
MANUAL OF CONTRACT DOCUMENTS FOR ROAD WORKS
VOLUME 2 NOTES FOR GUIDANCE ON THE SPECIFICATION FOR ROAD WORKS

SERIES NG 100

PRELIMINARIES

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NATIONAL ALTERATIONS OF THE OVERSEEING ORGANISATIONS OF MALTA

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denotes a Clause or Sample Appendix which has a substitute National Clause or Sample Appendix for one or more of the Overseeing Organisations of Malta.

PRELIMINARIES

NG 101 Temporary Accommodation and Equipment for the Overseeing Organisation

1 This Clause will generally need to be supplemented by drawings cross-referenced in Appendix 1/1. In addition, Appendix 1/1 should indicate:

- (i) accommodation and commencement date, if different from sub-Clause 101.2, and/or removal date.
- (ii) the size and nature of accommodation needed;
- (iii) all the required furniture and fittings, equipment (including surveying) supplies, definitive quantity of consumables, drainage facilities and other services. The Appendix should also include the standards of artificial lighting intensity and the minimum room temperature to be maintained during stated hours, including weekends where required.

2 The accommodation, furnishings and fittings and equipment provided should be in good condition, but unless there is any particular reason need not be new.

3 The provision of special temporary accommodation may be unnecessary in some instances where suitable existing property can be used. In such instances details of the property should be described in Appendix 1/1 together with the terms under which the property can be made available.

4 Appendix 1/1 should indicate, when applicable, the accommodation requirements (which may be either portable or in existing

premises) needed by the Overseeing Organisation to supervise major components of the Works likely to be manufactured and tested off Site.

5 Testing equipment to be listed in Appendix 1/1 should only include that to be used by the Overseeing Organisation for tests which are necessary to ensure compliance with the Specification. In particular, the list should include equipment for carrying out tests on samples described in Appendix 1/6, having regard to laboratory accreditation requirements where appropriate.

6 It should be noted that laboratory accreditation for tests becomes invalid where test equipment is defective, therefore the Contractor should take prompt action to repair, replace and/or recalibrate any test equipment requiring such attention.

7 When the Contractor erects temporary accommodation on land which is part of the Site or adjoining the Site (ie. has a common boundary with it) planning permission for the erection of the temporary accommodation is deemed to have been granted for the duration of construction operations.

NG 102 Vehicles for the Overseeing Organisation

1 This Clause will need supplementing by Appendix 1/2 which should describe the number and type of vehicles and indicate the period for which each vehicle is required.

2 Vehicles should not be described by proprietary names; if they cannot otherwise be described, the words 'or equivalent'

should be added. New vehicles should only be required where the nature of the Works and Contract period make it essential.

3 The frequency that the Overseeing Organisation's vehicles are to be cleaned by the Contractor should be described in Appendix 1/2.

NG 103 Communication System for the Overseeing Organisation

1 When a communication system is required this should be stated in Appendix 1/3, together with requirements specific to the Contract which should include:

- (i) Type of equipment required.
- (ii) Location of base station if necessary.
- (iii) Number and description of sets, (including spare batteries and charging apparatus) required for:
 - (a) installation in vehicles, stating that hands free kits shall be provided;
 - (b) portable use.
- (iv) If a radio communication system is to be used the radio frequency should be obtained from the Overseeing Organisation.

2 The scale of provision should bear some relation to the length of the scheme and should not normally exceed one set per kilometer of a road scheme in addition to the base set, although variations may be necessary where particular problems of control arise.

3 When there are particular reasons for requiring the communication facilities earlier than the normal 4 weeks from the date for commencement of the Works (eg. on major maintenance contracts where traffic management measures need to be commenced early after the Contract has been awarded) this should be stated in Appendix 1/3.

NG 104 Standards, Quality Assurance, Agreement Certificates and Other Approvals Standards

1 Where there is no declaration of equivalence in respect of a proposed alternative standard, the Overseeing Organisation should ascertain whether or not the proposed standard lays down levels of safety, suitability and fitness for purpose equivalent to those required by the specified standard. The Overseeing Organisation may also need to seek advice from the designer. The factors underlying the purpose of the specified standard and their criticality should be evaluated for each application. If the proposed standard only differs from the specified standard in a way not essential to the underlying purpose it should be considered equivalent. Similarly, if the proposed standard contains such factors but in a different technical form which achieves the same purpose as the specified standard, it should be considered equivalent.

Quality Assurance

2 A contract specific Quality Plan should be prepared by the Contractor, which should be as brief as possible but cover all the topics in the "Model Requirements". (See NG Sample Appendix 1/24). The quality plan should include the requirements listed in the quality

plans contained in the relevant quality management schemes described in Appendix A of the Specification for Road Works.

3 National Sector Schemes for Quality Management in Road Works are being developed, as a partnership, by all sides of the road industry to interpret BS EN ISO 9002 : 1994 as it applies to a particular road activity/industry within Malta. Changes to scheme structure and requirements are being incorporated in the light of revisions to the standard in the shape of BS EN ISO 9001 : 2000.

4 National QMSS have generally been developed from schemes that were originally operated by individual certification bodies accredited by the MSA or ADT.

5 National QMSS were developed, and are complementary to and interpret BS EN ISO 9002 : 1994, but do not duplicate this standard. They are designed to:

- (i) provide an industry benchmark;
- (ii) ensure that all processes are planned;
- (iii) provide a basis for continuous improvement;
- (iv) focus on quality as an objective;
- (v) reduce costs for client and supplier;
- (vi) provide and maintain a properly trained and competent workforce;
- (vii) involve all sides of industry in scheme ownership within a partnership framework;
- (viii) ensure that Certification Bodies use auditors with technical knowledge

and experience of the sector concerned; and

- (ix) promote confidence in quality management systems by provision of a robust transparent system.

6 MSA and ADT are advised on each sector scheme by a separate Technical Advisory Committee (TAC). Each TAC interprets ISO 9002 : 1994 in relation to the requirements of their particular activity. The TAC comes to a consensus on the minimum levels of workmanship, services, products, testing, and the training and competency of operatives needed to meet specification requirements, as well as auditor qualification. These details are contained in the individual Sector Scheme Documents (SSDs).

7 After reaching consensus on the SSD, the final draft is then submitted to MSA and ADT for final scrutiny as a sector scheme before being accepted. MSA particularly check which organisations have participated in the development of the scheme, the interpretation of ISO 9002 : 1994, especially the training elements and the auditor qualifications for the certification bodies. Following this scrutiny and the making of any necessary amendments, the document is then published by MSA. MSA provide copies to MSA accredited certification bodies that wish to participate in the scheme for a sector activity, and to the relevant TAC chairpersons. These organisations and the relevant chairpersons are then responsible for circulating copies to their respective suppliers and committee members.

8 Implementation of a new scheme or an amendment to a scheme is bound by time constraints. For a completely new scheme, the implementation period must allow for the accreditation of the certification bodies

by MSA and then subsequent registration of suppliers by the certification body. This is unlikely to be less than 9 months. Where a scheme is amended, the implementation period must allow suppliers time to update their quality system and be assessed against the requirements. This period will not be less than 6 months, which should generally be sufficient for certification bodies to notify suppliers of the changes so that they can be included in their quality system prior to their next surveillance assessment.

9 When needed, the schemes include a requirement for a supplier to provide, for approval by the Customer, a quality plan prior to commencement of work. This will include contract specific method statements where applicable. The plan and statements should be reviewed during the currency of a contract, and may also be audited subsequently by the certification body during a surveillance or reassessment visit.

10 Each scheme is reviewed, at least annually, by the appropriate TAC. The review takes account of feedback on the performance of the scheme including perceived deficiencies, comments received from users of the scheme and the effect that new standards or codes of practice may have on the scheme. This allows the scheme to develop naturally and provides for continuous improvement.

11 Individual technical advisory committees are overseen by the ADT. This group provides a forum for discussion on the effectiveness of the sector schemes and co-ordinates developments so that they can be uniformly taken forward by each of the technical advisory committees. It is also the venue where dialogue with MSA and the certification bodies on the application of the schemes is discussed. One of the main aims of the group is to promote the schemes

throughout the country so that only certificated suppliers are used.

12 National QMSS provide a major opportunity for Clients to review their procurement policies, contract procedures and supervision responsibilities, enabling savings to be made in manpower and compliance testing without comprising quality.

13 The introduction of harmonised European Standards includes requirements for factory production control and attestation of conformity. This will vary from self-certification by the manufacturer to approved third party product certification process. Currently, the European Commission has set up a Notified Bodies Group which has been charged with the responsibility of interpreting European Standards where third party certification is included in a standard. QMSS are seen as complementary to this process.

14 Suppliers' quality management schemes listed in Appendix A and product certification schemes in Appendix B comply with MSA EN ISO 9002 : 1994, and are third party certificated by a certification body satisfying the requirements of EN 45012 or EN 45011 and accredited for the scheme. MSA uses EN 45011 and EN 45012 as part of the criteria for assessment so certification bodies accredited satisfy the requirements of these European Standards. Each Supplier should prepare a Quality Plan covering the topics in the "Model Requirements" in addition to any requirements included in relevant National QMSS documents cited in Appendix A.

15 For listed schemes, other than National QMSS, Overseeing Organisations should consider the critical factors which form the basis of the acceptability of the listed

scheme when ascertaining whether or not a proposed alternative quality management scheme or product certification scheme is equivalent. The Overseeing Organisation should check that certification of the proposed quality assurance scheme has been undertaken by an independent body. Such bodies are those accredited by MSA for certification body accreditation, or similar bodies in other Member States of the European Economic Area. For organizations which have achieved certification under National Sector Schemes for Quality Management in Road Works, registration on the QA Register forms part of the requirements of the scheme. It should be noted that not all third party certification bodies are accredited for all their activities. In the case of product certification schemes, equivalence of testing facilities may have to be checked.

16 To date only a few quality management schemes have been adopted by the ADT. It is intended to list other recognized schemes when these become established and enough firms are registered to ensure adequate competition within a geographical region. It should be noted that firms may be registered for part only of some schemes.

17 The Overseeing Organisation should retain the copy certificates of conformity provided in compliance with Clause 104 as evidence of the operation of quality management schemes and product certification schemes. Certificate issued in

respect of National Sector Schemes for Quality Management in Road Works will include reference to the specific sector scheme or will be included on an attached schedule to the certificate.

18 Some of the National QMSS enquire that operatives successfully complete specific training and/or competency assessment. These achievements are recognized as registered operatives and foremen are required to carry registration skill cards, which indicate status and categories of work that the holder can carry out. Each card carries a photograph of the holder. The Overseeing Organisation should check the cards against the holder and also check the validity of cards with the issuing Authority. Table NG ½ provides a summary of national sector scheme requirements for registration/skill cards.

Table NG 1/2: Summary of National Sector Scheme Requirements for Registration/ Skill Cards

Scheme	Operative/ Erectors	Foreman/ Lead Operative/ Lead Erectors	Issuing Authority
2A – Fencing	Required	Required	MSA/ ADT
2B – Vehicle Restraint Systems	*	Required	MSA/ ADT
4 – Timber Preservation	Not applicable **	Not applicable **	MSA/ ADT
6 – Lightning Column manufacture supply and verification	Not applicable	Not applicable	MSA/ ADT
7 – Application of road marking and road studs	Required (NVQ level 2 or Certified Operative)	Required (NVQ level 2 or Certified Operative)	MSA/ ADT
12A – Static Temporary Traffic Temporary	Required	Required	MSA/ ADT
12B – Static Temporary Traffic Temporary	Required	Required	MSA/ ADT
12C – Mobile Lane Closures	Required	Required	MSA/ ADT
13 – Surface Dressing	Not Required	Not Required	MSA/ ADT
14 – Asphalt Production	Not required	Not required	MSA/ ADT

* To be implemented for operatives from December 2001

** (plant operatives required to hold NVQ)

19 The need for inspecting of manufacturer's premises and the testing of goods and materials subject to a quality management scheme or product certification scheme should be reviewed. If the Overseeing Organisation has reasonable confidence in the operation of a quality management scheme or product certification scheme, it can substantially reduce the level of inspection and testing or in some cases eliminate it. It should be noted that a quality management scheme differs from a product certification scheme by being based solely on written management procedures. Such schemes do not guarantee the quality of the actual product or workmanship. In the case

of product certification schemes, the goods and materials have already undergone independent testing. Nevertheless if the Overseeing Organisation is not satisfied with a product appropriate testing should be undertaken. If the performance of a quality assurance scheme is not satisfactory the certification body should be informed in writing.

MSA/ ADT

20 The Overseeing Organisation may accept equivalent certificates issued by Members of the European Union of Agrément (UEAtc).

Statutory Type Approval

21 Statutory type approval is granted by the ADT. Products which have obtained statutory type approval are listed in Advice Note SA1 (MCHW 0.3.1). Where the Contractor designs part of the Works and makes application for approval, he should forward the information to the Overseeing Organisation in sufficient time for approval to be given, taking into account the programme for the Works. Where statutory type approval is given, one copy of the approval certificate should be returned to the Contractor.

Statutory Authorisation

22 Statutory authorisation is granted by the ADT. Where the Contractor designs part of the Works and makes application for authorisation, he should forward the information to the Overseeing Organisation in sufficient time for authorisation to be given, taking into account the programme for the Works. Where statutory authorisation is given, one copy of the authorisation should be returned to the Contractor.

Type Approval/Registration

23 Type approval/registration is given by the Overseeing Organisation. Products which have obtained type approval and registration are listed in Advice Note SA1 (MCHW 0.3.1). Where the Contractor makes application to use work, goods or materials which are claimed to have an equivalent type approval/registration of the national roads authority of another Member State of the European Economic Area, he should forward the information to the Overseeing Organisation in sufficient time for consideration to be given, taking into account the programme for the Works.

Where type approval/registration is given, one copy of the approval certificate should be returned to the Contractor.

Provision of Information

24 The Overseeing Organisation should check that all information and certificates are valid. Where certificates relate to a particular batch, it is important to ensure that the goods or materials incorporated in the Works form part of that batch.

25 Frequently there is a need for the Contractor to submit working and fabrication drawings to the Overseeing Organisation. The compiler should include in Appendix 1/4 relevant details of all works (eg. steelwork, parapets, diaphragm wall details, waterproofing details, traffic signs, lighting, bearings, piles, precast concrete, joints, environmental barriers, corrugated steel buried structures, combined drainage and kerb systems) for which he requires working or fabrication drawings to be prepared by the Contractor, together with the minimum periods for submission of the drawings prior to commencement of the related works.

26 Where Proposed Equivalent Work, Goods and Materials (PEQs) are required to have statutory or type approval/registration, this can take a considerable time to evaluate and may not be possible within the timescale of the Contract. The Overseeing Organisation should inform the Contractor of the likely timescale together with an assessment of whether it is possible to achieve approval within the time available. Guidance on the evaluation of proposed equivalent work, goods and materials offered by the Contractor purporting to have levels of safety, suitability and fitness for purpose equivalent to those specified in the

Contract is given in Advice Note SA2 (MCHW 0.3.2).

NG 105 Goods, Materials, Sampling and Testing Goods and Materials

1 Samples of goods and materials should be retained until the completion of the Works.

Sampling and Testing

2 The compiler should refer to MCHW 0.3.3 (SA 3) before determining the extent of testing by the Overseeing Organisation and by the Contractor. It is not intended that all the testing (appropriate to the Contract) specified in the Specification for Road Works should necessarily be undertaken by the Contractor. The compiler should consider carefully and decide which of the specified tests would be better undertaken by the Overseeing Organisation. The Specification requires those tests marked ‘†’ in Table NG 1/1 to be undertaken by the Contractor and this requirement should not normally be changed.

3 Details of testing to be carried out by the Contractor and test certificates to be supplied should be abstracted selectively from Table NG 1/1 and scheduled in Appendix 1/5 to enable tenderers where appropriate to allow for these in their rates and prices as no separate items (except for proof loading of piles) should be contained in the Bill of Quantities, unless there has been an agreed departure from the Method of Measurement (see MCHW 4.2, Chapters I, II and III, Note 7 ‘Testing’). The Contractor may propose that testing be carried out on his behalf by a testing laboratory, manufacturer or supplier.

4 The testing detailed in Table NG 1/1 is not

necessarily exhaustive and other tests may be required. Where Contract-specific Clauses contain testing requirements, details should be scheduled in Appendix 1/5 or 1/6 as appropriate.

5 The frequencies of testing marked ‘*’ in Table NG 1/1 are given for general guidance and are only indicative of the frequencies that may be appropriate. The compiler should determine the frequencies to be used for the Contract, taking into account all relevant factors and circumstances such as size, location, time for completion, QA schemes. Where a British Standard or Specification Clause number is listed, the frequency of testing is specified therein and should not normally be changed.

6 Details of provision and delivery of samples by the Contractor for testing by the Overseeing Organisation should be scheduled in Appendix 1/6, to enable tenderers where appropriate to allow for these in their rates and prices as no separate items for supplying samples should be contained in the Bill of Quantities, unless there has been an agreed departure from the Method of Measurement (see MCHW 4.2, Chapters I, II and III, Note 7 ‘Testing’). The compiler should avoid duplication of testing wherever possible.

7 Where a part of the Permanent Works is to be designed by the Contractor and the associated materials and workmanship are to be tested by the Contractor, the compiler should ensure that the tests scheduled in Appendix 1/5 cover all the options permitted by the design specification. Similarly, where a part of the Permanent Works designed by the Contractor is to be tested by the Overseeing Organisation, the samples scheduled in Appendix 1/6 should cover all the permitted options. The same considerations apply where the Contractor

selects materials from a range of permitted options (eg. type of pavement, safety fencing, pipes for drainage and ducts).

8 It is the policy of the Overseeing Organisations to require the use of testing laboratories accredited for certain tests and sampling by the MSA/ ADT for laboratory accreditation for on Site and off Site testing and sampling. Test results which are required to be MSA accredited are indicated in Table NG 1/1.

9 In cases where the Contractor has sublet his testing obligations, the following should be noted. The time requirements in sub-Clause 105.2 of the Specification are of the essence and the Contractor has an obligation under the Contract to ensure that his subcontractor complies with sub-Clause 105.2, inter alia.

Test Certificates

10 Appendix 1/5 should indicate, where appropriate, the requirement for a test certificate for each test or series of tests carried out by the Contractor, supplier or manufacturer.

11 British Standards which specify tests are usually written in a form in which test requirements are a matter between the supplier or manufacturer and the purchaser. The Contractor is the purchaser in this context and sub-Clause 105.3 requires him to obtain test certificates provided for in a British Standard (or other standard or specification) where stated in Appendix 1/5.

NG 106 Design of Permanent Works by the Contractor General

1 Appendices 1/10 and 1/11 should include for each structure, structural element or

feature listed a design specification (or design specifications where a choice is offered) incorporating any relevant Appendices, Standards or other requirements appropriate to the design. A Designated Outline should be shown on the Drawings for each structure to be designed by the Contractor and each structure for which a choice of designs is offered. Advice on the Designated Outline is given in Standard SD 4 (MCHW 0.2.4).

