

MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS
VOLUME 1 SPECIFICATION FOR HIGHWAY WORKS

SERIES 1300

(11/03) **ROAD LIGHTING COLUMNS AND
BRACKETS, CCTV MASTS AND
CANTILEVER MASTS**

Contents

Clause	Title	Page
#1301	(05/01) General	2
1302	(11/03) Design of Lighting Columns, Brackets, CCTV Masts, Cantilever Masts, Foundations, Anchorages and Attachment Systems	2
1303	(05/01) Data Sheets	3
1304	(05/01) Identification and Location Markings	3
1305	Installation of Foundations, Anchorages and Attachment Systems	3
1306	Site Tests on Anchorages in Drilled Holes	4
1307	Materials and Surface Finishes	5
#1308	(05/01) Handling, Transport and Erection	5
1309	(11/04) Amendments and Additions to BS 5649-2: 1978 (AMD 3136, 1979) for Lighting Columns	5
1310	(11/04) Amendments and Additions to BS EN 40-5 and BS EN 40-6 for Lighting Columns and Brackets, CCTV Masts and Cantilever Masts	6
1311	(11/04) Amendments and Additions to BS 5649-5 for Lighting Columns, CCTV Masts and Cantilever Masts	10
1312	(11/03) Attachments to Lighting Columns, CCTV Masts and Cantilever Masts	11
1313	(05/01) Laminated Glass Fibre Reinforced Plastic (GFRP) Lighting Columns	11
1314	Brackets for Laminated GFRP Lighting Columns	12

**NATIONAL ALTERATIONS OF THE
OVERSEEING ORGANISATIONS OF
SCOTLAND, WALES AND NORTHERN
IRELAND**

Northern Ireland

1301NI	(05/01) General	N1
1308NI	(05/01) Handling, Transport and Erection	N1

denotes a Clause or Sample Appendix which has a substitute National Clause or Sample Appendix for one or more of the Overseeing Organisations of Scotland, Wales or Northern Ireland.

(11/03) ROAD LIGHTING COLUMNS AND BRACKETS, CCTV MASTS AND CANTILEVER MASTS

#1301 (05/01) General

1 (11/03) This Series shall apply to the design, supply and installation of lighting columns and brackets and CCTV masts and cantilever masts for traffic signals and/or speed cameras (hereafter called cantilever masts) within the following dimensional limitations:

- (i) For steel, aluminium and concrete lighting columns:
 - (a) post top columns not exceeding 20 m nominal height;
 - (b) columns with brackets not exceeding 18 m nominal height;
 - (c) bracket projections not exceeding 0.25 x nominal height or 3 m whichever is the lesser.
- (ii) For glass fibre reinforced plastic lighting columns:
 - (a) columns not exceeding 10 m nominal height;
 - (b) bracket projections not exceeding 1.5 m.
- (iii) For steel CCTV masts:
 - (a) post top masts not exceeding 25 m nominal height.
- (iv) (11/03) For steel cantilever masts:
 - (a) nominal height not exceeding 8.5 m;
 - (b) cantilever projection not exceeding 8.5 m.

Where nominal height is taken as the distance between of the underside of the flange plate and the highest point of the mast (see Figure 1 of BD 88 (DMRB 2.2.13)).

2 (11/03) The Contractor shall propose lighting columns and brackets, CCTV masts and cantilever masts which have been designed by the manufacturer. The manufacture, supply and verification of lighting columns and bracket arms shall comply with the quality management scheme described in Appendix A.

The Contractor shall design foundations for planted lighting columns and cantilever masts in accordance with BD 26 Chapter 8 (DMRB 2.2.1) or of BD 88/03 Chapter 8 (DMRB 2.2.13) using the soil type information as described in Appendices 13/1 and 13/7.

The Contractor shall where required design:

- (i) anchorages and attachment systems for columns and masts with flange plates to foundation or bridge deck;
- (ii) foundations for columns and masts with flange plates;

as described in Appendices 13/1, 13/4 and 13/7.

3 (05/06) Lighting columns and brackets, CCTV masts and cantilever masts shall be supplied and installed in compliance with the relevant requirements of BS EN 40-1, BS EN 40-3-1, BS EN 40-3-2, BS EN 40-4, BS EN 40-5, BS EN 40-6 and BS 5649-2, BS 5649-5 and BS 5649-7 together with the amendments and additions stated in Clauses 1309, 1310 and 1311 and all the other requirements of this Series.

4 Brackets for lighting columns shall include wall mounted brackets and fixtures.

5 Temporary lighting on temporary diversions for traffic, and crossovers, shall comply with this Series.

6 (11/03) Where lighting columns, CCTV masts and cantilever masts are to be in the vicinity of overhead power lines the Contractor shall ensure that the appropriate Electricity Authorities are notified and give written agreement to the specific clearances to be provided and that warning notices as described in Appendices 13/1, 13/4 and 13/7 are permanently fixed to these columns prior to erection.

7 (11/03) Headroom over the carriageway for cantilever mast shall be in accordance with the requirements of paragraph 3.2 of Standard BD 88 (DMRB 2.2.13).

1302 (11/03) Design of Lighting Columns, Brackets, CCTV Masts, Cantilever Masts, Foundations, Anchorages and Attachment Systems

1 (11/03) Lighting columns, brackets, CCTV masts, cantilever masts, the foundations of both planted columns and columns and masts with flange plates, and the anchorages and attachment systems for columns and masts with flange plates shall be designed to comply with the requirements of Standards BD 26 (DMRB 2.2.1), BD 83 (DMRB 2.2.11), BD 88 (DMRB 2.2.13) and the technical approval scheme adopted by the Overseeing Organisation.

The Contractor shall submit to the Overseeing Organisation a copy of the design and check certificates for lighting columns, brackets, CCTV masts, cantilever masts and foundations. The design of the foundations shall be appropriate to the soil types encountered on site, as identified in Appendices 13/1, 13/4 and 13/7.

Aesthetic Requirements

2 (11/04) The aesthetic design of lighting columns, luminaires including those with bracket arms, CCTV masts and cantilever masts shall be submitted by the Contractor to the Overseeing Organisation. The design of lighting columns and luminaires including those with bracket arms shall comply with the general advice given in BS 5489-1 for the appearance of lighting installations by day and by night both from the viewpoint of the road and from the surrounding neighbourhood.

