh concrete and excessive thermal stresses during hardening.

1.6 Curing

After placing, concrete shall be protected, during setting and in the first stages of hardening, from shocks, running or surface water and the harmful effects of sunshine, drying winds and cold. The concrete shall

**CS 107 Portland cement (ordinary)*

***SLS... Mineral aggregates for cement and concrete mixtures.*

†SLS... Tests for water for making concrete.

be prevented from drying out for at least 7 days.

Concrete made from Portland cement may be steam cured if desired, in which case rapid cooling, which could be detrimental to the concrete, should be avoided. The concrete shall be prevented from the drying out for at least 4 days.

1.7 Finish and tolerances

1.7.1 *Finish*

The concrete when demoulded shall be of good finish and free from honeycombing. All arrises shall be clean and true and shall present a neat appearance.

1.7.2 *Straightness tolerances*

The part of the column above the ground in a vertical position shall not deviate from straightness by more than an amount calculated at a rate of 2 millimetres per metre of the column length.

1.7.3 *Column height and bracket projection*

The column height and/or bracket projection shall not vary from the manufacturer's stated dimension by more than ± 15 mm.

1.8 Concrete cover for reinforcement

All steel reinforcement shall have a cover of concrete of at least 20 mm except where spun concrete is used, when this cover shall be not less than 12 mm.

1.9 Bracket projection

Preferred dimensions for bracket projections are shown in Table 1.

TABLE 1 - Preferred dimensions for bracket projections

Mounting height	Bracket projection(m)
Up to and including 6 m	0.50
Above 6 m	0.50 1.25 2.75

1.10 Lantern fixing

Preferred sizes for connections on the brackets and columns for lantern fixing are shown in Table 2.

1.11 Base compartment

If a control gear compartment is required the door, door opening and the base board for the control gear compartment shall comply with the following requirements.

1.11.1 *Door and door opening*

Unless otherwise specified by the purchaser, a weather-proof door with a locking device, which will resist unauthorized entry, shall be included in the column. The door opening shall be one of the following sizes unless otherwise agreed between the manufacturer and the purchaser:

700 mm x 150 mm
600 mm x 150 mm
450 mm x 150 mm
300 mm x 120 mm

The bottom of the door shall not be less than 300 mm above the ground line.

TABLE 2 - Preferred sizes for connections for lantern fixing

Mounting height	For top entry lantern	For side entry lantern	For post top lantern
A Above 6 m	A male parallel thread R $1\frac{1}{2}$ of length 25 mm minimum	A spigot 42 mm o.d. x 125 mm long	A spigot 100 mm o.d. x 150 mm long
B Up to and including 6 m	A male parallel thread R $\frac{3}{4}$ of length 20 mm minimum	A spigot 27 mm o.d. x 75 mm long	A spigot 75 mm o.d. x 75 mm long

*NOTE - *R_L = Sri Lanka Standard Long screw thread.*
**SLS 282 Pipe threads for tubes and fittings where pressure tight joints are made on the threads.*

1.11.2 *Baseboard for the control gear*

Unless otherwise specified by the purchaser, a column with a door and door opening shall be fitted with a baseboard for control gear. The baseboard shall be manufactured from material which is substantially non-hygroscopic. The manufacturer shall provide a drawing to show the internal measurements of the control gear compartment and the dimensions and the position of the baseboard.

1.12 Earthing

When metal doors and/or frames are used a non-ferrous terminal shall be fitted to enable these to be earthed.

1.13 Breather holes

To limit condensation the base compartment shall be ventilated by holes in the door or by other suitable means and also as near to the top of the column as is practicable to allow circulation of air. The holes shall be arranged so as to prevent the entry of rain into the column.

1.14 Metal work

All exposed metal work shall be of corrosion resistant metal or shall be suitably protected against corrosion.

1.15 Fittings

If brackets or other fittings are of reinforced concrete such brackets or fittings shall comply with the requirements of the relevant clauses in Section 2 of this standard. If brackets or other fittings are of prestressed concrete, and are attached to or form part of the column they shall comply with the requirements of the relevant clauses in Section 3 of this standard.

1.16 Bore

All columns shall have a substantially smooth walled central duct of diameter not less than 25 mm for the purpose of taking the supply from the base compartment to the top of the column. A duct of not less than 65 mm diameter shall be provided from the base compartment to the bottom of the service slot.