Structures

2 The Contract should be compiled in accordance with Standard SD 4 (MCHW 0.2.4) in respect of:

- (i) Each structure for which a design (based on a proprietary manufactured structure) is to be submitted by the Contractor. (These structures should be listed in Appendix 1/10 (A).)
- (ii) Each structure for which the Overseeing Organisation has prepared a (nonproprietary) design but for which a proprietary manufactured structure is a suitable option. (These structures should be listed in Appendix 1/10 (B).)

Examples of structures for which the suitability of proprietary systems should be considered are:

- environmental barriers;
- drains (exceeding 0.9 m diameter);
- crib walling;
- precast concrete box culverts (up to 8 m span);

- corrugated steel buried structures (0.9 to 8 m span);
- reinforced earth structures;
- anchored earth structures;
- footbridges;
- small span underbridges (up to 8 m span).

3 The compiler should ensure that each design specification includes an outline Approval in Principle form as referred to in Standard BD 2 or the Technical Approval Scheme adopted by the Overseeing Organisation and Advice Note BA 32.

4 The design certificate, completed by the Contractor, should be forwarded to the Technical Approval Authority for acceptance, together with the check certificate. On receipt of the countersigned certificates, one copy should be returned to the Contractor.

Lighting Columns and Brackets and Closed Circuit Television (CCTV) Masts

5 Clause 1301 requires the Contractor to propose lighting columns and brackets and CCTV masts which have been designed by the manufacturer (and checked by a checking consultant) in accordance with Standard BD 2 or the Technical Approval Scheme adopted by the Overseeing Organisation and Series 1300. The Overseeing Organisation should ensure that the design and check certificates provided comply with these requirements and where a sign is to be fitted to a lighting column, with the requirements of sub-Clause 1207.13.

Structural Elements and Other Features

6 The compiler should ensure that structural elements and other features based on

proprietary products have not been specified in the Contract. Such elements and features should be designed by the Contractor, or where appropriate, by the manufacturer and proposed by the Contractor. Such elements and features, examples of which are given below, should be listed in Appendix 1/11:

- combined drainage and kerb systems;
- linear drainage channels;
- ground anchorages for anchored structures;
- piles;
- bridge bearings;
- bridge expansion joints;
- parapets.

7 Non-proprietary structural elements and other features to be designed by the Contractor should also be listed in Appendix 1/11. Examples of such elements are:

- foundations to environmental barriers;
- foundations to lighting columns.

NG 107 Site Extent and Limitations on Use

1 The extent of the Site should normally be shown on the Drawings but for schemes where traffic management involves temporary traffic signs outside the area of the Works it may be more appropriate to describe the extent of the Site in Appendix 1/7. Where the Site is shown on the Drawings, the drawing numbers should be stated in Appendix 1/7.

2 Where the Contractor is responsible for temporary traffic signs giving advance warning of the Works, those areas of road necessary for the installation, maintenance and removal of advance signs, cones and road markings should be included in the Site, with the agreement of the roads authority.

3 Any limitations on the use of the Site, for example restrictions on the use of verges and paved areas that have been coned off adjacent to traffic, should be described in Appendix 1/7.

NG 108 Operatives for the Overseeing Organisation

1 The number and function of operatives required by the Overseeing Organisation should be included in Appendix 1/8.

NG 109 Control of Noise and Vibration Noise

1 Where it is envisaged that construction or reconstruction might involve noise disturbance, the Overseeing Organisation should have informal discussions with the Local Authority during the scheme preparation and, where possible, an informal agreement to a noise control system should be concluded.

2 The noise control requirements informally agreed with the Local Authority should be described in Appendix 1/9 together with any specific requirements of the Overseeing Organisation which are not covered by BS 5228 : Parts 1, 2 and 4 or by the Local Authority.

3 Appendix 1/9 should state that the Local Authority requirements are given as a guide

to the Contractor, and it is for the Contractor to decide whether to seek the Local Authority's consent to his proposed method of work and to the steps he proposes to take to minimize noise.

4 Local Authorities have powers to control pollution by imposing requirements as to the way in which work is to be carried out and, in particular:

- (i) the plant or machinery which is, or is not, to be used;
- (ii) the hours during which work may be carried out;
- (iii) the level of noise which may be emitted.

Guidance on noise control legislation is given in BS 5228 : Part 2.

Vibration

5 Any requirements for the control of vibration other than that due to blasting for excavation should be included in Appendix 1/9. Vibration limits for blasting are given in Clause 607, but may be varied as in Appendix 6/3.

NG 110 Information Boards

1 The compiler should provide in Appendix 1/21 details of any specific requirements, and cross-refer to drawings of the information boards required for the Works. Whenever possible information boards should be erected within the road boundary, consistent with the safety of road users and although planning permission is not required for trunk roads the Local Planning Authority should be informed of the proposal to erect them as a matter of courtesy. The permission

of the Local Authority is required for information boards erected on a non-trunk road. Safety fencing should be detailed at the site of information boards where appropriate.

2 Contractor's advertising boards should not be located with advance direction signs or traffic management signs except when associated with information boards. Planning permission for advertisements on construction sites is covered by MEPA and ADT regulations.

NG 112 Setting Out

1 Generally on large schemes a pre-construction survey is undertaken by the Overseeing Organisation to confirm the co-ordinates and levels of permanent ground markers (PGMs) and permanent bench marks (PBMs). The Overseeing Organisation should ensure that missing ones are replaced and new ones provided where required to ensure that there is a sufficient number immediately adjacent to the Works.

2 The compiler should include in Appendix 1/12 particulars of the setting out details which are available. This will usually include:

- (i) Co-ordinates and levels of PGMs, PBMs.
- (ii) Offset information.
- (iii) Cross-section details.
- (iv) Computerised data.

3 Normally it is not necessary to supply each tenderer with all this information, but it should be made available for inspection.

Once the Contract is awarded, the details should be given to the Contractor, who is responsible for setting out.

4 No specific tolerances are given for setting out. The construction tolerances given in the Specification relate to the agreed lines and levels of the Works.

5 The Contractor should check the co-ordinates and levels of PGMs and PBMs before setting out and the Overseeing Organisation may check the setting out as the work proceeds.

6 Any specific requirements for setting out should be given in Appendix 1/12.

7 Any special requirements regarding the level of information on existing details to be recorded by the Contractor should be given in Appendix 1/12.

NG 113 Programme of Works

1 Appendix 1/13 should describe the Overseeing Organisation's requirements for the programme to be submitted in accordance with the Conditions of Contract and all supplementary information related to the programme that may be required.

2 The Contract may require the Overseeing Organisation to approve this programme and in this respect it is often appropriate that a schedule of output and resources to support all activities shown in the programme is requested.

3 Contractors will vary in the detail into which they break down the activities of the programme. It should be remembered that there is little to be gained from requiring the Contractor to provide a programme in more detail than is his usual practice for

construction projects of similar complexity. This is likely to lead to the submission of a programme which although feasible soon becomes out of date as the work progresses.

4 Regardless of how carefully the Overseeing Organisation vets the programme, it is likely to require amendment as the work progresses. The aim should be for the programme to always represent the Contractor's current working programme throughout the Contract. This may require updating of the programme throughout the duration of the Contract. It is recommended that the Contractor should be requested to update the programme if necessary to match progress meetings.

NG 114 Payment Applications

1 Appendix 1/14 should describe the Overseeing Organisation's requirements for applications for payment from the Contractor, unless described elsewhere within the Conditions of Contract. Standard requirements are described in NG Sample Appendix 1/14.

NG 115 Accommodation Works

1 Accommodation works should be described in Appendix 1/15, indicating where appropriate the periods for completion together with the requirements on individual plots for the benefit of each owner, lessee or occupier. Where accommodation works are not known at the time of tender, Appendix 1/15 should state where land reference plans and schedules can be inspected. Details of accommodation works that have been agreed after compilation of Appendix 1/15 should be available for reference where described therein.

NG 116 Privately and Publicly Owned Services or Supplies

1 Generally the Overseeing Organisation will make preliminary arrangements with the Statutory Undertakers for the alteration of services and supplies affected by the Works. It should also, where possible, make similar arrangements for the alteration of other publicly and privately owned services and supplies.

2 The above particulars should be contained in Appendix 1/16 and include details of any advance contracts, agreements and pre-ordered material.

3 The position of all known services and supplies should be shown on the Drawings, cross-referenced in Appendix 1/16.

4 Appendix 1/16 should include details of motorway communications and/or other motorway systems which may be affected by the Works together with details of any necessary alterations or temporary alternative provisions.

NG 117 Traffic Safety and Management

1 When major reconstruction or maintenance work is carried out on roads carrying a heavy flow of vehicles, for which the Overseeing Organisation is the roads authority, particularly where contraflow traffic management is intended or envisaged, the Contractor may be required to undertake maintenance functions on such roads within the Site. If so, this should be stated, together with a list of these functions, in Appendix 1/17. The limits of the road to be maintained should be stated together with the timescale during which the Contractor is responsible for maintenance.

2 Where contraflow traffic operation is specified by the Overseeing Organisation for which crossovers are to be designed by the Contractor full design requirements should be given in Appendix 1/17. Where crossovers are specified in Appendix 1/17 the Overseeing Organisation should ensure that the ADT has been consulted, and list in Appendix 1/17 any maintenance functions to be carried out by the Contractor. When crossovers are proposed by the Contractor, they may be constructed only if the ADT agree. The police should also be consulted. The Contractor will agree details of construction and maintenance with the roads authority and Clause 117 requires him to inform the Overseeing Organisation of these details. The compiler should state in Appendix 1/17 the timescale for submission and making of any statutory orders needed before work can commence.

3 If, in addition to routine maintenance functions, the Contractor is to be required when requested by ADT to repair accidental or wilful damage to any road within the Site for which that authority is responsible (including any central reserve crossover specified by the Overseeing Organisation), full details should be stated in Appendix 1/17. The Overseeing Organisation should ensure that the ADT has been consulted.

4 Legally, it is the ADT's responsibility to maintain the roads and that the Contractor was employed to carry out or supervise the maintenance of the roads. However, compensation for breach of contract may be obtainable from the Contractor if damages are paid by the ADT because of a failure in maintenance due to fault by the Contractor.

5 It is essential that all traffic safety measures are in accordance, where applicable, with the requirements and advice

given in Chapter 8 of the Traffic Signs Manual and the associated amendments detailed in Annex B of Advice Note TA 61, Standard TD 49, Advice Note TA 63, Advice Note TA 64 and any other relevant requirements. Chapter 8 of the Traffic Signs Manual is not a specification, and in many instances provides guidance and options. In such circumstances Appendix 1/17 should clearly indicate any specific requirements. The Contractor's programme for traffic management and site access/egress should take into account the views of the police and the ADT.

6 It may be necessary to erect, alter, cover, uncover and take down advance direction signs and other similar signs to be compatible with the state of the Works. The responsibility for this should be stated in Appendix 1/17. Where the Contractor is to be responsible, the areas of road affected by advance signs, cones and road markings should be included in Appendix 1/7 as forming part of the Site (see NG 107.2).

7 Authorisation of non-prescribed signs or temporary traffic signals should be obtained through the Overseeing Organisation giving at least 28 days' notice. (This time period can vary.) Any other requirements which are likely to be needed should be included in Appendix 1/17.

8 The compiler should state in Appendix 1/17 the timescale for the Contractor to submit his traffic management proposals. The Contractor should also ensure that necessary steps have been or are being taken to obtain any statutory orders required from the appropriate authority. Details of these orders should be stated in Appendix 1/17.

9 Appendix 1/17 should state the length of notice required for the making of orders

necessitated by the Contractor's proposals, or if he wishes to vary the agreed measures.

10 Before the Contractor commences work on a road, or reopens a closed road, he should ensure that the police and road authority agree with the proposals and are satisfied with the state of the road to be reopened.

11 Any requirements for temporary lighting should be included by cross-reference to Appendix 14/3.

12 The x heights of the lettering on vehicle sign boards of 37.5, 50, 62.5, 75, 100 and 150 mm relate to the lower case and the capital sizes are 52.4, 70, 87.5, 105, 140 and 210 mm in height.

13 The compiler should detail in Appendix 1/17 the roads and private rights of way which are to be kept open, and those for which orders have been obtained for their closure.

Driver Information Signs at Roadworks

14 Driver Information Signs are for use on roads that are the Overseeing Organisation's responsibility and where closure of traffic lanes is required for maintenance, new works or improvement schemes. Advance signs will give warning of road works ahead, and provide information about the nature and duration of the Works. Signs located within the road works will provide information about work in progress when a lane is closed and there may appear to be no activity. These signs will be used in addition to scheme notice boards where required. Authorised legends are given in Table 1/1. Appendix 1/17 should state where driver information signs are required and should include details of required variations to the

legends of Table 1/1, which shall be agreed with the Overseeing Organisation.

TASCAR

15 Where a Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Roadworks (TASCAR) is to be provided in accordance with the sub-Clause 117.32, it is desirable to include the following in the Instructions for Tendering:

'The Contractor's attention is drawn to Specification sub-Clause 117.32 together with Appendices 1/17, 1/26 and 1/27 which require the provision and maintenance of a Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Roadworks (TASCAR) which will be operated under the control of the Chief Officer of Police for the *[give name of police district as specified in Appendix 1/27]* and regularly maintained under the Contract at the expense of the Contractor in accordance with standards required by the Home Office in accordance with current legislation for traffic enforcement.'

NG 118 Temporary Diversions for Traffic

1 The definition of the term 'temporary diversion for traffic' is included in Volume 4 of the Manual of Contract Documents for Road Works, Section 1, Chapter IV, Series 100, Paragraph 1(c).

Temporary Diversions for Traffic Specified by the Overseeing Organisation

2 The Overseeing Organisation should ensure that:

- (i) all temporary diversions for traffic required for reasons of safety or practicality, including any structures, have been specified in Appendix 1/18;
- (ii) details of their construction and maintenance, together with any constraints, have been agreed with the ADT, and described in Appendix 1/18;
- (iii) where applicable, licences or other rights to operate on land not owned by the Overseeing Organisation have been obtained and such land has been included in Appendix 1/7 as forming part of the Site;
- (iv) the necessary orders have been or will be made by the appropriate authority.

3 If, in addition to routine maintenance functions, the Contractor is to be required to repair accidental or willful damage to any temporary diversion for traffic specified by the Overseeing Organisation at the request of the road authority responsible for that diversion, full details should be stated in Appendix 1/18.

4 Where the Contractor is required to design a temporary diversion for traffic, or any temporary structures, design requirements should be stated in Appendix 1/18.

5 If the ground over which the diversion route is to be provided is not to be reinstated to its original condition on completion of the Works this should be stated in Appendix 1/18 together with details of any treatment required.

Temporary Diversions for Traffic Proposed by the Contractor

6 If the Contractor proposes temporary diversions for traffic, they may be implemented only if the appropriate authority agree and the police have been consulted.

7 The compiler should state in Appendix 1/18 the timescale for submission of any statutory orders which would need to be made where required by the Contractor's proposals.

8 The Contractor will agree details of construction and maintenance with the appropriate authority and Clause 118 requires him to inform the Overseeing Organisation of the details.

NG 119 Routing of Vehicles

1 Appendix 1/19 should contain where applicable the Overseeing Organisation's specific requirements. These should include details of:

- (i) Routing of vehicles to and from the Site;
- (ii) The use of the Permanent Works by construction traffic;
- (iii) Traffic control required for machinery and plant crossing public roads and notice required before this can be implemented;
- (iv) Procedures to be adopted in complying with the Conditions of Contract to enable the Contractor to satisfy the Overseeing Organisation of the adequacy of his proposals.

NG 120 Recovery Vehicles for Breakdowns

1 If recovery vehicles for breakdowns are required in the Contract because of the Works interfering with roads carrying a heavy flow of vehicles, this should be stated in Appendix 1/20 together with requirements specific to the Contract which should include:

- (i) Number, category of vehicle and period required. Vehicle categories are:
 - (a) Heavy recovery vehicles;
 - (b) Light recovery vehicles; A list of equipment to be provided for each vehicle should be given in Appendix 1/20.
- (ii) Location(s) where the recovery vehicle(s) shall be sited.
- (iii) Location(s) to which broken-down or accident-damaged vehicles shall be removed and facilities to be provided at those locations.
- (iv) Details of equipment for communication.

2 The Overseeing Organisation should provide a suitable printed leaflet for the Contractor to hand out to the drivers of broken-down or accident-damaged vehicles prior to assistance being provided. Appendix 1/20 should specify a sample leaflet (see Sheet 3) which should include the following information:

- (i) Definition of roadworks operations. This is usually between the 'Roadworks Ahead-2 miles sign and the 'Road Works End' sign.

- (ii) Location to which the vehicle is to be towed.
- (iii) A statement that the recovery service is free and is limited to the area of roadworks operations (as (i) above) and between that and the location to which the vehicle is to be towed (as (ii) above).
- (iv) A statement that it will be at the discretion of individual drivers to arrange for assistance or the removal of their vehicle to garages of their choice from the location to which it has been towed.
- (v) Telephone numbers of local garages, produced following liaison with the police, which may assist with onward recovery. Where the location for depositing recovered vehicles is adjacent to an operational emergency roadside telephone, the leaflet should advise that the emergency telephone may be used to gain police assistance.
- (vi) That the operatives of the recovery vehicles do not make arrangements with private garages for the repair of vehicles.

NG 122 Progress Photographs

1 When required, Clause 122 will need supplementing by Appendix 1/22, describing the number of, and interval between visits and the number, size, type and finish of photographs required.

2 The compiler should include in Appendix 1/22 the designation of the person who should accompany the photographer to

ensure that only relevant photographs are taken.

3 Photographs should be taken as a record of any procedures or features which are, or could be, the subject of a third party claim or complaint eg. Works which by their nature could generate considerable quantities of dust.

NG 123 Not Used

NG 124 Health and Safety Restrictions, Precautions and Monitoring

1 Clause 124 will be supplemented by Appendix 1/23 which should describe any limitations on the Contractor's method of working or monitoring requirements when using substances hazardous to health such as silane, bridge deck waterproofing systems, paints, where these are used in locations which could result in a risk to members of the public.

2 Where protective clothing or other safety apparatus in relation to the specified use of substances hazardous to health is required for the Overseeing Organisation's staff, this should be listed in Appendix 1/1.

3 Further information and advice on the use of specified substances hazardous to health may be obtained from the Overseeing Organisation.

NG 125 Temporary Closed Circuit Television (CCTV) System for the Monitoring of Traffic

1 The Overseeing Organisation should consult with the police force before specifying a temporary CCTV system. The police requirements for a dedicated communications link should be obtained and included in Appendix 1/25.

2 The Overseeing Organisation should specify supplementary cameras at areas such as interchanges, entrances to and exits from contraflow, etc.