1303 (05/01) Data Sheets

1 (11/03) The Contractor shall complete the details in Appendices 13/2, 13/5 and 13/8 in accordance with the instructions given in Appendices 13/3, 13/6 and 13/9. The Contractor shall provide the Overseeing Organisation with triplicate copies of the completed Data Sheets for each type of column and bracket, CCTV mast and cantilever mast not later than the date stated in Appendices 13/1, 13/4 and 13/7.

2 (11/03) The columns and brackets, CCTV masts and cantilever masts shall not be ordered or erected until the Overseeing Organisation has notified its acceptance of the completed Data Sheet in writing to the Contractor.

1304 (05/01) Identification and Location Markings

1 (11/03) All lighting columns and brackets, CCTV masts and cantilever masts shall carry unique identification marks which indicate the name of the manufacturer, year of manufacture, the unique product code and other relevant information, to enable details of the lighting column and bracket, CCTV masts and cantilever masts to be determined by reference to the appropriate Lighting Column and Bracket, CCTV masts and cantilever masts Data Sheets.

2 The column and mast identification marks shall be permanent, legible and clearly visible and be:

- (i) on a permanent fixed label; or
- (ii) hard stamped; or
- (iii) formed in the material of the column/mast on an external face only.

It shall be located either within the base compartment or, except in the case of hard stamping, immediately above or below the door. It shall not be located on the door.

All hard stamping shall be made only in a secondary member of the column/mast and shall be done in a manner, which will not induce any stresses in the material of the main member of the column/mast.

3 The bracket identification mark shall be permanent and legible and be:

- (i) hard stamped; or
- (ii) formed in the material of the bracket on an external face only.

The mark shall be located either on the luminaire spigot or on the underside of the bracket adjacent to the column shaft or wall or pole mounting plate.

4 Alternatively the bracket identification mark shall be hard stamped or formed in a detachable label supplied fixed to the bracket. This label shall be moved from its temporary position and fixed on erection to a suitably provided hole next to the label on the column.

5 (11/03) In addition, location marks for inspection and maintenance purposes shall be applied to each column as described in Appendices 13/1, 13/4 and 13/7.

1305 Installation of Foundations, Anchorages and Attachment Systems

(11/03) Planted Lighting Columns and Cantilever Masts

1 (11/03) A layer of ST4 concrete 75 mm thick, complying with Clause 2602 shall be placed and compacted in the bottom of the excavation up to the base of the column or mast post.

2 The cable entry slot shall be temporarily plugged as necessary in order to prevent any ingress of concrete or filling material during the concreting and backfilling operations.

3 (11/03) The hole into which the lighting column or cantilever mast is placed shall be backfilled as follows:

- (i) in the case of metal and glass fibre reinforced plastic columns with concrete or other material described in Appendix 13/1;
- (ii) in the case of concrete columns with concrete or earth fill complying with sub-Clause 5 of this Clause or other material described in Appendix 13/1;
- (iii) (11/03) in the case of cantilever masts with concrete or other material described in Appendix 13/7.

4 (11/03) Concrete backfill shall be ST5 concrete complying with Clause 2602, well compacted by vibration over the full planting depth of the column/mast post. A duct equal in size to the width of the cable entry hole, shall be formed through the concrete filling using a suitable preformed lining tube capable of retaining its cross-sectional shape during compaction. The concrete shall be placed 10 mm above ground level adjacent to the column/mast post and taper to ground level 100 mm from the column/mast post face.

5 (11/03) Earth backfill shall be Class 8 material complying with Clause 601, Table 6/1 unless otherwise described in Appendices 13/1 and 13/7. The material shall be placed in 150 mm thick layers and shall be well rammed and compacted in order to provide full lateral support to the planting depth of the column/mast post. If the backfilling is disturbed for any reason it shall be reinstated in compliance with this Clause. A duct equal in size to the width of the cable entry hole, shall be made through the backfill material using a suitable preformed lining tube capable of retaining its cross-sectional shape during compaction.

(11/03) Columns, CCTV Masts and Cantilever Masts with Flange Plates

6 (05/01) Concrete in the foundations shall comply with Series 1700.

7 (11/03) The bedding mortar between the underside of the column/mast flange plate and the top of the concrete base shall comply with Clause 2601. The bearing stresses in any bedding mortar under the flange plates shall not exceed 20 N/mm².

8 (11/03) A cable duct, 75 mm diameter, shall be provided through the foundation or bridge component as described in Appendices 13/1, 13/4 and 13/7.

9 (11/03) Steel anchorages and attachment systems shall be used and the anchorage shall include an internally threaded component to receive the attachment system, i.e. holding down bolt.

10 (11/03) Where anchorages in drilled holes are to be used, the Contractor shall, unless otherwise described in Appendices 13/1, 13/4 or 13/7, submit to the Overseeing Organisation at least 4 weeks before installation well attested and documented evidence that the proposed anchorage is:

- (i) capable of complying with the test requirements specified in Clause 1306; and
- (ii) capable of resisting pulsating loading.

Anchorages in drilled holes of an expanding type shall not be used.

11 For anchorages in drilled holes the hole location shall be checked to ensure that the hole will be clear of reinforcement before drilling is carried out.

12 Before installation of anchorages in drilled holes, the hole shall be sound, clean and dry and the tolerance of the hole shall be within the values given by the anchorage manufacturer.

13 The threads of steel anchorages shall be lined with grease having a high resistance to creep and being suitable for hot or cold smearing. The grease shall provide protection to the threads for a minimum of either 18 months under cover or 6 months exposed on Site.

14 (11/04) Attachment systems shall be tightened to the appropriate torque and have the minimum thread engagement calculated in accordance with the requirements of BS 6779-1: 1998 (Amd. No. 14290, 21 March 2003) sub-Clause 6.6.4.

15 All voids in anchorages, attachment systems and flange plates shall be filled with a non-setting passive filler to prevent the collection of water.