1.17 Service connections

A service slot or slots free from sharp corners and edges shall be provided in the columns below the ground line for entry of electric cables. Unless otherwise specified, service slots shall be not less than 225 mm long by approximately 75 mm wide with the top of the slot at least 225 mm below the ground line, the slot being directly below the door opening. Unless otherwise specified only one service slot shall be provided.

1.18 Age at test

Columns shall be tested within the following periods from the date of their manufacture:

Ordinary Portland cement	28 to 42 days
Rapid-hardening Portland cement	21 to 35 days
Ordinary Portland cement (steam cured)	14 to 28 days

1.19 Design

Unless otherwise stated by the manufacturer, the following assumptions shall be made for the design of columns to comply with the requirements of this standard.

1.19.1 The loads for which columns shall be designed in order to comply with the requirements of this standard are:

a) the loads due to the mass of the column, the lantern or lanterns and the bracket arm or arms;

b) the wind loads on the column, the lantern and assoicated suspended equipment or lanterns and the bracket arm or arms.

1.19.2 The projected area and mass of a lantern shall be in accordance with Table 3.

TABLE 3 - Projected area and mass of a lantern

Mounting height	Projected area m^2	Mass kg
Up to and including 6 m	0.2	10
Above 6 m	0.3	15

Columns may be supplied for greater lantern areas or masses and, provided these comply in all other respects with the requirements of this standard, they shall be deemed to comply with this standard.

1.19.3 The minimum recommended wind loads shall be in accordance with the values given in Table 4 for projected area.

The design load shall be based on the total mass of the lantern, its contents and attachments and the windload acting on the overall projected area of this equipment.

1.20 Marking of columns

The columns shall be clearly and indelibly marked with:

a) the day, month and year of manufacture;
b) the manufacturer's name and means of identification of the column shaft. This shall be marked, where practicable, so that after erection the mark is in a readily visible position.

TABLE 4 - Wind loads

Part of column	Loads for wind speeds of 120 km/h
	N/m^2
Columns and brackets arms; cross section profile:	
Circular	770
Octagonal	950
Hexagonal	1075
Square	1540
Triangular	1540
Lanterns	770
Raising and lowering gear	770

1.21 Information to be supplied with the enquiry or order

The following information shall be supplied with the enquiry or order:

a) Mounting height (See 1.2.1)
b) The bracket projection and whether post top, side entry or top entry fittings (See 1.2.4)
c) Alternative figures where the mass and projected area exceed figures quoted in 1.19.2.
d) Lantern fixing dimensions (See 1.10)
e) Minimum size of door opening (See 1.11.1)
f) Minimum depth of control gear compartment from back of door to face of baseboard (See 1.11.2)
g) Any special door position requirements in relation to the bracket.
h) Any special requirements affecting the depth in planting.

j) Special roots, if required.
k) Any special requirements for service slots.

1.22 Quality control tests

Certified records of the quality control tests specified in 2.1, 2.2, 3.1 and 3.2 shall be kept by the manufacturer for inspection by the purchaser.

2 REINFORCED CONCRETE LIGHTING COLUMNS

2.1 Concrete strength

For ordinary Portland cement concrete, the proportions of cement to total aggregate shall be not leaner than 1 : 6 by mass and the minimum works cube strength at 28 days, when made, cured and tested in accordance with the requirements of SLS 262* shall be not less than 30 MN/m^2.

The minimum requirement shall be one concrete cube taken from one batch of concrete for each 40 columns produced. Where less than 40 columns are produced per day, at least one cube shall be cast daily. If any result lies below the minimum works cube strength specified above, three columns made with the corresponding batch of concrete shall be tested for structural strength in accordance with 2.4.

2.2 Water absorption

When tested in accordance with Appendix A the increase in mass by absorption of water in the first 10 minutes shall not exceed 2.5 per cent of the dry mass of the test piece, nor shall the absorption after 24 hours exceed 6.5 per cent of the dry mass of the test piece.

**SLS 262 Methods of sampling, analysis and testing of concrete.*

The minimum requirements shall be one test piece of the full thickness of the column approximately and 100 mm square, all edges being broken, or a core approximately 75 mm diameter, once a week, for each factory producing columns.