TABLE NG 1/1: (05/01) Typical Testing Details

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 300					
306	Permanent fencing				Quality management scheme applies
	Concrete components	Cover to reinforcement	1 per consignment (maximum 1 per 100 components) (BS 1722)		<i>[Tests/samples should not normally be required]</i>
308	Gates and stiles				Quality management scheme applies
	Reinforced concrete posts	Cover to reinforcement	1 per consignment (maximum 1 per 100 components) (BS 3470)		<i>[Tests/samples should not normally be required]</i>
308 & 311	Preservation of timber	Full sapwood penetration.	As required in sub-Clause 311.2(v)	Required for each batch	Quality management scheme applies <i>[Tests/Samples should not normally be required]</i>
Series 400					
402	Welding	Welding procedures (Manufacturer's tests)	(Every seven years)		Quality management scheme applies
		Welder qualification (Manufacturer's tests)	As required in sub-Clause 402.5(iii)		
		Production testing (Manufacturer's tests)	As required in sub-Clause 402.5(iv)		
	Welded joints	Destructive testing	<i>[See sub-Clause 402.5(v)]</i>		<i>††[See NG 402(N)]</i>
	Wire rope terminals	Tensile tests (Manufacturer's tests)	(Annually and when production technique changed)	Required	To provide evidence of tests by a testing laboratory
403	Anchorage and attachment systems for use in drilled holes	Ultimate tensile load (Manufacturer's tests)		Required	To provide well attested and documented evidence <i>[See NG 403.5]</i>
404	Anchorage in drilled holes	Loading test on site	As required in Appendix 4/1		†
	Post foundations				<i>[See NG 404.3]</i>

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 500					
501	Pipes for drainage and service ducts				
	Vitrified clay	[See Note 1]			Product certification scheme applies [Note 1. Additional manufacturer's tests are provided for in the relevant BS but should not normally be required.]
	Concrete-PC/SRC	[See Note 1]		[See Note 2]	
	Concrete-Prestressed				
	Iron-cast				[Note 2. Certificates are provided for in the relevant BS but should not normally be required except for pipes which are not quality marked by a UKAS accredited body listed in Appendix B of SHW.]
	Iron-ductile			[See Note 2]	
	PVC-U				
	GRP				
	Plastics. See Table 5/1				
	Corrugated steel	(Manufacturer's tests)		Required (AASHTO)	
	Corrugated steel bitumen protection	Not exceeding 900 mm dia			
	Other materials			Required	BBA certification (or equivalent) applies
503	Pipe bedding	Grading	1 per 500 tonnes (min of 3)*		[Appropriate tests/samples for soundness and frost heave should be scheduled where required]
		Soluble sulfate content (N)	1 per source*		
		10% fines value (N)			
505	Filter medium backfill	Plastic index (N)	1 per source*		[Appropriate tests/samples for soundness and frost heave should be scheduled where required]
		10% fines value (N)			
		Soluble sulfate content (N)			
		Grading	1 per 500 tonnes*		Washing and sieving method to be used
		Permeability (N)	1 per source*		
506	Sealing existing drains				[Appropriate tests/samples should be scheduled where not included under other Clauses]
	Concrete				
	Grout				

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 500 (continued)					
507	Chambers				Product certification scheme applies
	Precast concrete	[See Note 1]			
	Corrugated galvanized steel	(Manufacturer's tests)		Required	Product certification scheme applies
	Manhole steps			[See Note 2]	
	Steel fitments				
	Covers, grates and frames	[See Note 1]		[See Note 2]	Product certification scheme applies
	Cover bolts	[See Note 1]		[See Note 2]	Quality management scheme applies
508	Gullies and pipe junction				Product certification scheme applies
	Precast concrete	[See Note 1]			
	Clay				
	Cast iron and steel	[See Note 1]		[See Note 2]	
509	Watertightness of joints	Air test	All pipelines with watertight joints [As required in Appendix 5/1 for partly watertight joints]		
512	Backfill to pipe bays	Grading	1 per 50 tonnes (min of 3)*		[Appropriate tests/samples for soundness and frost heave should be scheduled where required]
		Soluble sulfate Content (N)	1 per source*		
513	Permeable backing to earth retaining structures	Plastic index (N)	1 per source*		[Appropriate tests/samples for soundness and frost heave should be scheduled where required]
		Soluble sulfate content (N)			
		10% fines value (N)			
		Grading	1 per 200 tonnes (min of 3)*		
		Permeability (N)	1 per source*		
	Precast hollow concrete blocks	(Manufacturer's tests)		Required	
514	Fin Drains	(Manufacturer's tests)		Required	BBA certification (or equivalent) applies

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 500 (continued)						
515	Narrow filter drains					
		Geotextile, pipes and fittings	(Manufacturer's tests)		Required	BBA certification (or equivalent) applies
		Granular fill	Plastic index (N)	1 per source*		
			10% fines value (N)			
			Soluble sulfate content (N)	1 per 200 tonnes (min of 3)*		
			Grading			
		Permeability (N)	1 per source*			
516	Combined drainage and kerb systems		Load test	A minimum of 1 test and not less than 1 test per 1000 m for each type and source	Required	Certification that the systems comply with Clause 516 is required
517	Linear drainage systems		Load test	A minimum of 1 test and not less than 1 test per 1000 m for each type and source	Required	Certification that the systems comply with Clause 517 is required
518	Thermoplastics structured wall pipes and fittings		(Manufacturer's tests)		Required	BBA certification (or equivalent) applies
Series 600						
601, 631 to 637, 640	Acceptable material					[For recycled aggregate, see sub-Clauses 601.12 and 601.18]
	Class	General Description				
	1	General granular fill	Grading/uniformity coefficient	Twice a week*		
			mc/MCV (N)	2 per 1000 m³ up to max of 5 per day*		
			SMC of chalk (N)	Twice a week*		
			1C only	10% fines value (N)	Weekly*	
	2	General cohesive fill	Grading	Twice a week*		[Cross-reference should be made to any requirements in Appendix 6/1]
			mc/MCV/PL Undrained shear strength (N)	2 per 1000 m³ up to max of 5 per day*		
			SMC of chalk (N)	Twice a week*		
			Bulk density (pfa) (N)	2 per 1000 m³ up to max of 5 per day*		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 600 (continued)					
	Class	General Description			
	3	General chalk fill	mc (N)	2 per 1000 m ³ up to max of 5 per day*	
			SMC (N)	Daily*	
	4	Landscape fill	Grading/mc/MCV (N)	Daily*	
	5	Topsoil	Grading	Daily*	
	6	Selected granular fill	Grading/uniformity coefficient	1 per 400 tonnes*	
			PI/LL (N)	Daily*	
			10% fines value/SMC (N)	Weekly*	
			omc/mc, mc or MCV (N)	1 per 400 tonnes*	
			Organic matter/water soluble or total sulfate content (N)	Weekly*	
			pH/chloride ion content (N)	Weekly*	
			Resistivity (N)	[As required]	
			Undrained and drained shear parameters (N)	[As required]	[Cross-reference should be made to any requirements in Appendix 6/1]
	7	Selected cohesive fill	Grading/mc/MCV/ bulk density (N)	1 per 400 tonnes*	
			SMC of chalk (N)	Twice a week*	
			PI/LL (N)	Daily*	
			Organic matter/total or water soluble sulfate content (N)	Twice a week* or daily where sulfates are expected.	
			Total sulfur content (N)	Twice a week* or daily when sulfides are expected.	
			pH/chloride ion content (N)	Weekly*	
			Resistivity (N)	[As required]	
			Undrained and drained shear parameters (N)	[As required]	[Cross-reference should be made to any requirements in Appendix 6/1]
			Permeability (N)	[As required]	

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 600 (continued)						
	Class	General Description				
	8	Miscellaneous fill	mc/MCV (N)	Daily*		
	9	Stabilised materials	Pulverisation	1 per lane width per 200 m length*		
			mc/MCV (N)			
			Bearing ratio (N)			
	Pulvenised fuel ash		Chemical analysis <i>[As appropriate to properties stated in Table 6/1 or Appendix 6/1]</i>	1 per consignment*		
	Furnace bottom ash		Grading	1 per 300 tonnes*		
	Fill adjacent to cementitious material or metallic items		Soluble sulfate content (N)	1 per 400 tonnes or per location if less than 400 tonnes*		
602	Earthworks material beneath surface of a road or paved central reserve (i) Off site source (ii) On site source	Frost heave (N)	 1 every four months* As required			
609 621	Geotextiles	Tensile load Permeability Pore size	1 per 400 square metres*		<i>[Requirements should be given in Appendix 6/5 or 6/9 as appropriate]</i>	
612	Compaction of fills					
	Method compaction	Field dry density (N)	<i>[As required]</i>		††	
	End product compaction	Optimum mc (2.5 kg rammeter/vibrating hammer method) (N)	Each class or sub class of material*		†	
		Field dry density (N)	1 per 400 tonnes*		†	
614	Cement stabilisation to form capping	Rate of spread of cement	1 per 500 square metres of cement spread*			
615 641 643	Lime stabilisation to form capping	Rate of spread of lime Available lime content	1 per 500 square metres of lime spread* Each source of lime weekly during stabilisation operation*		 †	

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments	
Series 600 (continued)						
622 638 639	Earthworks for reinforced soil and anchored earth structures	Redox potential	5 locations within the affected area*		†	
		Drainage layers	Grading			1 per 400 tonnes*
			Chemical analysis			
		Reinforcing elements	Coeff. of friction		Each type of element with each type of fill*	
			Anchor elements			Adhesion
624	Ground anchorages	Proof loading	As required in Appendix 6/10		†	
626	Gabions					
		Fill	Grading			1 per 400 tonnes*
			10% fines value (N)			
		Geomesh	[As appropriate to properties stated in Appendix 6/10]			1 per 400 square metres*
		PVC coated wire				
642	Earthworks materials for corrugated steel buried structures	Constrained soil modulus (M*)	3 on each side of each structure*			
Series 700						
710	Constituent materials in recycled aggregate	Quality control	Checks are to be carried out by the Contractor in accordance with the procedure set down in 'Quality Control - Production of Recycled Aggregates' and with those in this Clause		The quality control procedure should be in accordance with the 'Quality Control – Production of Recycled Aggregates' published by Construction Research Communications (CRC). The results of all quality control checks shall be delivered promptly to the Overseeing Organisation on request.	
711	Overbanding and inlaid crack sealing systems			Required	BBA certification (or equivalent) applies	

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 800					
801	Unbound, hydraulically bound and other sub-base material (other than slag) adjacent to cement bound materials, concrete pavements, structures or products	Soluble sulfate Content (N)	1 per 400 tonnes or per location if less than 400 tonnes*		
	Blastfurnace slag	Bulk density (N)	1 per 500 tonnes*		
		Stability (N)			
		Sulfur content (N)			
	Steel slag	Bulk density (N)	1 per 500 tonnes*		
Sub-base and roadbase material beneath surface of a road or paved central reserve	Frost heave (N)	1 per source*			
803	Granular sub-base material Type 1	Grading	1 per 400 tonnes*		[Where required-See NG 803.5]
		Plastic index (N)	1 per source and then monthly*		
		10% fines value (N)			
		Soundness (N)	1 per source*		
		Water absorption (N)	[As required]		
804	Granular sub-base material Type 2	Grading	1 per 400 tonnes*		[Where required-See NG 804.5]
		Plastic index (N)	1 per source and then monthly*		
		CBR (N)			
		OMC/mc (N)			
		Density (N)			
		10% fines value (N)			
		Soundness (N)	1 per source*		
		Water absorption (N)	[As required]		
805	Slag Bound Materials				
	Aggregates	Grading	1 per 400 tonnes*		
		Soundness (N)	1 per source*		
		Water absorption (N)	[As required]		
806	Granular sub-base material Type 4	Grading	1 per 400 tonnes*		
		Recovered bitumen content (N)	1 per 400 tonnes*		
		OMC/mc (N)	1 per 400 tonnes*		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900					
901, 925, 937, 938	Aggregates for bituminous materials				National quality management sector scheme applies.
	Hardness	10% fines value (N)	Monthly*		
		Impact value (N)	Monthly*		
	Durability	Soundness (N)	1 per source*		[Where required-See NG 901.2]
		Water absorption (N)	[As required]		
	Cleanness	Sieve test (mass passing 75 micron sieve) (N)	Monthly*		Washing and sieving method to be used
	Shape	Flakiness index (N)	Monthly*		
	Blastfurnace slag	Soundness (N)	Once every 4 months		
		Bulk density (N)	1 per 500 tonnes*		
		Stability (N)			
		Sulfur content (N)			
	Steel slag	Bulk density	1 per 500 tonnes*		
	Coarse aggregate for wearing courses	PSV (N)	1 per source*		
		AAV (N)	1 per source*		
	Binders for bituminous materials	Penetration (N)	1 per 750 tonnes*		National quality management sector scheme applies.
		Softening point (N)	1 per 750 tonnes*		:
		[Other BS tests]	[As required]		1
	Bituminous mixtures	Grading (N)	For Audit Test purpose only		i
		Binder Content (N)			1
903 to 912, 914, 916, 925, 926, 930, 932 to 938, 942, 943, 946 to 948					i
					i
					1
					i
					1
					i
					1
					i
					1
					i

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900 (continued)					
929	Roadbase and Basecourse Macadams	In situ air void content (N)	[As required]		
		Refusal air void content (N) (PRD Test)			
		Binder volume (N)			
		Grading (N)			
		Binder content (N)			
911	Rolled asphalt wearing course (design mix)	Stability value (N)	1 per source*		National quality management sector scheme applies
		Flow value (N)			
		Density (N)			
915 925	Coated chippings	Grading (N)	1 per stockpile*		Not required for coated chippings for surface dressing to Clause 919
		Binder content (N)	1 per stockpile*		
		Flakiness index (N)	1 per source*		
		PSV (N)	1 per source*		
		AAV (N)	1 per source*		
		Hot sand test (N)	1 per source*		
		Rate of spread (N)	[As required]		
921	Surface texture	BS 598 : Part 105 Sand Patch (N)	BS 598 : Part 105		
924	High friction surfaces	Quality control checks	As required in sub-Clause 924.5	Required	BBA HAPAS Roads and Bridges certification (or equivalent) applies
		System coverage	As required in sub-Clause 924.6		
	Aggregate	PSV (N)	1 per source* and as required for coated chippings in Clause 915.3	Required	

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900 (continued)					
937	Stone mastic asphalt binder course and regulating course				National quality management sector scheme applies.
		Binder drainage test	In accordance with BS DD 232		
938	Porous asphalt surface course				National quality management sector scheme applies.
		Relative hydraulic conductivity	In accordance with Clause 938		
		Modified binder storage stability	In accordance with Clause 941		
		Binder drainage test	In accordance with BS DD 232		
942	Thin surface course systems				National quality management sector scheme applies.
		Binder drainage test	In accordance with BS DD 232		
943	Rolled asphalt wearing course (performance-related design mix)				National quality management sector scheme applies
		Grading (N)	[As required]		
		Binder content (N)			
		Density (N)			
		Wheel-tracking rate (N)			
		Wheel-tracking rut depth (N)			
		Air voids content			
944	Performance-specified roadbase				National quality management sector scheme applies

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900 (continued)					
918	Slurry surfacing incorporating microsurfacing				
	Binder				
		Product Identification	Per product per source	Required	Tests are expected to be repeated every two years
		Vialit cohesion	Per product per source	Required	Tests are expected to be repeated every two years
		Rate of spread	For each machine	Required	Not more than 6 weeks prior to start of work
		Penetration at 25°C and 5°C (N)	Every manufactured batch		Manufacturer's QA test results may be submitted
	Aggregates	Polished stone value (N)	Source approval	Required	Less than 6 months prior to work
		Aggregate abrasion value (N)	Source approval	Required	Less than 6 months prior to work
		Grading (N)	1 per 200 tonnes		
	System	TAIT or BBA/HAPAS		Required	
920	Bond coats, tack coats and other bituminous sprays				
	Binder	Product identification	1 per product per source	Required	Tests are expected to be repeated every two years
		Vialit cohesion	1 per product per source	Required	Tests are expected to be repeated every two years
		Accuracy of spread	1 for each binder and sprayer per month	Required	Not more than 6 weeks prior to start of work and one per month
		Rate of spread	1 per week		
		Penetration at 25°C and 5°C (N)	Every manufactured batch		Manufacturer's QA test results may be submitted

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900 (continued)					
919 922	Surface Dressing				National quality management sector scheme applies
	Binder				...
					...
					...
					...
					...
		Product Identification	1 per product per source	Required	Tests are expected to be repeated every two years
		Vialit cohesion (N)	1 per product per source	Required	Tests are expected to be repeated every two years
		Accuracy of spread	1 for each binder sprayer per week	Required	Not more than 6 weeks prior to start of work and one per week
		Rate of spread	Every 1000 linear metres initially		Frequency to be reduced to daily after 3 satisfactory results, but not less than 1 test per site
		Penetration at 25°C and 5°C (N)	Every batch		For cut back binders as supplied, manufacturer's QA viscosity test results may be submitted.
	Chippings	Polished stone value (N)	Source approval	Required	Less than 6 months prior to work
		Aggregate abrasion value (N)	Source approval	Required	Less than 6 months prior to work
		Grading (N)	1 per 200 tonnes		
		Binder content (N)	1 per 200 tonnes		Coated chippings only
		Flakiness index (N)	1 per 200 tonnes		
		Accuracy of spread (N)	1 for each chipping spreader for every change of chipping size or source	Required	Initial test not more than 6 weeks prior to start of work
		Rate of spread	Every 500 linear metres initially		Frequency to be reduced to daily after 3 satisfactory results, but not less than 1 test per lane per site
	System	TAIT or BBA/HAPAS		Required	
	Rollers	Spray bars working	Before work starts and daily during works		
950	Depressions				...