1306 Site Tests on Anchorages in Drilled Holes

1 (11/04) The Contractor shall carry out site tests on anchorages in drilled holes. For the purpose of this sub-Clause the types of fixing referred to in clause 1 of BS 5080-1 shall include "anchorages". Where anchorages are tested they shall be loaded incrementally in tension in accordance with BS 5080-1 except that they shall be capable of resisting a test load equal to 10 per cent above the nominal tensile load to be resisted by the anchorage in lieu of testing to failure. The tensile load shall be determined in accordance with the criteria given in sub-Clauses 8.15 to 8.18 of Standard BD 26 (DMRB 2.2.1), Chapter 7 of Standard BD 83 (DMRB 2.2.11) and Chapter 9 of BD 88 (DMRB 2.2.13). Incremental loads shall be held for not less than half a minute and the test load for not less than five minutes. Readings shall be taken immediately after applying load and at the end of the time intervals stated above.

2 (11/03) The total movement of the anchorage shall not exceed 1.0 mm during the test. Any evidence of slip during loading up to the test load, as demonstrated by a significant change in the slope of the load/extension curve, shall constitute failure.

3 The Contractor shall test anchorages selected on behalf of the Overseeing Organisation at the testing frequency in accordance with Appendix 1/5.

1307 Materials and Surface Finishes

- 1 (11/05) All steel fixings including doors, door hinges, chains and locks shall be stainless steel to BS EN 10029, BS 970-1 or BS EN ISO 3506-1 and BS EN ISO 3506-2 as appropriate or steel to BS EN 10025-1, BS EN 10025-2 or BS EN 40-5 and BS EN 40-6 as amended in Clause 1310, galvanized in compliance with Series 1900.
- 2 Where different metals are in contact, consideration shall be given to the necessary measures to avoid galvanic corrosion.
- 3 (11/03) The surface preparation and protection of steel lighting columns, brackets and wall mountings, steel CCTV masts and steel cantilever masts, mountings and housings shall comply with Appendix 19/1 and the relevant Clauses in Series 1900.
- 4 (11/03) The exterior and interior surfaces of the intended planted depth of an aluminium alloy lighting column shaft and a length of 250 mm above the ground level shall be coated with a non-porous electrically insulating bitumen with a minimum layer thickness of 250 microns. The coating shall only be applied after degreasing and after an approved preliminary treatment in order to ensure adhesion.
- 5 The underside of an aluminium alloy flange plate shall be treated before erection with bituminous paint complying with BS 3416 or BS 6949.
- 6 The finish to concrete lighting columns and brackets shall be Class F3 in compliance with Clause 1708.

#1308 (05/01) Handling, Transport and Erection

- 1 (11/03) Lighting columns and brackets, CCTV masts and cantilever masts shall be handled, transported and stored in such a way as to avoid any structural damage or damage to the surface protection system. Any damage incurred shall be made good in such a way that the structural performance and durability of the item shall be in no way reduced.
- 2 (11/03) Lighting columns and brackets, CCTV masts and cantilever masts shall be stored clear of the ground in such a way that contact with cement, groundwater, soil or ash or other deleterious material is prevented and that water does not accumulate on any surfaces or inside sections. Suitable packings shall be placed between the columns/masts to allow a free passage of air and dispersion of water.
- 3 All rivets, bolts, nuts, washers, screws, small plates and small articles generally shall be suitably packed and identified. All such items shall be stored under cover.

4 (11/03) Columns and masts shall be installed in accordance with the manufacturer's recommendations. The door shall face the direction described in Appendices 13/1, 13/4 and 13/7.

5 Wall mounted lighting brackets and fixtures shall be fixed as described in Appendix 13/1.

1309 (11/04) Amendments and Additions to BS 5649-2 : 1978 (AMD 3136, 1979) for Lighting Columns

(11/03) Page 5 - Clause 3

Delete Note "Lantern fixing angle 5° or 15°" and

Insert Note "Lantern fixing angle 3°, 5° or 15°".

In the Table insert additional bracket projections w of "0.5 m, 1.0 m, 1.5 m and 2.5 m".

(11/03) Page 6 - Clause 4

Figure 4

Delete cable entry slot width dimension "50 mm" and

Insert cable entry slot width dimension "X".

Insert additional note as follows:

"5) Cable entry slot width dimension "X" shall be either 75 mm or 50 mm as described in Appendix 13/1."

(11/03) Page 8 - Clause 6

Delete existing Tables and replace by the following:

h	s ^{a)}	a	d ₁ ^{a)}	d ₂
m	min		min	min
≤5	8	200	M12	13
≤12	10	300	M16	17
≤20	15	300 400	M24	26

Delete 'l' from Figure 7 and 'c' from Figure 8.

Insert additional notes as follows:

"2 Unless otherwise described in Appendix 13/1 circumferential slotted holes shall be used instead of round holes in the flange plates in order to allow ± 5° of rotational adjustment.

3 Where slotted holes are required in the flange plate to allow for rotational adjustment of the column then the flange plate sizes shall be increased to give a suitable edge distance.

4 The distance from the edge of the hole or slot to the edge of the plate shall be not less than d_2 .

5 Washers complying with BS 4320 shall be used between the holding down fastener and the flange plate."

(11/04) **Page 9 - Clause 7**

Delete existing Table for post top lanterns and replace by the following:

$d_1^{b)}$	l_1
60.3	70 100
76.1	76 100
101.6	250
108.0	250

Delete existing Table for side entry lanterns and replace by the following:

$d_2^{b)}$	l_2
33.7	80
42.4	110 400
48.3	110
60.3	110 250 400

(11/04) **Page 9 - Note b**

Delete "ISO 64 : 1974" and insert "ISO 4200"

(11/03) **Page 10 - Clause 8**

8.7 Column cross-section

Insert additional sub-Clause as follows:

"8.7.1.3 Material thickness tolerance
(+ unspecified, - 5%)".

8.7.2.2 Deviation in shape

Delete content of entire sub-Clause and insert the following:

"Cross-section dimensional tolerances $\pm 5\%$ with a maximum of ± 10 mm."