If the sample fails either of the above requirements, three columns made with the corresponding batch of concrete shall be tested for structural strength in accordance with 2.4.

2.3 Reinforcement

2.3.1 Steel reinforcing bars or wire shall be free from loose rust, scale, oil or grease and shall comply with the requirements of SLS 375* or CS 26** or SLS...***.

2.3.2 Longitudinal reinforcing bars shall where possible be continuous throughout the length of the column, but may contain not more than one lap in each barline, subject to the following conditions:

2.3.2.1 The laps shall be staggered.

2.3.2.2 The length of the lap shall be not less than 40 times the diameter in the case of mild steel bars and 50 times in the case of cold worked deformed bars, of the smaller rod, unless welded, in which case the strength of the welded joint shall be not less than the strength of the two bars being jointed.

2.3.3 All reinforcement shall be accurately placed and effective means shall be provided for maintaining it in

**SLS 375 Cold worked deformed steel bars for the reinforcement of concrete.*

***CS 26 Hot rolled mild steel round bars for concrete reinforcement.*

****SLS... Hard drawn mild steel wire for the reinforcement of concrete.*

position during the manufacture of the column. All spacers or other devices used for this purpose shall be of rust proof material.

2.4 Structural strength (type test)

2.4.1 *Column*

The structural strength of the column shall be verified by a test in accordance with Appendix B.

Under this test, a single load shall be applied, at the test position of magnitude such that it creates a bending moment at the ground line equal to the design bending moment. The column shall be considered satisfactory if the recovery is at least 75 per cent of the maximum deflection while under load.

2.4.2 *Bracket*

The structural strength of the bracket shall be verified by a test in accordance with Appendix C. Under this test a single vertical and a single horizontal load shall be applied to the bracket such that they create bending moments equal to the maximum design bending moments due to horizontal and vertical loads respectively. The bracket shall be considered satisfactory if the recovery is at least 75 per cent of the maximum deflection while under load.

2.4.3 *Requirement*

To ensure compliance with the requirements of this standard, three columns and/or brackets of any one structural design shall satisfactorily withstand this strength test. Records of these tests shall be kept by the manufacturer for inspection by the purchaser.

3 PRESTRESSED CONCRETE LIGHTING COLUMNS

3.1 Concrete strength

For ordinary and rapid-hardening Portland cement concrete, the proportions of cement to total aggregate shall be not leaner than 1 : 5 by mass and the minimum works cube strength at 28 days, when made, cured and tested in accordance with the requirements of SLS 262* shall be not less than 40 MN/m^2.

The minimum requirement shall be one concrete cube taken from one batch of concrete for each 40 columns produced. Where less than 40 columns are produced per day, at least one cube should be cast daily. If any result lies below the minimum works cube strength specified above, three columns made with the corresponding batch of concrete shall be tested for structural strength in accordance with 3.7.

3.2 Water absorption

When tested in accordance with Appendix A the increase in mass by absorption of water in the first 10 minutes shall not exceed 2.5 per cent of the dry mass of the test piece, nor shall the absorption after 24 hours exceed 6.5 per cent of the dry mass of the test piece.

The minimum requirement shall be one test piece of the full thickness of the column approximately and 100 mm square, all edges being broken, or a core approximately 75 mm diameter, once a week, for each factory producing columns.

If the sample fails either of the above requirements, three columns made with the corresponding batch of concrete shall be tested for structural strength in accordance with 3.7.

**SLS 262 Methods of sampling, analysis and testing of concrete.*

3.3 Prestressing steel

The prestressing steel shall be hard-drawn steel wire complying with the requirements of SLS...*.

NOTE - Wires should be free from grease or other material likely to impair the bond. A slight film of rust is not necessarily harmful and may improve the bond, The steel however, should not be pitted.

3.4 Untensioned steel reinforcement

Untensioned steel reinforcement shall comply with the requirements of 2.3 of this standard where applicable.