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1000					
1001 1030 1035 1044	Cement				Quality management and product certification schemes apply
	Portland cement CEM I				Tests and test certificates are required
	Portland blastfurnace cement				
	Blastfurnace cement CEM III/A				
	Portland pfa cement CEM II/B-V				
	Pozzolanic cement CEM IV/A			Required (BS 6610)	
	Portland cement with microsilica				BBA Roads and Bridges Certificate required for microsilica
	Pulverised-fuel ash				Tests and test certificates are required. Product certification schemes apply to pfa and slag.
	Ground granulated blast furnace slag				
	Admixtures				
	Aggregates	Soundness value (N)	1 per source*		[Where required-See NG 1001.19]
		Water absorption (N)	[As required]		
		Flakiness index (N)	Monthly*		
		Shell content (N)	1 per source*		
		10% fines value (N)	Monthly*		
		Grading (N)	Daily*		Washing and sieving method to be used for CBM aggregate [See also NG 1001.20-23]
		Chloride content (N)	Weekly (1 per source for CBM Aggregate)		
	Flint coarse aggregate containing white flints	Water absorption (N)	3 per source thereafter weekly		
	Sand (ie fine aggregate)	Acid-soluble material (N)	Monthly*		Not required for CBM Aggregate
	Blastfurnace slag	Bulk density Stability Sulfur content (N)	1 per 500 tonnes*		
	Pulverised-fuel ash			Required (BS 3892: Part 2)	

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1000 (continued)					
1002 1003 1004 1044	Concrete	Air content test (N)	As required in Table 10/8		Product certification scheme applies
		Density of in situ Concrete cores (N)	3 per 1200 m		
		Cube strength (N)	As required in Table 10/8		
1005	Workability	Compacting factor (N)	As required in Table 10/8		[See also sub-Clause 1005.2]
		Vebe (N)			
		Slump (N)			
1011 1012	Dowel bars Tie bars			Required (BS 4449)	Product certification scheme applies
	Dowel bars and supporting cradles	Load test	1 per arrangement*		
	Sheathed dowel bars	Bond stress	4 bars		
	Cranked tie bars (coated)	Bend test	4 bars*		
		Salt fog cabinet	4 bars*		
1015	Joint filler board	Weathering test	3 per source		Normally undertaken by manufacturer
		Compression and recovery	4 per source		
		Extrusion	1 per source		
	Cork filler board	Immersion in water	2 per source		
		Immersion in acid	2 per source		
1016 1017	Applied sealants			Required (BS 2499) (BS 5212: Part 1) (BS 4254)	
		Initial Penetration	1 per 1000m or 1 per day		
		Resilience	1 per 1000m or 1 per day		
	Compression seals			Required (ASTM) (BS 2752) (BS 4443: Part 4)	
		Compression set	1 per type of seal*		
		Immersion in oil	1 per type of seal*		
	Self expanding cork seal	Tests specified in Clause 1017	1 per type of seal*		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 1000 (continued)						
1026 1044	Surface texture		Sand patch (N)	1 per day (set of 10)*		
1027	Aluminised curing compound		Efficiency index	1 per source*		
1030	Wet lean concrete		Density	As required in Table 10/8		
			Cube strength (N)			
1036 to 1040	Cement bound material		Laboratory wet density (N)	1 per cube		
			In situ wet density (N)	As required in Clause 1040		
			Cube strength (N)	As required in Clause 1040		
	CBM 1 and 1A CBM 2 and 2A	Immersed cube strength (N)	5 per mix			
1043	Foamed Concrete		Cube strength (N)	2 cubes per 12 m³		
Series 1100						
1101	Precast concrete kerbs, channels, edgings and quadrants		Transverse strength	Minimum of 3 per 1000 units of each product (BS 7263: Part 1)		
			Water absorption			
1102	In situ asphalt kerbs		Grading	1 test per 500 metres laid*		
			Binder content			
1104	Precast concrete flags		Transverse strength	Minimum of 3 per 1000 units of each product (BS 7263: Part 1)		[Appropriate tests/samples should be scheduled where not included under other Clauses]
			Water absorption			
	Bedding	Granular material				
		Mortar				
1107	Concrete block paving		Compressive strength	16 per 5000 blocks (BS 6717: Part 1)		
1108	Clay pavers		Transverse breaking load	Minimum of 10 per 10000 pavers (BS 6677: Part 1)		
			Skid resistance	Minimum of 5 per 10000 pavers (BS 6677: Part 1)		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1200					
1202	Permanent traffic signs			Required <i>[where considered appropriate]</i>	Quality management scheme applies. Certification that the traffic signs capable of passing the tests in BS 873 : Part 1 is required
1207	Anchorage in drilled holes to supports of traffic signs	Loading test on site	<i>[As required]</i>		
1210	Holding down bolts and anchorages to bases of permanent bollards			Required <i>[where considered appropriate]</i>	Certification that the holding down bolts and anchorages are capable of complying with the performance requirements of BS 873 : Part 3 is required
1212	Road Markings				National quality management sector scheme applies. Procedures are given in MSA EN 1824
		Tests specified in MSA EN 1824		Required	
1214	Permanent traffic cones and traffic cylinders			Required	Certification that permanent traffic cones and cylinders have been tested and comply with BS 873 : Part 8 is required
		Tests specified in BS 873: Part 8	2 of each size and category/type*		† <i>[Where required]</i>
	Flat traffic delineators			Required	Certification that FTD's have been tested and comply with Clause 1214 is required
		Tests specified in Clause 1214	<i>[As required]</i>		† <i>[Where required]</i>
	Other traffic delineators			Required	Certification that the delineators have been tested and comply with Clause 1214 is required
		Tests specified in Appendix 12/4	<i>[As required]</i>		† <i>[Where required]</i>
	Temporary cones, cylinders, FTD's and other delineators			Required	Certification that at least 1 in 500 of any batch of cones, cylinders, FTD's and other delineators to be used in the Temporary Works have passed the tests in Clause 1214 as appropriate is required

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1200 (continued)					
1217	Traffic signals				Quality management scheme applies. Statutory type approval of equipment applies
	Cables				[Special sample tests to BS 6346 should be scheduled where appropriate] Product certification scheme applies
	Controllers [Other equipment]	Test specified in Appendix 12/5	Each controller before delivery to Site and again after installation		
	Cabling	Tests a, b, c, e, f, g, h, j as defined in sub-Clause 1424.2	Each traffic signals installation	Required	Certification that the installation complies with BS7671 (the IEE Wiring Regulations) is required
1218	Detector loops				
	Cable			Required	Certification that completed cables comply with specification TR 2029 is required
	Epoxy resin			Required [where considered appropriate]	Certification that the epoxy resin complies with specification MCH 1540 is required
	Feeder cable			Required	Certification that completed cables comply with specification TR 2031 is required
	Joints	Pull test (4 kgf)	Each crimp		
	Installation	Series resistance	Each loop	Required	Certification in accordance with specification MCH 1540 is required
		Insulation resistance			
		Inductance			
Series 1300					
1305	Anchorage for use in drilled holes	Tensile load (Manufacturer's tests)		Required	To provide well attested and documented evidence
1306	Anchorage in drilled holes to columns with flange plates	Loading test on site	[As required]		†
1310	Welding	Welding procedures (Manufacturer's tests)	(Every seven years)		Quality management scheme applies
		Welder qualification (Manufacturer's tests)	(Sub-Clauses 1310.1 and 1310.2 (7.1.3))		
		Production testing (Manufacturer's tests)	(Sub-Clauses 1310.1 and 1310.2 (7.1.4))		
	Welded joints	Destructive testing	[See sub-Clause 1310.1 and 1310.2 (7.1.5)]		†† [[N] See NG 1310]

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1300 (continued)					
1313	GFRP laminates	Loss on ignition	1 per 200 production columns		
		Colour fastness	1 per batch		
		Electric strength			
		Water absorption			
		Impact strength			
1314	Brackets for laminated GFRP lighting columns				
	Polyurethane foam	Bulk density	1 per batch		
		Surface hardness			
		Apparent bulk density	2 per batch		
		Impact strength			
		Flexural stress			
Series 1400					
1421	Cable				[Special sample tests to BS 6346 should be scheduled where appropriate] Product certification scheme applies
1424	Lighting Units	Tests specified in Clause 1424	Each unit	Required	† Product certification scheme applies Certification that the installation complies with BS7671 (the IEE Wiring Regulations) is required
	Networks	Tests specified in Clause 1424	Each network	Required	† Certification that the installation complies with BS7671 (the IEE Wiring Regulations) is required

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1500					
1506	Copper communications cable			Required	Certification that each completed cable complies with specification TR 2150 or TR 2158, as appropriate, is required.
	Optical fibre communications cable			Required	Certification that each completed cable complies with specification TR 2151 or TR 2159, as appropriate, is required.
	Coaxial communications				Certification that each completed cable complies with specification TR 2152 or TR 2160, as appropriate, is required.
	Energy cable			Required	Certification that each completed cable complies with specification TR 2153 or TR 2161, as appropriate, is required.
1513	Cable Joint Enclosures	Test specified in Clause 1513.12	Each CJE	Required	† Certification that the CJE satisfies the air pressure test is required.
1518	Coaxial and copper communications and power cable	Tests specified in specification MCG 1022 or MCG 1099, as appropriate	Each cable (Stage 1) As required in Appendix 15/1 (Stage 2)		† Results to be reported in accordance with MCG 1022 or MCG 1099, as appropriate.
	Optical fibre communications cable	Tests specified in specification MCG 1055 or MCG 1099, as appropriate	Each cable (Stage 1) As required in Appendix 15/1 (Stage 2)		† Results to be reported in accordance with MCG 1055 or MCG 1099, as appropriate.
1522	Motorway System				
	Steel posts			Required (BS 6323)	
1526	Electrical Installations	Tests specified in BS 7671	Each installation	Required	† Certification that the installation complies with BS 7671 (the IEE Wiring Regulations) is required.
1530	Cable ducts	Test specified in MSA EN 50086-1, 2 and 4	Each supplier	Required	Current British Board of Agrément Certificate is required.
1533	Cable ducts				
	Mandrel test	Test specified in Clause 1533	Each duct	Required	† Certificate that each length of duct between chambers satisfies the mandrel test is required.
	Air test	Test specified in Clause 1533	Each duct	Required	† Certificate that each length of duct between chambers satisfies the air test is required.

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1600					
1601	Soil samples In situ soil tests				<i>[Appropriate soil tests should be scheduled where required]</i>
1602 to 1606 1610 to 1615	Concrete Grout Reinforcement Prestressing Steelwork Welding Protection against corrosion				<i>[Appropriate tests/samples should be scheduled where not included under other Clauses/Series]</i>
1606	Coatings for protection against corrosion	Adhesion	As required in Appendix 16/6		
1607	Reduction of friction on piles				<i>[Particular requirements detailed in Appendix 16/7 should be scheduled]</i>
1608 1616	Integrity testing Dynamic testing				<i>[Particular requirements detailed in Appendix 16/8 or 16/16 should be scheduled]</i>
1609	Static load testing of piles				<i>[Testing of preliminary piles should not be scheduled in Appendix 1/5 Particular requirements detailed in Appendix 16/9 should be scheduled]</i>
1612	Self hardening slurry mixes				<i>[Particular requirements detailed in Appendix 16/12 should be scheduled]</i>
1617	Instrumentation				<i>[Particular requirements detailed in Appendix 16/17 should be scheduled]</i>
1618	Support fluids	To be proposed by the Contractor			<i>[Particular requirements detailed in Appendix 16/18 should be scheduled]</i>

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 1700						
1702 1703 1704	Cement	Portland			Required (BS 12)	Certificate to be provided monthly* for each type of cement
		Portland - Blastfurnace			Required (BS 146)	Quality management and product certification schemes apply
		Sulfate-resisting Portland			Required (BS 4027)	
		Portland pulverised-fuel ash			Required (BS 6588)	
		Low heat Portland			Required (BS 1370)	
		High Slag blastfurnace			Required (BS 4246)	
	Pulverised-fuel ash		Colour index	Monthly*	Required (BS 3892: Part 1)	Certificate to be provided monthly* Product certification scheme applies
	Ground granulated blastfurnace slag				Required (BS 6699)	Certificate to be provided monthly* Product certification scheme applies
	Cements (all types)		Chloride content	Monthly*		Tests to be carried out by the manufacturer and results included on the test certificates required above
	Pulverised-fuel ash		Sulfate content	Monthly*		
	Ground granulated blastfurnace slag		Acid-soluble alkali content	Daily (PC) Weekly (pfa ggbs)		
	Aggregates		Grading	1 per delivery (min 1 weekly per source)		Results of routine control tests by the manufacturer/supplier to be provided Product certification scheme applies
			Shell content (N)	Monthly*		
			Flakiness index (N)	Monthly*		
			10% fines value (N)	Monthly*		
			Drying shrinkage (N)	Yearly		
			Chloride content (N)	Daily or as otherwise agreed		
			Sulfate content (N)	Monthly*		
	Blastfurnace slag		Bulk density (N)	1 per 500 tonnes*		
			Stability (N)	1 per 500 tonnes*		
			Sulfur content (N)	1 per 500 tonnes*		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1700 (continued)					
	Water	Tests specified in BS 3148	<i>[As required]</i>		<i>[See also sub-Clause 1702.3]</i>
		Chloride content	Monthly*		
		Sulfate content	Monthly*		
		Acid-soluble alkali content	Weekly*		
	Admixtures	Chloride content	1 per consignment	Required (BS 5075)	
		Sulfate content	1 per consignment		
Acid-soluble alkali Content		1 per consignment			
1707	Concrete	Cube strength (N)	Prestressed concrete-two cubes from 10 m³ or 10 batches whichever represents the lesser volume		Contractor to cast and test sufficient additional cubes to demonstrate cube strength before transfer †
			Reinforced concrete-two cubes from 20 m³ or 20 batches whichever represents the lesser volume		
			Mass concrete-two cubes from 50 m³ or 50 batches whichever represents the lesser volume		
			Additional cubes for special purposes		
		Cube strength-special testing as described in Appendix 17/4 (N)	2 cubes from each of two samples of each batch		<i>[Tests/samples should be scheduled as required See NG 1707.6]</i>
		Density	<i>[As required]</i>		<i>[Requirements should be given in Appendix 17/4 as appropriate]</i>
		Modulus of elasticity			<i>[Requirements should be given in Appendix 17/1 as appropriate]</i>
	Fresh concrete	Workability (slump or compacting factor or Vebe) (N)	Each batch		
		Air content	Each batch		
		Cement content	<i>[As required]</i>		
		Water/cement ratio			

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1700 (continued)					
1709	Silane			Required for each delivery	Certification that the silane complies with Clause 1709 is required
		Refractive Index	Three samples		[See sub-Clause 1709.2(ii)]
		Trial panels, where required in the Contract			[See sub-Clause 1709.8]
1710	Concrete packing Mortar packing Epoxy resin bonding agent				[Appropriate tests/samples should be scheduled]
	Precast concrete manufactured off Site	Cube strength (Manufacturer's tests)			Contractor to make available records of tests by the manufacturer
1711	Grouting and Duct Systems for Post-tensioned tendons				CARES Scheme for Supply and Installation of Post-tensioned Systems In Concrete Structures or an equivalent scheme is required. Quality management and product certification schemes for cement apply
		Full scale trials, where required in the Contract			See sub-Clause 1711.1 and Appendix 17/6
		Air pressure tests			See sub-Clause 1711.3 and Appendix 17/6
		Duct assembly verification tests			See sub-Clause 1711.3 and Appendix 17/6
		Wall thickness of ducts after tensioning			See sub-Clause 1711.3 and Appendix 17/6. Contractor should provide evidence of testing
		Fluidity	See Table 17/9		See sub-Clause 1711.8 and sub-Clause 1711.9 and Table 17/10
		Bleeding			
		Volume change			
		Cube strength			
		Sieve			
		Sedimentation			
	Admixtures			Required	Quality management and product certification schemes apply Data on their suitability, including previous experience should be made available. See sub-Clause 1711.9

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1700 (continued)					
1712	Reinforcement				Product certification scheme applies
	Steel bars			Required (BS 4449)	
	Steel wire			Required (BS 4482)	
	Steel fabric			Required (BS 4483)	
1713	Fabricated reinforcement			Required	Certification that fabricated reinforcement complies with the routine inspection/testing requirements of BS 8666 is required if the fabrication is not covered by a product certification scheme listed in Appendix B
1716	Reinforcement jointing systems	Permanent elongation Characteristic strength (Manufacturer's tests)		Required for each type of connection	BBA Roads and Bridges certificate or CARES certificate of product assessment or fully equivalent scheme apply
1717	Reinforcement metal arc welding	Welding procedure approval (BS 7123)	As required in BS 7123		[Where tests in addition to those specified in BS 7123 (tensile test and macroetch test) are required full details should be scheduled] Tests should be carried out by an independent testing body specified in BS 8666
		Welder approval (BS 7123)			
1718	Prestressing tendons				Product certification scheme applies
	Steel wire			Required (BS 5896)	
	Steel bar			Required (BS 4486)	
	Seven-wire strand			Required (BS 5896)	
	Prestressing steel (all types)	Proof load Breaking load Elongation Ductility Relaxation Modulus of elasticity	[As required]		†
	Super strand to BS 5896 or other than lowest strength 3-7 mm dia wires to BS 5896	0.1% proof load Breaking load	Each reel		†

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1700 (continued)					
1724	Post-tensioning anchorages	Tests in accordance with BS 4447 (Manufacturer's tests)			Contractor to make available records of tests by the manufacturer
1726	Stainless steel bar			Required (BS 6744)	
1727	Inspection and testing of structures and components				<i>[Tests should be scheduled as appropriate and requirements given in Appendix 17/4]</i>
Series 1800					
1801 1803	Structural steel to MSA EN 10025, MSA EN 10113, MSA EN 10137, MSA EN 10155, MSA EN 10210			Required	<i>[Give type of document required] [Options as appropriate should be listed in Appendix 18/1]</i>
	Structural steels to BS 7668			Required (BS 7668)	<i>[Options B26-B36 as appropriate should be listed in Appendix 18/1]</i>
	Stainless Steels to BS 970; MSA EN 10084, MSA EN 10087, MSA EN 10095, MSA EN 10277, and MSA EN 10278			Required (BS 970, MSA EN 10084, MSA EN 10087, MSA EN 10095, MSA EN 10277 and MSA EN 10278)	<i>[Inter-crystalline corrosion test should be scheduled where required]</i>
	Stainless steel to MSA EN 10029, MSA EN 10048, MSA EN 10051, MSA EN 10258, MSA EN 10259			Required (MSA EN 10029, MSA EN 10048, MSA EN 10051, MSA EN 10258 and MSA EN 10259)	(State condition of material if not softened condition. Give information required for test certificate as MSA EN 10029 MSA EN 10048 MSA EN 10051 MSA EN 10258 MSA EN 10259)
	Steel plate	Ultrasonic testing	<i>[As required]</i>		<i>[See guidance clause 3.1.4 of BS 5400 : Part 6]</i>