8.8.2 Diameter of lantern connection (ungalvanised)

(11/04) Delete "ISO 64 : 1974" and insert "ISO 4200"

1310 (11/04) Amendments and Additions to BS EN 40-5 and BS EN 40-6 for Lighting Columns and Brackets, CCTV Masts and Cantilever Masts

1310.1 For Lighting Columns and Brackets:

(11/04) BS EN 40-5 and BS EN 40-6 shall apply subject to the following amendments and additions:

(11/05) **Page 6 - Clause 4** (BS EN 40-5)

Delete the last five lines in sub-Clause 4.1 and replace with "The steel shall be equivalent to or better than BS EN 10025-1, BS EN 10025-2, Grade S275 JR or BS EN 10210, Grade S275 JOH".

(11/05) **Page 6 - Clause 4** (BS EN 40-5 and BS EN 40-6)

Delete sub-Clause 4.2 and replace with: "The steel used for foundation bolts shall be equivalent to or better than BS EN 10025-2, BS EN 10025-2, Grade S275 JR."

(11/04) **Page 6 - Clause 5** (BS EN 40-5 and BS EN 40-6)

(11/04) replace "prEN 40-2" with "BS 5649-2 : 1978 (AMD 3136, 1979)"

(11/04) **Page 6 - Clause 6** (BS EN 40-5 and BS EN 40-6)

(11/04) replace "prEN 40-3-3" with "BS 5649-7"

(11/04) **Pages 6 and 7 - Clause 7** (BS EN 40-5 and BS EN 40-6)

(11/03) Delete sub-Clauses 7.1, 7.2 and 7.3 and insert the following:

"7.1. Steel and Aluminium Lighting Columns

(11/03) 7.1.1 General. Arc welding of ferritic steels shall comply with BS EN 1011-1 and BS EN 1011-2, Welding - Recommendations for welding of metallic materials. Arc welding of stainless steels shall comply with BS 4677. Arc welding of aluminium alloys shall comply with BS EN 1011-1 and BS EN 1011-4.

(11/05) 7.1.2 Procedures. Written welding procedures shall be used with testing to BS EN ISO 15607, BS EN ISO 15609-1 and BS EN ISO 15614-1 for steel and BS EN ISO 15607, BS EN ISO 15609-1 and BS EN ISO 15609-2 for aluminium alloys and shall apply to all production and repair procedures. These shall be subject to reapproval after a period of seven years. When applying BS EN ISO 15607, BS EN ISO 15609-1 and BS EN ISO 15614-1 the welding consumables and procedures used for steel shall be such that the mechanical properties of deposited weld metal will not be less than the respective minimum specified values of the parent metal being welded. Weld testing shall be undertaken by an appropriate organisation accredited in accordance with sub-Clauses 105.3 and 105.4. Approval shall be by an Independent Inspecting Authority using Registered

Welding Engineers, Registered Welding Quality Engineers or equivalent. Welding procedures shall be approved in accordance with BS EN ISO 15613. Pre-production test pieces shall represent the main assembly types.

(11/05) 7.1.3 Welder Qualification. All welders shall be approved to BS EN 287-1 for steel and BS EN ISO 9606-2 for aluminium alloys. The tests shall include in addition an application test representative of the 'main structural' joints on which the welder is to be approved to work. The main structural joints shall include, where relevant, the flange plate joint, the base compartment to shaft joint, the door reinforcement, any intermediate column joint, the column to bracket joint and the column seam weld. Welders shall be subject to reapproval in accordance with BS EN 287-1 and BS EN ISO 9606-2. Weld testing shall be undertaken by an appropriate organisation accredited in accordance with sub-Clauses 105.3 and 105.4. Approval shall be by an Independent Inspecting Authority using Registered Welding Engineers, Registered Welding Quality Engineers or Welding Inspectors certified by the Certification Scheme for Weldment Inspection Personnel (CSWIP) or equivalent. Test results shall be kept current and made available for review on request.

7.1.4 Inspection and Non-Destructive Testing

(11/03) 7.1.4.1 Inspection Personnel. The manufacturer shall provide suitable personnel to carry out inspection of production welds as required in 7.1.4.2 to 7.1.4.4. Personnel conducting visual inspection shall have a nationally recognised certificate of competence appropriate to the type of welding being inspected. Personnel conducting non-destructive testing (NDT) shall be certified according to a nationally recognised certification scheme appropriate to the equipment used and the weld groups inspected all in accordance with BS EN 473. Evidence of training and qualification shall be retained and made available for examination when required. The results of all weld inspections shall be recorded.

(11/04) 7.1.4.2 Visual Inspection. All welds shall be subject to visual inspection in accordance with BS EN 970 prior to any NDT and galvanizing. Weld surfaces shall be free of slag residues and sharp edges. All surfaces shall be free of traces of weld spatter, arc strikes and contaminants. The apparent throat dimensions of butt welds and the apparent leg length and apparent throat dimensions of fillet welds, as measured by a welding gauge and taking into account any known lack of fit, shall not be less than those specified, except that local shortfalls up to 0.5 mm may be accepted provided the average over any 50 mm length is not less than the specified dimension. The toe

angle shall not be less than 110°. The surface of all welds shall be free from cracks, lack of fusion including overlap, and slag. Isolated discontinuous porosity may be accepted provided it is not detrimental to the galvanizing process. Undercut shall not result in a section loss of more than 5% over any 50 mm length of joint, nor shall its depth exceed 0.5 mm or 10% of the thickness, whichever is the less.

(11/03) 7.1.4.3 Magnetic Particle Inspection (MPI) and Liquid Penetrant Inspection. MPI shall be applied in accordance with BS EN ISO 9934-1 to joints in steel lighting columns selected in accordance with 7.1.4.5, where any of the material thickness exceeds 20 mm. Liquid penetrant inspection in accordance with BS EN 571-1 shall be applied to transverse welds in aluminium columns selected in accordance with 7.1.4.5. Notwithstanding the requirements of 7.1.4.5, one of the above methods shall be applied as appropriate where on visual inspection the presence of cracking or lack of fusion may be suspected. To aid inspection the profile of the weld may be dressed by burr grinding provided that the specified throat size and leg length is still maintained. The surface of the weld shall be free of cracks, lack of fusion and slag.