3.5 Resistance to impact

In order to provide adequate impact resistance for columns in excess of 7.5 m in height and, in particular to reduce the danger of collapse when subject to impact, a minimum of 284 mm^2 of steel reinforcement shall be provided in the lower portion of the column extending from a minimum distance of 600 mm below the ground line to a minimum height of 600 mm above the door opening. Effective means shall be provided for maintaining it in position during the manufacture of the column, and all spacers or other devices used for this purpose shall be of rust proof material. Such steel shall be continuous and suitably distributed over the section of the concrete to resist impact from any direction and shall be spaced by means of transverse reinforcement to form a rigid cage. The diameter of the transverse reinforcement, shall be not less than 5 mm at a spacing not greater than 16 times the diameter of the untensioned longitudinal reinforcement in the column.

**SLS... Steel wire for prestressed concrete (under preparation).*

3.6 Pretensioning and release of wires

All wires which are stressed in one operation shall be of the same length. The necessary elongation shall be directly determined by measuring the stretching force and elongation of the pre-stressing wire prior to concreting. In all cases the yield of the gripping devices shall be taken into account and the accuracy of the equipment used for determining the prestressing force shall be checked at least once every 14 days.

Between tensioning and release (i.e. during the setting and hardening of the concrete), the tension shall be fully maintained by some positive means. The stress in the concrete at the time of transfer shall not exceed 0.4 times the cube strength at time of transfer.

3.7 Structural strength (type test)

3.7.1 *Column*

The structural strength of the column shall be verified by a test in accordance with Appendix B. Under this test, a single load shall be applied, at the test position, of magnitude such that it creates a bending moment at the ground line equal to the design bending moment. The columns shall be considered satisfactory if the recovery is at least 85 per cent of the maximum deflection while under load.

3.7.2 *Bracket*

The structural strength of the bracket shall be verified by a test in accordance with Appendix C. Under this test a single vertical and a single horizontal load shall be applied to the bracket such that they create bending moments equal to the maximum design bending moments due to horizontal and vertical loads respectively. The bracket shall be considered satisfactory if the recovery is at least 85 per cent of the maximum deflection while under load.

3.7.3 *Requirement*

To ensure compliance with this standard, three columns and/or brackets of any one structural design shall satisfactorily withstand this strength test. Records of those tests shall be kept by the manufacturer for inspection by the purchaser.

APPENDIX A

TEST FOR WATER ABSORPTION

Dry the test piece for 72 hours in a suitable ventilated drying oven the temperature of which as measured by a thermometer suspended centrally, is between 100 °C and 110 °C. On removal from the oven, allow to cool to ambient temperature, weigh and immediately submerge in water, the temperature of which is 27 ± 2 °C, for a period of 10 minutes, at the end of which time take it out, immediately wipe with a dry cloth for a period of half a minute, and again weigh. Then submerge in water again for a total period of half a minute, and again weigh. Then submerge in water again for a total period of 24 hours, at the end of which time take it out, wipe with a dry cloth and reweigh.

$$\text{Absorption (percentage of dry mass)} = \frac{(\text{wet mass} - \text{dry mass})}{\text{dry mass}} \times 100$$

APPENDIX B

STRUCTURAL TEST FOR COLUMNS

The column shall be tested in the direction in which it is subjected to the maximum stress conditions for which it is designed. A column may be tested either in the horizontal or in the vertical position. If tested in the horizontal position provision may be made by suitable supports to minimize the bending moment induced by the mass of the column.

Support the column rigidly at the butt end up to the ground line but do not fix the bracket to the column. Gradually apply the test load at the test position, maintain it for at least 2 minutes and measure the maximum deflection. Then reduce the load to zero and measure the residual deflection after 10 minutes. Calculate the recovery as,

$$\text{Recovery percentage} = \frac{\text{maximum deflection - residual deflection}}{\text{maximum deflection}} \times 100$$

APPENDIX C

STRUCTURAL TEST FOR BRACKETS

A bracket may be tested either in its normal position at the top of the column or fixed into a special column head of identical dimensions, which may be a portion cut from a column.

Fix the column or column head rigidly in a vertical position and fix the bracket rigidly in its normal position. Gradually apply the vertical and horizontal test

loads ensuring that the ratio between these loads is kept as constant as possible. When the design loads are reached, maintain them for at least 2 minutes and measure the maximum deflection. Then reduce the loads to zero and measure the residual deflection after 10 minutes. Calculate the recovery as,

$$\text{Recovery percentage} = \frac{\text{maximum deflection} - \text{residual deflection}}{\text{maximum deflection}} \times 100$$

NOTE - The deflections are to be measured in the plane of loading.

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