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1800 (continued)					
	Bolts, nuts and washers				Quality management scheme applies
	All types except high strength friction grip	Test specified in BS 4395: Part 2	As required in BS 4395: Part 2		
	High strength friction grip	Test specified in BS 4395: Part 1 or Part 2	As required in BS 4395: Part 1 or Part 2		[Tests/samples for the optional tests provided for in BS 4395: Parts 1 and 2 should be scheduled where required]
	Tension Control Bolts	Test specified in JSS II-09-1981 or BS 4395	As required in JSS II-09-1981 or BS 4395		
	Welding electrodes				
	Covered steel			Required (MSA EN 499)	
	Wire			Required (MSA EN756; MSA 760)	
	Welding				
	Welding procedures	Tests Specified in MSA EN 288:	As required in MSA EN 288: Part 3 And appendix 18/1		Results to be reported in accordance with Annex A of MSA EN 288 Part 3
	Welder qualification	Test Specified in MSA EN 287:	As required in MSA EN 287: Part 1 for each welder	Required MSA EN 287: Part 1	Certificate to be in accordance with Annex B of MSA EN 287 Part 1
	Butt weld 'run-off' plates	Destructive tests specified in MSA EN 5400: Part 6	As required in BS 5400 : Part 6		
	Butt welds and adjacent areas of steelwork	Non-destructive tests using methods to be agreed	As required in BS 5400 : Part 6 and the following: [As required]		[Full details should be scheduled. See clause 5.5.2 of BS 5400: Part 6 and its guidance clauses]
	Fillet welds	Non-destructive tests	[As required]		[Full details should be scheduled]
	Flame cutting and shearing	Tests to demonstrate procedures comply with BS 5400 : Part 6 and Appendix 18/1	As required in Appendix 18/1		
	Stud shear connectors	Fixing (BS 5400 : Part 6)	Each stud		
		Bending (BS 5400 : Part 6)	[As required]		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1900					
1903	Abrasives	Grading	[As required]		†† [See NG 1903]
		Hardness			
1909	Galvanized coatings	Tests specified in MSA EN ISO 1461	[As required]		Method of sampling to be in accordance with Clause 1910
	Aluminium and zinc spray coatings	Test specified in MSA EN 22063	[As required]		Areas to be tested to be in accordance with Clause 1910
	Aluminium coating material			Required (MSA EN 1301)	
	Zinc coating material			Required (MSA EN 1179)	
	Sherardized coatings	Tests specified in BS 4921	[As required]	[Sampling procedure and any special adhesion requirements including test method should be scheduled]	
	Zinc electroplated coatings	Tests specified in BS 3382 : Part 2	[As required]		
	Plating to high strength friction grip and tension control bolts				[Special tests to detect hydrogen embrittlement should be scheduled where required]
1910	Metal spray coatings	Tensile test specified in MSA EN 22063	[As required]		†
		Grid test specified in MSA EN 22063	[As required]		†
1911	Paints				
	Samples 'A' and 'B'	Specific gravity	[See Clause 1911]		†† [See NG 1911] Samples will be selected in accordance with Clause 1911
		Colour match			
		Composition			
		Application characteristics			
Series 2000					
2003	Permitted waterproofing systems	[As required- See NG 2003]			Registration and BBA Roads and Bridges Agrément certification apply
	Additional bituminous protection	Tests specified in BS 594: Part 1	1 per 15 tonnes*		Sampling to comply with BS 594: Part 1
	Stability value	Test specified in BS 598: Part 107	1 per 15 tonnes*		
2004	Tar	Tests specified in BS 76	1 per source*		Sampling to comply with BS 76
	Cut back bitumen	Tests specified in BS 3690: Part 1	1 per source*		Sampling to comply with BS 3690: Part 1 [The viscosity test is normally sufficient]

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2100					
2101	Bridge bearings				
	Elastomeric bearings	Hardness	<i>[As required]</i>	Required (BS 5400 : Section 9.2)	<i>[Tests/samples should be scheduled only where tests are required on samples cut from a finished bearing]</i>
		Tensile strength			
		Elongation			
		Ageing			
		Compression set			
		Ozone resistance			
	Complete bearings	Tests specified in Appendix 21/1	As required in Appendix 21/1		
Series 2200					
2202	Metal parapets			Required (BS 6779: Part 1)	Quality management scheme applies
2204	Welding	Welding procedures (Manufacturer's tests)			<i>[(N) See NG 2204]</i>
		Welder qualification (Manufacturer's tests)			
		Production testing (Manufacturer's tests)			
	Welded joints	Destructive testing			
2207	Parapet posts	Production testing as specified in BS 6779 : Part 1 : 1998 (Manufacturer's tests)		Required	Certification in accordance with Clause 2207 is required
2208	Anchorage in drilled holes	Loading test on site	<i>[As required]</i>		Anchorage should hold a current BBA HAPAS Roads and Bridges Certificate
Series 2400					
2401	Masonry cement			Required (BS 5224)	Quality management scheme applies
		Chloride content	Monthly*		Test to be carried out by the manufacturer and results included on the test certificate
2402	Sand			Required per consignment (BS 1199 and 1200)	
		Chloride content	Monthly*		Test to be carried out by the manufacturer and results included on the test certificate

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2400 (continued)					
2403	Water	Tests specified in BS 3148	[As required]		
2404	Mortar admixtures			Required (BS 4887) (BS 5075)	
2405	Lime			Required (BS 890)	
2406	Bricks				
	Clay	(Soluble salt content Efflorescence Compressive strength Water absorption Initial rate of suction) (BS 3921)			[Tests/samples (in accordance with BS 3921) should be scheduled as required]
	Calcium silicate			Required (BS 187)	
	Concrete			Required (BS 6073 : Part 1)	
2407	Blocks				
	Clay	(Soluble salt content Efflorescence Compressive strength Water absorption Initial rate of suction) (BS 3921)			[Tests/samples (in accordance with BS 3921) should be scheduled as required]
	Concrete			Required (BS 6073 : Part 1)	
2408	Reconstituted stone				[Tests/samples (in accordance with BS 6457) should be scheduled as required]
2410 2411	Stainless steel				
	Wire/fabric			Required (BS 970 : Part 1)	
	Bars			Required (BS 6744)	
	Ready mixed mortars			Required (BS 4721)	
	Mortars	Tests specified in Appendix A1 of BS 5628 : Part 1 (1985)	1 set of tests per mix*		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2500					
2501	Materials for corrugated steel buried structures exceeding 900 mm clear span or internal diameter				Type approval applies
	Steel components			Required as appropriate to the standard or specification listed in the type approval Certificate	
	Zinc coating				
	Protective coating				
	Paved invert system				BBA Roads and Bridges Certification applies
2502	Materials for reinforcing elements, prefabricated facing and capping units, and washers				BBA Roads and Bridges Certification applies
	Carbon steel strip			Required (BS 1449: Part 1 or BS EN 10025)	Silicon content and mechanical properties to be stated on the certificate
	Stainless steel strip			Required (BS 1449: Part 2)	Mechanical properties to be stated on the certificate
	Reinforcing bar for anchor elements			Required (BS 4449)	Tests scheduled under Clauses 1717 and 1909 are required for welding and galvanizing of anchor elements
	Materials for fasteners				
	Stainless steel			Required (BS 970: Part 1) (BS 6105)	
	Bolts, screws and nuts			Required MSA EN ISO 898, 24016, 24018, 24034	Tests scheduled under Clause 1909 are required for hot dip galvanizing
2503	Materials for pocket type reinforced brickwork retaining wall structures				
	Clay bricks	(Soluble salt content Efflorescence Compressive strength Water absorption Initial rate of suction) (BS 3921)	1 set of tests per type of brick*		Random sampling to BS 3921 to be employed

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2500 (continued)					
2504	Environmental barriers				Quality management scheme applies <i>[Appropriate tests/samples should be scheduled where not included under other Clauses]</i>
	Timber				
	Concrete				
	Steel				
	Brickwork				
	Other materials				
	Barriers	Sound absorption Sound insulation	As required in Appendix 25/4		<i>[See NG 2504 14 - 17]</i>
	Post foundations	Loading test on site	As required in Appendix 25/4		<i>[See NG 2504.12]</i>
2505, 2506	Drainage structures/buried rigid pipes for drainage structures Pipes for drains and culverts having diameters or clear span exceeding 900 mm				
	Vitrified clay	<i>[see Note 1]</i>			Product certification scheme applies <i>[Note 1. Additional manufacturer's tests are provided for in the relevant BS but should not normally be required.]</i>
	Concrete PC/SRC	(Manufacturer's test)			See sub-Clause 2506.28
	Iron	<i>[see Note 2]</i>			<i>Note 2. Certificate are provided for in the relevant BS but should not normally be required except for pipes which are not quality marked by a MSA accredited body listed in Appendix B of SHW</i>
	Corrugated steel	(Manufacturer's test)			Type Approval Certificate and BBA Roads and Bridges Certificate apply
Series 2600					
2601	Bedding mortar materials			Required for each batch	Certification in accordance with Clause 2601 is required
	Bedding mortar	Flow cone test	Each batch		† Laboratory tests
		Flow between glass plates			
		Compressive strength			
		Expansion test			
		Water absorption			
		Elastic stability	1 per source		
		Flow cone test Compressive strength	Each load		Site control tests

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2600 (continued)					
2604	Plastic coating to fencing posts, gates and ancillaries			Required (BS 172: Part 16)	Certification by powder manufacturer and coating applicator is required.
2607	Granolithic concrete				Testing to be in accordance with Clauses 1702, 1703, 1707 and 1710
Series 3000					
3001	General				Inspection Reports as required in Appendix 30/1
3005	Grass seeding, Wildflower seeding and turfing	Rate of spread of fertiliser	1 per 1000 square metres*		
		Rate of spread of seeding	1 per 1000 square metres*		
		Chemical analysis of fertiliser	1 per source*		††
		Grass seed germination and purity (Official Seed Testing Station tests)	1 per source and mix variety*	Required prior to sowing	†

Key

- † indicates a requirement in SHW for the test to be carried out by the Contractor; such tests should therefore be scheduled in Appendix 1/5.
- †† indicates a statement in SHW that the test may/will be carried out under the direction of the Overseeing Organisation; samples for such tests should therefore be required in Appendix 1/6.
- * indicates that the frequency of testing is given for general guidance and is only indicative of the frequency that may be appropriate (ie. no frequency is given in the SHW or reference documents). Where materials are known to be marginal or if initial test results show them to be such, the frequency of testing should be increased. Conversely where material properties are consistently in excess of specified minimum requirements or well below specified maximum limits, then the frequency of testing should be reduced.

(N) Indicates that an MSA accredited laboratory sampling and test report or certificate is required.

[Notes to compiler:

- 1. The above symbols apart from (N) are for guidance when preparing Appendices 1/5 and 1/6 and should not be reproduced in those Appendices.*
- 2. Other guidance is printed in italics and should likewise not be reproduced in Appendices 1/5 and 1/6. Appropriate Contract-specific requirements should be scheduled.]*

NG SAMPLE APPENDIX 1/1: ^(05/01) TEMPORARY ACCOMMODATION AND EQUIPMENT FOR THE OVERSEEING ORGANISATION

1 Accommodation Required

- | | | |
|--|---|----------------------------------|
| (i) Temporary initial accommodation |) | |
| (ii) Principal office |) | |
| (iii) Laboratory |) | |
| <i>[sufficient space to be allowed to retain samples of materials]</i> |) | Location (if appropriate |
| (iv) Subsidiary static office |) | and floor area to be |
| (v) Subsidiary portable office |) | inserted or referenced to |
| (vi) Off Site accommodation at |) | drawing numbers] |
| fabricator's or precaster's works |) | |

[Note: The compiler should bear in mind that all accommodation should satisfy the relevant requirements of current legislation on health, safety and welfare.]

2 Duration of Time Accommodation Required

[Include if the date when offices/laboratories are to be occupied and equipment is to be installed, tested and made operational is different from that stated in sub-Clause #101.2.

Include date all accommodation is vacated and removed.

Include time of day and number of days in week that accommodation is required.]

3 Fittings and Furnishings of Accommodation

[The details should include a list of consumable stores, surveying and testing equipment, first aid equipment and details of room temperature needed.]

#NG SAMPLE APPENDIX 1/2: (05/01) VEHICLES FOR THE OVERSEEING ORGANISATION

Type (as defined below)	Number Required	Period Required	Cleaning Frequency
A B C D			

1 Type "A" 8/12 Seat Station Wagon

The vehicle is to be suitable for off-road use, have 4 wheel drive, power steering and be supplied in white or yellow colour. The vehicle shall be free from markings identifying any company associated with the Contract. The equipment shall include:

Fire extinguisher, heater and demister, hazard flashing unit, heavy duty suspension, spare wheel, fuel filler cap lock, bonnet lock and spare wheel lock, internal and external mirrors, mud flaps, link mats front and rear, mudshield for front and rear brakes, rubber pads for clutch and brake pedals, interior sun visors, gearbox covers, tow rope, towing hooks front and rear, laminated windscreen, wire mesh guards for side, tail, stop and flasher lamps, covers for universal joints, sign boards reading 'Highway Maintenance' or where appropriate 'Motorway Maintenance' in accordance with Diagram 7404 of Schedule 12, Part V of the Traffic Signs Regulations and General Directions 1994 on the rear of the vehicle (the lettering shall be the largest x height that can be accommodated out of the following heights: 37.5, 50, 62.5, 75 or 100 mm), retroreflective red and fluorescent yellow chevrons on the rear of the vehicle and a roof mounted amber flashing light bar comprising at least two light sources fitted in accordance with paragraph 2.3.7.4 of Chapter 8 of the Traffic Signs Manual and The Road Vehicles Lighting Regulations.

2 Type "B" Long Wheelbase Station Wagon

The vehicle shall be free from markings identifying any company associated with the Contract. The vehicle and equipment shall be as for Type A with the following variations:

Link mats and heater shall be supplied for the front only. The vehicle shall be adapted for CBR testing.

3 Type "C" Short Wheelbase Station Wagon

The vehicle and equipment is to be as type B but not adapted for CBR testing.

4 Type "D" 4-Door Estate Car

The vehicle shall have a carrying capacity of at least 0.25 tonne, a minimum ground clearance (unladen) of 150 mm and independent suspension.

The vehicle shall be finished in white or yellow colour and shall be free from markings identifying any company associated with the Contract. The equipment shall include:

Reversing lamp, fire extinguisher, luggage rack complete with straps suitable for carrying survey equipment, sign boards and roof mounted amber flashing light bar and red and yellow chevrons as above.

NG SAMPLE APPENDIX 1/3: COMMUNICATION SYSTEM FOR THE OVERSEEING ORGANISATION

Type of equipment-.....

Location of base station (for radio communication system) - office for the Overseeing Organisation

Location of other sets-.....

Each portable set shall have a spare set of batteries

No.	Office/Laboratory	Vehicle	Personnel	Period Required

Frequency for radio communication system

BaseMHz

MobileMHz

NG SAMPLE APPENDIX 1/4: WORKING AND FABRICATION DRAWINGS

Series	Description of Work submission of drawings	Minimum period for

NG SAMPLE APPENDIX 1/5: (05/01) TESTING TO BE CARRIED OUT BY THE CONTRACTOR

[Notes to compiler:

i) The scope of the testing covered in Table NG 1/1 should not be regarded as exhaustive. Routine tests carried out by manufacturers and suppliers in compliance with a British Standard or other standard or specification are not included but where a standard or specification makes provision for a test certificate this is indicated in the table.

ii) Where tests are taken from British Standards which are undated in the Specification they should be checked to ensure that test requirements have not been altered by subsequent issues since the date of the last published national alteration to the SHW (see NG 004.2).

iii) The schedule of tests for the Contract should be completed by selecting the tests and data from Table NG 1/1. Different frequencies and additional tests should be included as appropriate. Where the frequency of testing in Table NG 1/1 is given by reference to a Clause in the SHW, the frequency requirements of the Clause should be repeated in full in Appendix 1/5.

iv) Where MSA Laboratory accreditation is required this should be indicated by the symbol (N) in the Test column. Sampling and associated tests where this should apply are indicated in Table NG 1/1.

v) In the tabulation, include the same level of detail as is included in Table NG 1/1: Typical Testing Details]

Clause No	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments

Notes:

- 1 Unless otherwise stated above, all sampling and testing in this Appendix shall be by the Contractor.
- 2 Tests comparable to those specified in this Appendix will be necessary for any equivalent work, goods or materials proposed by the Contractor (See sub-Clause 105.4).
- 3 (N) Indicates that an MSA accredited Laboratory sampling and test report or certificate is required
- 4 Unless otherwise shown in this Appendix tests for work, goods or materials as scheduled under any one Clause are required for all such work, goods or materials in the Works.
- 5 Cube strength tests are not required for concrete complying with Clause 2602.
- 6 Unless otherwise shown in this Appendix test certificates for work, goods or materials as scheduled under any one Clause are required for all such work, goods or materials in the Works.

NG SAMPLE APPENDIX 1/6: (05/01) SUPPLY AND DELIVERY OF SAMPLES TO THE OVERSEEING ORGANISATION

[Notes to compiler:

- i) Give details of the samples, including source samples, to be provided or made available by the Contractor for testing by the Overseeing Organisation and the locations to which they are to be delivered. Where MSA Laboratory accreditation for sampling is required this should be indicated by the symbol (N) in the 'Sample Description' column. Samples where this should apply can be determined from subsequent testing requirements. Tests which required accreditation are indicated in Table NG 1/1
- ii) In this case of testing by the Overseeing Organisation, it is intended that column 3, 'Frequency of Sampling', is obtained by reference to Table NG 1/1 but see sub-Clause 105.7.
- iii) Compilers should consider whether the Appendix can be realistically completed in such a way as to properly indicate that the requirements can be met by use of the transport for the Overseeing Organisation to carry samples, leaving the Contractor to provide only small quantities of replacement materials. Excessive complication is often found to be unnecessary.]

Clause No. or Series	Sample Description	Frequency of Sampling	Delivery Location	Comments

Notes:

- 1 Samples comparable to those specified in this Appendix will be necessary for any equivalent work, goods or materials proposed by the Contractor (See sub-Clause 105.6).
- 2 Unless otherwise shown in this Appendix samples of work, goods or materials as scheduled under any one Clause are required for all such work, goods or materials in the Works.
- 3 Unless otherwise scheduled under Clause 2602 samples of concrete complying with that Clause are not required.
- 4 (N) indicates MSA laboratory accreditation required for sampling

NG SAMPLE APPENDIX 1/7: SITE EXTENT AND LIMITATIONS ON USE

[Note to compiler: Include details as appropriate, under the following headings:]

1 Extent of the Site.

[Cross-reference should be made to the Drawings where appropriate.

Include areas of highway for advance signing and coning by the Contractor where relevant.]

2 Limitations on the Use of the Site.

[Cross-reference should be made to Appendix 1/23 where appropriate.]

NG SAMPLE APPENDIX 1/8: OPERATIVES FOR THE OVERSEEING ORGANISATION

Operatives Required	No.	Period Required
Chainman/Driver Driver/Laboratory Handyman		

SAMPLE APPENDIX 1/9: CONTROL OF NOISE AND VIBRATION

Noise

- 1 The Local Authority has informally agreed that the following measures would be acceptable and these are given as a guide; however it is for the Contractor to decide whether to seek the Local Authority's formal consent to his proposed methods of work and to the steps he proposes in order to minimise noise.
- 2 The normal working hours within the Site shall be Monday to Friday between ... and ... hours and Saturday between ... and ... hours, with no working on Sundays or public holidays. Exceptionally, consent for work outside these hours may be given after any necessary consultation. ... days' notice is required from the Contractor when seeking such consent.
- 3 The noise levels (see Note (i) below) scheduled below for periods outside the normal working hours will only be permitted when consent has been given to exceptional working.
- 4 The ambient noise level, Leq (see Note (ii) below) from all sources when measured 2.0 m above the ground at noise control stations numbers 1 to ... on Drawing Numbers shall either not exceed the appropriate level given in the Schedule or not exceed by more than 3dB(A) the existing ambient noise level, Leq (see Note (iii) below), at the control station measured over the same period, whichever level is the greater. The maximum sound level at any noise control station shall not exceed the level given in the Schedule. Exceptionally the Contractor may be given permission to carry out works which exceed the noise levels in the Schedule, provided that ... days' notice of the date and timing of these works is given to the Overseeing Organisation and the Contractor demonstrates that he intends to take all reasonable measures to mitigate the noise nuisance. After consultations with the Local Authority and any other interested bodies a decision will be given within ... days of receipt of the notice.