(11/04) 7.1.4.4 Ultrasonic Testing. All butt joints selected in accordance with 7.1.4.5 shall be ultrasonically tested in accordance with BS EN 1714 where the column shaft is 8 mm thick or greater. The weld shall be free of cracks. The height of buried slag, lack of fusion or lack of penetration shall not exceed 3 mm. Within 6 mm of the outer surface, their individual length shall not exceed 5 mm. The resulting net throat area loss over any 50 mm length of weld shall not exceed 5%.

7.1.4.5 Frequency of Testing. Joints for MPI, liquid penetrant inspection or ultrasonic testing shall be selected as follows:

10% of lighting columns of each type shall be inspected. The sample shall include all variations in joint geometry, material thickness and weld size covered by the basic type, that are within the scope of 7.1.4.3 and 7.1.4.4. If non-conformances are found the scope of MPI, liquid penetrant inspection and ultrasonic testing shall be doubled. If further non-conformances are found, the whole batch shall be tested.

7.1.4.6 Reporting. Inspection records for production welds shall be retained by the manufacturer for seven years and those covering the production periods relating to the lighting columns supplied shall be made available for examination.

7.1.5 Destructive Testing. Copies of certified reports of destructive tests on lighting columns supplied under earlier contracts with the Overseeing Organisation shall be made available for examination.

The Contractor shall supply sample joints cut from complete lighting columns for destructive testing as selected on behalf of the Overseeing Organisation. The sample joints shall be cut from the column, extension piece, bracket and welded anchorage where relevant. The basis of selection shall be as follows:

- a) For orders of 1 to 10 lighting columns - one complete lighting column for each type, unless destructive testing has been carried out within the last year on a lighting column of that type. The manufacture, supply and verification of lighting columns and bracket arms shall comply with the quality management scheme described in Appendix A.
- b) For orders of 11 to 300 lighting columns - one complete lighting column for each type unless destructive testing has been carried out within the last month on a lighting column of that type where the lighting column to be tested was also selected on behalf of the Overseeing Organisation.
- c) For orders exceeding 300 lighting columns - two complete lighting columns for each type.

Acceptance criteria shall be as specified in 7.1.4, except that in 7.1.4.2 the throat and leg dimension shall apply to the true rather than the apparent dimension.

In the event that there is a non-conformance arising from a serious deviation in materials, preparation, assembly, or welding procedure, the batch concerned shall be rejected and further production of the columns affected stopped until such time as the fault has been corrected. A minor non-conformance shall only be accepted on the basis that further sampling and testing shows that fault is not repetitive and in the view of the Overseeing Organisation will not in that instance impair structural integrity.

If the problem can be traced to a particular manufacturing period, operator, piece of equipment or batch of materials and if proper traceability to individual batches of components can be assured, only those batches affected may be subject to rejection.

The destructive test reports shall be retained by the manufacturer and recorded in a register for a period of two years. The destructive test specimens shall be retained for a period of 12 months. These shall be made available for examination on future contracts with the Overseeing Organisation.

7.1.6 Remedial Work. Welds which do not comply with the Specification may be repaired to an approved procedure, as described in 7.1.2."

(11/04) **Page 12 sub-Clause 13.6.1** (BS EN 40-5 and BS EN 40-6)

(11/04) In the first paragraph delete "in 7.2"

In third paragraph delete "13.6.3" and add "7.1.4.2, 7.1.4.3, 7.1.4.4 and 7.1.4.5"

(11/04) **Pages 12 and 13 Clause 13** (BS EN 40-5 and BS EN 40-6)

Delete sub-Clauses 13.6.2, 13.6.3 and 13.6.4

(11/04) **Pages 13, 14 and 15 Clause 14** (BS EN 40-5 and BS EN 40-6)

Delete sub-Clauses 14.5.1, 14.5.2, 14.5.3 and 14.5.4

(11/03) **1310.2 For CCTV Masts and Cantilever Masts:**

(11/04) BS EN 40-5 applies subject to the following amendments:

Page 6 - Clause 4

(11/05) Delete the last five lines in sub-Clause 4.1 and replace with: "The steel shall be equivalent to or better than BS EN 10025-1, BS EN 10025-2, Grade S275 JR or BS EN 10210, Grade S275 JOH".

(11/05) Delete sub-Clause 4.2 and replace with: "The steel used for foundation bolts shall be equivalent to or better than BS EN 10025-1, BS EN 10025-2, Grade S275 JR".

Page 7 - Clause 7

Delete sub-Clauses 7.1, 7.2 and 7.3 and insert the following:

(11/03) "7.1. Steel CCTV masts and Cantilever masts

(11/04) 7.1.1 General. Arc welding of ferritic steels shall comply with BS EN 1011-1 and BS EN 1011-2. Arc welding of stainless steels shall comply with BS EN 1011-3.

(11/05) 7.1.2 Procedures. Written welding procedures shall be used with testing to BS EN ISO 15607, BS EN ISO 15609-1 and BS EN ISO 15614-1 for steel and shall apply to all production and repair procedures. These shall be subject to reapproval after a period of seven years. When applying BS EN ISO 15607, BS EN ISO 15609-1 and BS EN ISO 15614-1 the welding consumables and procedures used for steel shall be such that the mechanical properties of deposited weld metal will not be less than the respective minimum specified values of the parent metal being welded. Weld testing shall be undertaken by an appropriate organisation accredited in accordance with sub-Clauses 105.3 and 105.4. Approval shall be by an Independent Inspecting Authority using Registered Welding Engineers, Registered Welding Quality

Engineers or equivalent. Welding procedures shall be approved in accordance with BS EN ISO 15613. Pre-production test pieces shall represent the main assembly types.

(11/05) 7.1.3 Welder Qualification. All welders shall be approved to BS EN 287-1. The tests shall include in addition an application test representative of the 'main structural' joints on which the welder is to be approved to work. The main structural joints shall include, where relevant, the flange plate joint, the base compartment to shaft joint, the door reinforcement, any intermediate mast joint, the mast to bracket joint and the mast seam weld. Welders shall be subject to reapproval in accordance with BS EN 287-1. Weld testing shall be undertaken by an appropriate organisation accredited in accordance with sub-Clauses 105.3 and 105.4. Approval shall be by an Independent Inspecting Authority using Registered Welding Engineers, Registered Welding Quality Engineers or Welding Inspectors certified by the Certification Scheme for Weldment Inspection Personnel (CSWIP) or equivalent. Test results shall be kept current and made available for review on request.

7.1.4 Inspection and Non-Destructive Testing

(11/03) 7.1.4.1 Inspection Personnel. The manufacturer shall provide suitable personnel to carry out inspection of production welds as required in 7.1.4.2 to 7.1.4.4. Personnel conducting visual inspection shall have a nationally recognised certificate of competence appropriate to the type of welding being inspected. Personnel conducting non-destructive testing (NDT) shall be certified according to a nationally recognised certification scheme appropriate to the equipment used and the weld groups inspected all in accordance with BS EN 473. Evidence of training and qualification shall be retained and made available for examination when required. The results of all weld inspections shall be recorded.

(11/04) 7.1.4.2 Visual Inspection. All welds shall be subject to visual inspection in accordance with BS EN 970 prior to any NDT and galvanizing. Weld surfaces shall be free of slag residues and sharp edges. All surfaces shall be free of traces of weld spatter, arc strikes and contaminants. The apparent throat dimensions of butt welds and the apparent leg length and apparent throat dimensions of fillet welds, as measured by a welding gauge and taking into account any known lack of fit, shall not be less than those specified, except that local shortfalls up to 0.5 mm may be accepted provided the average over any 50 mm length is not less than the specified dimension. The toe angle shall not be less than 110°. The surface of all welds shall be free from cracks, lack of fusion including overlap, and slag. Isolated discontinuous porosity may be accepted provided it is not detrimental to the

galvanizing process. Undercut shall not result in a section loss of more than 5% over any 50 mm length of joint, nor shall its depth exceed 0.5 mm or 10% of the thickness, whichever is the less.

(11/03) 7.1.4.3 Magnetic Particle Inspection (MPI) and Liquid Penetrant Inspection. MPI shall be applied in accordance with BS EN ISO 9934-1 to joints in steel CCTV masts and cantilever masts selected in accordance with 7.1.4.5, where any of the material thickness exceeds 20 mm. Liquid Penetrant Inspection in accordance with BS 571-1 shall be applied to transverse joints in masts selected in accordance with 7.1.4.5. Notwithstanding the requirements of 7.1.4.5, one of the above methods shall be applied as appropriate where on visual inspection the presence of cracking or lack of fusion may be suspected. To aid inspection the profile of the weld may be dressed by burr grinding provided that the specified throat size and leg length is still maintained. The surface of the weld shall be free of cracks, lack of fusion and slag.

7.1.4.4 Ultrasonic Testing. All butt joints selected in accordance with 7.1.4.5 shall be ultrasonically tested in accordance with BS EN 1714 where the mast shaft is 8 mm thick or greater. The weld shall be free of cracks. The height of buried slag, lack of fusion or lack of penetration shall not exceed 3 mm. Within 6 mm of the outer surface, their individual length shall not exceed 5 mm. The resulting net throat area loss over any 50 mm length of weld shall not exceed 5%.

(11/03) 7.1.4.5 Frequency of Testing. Joints for MPI, liquid penetrant inspection or ultrasonic testing shall be selected as follows:

10% of CCTV masts of each type shall be inspected, except for orders of 1 to 10 masts, in which case 50% shall be inspected. The sample shall include all variations in joint geometry, material thickness and weld size covered by the basic type, that are within the scope of 7.1.4.3 and 7.1.4.4. If non-conformances are found the scope of MPI, liquid penetrant inspection and ultrasonic testing shall be doubled. If further non-conformances are found, the whole batch shall be tested.

(11/03) 7.1.4.6 Reporting. Inspection records for production welds shall be retained by the manufacturer for seven years and those covering the production periods relating to the CCTV masts and/or cantilever masts supplied shall be made available for examination.

(11/03) 7.1.5 Destructive Testing. Copies of certified reports of destructive tests on CCTV masts and/or cantilever masts supplied under earlier contracts with the Overseeing Organisation shall be made available for examination.

The Contractor shall supply sample joints cut from complete CCTV masts and/or cantilever masts for destructive testing as selected on behalf of the Overseeing Organisation. The sample joints shall be cut from the mast, extension piece, bracket and welded anchorage where relevant. The basis of selection shall be as follows:

- a) (11/03) For orders of 1 to 10 CCTV masts and/or cantilever masts - no requirement.
- b) (11/03) For orders of 11 to 300 CCTV masts and/or cantilever masts - one complete CCTV mast and/or cantilever mast for each type unless destructive testing has been carried out within the last month on a CCTV mast and/or cantilever mast of that type where the CCTV mast and/or cantilever mast to be tested was also selected on behalf of the Overseeing Organisation.
- c) (11/03) For orders exceeding 300 CCTV masts and/or cantilever masts - two complete CCTV masts and/or cantilever masts for each type.

Acceptance criteria shall be as specified in 7.1.4, except that in 7.1.4.2 the throat and leg dimension shall apply to the true rather than the apparent dimension.

In the event that there is a non-conformance arising from a serious deviation in materials, preparation, assembly, or welding procedure, the batch concerned shall be rejected and further production of the masts affected stopped until such time as the fault has been corrected. A minor non-conformance shall only be accepted on the basis that further sampling and testing shows that fault is not repetitive and in the view of the Overseeing Organisation will not in that instance impair structural integrity.

If the problem can be traced to a particular manufacturing period, operator, piece of equipment or batch of materials and if proper traceability to individual batches of components can be assured, only those batches affected may be subject to rejection.

The destructive test reports shall be retained by the manufacturer and recorded in a register for a period of two years. The destructive test specimens shall be retained for a period of 12 months. These shall be made available for examination on future contracts with the Overseeing Organisation.

(11/03) 7.1.6 Remedial Work. Welds which do not comply with the Specification may be repaired to an approved procedure, as described in 7.1.2."