Schedule		Total Noise Levels at Control Stations		
Period	Hours	Ambient Noise Level, Leq Measured at Control Station: dB(A)	Period of Hours over which Leq is applicable	Maximum Sound Level (see Note (iv) below) measured at Control Station: dB(A)
Mondays to Fridays Saturdays All unattended plant outside normal working hours				

Notes:

- (i) Noise levels relate to free field conditions. Where noise control stations are located 1 m from facades of buildings, the permitted noise levels can be increased by 3 dB(A).
- (ii) The ambient noise level, Leq, at a noise control station is the total Leq from all the noise sources in the vicinity over the specified period.
- (iii) The existing ambient noise level, Leq, at a control station is the total Leq from all the noise sources in the vicinity over the specified period prior to the commencement of the Works.
- (iv) Maximum sound level is the highest value indicated on a sound level metre which meets the requirements of MSA EN 60651 Type 1 or 2 set to SLOW response and frequency weighting A or on an integrating – averaging sound level metre to MSA EN 60804.

Vibration

[Note to compiler: Include here:]

- (i) Locations where vibration limits are to be complied with.
- (ii) Limits of vibrational amplitude and resultant peak particle velocity.
- (iii) Requirements for instrumentation and monitoring.
- (iv) Overseeing Organisation's arrangements for Contractor to monitor vibration in property off Site.

NG SAMPLE APPENDIX 1/10: STRUCTURES TO BE DESIGNED BY THE CONTRACTOR

[Note to compiler: List under (A) the structures to be designed by the Contractor and under (B) the structures for which a choice of designs is offered, ie. structures for which the Contractor may propose a design if he elects not to construct the design prepared by the Overseeing Organisation. The design specifications and any special requirements should either follow immediately after the table or be cross-referenced to other Appendices.]

Structure	Location	Design Specification
(A)		
(B)		

NG SAMPLE APPENDIX 1/11: STRUCTURAL ELEMENTS AND OTHER FEATURES TO BE DESIGNED BY THE CONTRACTOR

[Note to compiler: List here the structural elements and other features to be designed by the Contractor. The design specifications and any special requirements should either follow immediately after the table or be cross-referenced to other Appendices.]

Element	Location	Design Specification

NG SAMPLE APPENDIX 1/12: SETTING OUT AND EXISTING GROUND LEVELS

1 The information given below will be available for inspection during the tender period at:

Regional/Agent/Consultant's Office

Address

Tel No.

and will be supplied to the Contractor at the commencement of the Works.

[Note to compiler: Include here details of the setting out information that is available.]

- 2 Specific requirements for setting out.
- 3 References to drawings or schedules quoting existing ground levels [III.1].
- 4 Level of information on existing detail to be recorded by the Contractor.

NG SAMPLE APPENDIX 1/13: ^(05/01) PROGRAMME OF WORKS

1 The Contractor shall provide the programme in a form of a network diagram/bar chart [delete as appropriate] produced as a result of a 'critical path analysis' and must abide by the constraints below. It shall show the level of detail appropriate to each stage of the Works and all activities and restraints, each of which shall be given a short title. All events shall be numbered and annotated with earliest and latest event dates.

2 At the time of presentation of the programme the Contractor shall also provide a mass-haul diagram showing his intended earthworks movements and locations and capacities of anticipated plant and other resource input.

3 Schedule of Constraints

[The constraints known at tender stage should be inserted here. Typical constraints, including those that could have been commitments by the Employer, are as follows:]

- (i) Work to privately and publicly owned services and supplies *[although this is usually agreed informally giving the Contractor latitude in determining his programme]*.
- (ii) Possession (rail, property, etc).
- (iii) Traffic safety and management including notice requirements.
- (iv) Restrictions arising from the use of substances hazardous to health.
- (v) Provision of environmental protection prior to the main construction operations (environmental barriers, etc).
- (vi) Trials and demonstrations in advance of main construction.
- (vii) Completion of the communications installation 8 weeks before the date for completion of the Works.
- (viii) Compliance with technical approval procedures in relation to structures designed by the Contractor, including awaiting approvals, resubmissions and modifications.
- (ix) (05/01) Date, day and time limitations for surface treatments *[918.1, 919.1, 922.1, eg not on market days or at rush hour]*. *[Note to compiler: Any limitations on availability should be included in this Appendix]*.
- (x) (05/01) The Contractor shall demonstrate to the Overseeing Organisation that he has available in a suitably located stockpile an adequate supply of surface dressing chippings which will enable him to not only commence the Works on the due date, but will enable him to progress the work at such a rate as will ensure compliance with the Programme of Works including traffic management.

4 The level of detail should be not less than the following:

Level 1

Within 21 days after the acceptance of Tender and any subsequent revision

- (i) Each bridge.
- (ii) Earthworks-each cutting and embankment.
- (iii) Roadworks-in lengths not exceeding 1.0 km for main route and for each side road, link road and slip road:
 - (a) Fencing
 - (b) Site clearance
 - (c) Topsoil strip
 - (d) Drainage (pre-earthworks and second stage)
 - (e) Sub-base

- (f) Subgrade improvement layer
- (g) Roadbase or concrete paving
- (h) Surfacing.
- (iv) Major privately and publicly owned services and supplies.
- (v) Traffic management measures including operation of site accesses, plant crossings and temporary diversions for traffic.

Level 2

At least four weeks before the commencement of any item of work:

- (i) For each bridge:
 - Piling
 - Substructure
 - Superstructure
 - Finishes
- (ii) Roadworks:
 - As for Level 1 but intervals not exceeding 200 m and including lighting, signing, soiling and seeding, road marking, cabling and communications equipment.
- (iii) All public alterations or additions to privately and publicly owned services and supplies.

Level 3

Further breakdown of items and other details as may be required.

NG SAMPLE APPENDIX 1/14: PAYMENT APPLICATIONS

The payment applications submitted to the Overseeing Organisation in accordance with the Conditions of Contract by the Contractor shall, whenever dealing with matters covered by the Bills of Quantities, be set out under Part and Section headings similar to those in the Bills of Quantities and shall separately identify each item and specify quantity, unit, rate and value. Items not described in Bills of Quantities but appropriate for inclusion as measured work shall be shown at the end of the relevant section or under section headings as appropriate indicating quantity, unit rate and value. In respect of all other matters referred to in the Conditions of Contract the Contractor shall separately show in the statement quantities, units and rates of goods and/or materials and also details of any other matters to which he considers himself entitled. The Contractor shall allow the Overseeing Organisation to inspect invoices for goods or materials included in the statement as may be required.

NG SAMPLE APPENDIX 1/15: ACCOMMODATION WORKS

1 Copies of Land Reference Plans and Schedules (*together with details of accommodation works already determined) will be available for inspection during the Tender period at:

Regional/Agent/Consultant's Office.....

Address.....

Tel No.....

and will be supplied to the Contractor before the commencement of the Works. Further information will be provided in respect of accommodation works when this has been agreed.

2 Details of accommodation works already determined are as follows:

*[*Delete where details are included]*

NG SAMPLE APPENDIX 1/16: PRIVATELY AND PUBLICLY OWNED SERVICES AND SUPPLIES

- 1 This Appendix contains details of services and supplies affected by the Works, details of preliminary arrangements that have been made with Statutory Undertakers and others for the alteration of services and supplies affected by the Works, and details of any orders already placed.
- 2 The Contractor shall make arrangements with the Statutory Undertakers and others concerned, for the co-ordination of his work with all work which needs to be done by them or their contractors concurrently with the Works. Compliance with the periods of notice given in this Appendix does not relieve the Contractor of his obligations.
- 3 Private services to individual properties have not generally been listed or shown on the Drawings. The Contractor shall make arrangements with the Statutory Undertakers and others concerned for the phasing of all necessary disconnections and diversion of private services affected by the Works.
- 4 Disconnected apparatus shall be removed by the Contractor only with the prior consent of the Authority concerned.
- 5 The names, addresses and telephone numbers of the authorities serving in the locality are listed below.

Names	Address Tel No.	Contact
Statutory Undertakers		
Other Authorities		

6 Services and Supplies Affected by the Works

Location	Description	Group*	Drawing No.	Notice Required to Commence	Time for Completion
Statutory Undertakers					
Other Authorities/ Bodies/Individuals					

*

- A Work expected to be completed before the commencement of the Works.
 - B Work required after commencement of the Works which does not require prior work by the Contractor.
 - C Work required after commencement of the Works which does require prior work by the Contractor.
 - D Work expected to be in progress at the commencement of the Works.
 - E Work to be wholly undertaken by the Contractor.
- 7 *[Note to compiler: Insert here details of any other preliminary arrangements that have been made and/or details of any orders already placed]*

6 Services and Supplies Affected by the Works

Location	Description	Group*	Drawing No.	Notice Required to Commence	Time for Completion
Statutory Undertakers					
Other Authorities/ Bodies/Individuals					

*

- A Work expected to be completed before the commencement of the Works.
 - B Work required after commencement of the Works which does not require prior work by the Contractor.
 - C Work required after commencement of the Works which does require prior work by the Contractor.
 - D Work expected to be in progress at the commencement of the Works.
 - E Work to be wholly undertaken by the Contractor.
- 7 [Note to compiler: Insert here details of any other preliminary arrangements that have been made and/or details of any orders already placed]

NG SAMPLE APPENDIX 1/17: ^(05/01) TRAFFIC SAFETY AND MANAGEMENT

[Note to compiler: The following should be inserted in the Appendix as appropriate and extended when required:]

1 Traffic Safety and Management Requirements

[When the Contractor is not required to submit traffic management proposals or to supply sign faces, posts or fixings, this should be stated.]

- (i) Phasing of Works *[include details of traffic orders that have been or are being made]*.
- (ii) Drawings showing traffic management layout, including:
 - (a) Position of traffic signals.
 - (b) Width of lanes.
 - (c) Working areas.
 - (d) Safety zones.
 - (e) Crossovers *[include construction details, and geometrical design required where this has not been shown on the Drawings]*.
 - (f) Running lane for emergency vehicles.
 - (g) Location for emergency vehicles.
- (iii) Timing of operations.
- (iv) Road lighting requirements (Appendix 14/3).
- (v) Requirements for Temporary Emergency Telephones.
- (vi) Whether a traffic safety and control officer is required *[117.19]*.
- (vii) Restriction arising from the use of substances hazardous to health *[crops - reference should be made to Appendix 1/23]*
- (viii) A Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Roadworks (TASCAR) shall be provided in accordance with Appendix 1/26 and Appendix 1/27 *[117.32]*.

The Contractor's attention is drawn to the need to assess the risks and develop and operate safe working practices when vehicles and plant are reversing on Site, whether or not they are on part of the highway. Rule 129 of The Highway Code 1993 is relevant but the Contractor's practices and procedures should take account of the different conditions, which will obtain on Site.

The responsibilities of the Traffic Safety and Control Officer and of his nominated deputy shall also include the following matters:

- (1) Monitoring, with the assistance of sufficient mobile personnel and of sufficient other suitable and appropriate aids, the flow of traffic within the area and within the period defined for the operation of the vehicle recovery service;
- (2) Ensuring that, within 5 minutes of the occurrence of an incident, as defined below, resulting in stationary vehicle(s) on a highway open to the public, the incident is reported to the vehicle recovery service;
- (3) Recording and logging all incidents and all movements of recovery vehicles and, when called, all movements of the emergency services. For the purposes of this Appendix, an "incident" is defined as a shed load, vehicle breakdown, vehicle abandonment or traffic accident, whether or not the latter involves personal injury.

2 Maintenance Requirements

- (i) Crossovers
- (ii) Ramps
- (iii) Highways
- (iv) Timescale for responsibility if different from sub-Clause 117.7

3 Notice Requirements

Notice required by the Overseeing Organisation in order to arrange for:

- (i) amending or making traffic orders
- (ii) authorising of non-prescribed signs
- (iii) authorising temporary traffic signals
- (iv) moving signs to be compatible with the state of the Works as described in sub-Clause 117.11.

4 Details of Events That Could Have a Bearing on the Works

[These could include such events as:]

Motor shows,
Race meetings,
Football fixtures, and
Highway reconstruction work being carried out in the vicinity.

5 Highways, Private Roads, and Other Ways Affected by the Works

Description	Predicted 24 Hour Annual Average Daily Traffic AADT	Eighty Five Percentile Speed of Cars (mph)	Speed Limit (mph) if Proposed <i>[State whether Mandatory or Advisory]</i>	Type(s) Of Traffic Control	Special Facilities <i>[Pedestrian, Equestrian etc.]</i>	Whether to be Kept Open or Closed

Note: Particulars of temporary diversions for traffic are contained in Appendix 1/18.

Highways including footpaths, cycle tracks and bridleways, described above or listed in Appendix 1/19 are the responsibility of:

Authority.....

Address.....

Tel No.....

6 Driver Information Signs at Roadworks

- (i) Requirements for the use of Driver Information Signs
- (ii) Required variations to legends

NG SAMPLE APPENDIX 1/18: (05/01) TEMPORARY DIVERSIONS FOR TRAFFIC

[Note to compiler: The following should be inserted in the Appendix as appropriate and extended when required:]

1 Temporary Diversions for Traffic Specified by the Overseeing Organisation

(i) Highways Open to Vehicles

Description	Drawing No. or Ref.	Construction/ Design Requirements*	Maintenance Requirements (including timescale for responsibility)	Remarks (including Constraints and Reinstatement details)
Major				
Minor				

(ii) Other Highways and Private Rights of Way

Description	Drawing No. or Ref.	Existing Usage	Construction/ Design Requirements*	Maintenance Requirements (including timescale for responsibility)	Remarks (including Constraints and Reinstatement details)
Footpaths					
Cycle Tracks					
Bridleways					
+ Private means of Access					

Note: Particulars of traffic are contained in Appendix 1/17.

[This could include a schedule of different forms of construction and geometrical design required where this has not been shown on the Drawings.]*

+ Not always a need to define individual accesses, particularly in urban situations. Reference can be made to road names or other appropriate means of identification.]

(iii) Temporary Structures Specified by the Overseeing Organisation

[Give full particulars, including outline Approval in Principle forms where appropriate, if temporary structures are to be designed by the Contractor.]

2 Temporary Diversions Proposed by the Contractor

(i) Notice Requirements [118.6]

(ii) Details of any Constraints

NG SAMPLE APPENDIX 1/19: ROUTEING OF VEHICLES

[Note to compiler: Insert details as appropriate under the following headings:]

- (i) Permitted Access Routes To and From the Site

[A list of drawings showing the permitted access routes and details of temporary traffic signs.]

- (ii) The Use of the Permanent Works by Construction Traffic

[The requirements with which the Contractor must comply in submitting details under the Conditions of Contract.]

- (iii) Movement of Machinery and Plant Across Public Roads

[The requirements for the provision of haul route traffic signals, the equipment for which requires the approval of the Secretary of State.]

- (iv) Temporary Structures for Construction Traffic Spanning Areas Used by the Public

[Detail to which temporary structures must be designed including, in the case of structures spanning a public highway, the requirement for the Contractor to follow the technical approval procedures contained in Standard BD 2. In the case of structures spanning a railway, river or canal, the requirements of the appropriate authority should be given.]

#NG SAMPLE APPENDIX 1/20: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 1: Information to be provided by the compiler

Requirements for Recovery Vehicle Operation

1 Recovery Vehicles to be Provided

1.1 *[Compiler: Include here details of circumstances when recovery vehicles are to be provided.]*

1.2 Heavy recovery vehicles:

- (a) ... no. heavy recovery vehicle(s) shall be provided, each having a crew of at least two operatives.
- (b) A heavy recovery vehicle shall comply with the following:
 - (i) *Be a recovery vehicle with not less than three axles, capable of towing by means of an underlift a loaded 44 tonnes vehicle up a slope of 4 °C and shall comply with all appropriate current legislation. The vehicle shall be fitted with either a 10 tonne single power winch or two power winches of not less than 8 tonnes each . All equipment shall be power-operated with SWL indicated and with operating levers/ buttons clearly marked for operational use*
 - (ii) Be equipped with chains, wire ropes and shackles suitable for the recovery of a fully-laden 44 tonnes GVW vehicle. All chains, wire ropes and shackles shall have test certificates and/or stamped showing the SWL, be free from snags, excess stretching and wear.
 - (iii) Have seating for not less than two adult passengers (in addition to the recovery operatives).
 - (iv) Be conspicuous, for example by marking with suitable tape (not less than 125 mm wide) to sides and rear of the vehicle.
 - (v) The heavy recovery vehicle(s) shall be fitted with the following as a minimum requirement:
 - (a) 1 no. amber lightbar to comply with The Road Vehicles Lighting Regulations 1989.
 - (b) 2 no. fully adjustable lights to illuminate both the sides and rear of the vehicle.
 - (c) 2 no. fire extinguishers (1 No. 6 kg (nett) dry powder; 1 No. 9 litre (nett) aqueous film forming foam).
 - (d) 1 no. 1-10 person first aid kit to include disposable surgical gloves.
 - (e) 2 no. 10 m 12 tonne nylon straps.
 - (f) 2 no. 30 m x 13 mm polypropylene rope.
 - (g) 1 no. 44 tonne straight tow pole.
 - (h) 1 no. 44 tonne cranked tow pole.
 - (j) 10 no. highway cones 750 mm height.
 - (k) 1 no. proof load tested crane. (Overlift proof test -static 7.5 tonnes, underlift proof test -static 7.0 tonnes.)
 - (l) 1 no. suitable socket set including AF/Metric and BA sizes.
 - (m) 1 no. suitable tool kit.
 - (n) 2 no. 12 tonne bottle jacks.
 - (o) 1 no. suitable wheelbrace to fit HGVs in common use and a torque wrench.
 - (p) 1 pair of jump leads (24 volt).
 - (q) 1 no. explosion and flameproof hand lamp.

- (r) 1 no. crowbar.
- (s) 1 no. copper hammer.
- (t) The necessary fittings for connection from the air braking system of a broken-down or accident-damaged vehicle to the air braking system of the heavy recovery vehicle.
- (u) 1 no. broom and shovel.
- (v) 2 no. wheel chocks of HGV size.
- (w) 4 no. suitable lengths of wood block skidding.
- (x) 1 no. rear lighting board incorporating 'On Tow' legend in lettering of not less than 70 mm on conspicuously coloured background to conform with the size, colour and type illustrated by Diagram 5, Section B, Schedule 19 of the Road Vehicles Lighting Regulations, 1989. The board shall be fitted with lights, reflectors and indicators. When required the recovery vehicle index number or trade licence plate shall be fitted.
- (y) 1 no. sledge hammer - 7lbs minimum.
- (z) 1 no. ADR (HAZCHEM) chart.
- (aa) 50 kg of dry fine sand stored in a waterproof container.
- (vi) The heavy recovery vehicle(s) shall also carry as a minimum requirement:
 - (a) 4 no. 'D' shackles SWL 12 tonnes each.
 - (b) 4 no. 'D' shackles SWL 3 tonnes each.
 - (c) 2 no. suitable length chains SWL 12 tonnes each.
 - (d) 2 no. suitable length chains SWL 5 tonnes each.
 - (e) 2 no. suitable length chains SWL 3 tonnes each.

NOTE: All lifting chains and equipment must be fully certified by an independent competent person to comply with all current legislation. Shackles listed in (vi) (a) and (b) should be stamped with the appropriate SWL. Equivalent wire ropes may be substituted for chains listed in (vi) (c), (d) and (e).