Page 12 sub-Clause 13.6.1

In first paragraph delete "7.2" and add "7.1.2"

In third paragraph delete "13.6.3" and add "7.1.4.2, 7.1.4.3, 7.1.4.4 and 7.1.4.5"

Page 13 Clause 13

Delete sub-Clauses 13.6.2, 13.6.3 and 13.6.4

Page 15 Clause 14

Delete sub-Clauses 14.5.1, 14.5.2, 14.5.3 and 14.5.4

1311 (11/04) Amendments and Additions to BS 5649-5 for Lighting Columns, CCTV Masts and Cantilever Masts

1311.1 (11/03) For Lighting Columns, CCTV Masts and Cantilever Masts:

Page 3

3.2, after paragraph 2

Insert additional paragraphs as follows:

(11/04) "The door arrangement shall be such that it can be opened by releasing a single threaded locking fastener. The fastener shall be of stainless steel to BS EN ISO 3506-1 and BS EN ISO 3506-2 or BS 970-1 with the dimensions given in HCD Drawing Number K1.

When the door is secured the fastener head shall be completely recessed into the door in a circular recess as indicated in HCD Drawing Number K1.

Six door keys as shown on HCD Drawing Number K1, or for alternative vandal resistant locks approved by the Overseeing Organisation shall be supplied to the Overseeing Organisation.

The locking fastener shall be suitable for opening with the standard key detailed in HCD Drawing Number K1."

1311.2 For Lighting Columns:

Page 3

3.4, after paragraph 2

Insert additional paragraph as follows:

"Where a cable entry slot width of 75 mm is provided, the minimum size of cableway from the cable entry slot to the base compartment shall be 75 mm"

After Page 3

Insert "HCD Drawing Number K1."

1312 (11/03) Attachments to Lighting Columns, CCTV Masts and Cantilever Masts

1 Attachments to lighting columns and CCTV masts shall be by means of circumferential clamps of stainless steel complying with AISI Grade 201 or other suitable material which shall not damage the column or its protective coating.

2 (11/03) Attachments to cantilever masts shall be in accordance with Chapter 7 of BD 88 (DMRB 2.2.13).

1313 (05/01) Laminated Glass Fibre Reinforced Plastic (GFRP) Lighting Columns

Manufacture of GFRP Laminates

1 The columns shall be produced either by hand lay-up or mechanical moulding technique. The mechanical manufacture shall be carried out either by filament winding, centrifugal casting, compression moulding, resin injection or any other appropriate method accepted by the Overseeing Organisation.

2 An exterior resin rich layer of at least 0.25 mm thickness shall be provided to ensure adequate protection of the reinforcing fibres against adverse effects of the weather and possible chemical attack.

3 Columns containing bubbles, cracks, holes, pits or other voids each greater than 7 mm² in area shall be rejected.

4 (11/04) The dimension and tolerances shall be those given in BS 5649-2 for seamless metal columns. The outer surface shall have a smooth uniform taper along its total length.

Materials for GFRP Laminates

5 The fibre reinforced plastic shall be in the form of laminate made of thermosetting resin, fibre reinforcement (mainly glass fibre), catalyst system and filler.

6 The resins used shall conform to the appropriate British Standards. Polyester resins shall be based on isophthalic acid and conform to BS 3532, Type B.

7 Any fillers and pigments incorporated in the resin shall form part of the total resin system and shall be subject to acceptance of the Overseeing Organisation.

8 (11/04) Fibre reinforcement shall conform to the appropriate British Standards. Where glass fibre is used as the base for mat or chopped fibre it shall conform to BS EN 14020-1, BS EN 14020-2 and BS EN 14020-3 and shall be treated with an appropriate finish compatible with the resin system used.

9 All accelerators, catalysts and hardeners shall be used in accordance with the resin manufacturer's instructions.

Testing of GFRP Laminates

10 The properties of the laminates shall be verified by testing as described in sub-Clauses 13 to 18 of this Clause. Any material failing any of the tests listed shall be rejected. Such tests shall, unless otherwise described in Appendix 13/1, be carried out on samples representing the batch of columns to be supplied under the Contract.

11 Two types of samples shall be provided for the tests:

(i) Samples from a specially prepared flat laminate for type tests or where changes in raw materials or manufacturing techniques are proposed. These shall comprise tests for colour fastness, electric strength, water absorption and impact strength.

(ii) (11/03) Samples cut from complete columns to be used for quality control purposes, to be carried out at a frequency of one in each fifty production columns. Each column for tests will be selected on a random basis and will be examined by visual inspection and for loss on ignition.

12 A flat laminate sample 300 mm ± 10 mm square by 3 mm + 0.5 mm/-0.0 mm thick shall be prepared by hand lay-up method using the same curing conditions resin and reinforcement systems as used for production columns. The total glass fibre content shall not exceed 40% by weight.

13 (05/06) The colour fastness test shall be conducted in accordance with 'BS EN ISO 877, BS 2782-5 : Method 550B' and the results assessed by Method 552A. Material with a colour change assessed greater than moderate will not be accepted.

14 (11/05) The electric strength test shall be carried out in accordance with 'BS EN 60243-2, IEC 60243-2'. The electric strength shall be not less than 10 kV/mm.

15 (11/03) The water absorption test shall be carried out in accordance with BS EN ISO 62. The absorption of water shall be not greater than 50 milligrammes.

16 (11/05) The impact strength test shall be carried out in accordance with 'BS EN ISO 179-2, BS 2782-3: Method 359B'. The impact resistance shall be at least 30 kJ/m².

17 (11/04) The loss on ignition tests shall be carried out in accordance with BS 2782-10 : Method 1002. The loss on ignition on samples taken at random throughout the length of a column shall not exceed 60% after

subtracting the amount allowed for non combustible fillers. The percentage of glass fibre remaining following ignition shall be at least 40% by weight.

18 Samples cut randomly throughout the length of a column shall be visually inspected to confirm that there are no delaminations or voids greater than specified in sub-Clause 3 of this Clause and that the laminate is fully densified and includes the required number of laminations.

1314 Brackets for Laminated GFRP Lighting Columns

General

1 Brackets shall consist of a galvanized steel tube assembly with an external self-skinning rigid polyurethane foam moulding.

Materials

2 (11/04) The steel tube assembly shall comply with BS EN 40-1 and BS 5649 and the requirements of this Series.