- (vii) The heavy recovery vehicle(s) shall carry, and use when necessary, equipment designed and manufactured for the purpose of locking the steering of the broken-down or accident-damaged vehicle in order to tow it safely in a reverse direction.
- (viii) The heavy recovery vehicle(s) shall carry equipment to enable the recovery crew to remove the drive line or shafts of the broken-down or accident-damaged vehicle.
- (ix) The heavy recovery vehicle(s) shall carry blocks with a SWL of 8 tonnes, 1 No. per winch and 2 No. on boom (crane) wires.

1.3 Light Recovery Vehicle

- (a) ... no. light recovery vehicle(s) shall be provided, each having a crew of not less than one operative.
- (b) A light recovery vehicle shall comply with the following:
 - (i) Be capable of carrying or towing, by means of an underlift, a vehicle weighing 2800Kg up a slope of 4 °C and shall comply with all appropriate current legislation
 - (ii) Be capable of recovering motor cycles.
 - (iii) Be capable of recovering trailers (ie caravans, boat trailers, horse boxes, etc.)
 - (iv) Have seating capacity for four adult passengers (in addition to the recovery operatives).
 - (v) Be conspicuous, for example, by marking with suitable tape (not less than 125mm wide) to sides and rear of the vehicle.

- (vi) The light recovery vehicle(s) shall be fitted with the following as a minimum requirement:
- (a) 1 no. amber lightbar to comply with The Road Vehicles Lighting Regulations 1989.
 - (b) 2 no. fully adjustable lights to illuminate both the sides and rear of the vehicle.
 - (c) 2 no. fire extinguishers (1 No. 6 kg (nett) dry powder; 1 No. 9 litre (nett) aqueous film forming foam).
 - (d) 1 no. 1-10 person first aid kit which should include disposable surgical gloves.
 - (e) 1 no. 30 m x 13 mm polypropylene rope.
 - (f) 1 no. 6 tonne straight tow pole.
 - (g) 10 no. highway cones 750 mm height.
 - (h) 1 no. proof load tested winch and/or spectacle lift.
 - (j) 1 no. suitable socket set including AF/Metric and BA sizes.
 - (k) 1 no. suitable tool kit.
 - (l) 1 no. 3 tonne bottle or trolley jack..
 - (m) 1 no. suitable wheelbrace to fit cars and light goods vehicles in common use.
 - (n) 1 pair of jump leads (24 volt).
 - (o) 1 no. explosion and flameproof hand lamp.
 - (p) 1 no. crowbar.
 - (q) 1 no. quick change towing hitch suitable for 50 mm, 2 inch or jaw type fittings.
 - (r) 1 no. broom and shovel.
 - (s) 1 no. wheel chock of light commercial size.
 - (t) 2 no. suitable lengths of wood block skidding.
 - (u) 1 no. rear lighting board incorporating 'On Tow' legend in lettering of not less than 70 mm on conspicuously coloured background to conform with the size, colour and type illustrated by Diagram 5, Section B, Schedule 19 of the Road Vehicles Lighting Regulations 1989. The board shall be fitted with lights, reflectors and indicators. When required the recovery vehicle index number or trade licence plate shall be fitted.
 - (v) Total lift facility - 2800kg slideback deck (7.6 m minimum) or heavy duty dollies.
 - (w) 50 kg of dry fine sand stored in a waterproof container.
- (vii) The light recovery vehicle(s) shall also carry as a minimum requirement:
- (a) 4 no. 'D' shackles SWL 3 tonnes each.
 - (b) 2 no. suitable length wire ropes SWL 3 tonnes each.
 - (c) 2 no. ratchet jacks SWL 6 tonnes each, or hydraulic equivalent.
 - (d) 1 No. suitable towing trolley.

NOTE: All lifting ropes and equipment must be fully certified by an independent competent person to comply with all current legislation. An equivalent chain may be substituted for the wire rope listed in (vii) (b).

- (viii) The light recovery vehicle(s) shall carry, and use when necessary, equipment designed and manufactured for the purpose of locking the steering of the broken-down or accident-damaged vehicle in order to tow in a reverse direction.

2 Inspection Requirements

2.1 The vehicle

The Contractor shall ensure that all recovery vehicles are maintained in such condition that at all times the vehicles conform to the requirements of the Road Traffic Act and Regulations made thereunder (Construction and Use and Road Vehicle Lighting Regulations) so as to be fit to be used on the road. Evidence of this roadworthiness shall be by successful completion of an inspection by the Vehicle Inspectorate or Freight Transport Association, conducted not less than 14 days nor more than 28 days before the vehicles are required.

If the duration of the works exceeds 6 months, the Contractor shall arrange for all recovery vehicles to be inspected by the Vehicle Inspectorate or Freight Transport Association at not less than 6 monthly intervals.

2.2 Lifting equipment

All lifting equipment shall be fully certified by an independent competent person to comply with all current legislation.

2.3 Reports

A copy of each inspection report shall be:

- (i) provided for the Overseeing Organisation.
- (ii) kept in the recovery vehicle.

2.4 Record form

The Contractor shall submit weekly to the Overseeing Organisation duplicate record forms which log the regular checks made on each recovery vehicle. A sample form is given in Sheet 2 of this Appendix.

3 Locations for Recovery Vehicles

[Compiler: State here details of locations for recovery vehicles together with any specific requirements such as need for hardstandings.]

4 Communication System

In addition to the requirements of Appendix 1/3, the Contractor shall:

- (a) provide a secondary 'back up' communications system (e.g. mobile telephone, 2-way radio link or land line) between the recovery base station(s) and all recovery vehicles, and
- (b) provide an emergency telephone and line at the recovery base station(s) for the sole use of emergency calls. Where possible, the link between the recovery base station(s) and the police shall be by direct land line.

The Contractor shall be responsible for all associated equipment and payment of fees to operate the system which shall be established and fully tested prior to the start of the Works.

[Compiler: Provide here details of specific communication system requirements].

5 Location(s) for Vehicle Removal

[Compiler: Insert details of location(s) to which broken-down or accident-damaged vehicles should be removed, and the facilities to be provided at those locations. These locations should take into account safety, security and the availability of a telephone, see Chapter 1.3 of Volume 1 of the Trunk Road Maintenance Manual.]

6 Explanatory Leaflet

The Contractor shall ensure that the recovery vehicle operatives issue leaflets to the drivers of vehicles requiring assistance, before recovery commences. These shall have been prepared in liaison with the police and in accordance with Sheet 3 of this Appendix, and have been approved by the Overseeing Organisation before issue to the recovery firm.

7 Limits of Service

[Compiler: Give details of the length of carriageway over which free recovery service will operate, including any specific requirements to cover slip roads, side roads etc].

8 Requirements for Recovery Personnel

(a) Suitability: It is the responsibility of the Contractor to ensure that all personnel involved with vehicle recovery are suitable to work with 'vulnerable' motorists.

(b) Training: The contractor shall ensure that all personnel involved with vehicle recovery shall hold a certificate certifying successful completion of an appropriate vehicle recovery course. A copy of each certificate shall be provided to the Overseeing Organisation not less than 14 days before the commencement of the works.

(c) Personal Protective Equipment: In addition to the provisions identified in the Health and Safety risk assessment conducted by the Contractor, the following items will be provided for each crew member of the recovery vehicle:

- (i) Safety Helmet CE marked to EN 397.
- (ii) Reflective Safety Garment complying with sub-Clause 117.18 of the Specification.
- (iii) Boots with steel reinforcement toecaps and/or safety footwear in accordance with MSA EN 345
- (iv) Suitable gloves with the appropriate CE mark.
- (v) Protective Goggles in accordance with BS 2092.

Note: All Personal Protective Equipment should be stored and maintained in good, clean condition.

(d) Identification: The Contractor shall ensure that all personnel involved with vehicle recovery are issued with the following:

- (i) An identity card which incorporates the name of the recovery contractor (or the Contractor), and the name and a photograph of the holder. This card must be available for inspection at all times and a copy must be submitted to the Overseeing Organisation prior to the commencement of the operative working.
- (ii) A reflective Safety Garment (referred to in (c) (ii) above) which prominently displays the Contractor's name.

(e) Working hours:

[Compiler: Include maximum hours to be worked by recovery operatives: (For example, 12 hours on duty with the provision that no work should be undertaken in the following 12 hour period).]

9 Record Form

The Contractor shall submit weekly to the Overseeing Organization completed duplicate record forms which log the assistance given by the recovery vehicle and their operatives. Sample forms are given in Sheet 4 of this Appendix.

#NG SAMPLE APPENDIX 1/20: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 2: Information to be provided by the Contractor

FORM FOR 'RECOVERY VEHICLE DAILY CHECK SHEET'

RECOVERY VEHICLE DAILY CHECK SHEET							
Week Commencing:							
Driver's Name:	Vehicle Type/Registration No:			Mileage:			
Driver to initial against check list below:							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
OIL LEVEL							
WATER							
ENGINE							
CLEANLINESS – interior							
CLEANLINESS – exterior							
WIPER/WASHERS							
TYRES							
LIGHTS							
Driver's Report (detail any problems):							
Action Taken (to solve above problems):							
Date:				Supervisor's Signature:			
COMPLETED SHEET TO BE RETURNED TO OVERSEEING ORGANISATION EACH WEEK							

#NG APPENDIX 1/20: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 3: Information to be provided by the Contractor

LEAFLET FOR ISSUE BY RECOVERY VEHICLE OPERATIVES TO DRIVERS OF ALL BROKEN-DOWN OR ACCIDENT-DAMAGED MOTOR VEHICLES

Name of Scheme:

[compiler: Insert accurate name of the scheme before the issue of tender documents]

Vehicle Recovery Service - Explanatory Leaflet authorised by the Highways Agency for issue to drivers of broken-down and accident-damaged motor vehicles within the above works.

Leaflet to be distributed by recovery vehicle operatives of the appointed recovery firm on behalf of the Highways Agency.

1. The roadworks operations commence at the "Roadworks Ahead - 2 miles" sign and end at the "Roadwork End" sign. *[compiler: See Note 1 below]*
2. The recovery service provided along the extent of the roadworks operations is free.
3. Vehicles will be recovered clear of the roadworks operations tounless otherwise directed by the police. *[compiler: See Note 2 below]*
4. It will then be at the discretion of individual drivers of broken-down or accident-damaged vehicles requiring assistance to arrange for assistance or the removal of their vehicle to a garage of their choice. The operators of the free recovery service do not make such arrangements.

A list of local garages is given below:

.....
.....

Assistance will also be given by telephoning *[compiler: See Note 3 below]*

If a motorway emergency telephone is used, the police will assist.

[Notes to compiler:

- (1) *If different, replace with the appropriate limits of service for the Works.*
- (2) *The chosen location should take into account safety, security and the availability of a telephone, see Chapter 1.3 of Volume 1 of the Trunk Road Maintenance Manual.*
- (3) *The telephone number should be agreed with the police prior to the commencement of the Works.]*

SHEET 4: Information to be provided by the Contractor

[illegible]

*P - Police **Y - Tow/Lift #C - Car M/C - Motorcycle
F - Fire Service R - Restart V - Van
A - Ambulance F - False Call HGV - Heavy Goods Vehicle

#NG SAMPLE APPENDIX 1/20: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 4 (continued)

[illegible]

NG SAMPLE APPENDIX 1/21: INFORMATION BOARDS

[Note to compiler: Include here the locations and details of information boards, or cross-references to the drawings giving the information.]

NG SAMPLE APPENDIX 1/22: PROGRESS PHOTOGRAPHS.

The designation of the person to accompany the photographer.

Location	Type	No.	Aerial/Ground	Frequency Required	Remarks

NG SAMPLE APPENDIX 1/23: RISKS TO HEALTH AND SAFETY FROM MATERIALS OR SUBSTANCES

[Note to compiler: Details should be inserted in the Appendix as appropriate under the following headings:]

- (i) Restrictions in relation to traffic management measures. *[These should include need for additional safety zones or lane closures.]*
- (ii) Restrictions in relation to working practices. *[These should include conditions in relation to wind speed and direction, night working and restrictions in relation to traffic conditions ie. working to stop when adjacent traffic speed falls below a specified level.]*
- (iii) Measures to be taken to protect members of the public. *[These should include measures such as screening and signing.]*
- (iv) Monitoring to be undertaken by Contractor. *[Depending on substances or processes, air quality monitoring may be required where traffic, pedestrians or properties are adjacent to or close to the Works. Details of requirements should be given.]*

[Note to compiler: Further information on the need for specific requirements may be obtained from the Overseeing Organisation.]

NG SAMPLE APPENDIX 1/24: QUALITY MANAGEMENT SYSTEM

[Notes to compiler:

- 1 The Overseeing Organisation must be consulted before preparing this Appendix.*
- 2 When the main Contractor is required to institute a quality management system, Appendix 1/24 shall be completed as indicated below.]*

1 (05/01) The Contractor shall institute and operate a quality management system complying with BS EN ISO 9002 : 1994 and Clause 104. The quality management system shall be described in a Quality Plan that shall be submitted to the Overseeing Organisation for its acceptance.

The Quality Plan shall cover the following items:

- (i) Contractor's organisation and management
 - (ii) Contractor's method statements and construction procedures
 - (iii) Contractor's construction quality control
 - (iv) Suppliers' Quality Plans
- (for each of the quality management schemes listed at Appendix A)

2 Quality Plans shall conform with the requirements tabulated in this Appendix, as follows:

[Compiler to insert "Model Requirements"]

3 Items i) and iii) of the Quality Plan shall be submitted to the Overseeing Organisation for its acceptance not later than* days after award of the Contract.

[normally 21 days]*

The Contractor shall submit other parts of the Quality Plan prior to commencement of any related work or activity and to a timetable included in item i).

4 Method statements are required for the works listed below:

[Note to compiler: Guidance regarding the activities requiring method statements is at Note 1 Guidance Notes to item ii) of the Model Requirements].

GUIDANCE NOTES

Numbers cross refer

- 2 An annotated chart is an effective means of illustrating the organisational relationships.*
- 3 These will include the roles commonly Attributed to the Contracts Manager, Site Agent/Contractor's Project Manager, Management Representative for Quality, Sub-agents, General Foreman, foreman, Chief and Senior Engineers and Contract Quantity Surveyor.*

CONTRACTOR'S ORGANISATION AND MANAGEMENT

This section of the Quality Plan shall include:

- 1 Definition of the Contract and its documentation.
- 2 The organisation of the Contract, including the line of command and communication links between parties involved in the Contract.
- 3 Names, roles, responsibilities and authority of principals and key personnel.

GUIDANCE NOTES

- 4 *e.g meetings with the police, statutory undertakers, local authorities, landowners and others.*
- 5 *Particular reference is to be made to the main Contractor's staff responsible for subcontracted activities.*
- 6 *This must include the assessment of the subcontractor's quality assurance and quality control capabilities, the identification and implementation of additional controls needed on them to fulfil the Contractor's obligations in respect of quality assurance, monitoring arrangements and the review and acceptance of 'deliverables'.*
- 8 *Adequate time shall be allowed for the Overseeing Organisation to examine these plans prior to commencement of the activity.*
- 9 *Suppliers QPs are required for schemes listed in Appendix A of the SHW. Suppliers' QPs should be based on the model.*

CONTRACTOR'S ORGANISATION AND MANAGEMENT

- 4 Control of liaison and meetings with third parties.
- 5 Identification of the Contractor's own staff responsible for overseeing each major activity.
- 6 The main Contractor's control of subcontracts.

- 7 Document control.
- 8 Programme for submission of method statements and Suppliers Quality Plans.

The Quality Plan shall identify procedures (which may be a part of the Contractor's general procedures) that cover the topics listed below. Copies of these procedures shall be made available to the Overseeing Organisation on request.

- 9 The quality plans for subcontractors and suppliers of work, goods and materials which are the subject of quality management schemes.
- 10 Procedure for the preparation, review and adjustment of programmes for the effective progression of the Works and the recording of this.
- 11 Control and approval of purchases of materials.
- 12 Control of off-site activities (where appropriate).
- 13 Procedures for the regular review and recording by the Contractor of the quality of the Works.
- 14 Control of personnel selection, based on their care, skill and experience.
- 15 Management review/audits to monitor and exercise adequate control over the implementation of the quality plan.
- 16 Any other relevant item.

GUIDANCE NOTES

Numbers cross refer

- 1 *Method statements are required for the Principal activities e.g.*
- *demolition & site clearance*
 - *safety fencing - probably subject to a Supplier's QP*
 - *drainage*
 - *earthworks - sub-divided as appropriate*
 - *landscaping*
 - *pavement construction - for each layer: flexible construction, or*
 - *each operation for rigid*
 - *each structure - by its main elements*
 - *lighting and communications cabling*
 - *each traffic management operation*
 - *sensitive/complex accommodation works*
 - *major service diversions*
 - *special activities, e.g. treatment of contaminated land, major temporary works, items of public interest/concern*

Method statements may be quite brief but should describe each stage of the construction, identify the plant and materials to be used, temporary works, safety measures, working space considerations, and where appropriate the requirements for skilled labour and/or special supervision etc.

Where work is subject to environmental control, e.g. temperature, noise control, working hours, traffic conditions etc, these should be stated.

Hold points should be identified i.e. the stages at which checks are necessary before continuing. The authority for release of the hold point shall be identified.

- 2 *These procedures invoked by method statements will typically include, from the quality controls required by the contractor's construction quality control:*
- *Control, identification and traceability of materials, including any material or samples temporarily or otherwise removed from site for testing or other reasons.*
 - *Procedure for the prevention of inadvertent use, installation or covering up of non-conforming work.*
 - *Other corporate and/or contract-specific work instructions to be applied.*

CONTRACTOR'S METHOD STATEMENTS AND CONSTRUCTION PROCEDURES

This section of the Quality Plan shall include:

- 1 Detailed method statements for each major activity whether directly controlled or subcontracted.

The method statements shall identify hold points and invoke:

- work instructions
- quality control procedures
- compliance testing/inspection arrangements
- and work acceptance procedures

for all activities that might affect the quality of the permanent and temporary works.

- 2 Identify the relevant construction procedures in the Contractor's own Quality Management System (and provide copies on request).

GUIDANCE NOTES

Numbers cross refer

- 1 *These statements will normally be expected to include:*
 - (i) *the responsibility for the initiation and updating of the Quality Plan.*
 - (ii) *responsibility of the 'Management Representative' for quality for monitoring compliance with it.*
 - (iii) *responsibility for the adequacy of the quality records produced.*
- 5 *These controls should include their identification, traceability requirements, control of document issues and their status.*

They should also include the control of documents recording the verification review, approval, release and amendment of the works.
- 6 *These should also identify 'hold points'.*
- 7 *These procedures should identify the proforma and/or database to be used for recording the inspection and test results, and the proforma to be used for recording the certification of compliance of all items of the Works by authorised key personnel. Each submission should be separately identified.*
- 8 *These procedures should include options for identification of non-conforming work and proposals for reworking and remedial work*
- 9 *Reference should be made to those records listed in the SHW Appendix H.*

CONTRACTOR'S CONSTRUCTION QUALITY CONTROL

This section of the Quality Plan shall include:

- 1 Statement of the Contractor's organisation for quality control.