3 (11/03) The rigid polyurethane foam shall be moulded in accordance with the manufacturer's instructions to give a bulk density within the range of $500 \pm 50 \text{ kg/m}^3$, when in the form of a test sheet in accordance with sub-Clause 5 of this Clause. The surface shall be free from obvious defects such as voiding, pitting or cracking. It shall have a surface hardness of at least D/30/1 when measured in accordance with BS EN ISO 868.

4 The polyurethane moulding shall be primed with a two part polyurethane primer and finished with a two part polyurethane top coating all in accordance with the manufacturer's instructions.

Testing of Polyurethane Foam

5 Properties of foam shall be verified by testing using specimens cut from moulded test sheets of 10 mm nominal thickness using the same material as in the manufacture of the bracket arms.

6 The apparent bulk density of a specimen shall be determined and be within the range of $500 \pm 50 \text{ kg/m}^3$. The method of testing shall be in accordance with the polyurethane foam manufacturer's instructions.

7 (11/05) The impact strength of a specimen shall be determined in accordance with 'BS EN ISO 179-2, BS 2782-3: Method 359B' and shall be at least 6.0 kJ/m^2 .

8 The flexural stress at a deflection of 10 mm carried out on a specimen shall be in the range of 24 to 30 MPa. The method of testing shall be in accordance with the polyurethane foam manufacturer's instructions.

9 The tests specified in sub-Clauses 6, 7 and 8 of this Clause shall each be carried out on two specimens and, unless otherwise stated in Appendix 13/1, the results shall be representative of the batch of columns to be supplied.

10 Evidence of quality control including results of tests similar to those required in sub-Clauses 6, 7 and 8 of this Clause shall be made available when required by the Overseeing Organisation.

11 Tests specified in sub-Clauses 6, 7 and 8 of this Clause shall be carried out when changes in raw materials or manufacturing techniques are proposed. For quality control purposes testing shall be carried out in accordance with sub-Clause 3 of this Clause on each production batch of brackets which are to be fitted to columns.

NATIONAL ALTERATIONS OF THE OVERSEEING ORGANISATION OF NORTHERN IRELAND

1301NI (05/01) General

1 (11/03) This Series shall apply to the design, supply and installation of lighting columns and brackets and CCTV masts and cantilever masts for traffic signals and/or speed cameras (hereafter called cantilever masts) within the following dimensional limitations:

- (i) For steel, aluminium and concrete lighting columns:
 - (a) post top columns not exceeding 20 m nominal height;
 - (b) columns with brackets not exceeding 18 m nominal height;
 - (c) bracket projections not exceeding 0.25 x nominal height or 3 m whichever is the lesser.
- (ii) For glass fibre reinforced plastic lighting columns:
 - (a) columns not exceeding 10 m nominal height;
 - (b) bracket projections not exceeding 1.5 m.
- (iii) For steel CCTV masts:
 - (a) post top masts not exceeding 25 m nominal height.
- (iv) (11/03) For steel cantilever masts:
 - (a) nominal height not exceeding 8.5 m;
 - (b) cantilever projection not exceeding 8.5 m.

Where nominal height is taken as the distance between of the underside of the flange plate and the highest point of the mast (see Figure 1 of BD 88 (DMRB 2.2.13)).

2 (11/03) The Contractor shall propose lighting columns and brackets, CCTV masts and cantilever masts which have been designed by the manufacturer. The manufacture, supply and verification of lighting columns and bracket arms shall comply with the quality management scheme described in Appendix A.

The Contractor shall design foundations for planted lighting columns and cantilever masts in accordance with BD 26 Chapter 8 (DMRB 2.2.1) or of BD 88/03 Chapter 8 (DMRB 2.2.13) using the soil type information as described in Appendices 13/1 and 13/7.

The Contractor shall, where required, design:

- (i) anchorages and attachment systems for columns and masts with flange plates to foundation or bridge deck;
- (ii) foundations for columns and masts with flange plates;

as described in Appendices 13/1, 13/4 and 13/7.

3 (05/06) Lighting columns and brackets, CCTV masts and cantilever masts shall be supplied and installed in compliance with the relevant requirements of BS EN 40-1, BS EN 40-3-1, BS EN 40-3-2, BS EN 40-4, BS EN 40-5, BS EN 40-6 and BS 5649-2, BS 5649-5 and BS 5649-7 together with the amendments and additions stated in Clauses 1309, 1310 and 1311 and all the other requirements of this Series.

4 Brackets shall include wall and wood pole mounted brackets and fixtures.

5 Temporary lighting on temporary diversions for traffic, and crossovers, shall comply with this Series.

6 (11/03) Where lighting columns, CCTV masts and cantilever masts are to be in the vicinity of overhead power lines the Contractor shall ensure that the appropriate Electricity Authorities are notified and give written agreement to the specific clearances to be provided and that warning notices as described in Appendices 13/1, 13/4 and 13/7 are permanently fixed to these columns prior to erection.

7 (11/03) Headroom over carriageway for cantilever masts shall be in accordance with the requirements of paragraph 3.2 of Standard BD 88 (DMRB 2.2.13).

1308NI (05/01) Handling, Transport and Erection

1 (11/03) Lighting columns and brackets, CCTV masts and cantilever masts shall be handled, transported and stored in such a way as to avoid any structural damage or damage to the surface protection system. Any damage incurred shall be made good in such a way that the structural performance and durability of the item shall be in no way reduced.

2 (11/03) Lighting columns and brackets, CCTV masts and cantilever masts shall be stored clear of the ground in such a way that contact with cement, groundwater, soil or ash or other deleterious material is prevented and

that water does not accumulate on any surfaces or inside sections. Suitable packings shall be placed between the columns/masts to allow a free passage of air and dispersion of water.

3 All rivets, bolts, nuts, washers, screws, small plates and small articles generally shall be suitably packed and identified. All such items shall be stored under cover.

4 (11/03) Columns and masts shall be installed in accordance with the manufacturer's recommendations. The door shall face the direction described in Appendices 13/1, 13/4 and 13/7.

5 Wall and wood pole mounted lighting brackets and fixtures shall be fixed as described in Appendix 13/1.