The quality plan shall identify procedures (which may be a part of the Contractor's general procedures) that cover the topics listed below. Copies of these procedures shall be made available to the Overseeing Organisation on request.
- 2 Arrangements for 'receiving' and 'in-process' testing.
- 3 Control of test laboratories.
- 4 Control of test, measuring and inspection equipment.
- 5 Document control.
- 6 Procedure for monitoring and recording the inspection, test and approval status of the constructed/installed work.
- 7 Procedures for tests and inspections for the purpose of the Contractor certifying that prior to covering up, each part of the Works is complete and conforms to the Contract.
- 8 Procedure for the review of work submitted for review but not accepted as conforming to the Contract.
- 9 (05/01) Procedure for the collation of quality records as identified in MSA EN ISO 9002 : 1994 and provision of copies when requested be the Overseeing Organisation.

GUIDANCE NOTES

Numbers cross refer

- 2 *An annotated chart is an effective means of illustrating the organisation structure.*

This must address all activities, including those sublet. Names of any subcontractors and suppliers involved in the production shall be provided.

- 3 *It is important for the Overseeing Organisation to be aware of the Supplier's quality control procedures, in order to decide on its own level of inspection and testing.*

- 4 *The Suppliers shall provide evidence that the training and experience requirements given in the appropriate Quality Assessment Schedule are being met. CVs may be appropriate.*

- 6 *Each piece or bundle of delivered product shall be indelibly marked and where appropriate, the lot identification shall be included on each package.*

- 7 *Instructions for repair of damaged products may be needed.*

- 8 *These shall include documents to demonstrate the achievement of the requirement standard, e.g. site logs, records of visits, records of verification, review and release, certificates of conformity and records of all design modifications to products and specifications.*

SUPPLIERS QUALITY PLANS

The Quality Plan shall include:

- 1 Definition of the product or service to be provided.
- 2 The organisation of the Supplier describing the line of command and stating the name of the senior manager responsible for the contracted Work and the name of the Supplier's on-site Management representative. Contact addresses, telephone numbers etc shall be provided.
- 3 *Identification of the relevant parts of the Supplier's quality system relevant to the product or service being provided. (Copies to be provided to the Overseeing Organisation on request).
- 4 The control of personnel selection (at works and on site), including special requirements for skilled personnel e.g. certification of welders, training of operatives, experience requirements etc.

Specific procedures for the following:

- 5 *Receipt and examination of certificates of conformity and test results for purchased products.
- 6 *Product identification and traceability.
- 7 *Handling, storage, packaging and delivery to site and storage and handling on Site.
- 8 Quality records,

Items marked * where available and appropriate, copies of the Supplier's quality system/general procedures may be acceptable.

NG SAMPLE APPENDIX 1/25: ^(05/01) TEMPORARY CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM FOR THE MONITORING OF TRAFFIC

[Note to compiler; Where this system is required the following details should be inserted and extended where necessary:]

- 1** Requirements for Temporary Closed Circuit Television (CCTV) system:
 - (i) The periods when the CCTV is required and operational requirements;
 - (ii) Locations of supplementary cameras;
 - (iii) Details of dedicated link to Police Control Office.

NG SAMPLE APPENDIX 1/26: (05/01) TEMPORARY AUTOMATIC SPEED CAMERA SYSTEM FOR THE ENFORCEMENT OF MANDATORY SPEED LIMITS AT ROADWORKS (TASCAR)

General

- 1** The Contractor shall supply, install, maintain in conjunction with the Chief Officer of Police and remove on completion the Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Roadworks (TASCAR) as described in this Appendix and in Appendix 1/27. Wherever 'the Chief Officer of Police' occurs in this Appendix it shall be construed to refer to the Chief Officer of Police named in Appendix 1/27. The Contractor shall ensure that the System is completely installed and fully operational from the time defined in Appendix 1/27 and that it remains in operation for the duration of the Contract unless otherwise specified in Appendix 1/27.
- 2** The TASCAR equipment shall consist of a detection and measuring device, camera/image recording device, flash (or other ancillary lighting) unit and dummy units, all of which shall be fully compatible and capable of being located in pole-mounted housings which shall themselves be capable of either fixed root or trailer mounting, all of which shall be provided as part of the Contract. If a trailer mounted system is supplied it shall be fitted with retractable de-mountable wheels. The scope shall include but not be limited to all equipment, poles, housings and power supplies. The quantities of equipment required are specified in Appendix 1/27.
- 3** The Contractor shall arrange for the provision of a 240v AC single-phase mains electrical supply of adequate power capacity to all components of the system. Alternatively, he may provide an equivalent supply from a local electrical generator or generators which shall be used only for this purpose. Such generator(s) shall have electric start mechanisms and be adequately regulated as to voltage and frequency to suit the accuracy requirements of the equipment provided for TASCAR and be capable of running constantly for 48 hours without refuelling at an output of not less than 16.0 kVA at 0.8 power factor, or equivalent output. All generators shall be housed in vandal-proof containers and be securely locked. One set of keys shall be provided to the Overseeing Organisation for them to provide to the Chief Officer of Police.
- 4** As a prescribed device under the provisions of the Road Traffic Act 1991, all equipment shall conform as a minimum to the requirements of the Home Office "The Speedmeter Handbook" (Second Edition) issued by the Police Scientific Development Branch (PSDB), Publication No 27/92, and have received 'type approval' from the Secretary of State at the Home Office. All equipment shall be so maintained by the Contractor throughout the period that the TASCAR is required to be provided, as specified in Appendix 1/27.
- 5** The number of monitoring sites required for this Contract is specified in Appendix 1/27. All equipment necessary to bring the sites into operation shall be provided by the Contractor.
- 6** All electrical connections shall be easily disconnected and reconnected without the use of tools. All male plugs/ports shall be provided on the transportable equipment and all female plugs/ports shall be provided on the static equipment.
- 7** The Contractor shall be responsible for the design of the System which shall be approved by the Overseeing Organisation and the Chief Officer of Police before installation commences. The Contractor shall contact the Chief Officer of Police to determine the full design and operating requirements to enable his design to be equivalent to and compatible with the system of the Chief Officer of Police.

Camera and Control Unit

- 8** The camera and control unit shall be designed so that it is portable and easily transferable between housings. They shall be capable of operating both on a 240v AC single-phase mains supply and on a nominal 12v DC supply, at the choice of the operator.

9 The camera and control unit shall be designed such that they can be accurately positioned and firmly located within the housing. The camera mounting shall be designed so that the operator can only mount the camera in a previously calibrated position.

10 The camera unit shall be capable of taking either one or two colour photographs per offence with the operator having the facility to select the required option. If selecting the 'two photograph' option, the operator shall also have the facility to vary the interval between frames in 0.1 second steps, within the range 0.5 seconds to 1.0 seconds.

11 A video camera unit, if supplied, shall have the facility of producing one, or two or more, colour images per offence at a displayed fixed interval apart, one of which may be selected by the operator. The operator shall also have the facility to vary the interval between recorded images in 0.1 second steps within the range 0.5 seconds to 1.0 seconds.

[Compiler: This paragraph and paragraphs 13, 27 and 28 may be omitted if so agreed with the Chief Officer of Police. If this is done put instead "11 Not used." otherwise all the paragraphs will require renumbering and cross-references will need careful amendment and checking.]

12 The camera shall be so designed that the image of the target vehicle will be shown in the context of its surroundings while the registration number of the captured vehicle will also be legible in its context, in all but exceptionally adverse lighting and weather conditions. eg. a minimum resolution of 10 pixels per character in the case of a video image.

13 A video camera unit, if supplied, shall have a first stage storage medium from which it will be possible to recover a complete image not less than 24 months later without deterioration of the said image.

[Compiler: This paragraph and paragraphs 11, 27 and 28 may be omitted if so agreed with the Chief Officer of Police. If this is done put instead "13 Not used." otherwise all the paragraphs will require renumbering and cross-references will need careful amendment and checking.]

14 The camera unit shall use colour film of the specification, including type and speed, which shall have been approved in writing by the Chief Officer of Police, which approval will be copied to the Overseeing Organisation. The camera shall have automatic exposure control and be adjustable for film speeds in the range of not less than 21-27 DIN (100-400 ASA). Each film shall be capable of recording 800 frames. The quantity and supplier of film shall be as specified in Appendix 1/27. The Chief Officer of Police will arrange for processing.

15 Each camera unit shall be fitted with a magazine that is capable of containing and operating with a roll of film 30 metres or less in length. Two such magazines shall be supplied with each camera.

16 Each photograph or video image of any violation shall have an information block superimposed upon it. The operator shall have the ability to introduce manuscript data into the information block. The minimum automatically recorded and displayed information for each offence shall be:

- (i) Date of violation - displayed in Day, Month, Year;
- (ii) Time of violation - displayed in Hours, Minutes, Seconds;
- (iii) Speed of offending vehicle;
- (iv) Site identification code;
- (v) Offence number;
- (vi) Film number;
- (vii) Time interval between images.

17 If a segmented display is used, it shall only be displayed as a single image. Each element shall confirm the information block requirements of paragraph 16 above.

18 Any data collected by the camera unit shall be recorded onto a 'smart card' via a smart card reader to be supplied as part of this Contract. The format of the smart card file shall be compatible with the existing card reader interface of the Chief Officer of Police.

19 The TASCAR shall have the ability to distinguish between cars and long vehicles, with the operator being able to select an independent speed threshold for either vehicle type, within the range 13 mph - 140 mph in 1 mph steps, above which any offence will be photographed.

20 The control unit shall be capable of recording and showing on a counter the total number of vehicles monitored and the total number of offences above an operator-specified speed threshold within the speed range specified in paragraph 19 above. Any speed measurement shall be visually displayed on the unit.

21 The system shall be self-calibrating following a single operator action. The resulting checks should show clearly if any faults are present. If a segmented display is provided there shall be a facility to check that all segments are functioning. The system shall not be capable of operation while any fault exists.

Detection Unit

22 The detection unit shall be designed so as to be portable and easily transferable between housings; it shall also be capable of both fixed and mobile operation. It shall be capable of operating both on a 240v AC single-phase mains supply and on a nominal 12v DC supply, at the choice of the operator.

23 A radar unit, if supplied, shall be designed so that it can be accurately positioned and firmly located within the housing. The radar unit mounting shall be such that the radar can only be installed by the operator in a previously determined position so that the radar will measure vehicle speeds, across the carriageway or in a specific traffic flow, at a preset angle. If a trailer mounting is being supplied then a sighting device shall also be provided.

24 The radar frequency shall be $24.1 \text{ GHz} \pm 25 \text{ MHz}$.

25 The detector unit shall be capable of undertaking not less than 2 measurements per second.

26 If radar is proposed as the detection/measuring device, the operator shall have the facility to select receding or approaching vehicles for monitoring.

27 The Contractor may submit for consideration full technical and operational details of any alternative 'across-the-road' or traffic flow specific system which has been type-approved in accordance with paragraph 4 above and which he proposes offering to provide as a detection/measuring device. eg. laser, piezo, inductive loop.

[Compiler: This paragraph and paragraphs 11, 13, and 28 may be omitted if so agreed with the Chief Officer of Police. If this is done put instead "27 Not used." otherwise all the paragraphs will require renumbering and cross-references will need careful amendment and checking]

28 Any detection system/measuring device using two or more inductive loops, piezo cable or similar medium shall include a facility for the operator to enter/vary the detector spacing as part of the setup procedure.

[Compiler: This paragraph and paragraphs 11, 13, and 27 may be omitted if so agreed with the Chief Officer of Police. If this is done put instead "28 Not used." otherwise all the paragraphs will require renumbering and cross-references will need careful amendment and checking]

Flash Unit or Ancillary Lighting Unit

29 A flash unit or ancillary lighting unit shall be provided for each monitoring site.

30 The flash unit or ancillary lighting unit shall be designed so as to be portable and easily transferable between housings and shall also be capable of mobile operation. It shall be capable of operating both on a 240v AC single-phase mains supply and on a nominal 12v DC supply, at the choice of the operator. Alternatively, a mobile flash or lighting unit may be supplied for operation outside the fixed housing.

31 The flash or ancillary lighting unit shall be synchronised to operate with the camera and shall be adjustable so that as a minimum there shall be a Low, Medium and High setting. The power of a flash unit shall be not less than 100 watts on the Low setting and not less than 200 watts on the High setting. The flash unit or ancillary lighting unit shall be capable of being readily switched off.

32 The flash unit shall be designed to operate at intervals of not less than 0.5 seconds.

33 The unit shall be designed so that it can be accurately and firmly positioned within the housing, and the mounting so designed that the operator can only locate the flash or ancillary lighting unit in a previously fixed position.

34 The flash or ancillary lighting unit shall be capable of manual operation, for testing purposes.

Dummy Equipment

- 35 The dummy equipment shall be designed to be portable and easily transferable between housings.
- 36 Dummy units shall be designed so that each can be accurately and firmly located within the housing.
- 37 Dummy units shall operate such that they are indistinguishable from a camera unit and shall appear so unless the housing is open.
- 38 Dummy units shall be capable of manual operation for testing purposes.
- 39 Dummy units shall be capable of recording and showing on a counter the total number of vehicles monitored and the total number of offences above a threshold speed which is specified by the operator within the speed range specified in paragraph 19 above.

Street Furniture

- 40 The housing and pole shall be of robust construction and shall include security-locking mechanisms to prevent unauthorised access or operation. All access to any hinge mechanism, or securing bolt, shall only be via the security locks. Any security lock accessed from ground level shall itself have an additional cover which requires a further piece of equipment for removal eg. Allen key. The supplier shall provide proof that all parts exposed to the weather shall, as a minimum, comply with the requirements of IEC 529: 1976 IP Rating 555 for protection against dust and water ingress and mechanical impact.
- 41 The housing shall be vandal resistant. It shall be mounted on a pole at a height of not less than 2.5 metres above the verge or pavement surface. When the camera unit is mounted there shall be an unrestricted view from the camera of the section of carriageway to be monitored.
- 42 The housing shall be designed so that all elements of the monitoring equipment can be easily installed and removed by one person. All units shall be positively located within the housing. An optional facility to mask the flash or the ancillary lighting unit shall be available for external attachment to the housing.
- 43 The housings which are within the central reserve, or other locations specified in Appendix 1/27, shall be capable of being turned through 180 degrees \pm 5 degrees on the supplied pole. The Contractor shall provide a pole with a suitable mechanism to enable the direction of the camera housing to be reversed to a pre-calibrated orientation into which it can be locked. The camera shall be calibrated when in each of the two differing orientations. The locating mechanism shall be such that the housing can be set and locked in not less than two positions each of which has been pre-calibrated. An automatic switching mechanism shall be provided such that electrical power shall not be available to any unit located within the housing whilst the housing is not locked into either one of these two pre-calibrated positions. When turning the housing to an alternative monitoring position, the housing shall only be capable of returning to its original position by reversing the direction of travel ie. rotational movement greater than 180 degrees shall not be possible.
- 44 The housing or pole shall provide facilities for the termination of all external interconnections. Any terminations not accommodated within the housing or pole shall be secured against unauthorised access or operation as required in paragraph 40 above.
- 45 The camera pole and its support shall comply with BE Agreed Endorsement No. 1/94 for its design and structural certification. The Contractor shall supply the Overseeing Organisation with not less than 2 no. copies of the certified drawings of the pole and its supports. It shall be of a design that provides for the housing to be lowered and accessed from ground level while maintaining its upright position and orientation relative to its operational direction such that the operator can undertake all test procedures facing the section of carriageway to be monitored.
- 46 Security keys shall be supplied in the ratio of one set per monitoring site. Such keys shall be of a pattern unique to the Chief Officer of Police. A minimum of 2 no. keys shall be required to gain access to the automatic speed camera system at each monitoring site. The keys shall be provided to the Overseeing Organisation for them to provide to the Chief Officer of Police. The Overseeing Organisation will maintain a record of all keys received from the Contractor, the equipment and locations to which they relate and the dates of their handing over to the Chief Officer of Police, their return by them and their handing over to the Contractor, or otherwise, at the Completion of the Contract.

Installation

47 The Contractor shall install the equipment required under this Appendix and Appendix 1/27 at the monitoring locations specified in Appendix 1/27 and in accordance with any particular installation requirements in Appendix 1/27.

48 The Contractor shall install the poles in the individual monitoring locations within highway limits as instructed by the Overseeing Organisation and shall carry out reinstatement of the surface as directed by, and to the satisfaction of, the Overseeing Organisation and as specified in Appendix 1/27.

49 The Contractor shall attach the housings to the poles in the positions specified and shall install, connect and commission the remainder of the equipment as required.

50 All cables and cores shall be clearly identified at every termination point or jointing. Identification shall comply with TCSU 1 Section 5.

51 Any ducting, loop or peizo installation shall be carried out to the following Specifications:

[compiler: List of specifications should be obtained from the Overseeing Organisation]

Reusable joints shall be used between loop tails and feeder cables.

Commissioning and Acceptance

52 The Contractor shall be responsible for the commissioning of the TASCAR as a whole, including secondary checks and the calibration of each piece of equipment, including ensuring its correct operation. As part of this, the Contractor shall provide a secondary method of confirming the speed calculation of the equipment provided as shown on the Contract Drawing specified in Appendix 1/27. This method shall be approved by PSDB and involve a different principle which shall be used to verify the primary speed measurement.

53 The commissioning of the TASCAR shall be carried out by the supplier of the System in the presence of, and for acceptance by, the Chief Officer of Police and shall be in accordance with any particular requirements in Appendix 1/27. The Contractor shall give the Overseeing Organisation not less than 4 days clear notice of his intention to carry out this work, to allow for a designated representative of the Chief Officer of Police to attend. Commissioning certificates shall be provided to the Overseeing Organisation and shall include one pair of photographs or video images for acceptance by the Chief Officer of Police as part of the commissioning and acceptance procedure of the System.

Operation and Maintenance

54 The TASCAR operator will be the Chief Officer of Police and his delegated officers. Once the TASCAR has been commissioned, the repositioning of the monitoring equipment between the housings will be the responsibility of the Chief Officer of Police as operator. He will also be responsible for the loading and unloading of the film and for locating and relocating the trailer unit, if supplied. The Contractor shall furnish whatever assistance is requested by the Chief Officer of Police through the Overseeing Organisation to carry out these tasks

55 The Contractor shall provide the Overseeing Organisation with a log showing the locations of all the speed limit and repeater signs relative to existing marker posts. A repeater sign shall be positioned such that one is visible in each photograph.

56 The Contractor and his supplier shall maintain the System as specified in paragraphs 1 and 4 above and in Appendix 1/27.

NG SAMPLE APPENDIX 1/27: ^(05/01) TEMPORARY AUTOMATIC SPEED CAMERA SYSTEM FOR THE ENFORCEMENT OF MANDATORY SPEED LIMITS AT ROADWORKS (TASCAR) - PARTICULAR REQUIREMENTS

Scope - Locations and Quantities

1 The number of monitoring sites required for the TASCAR on this Contract is ... no. The following ancillary equipment is therefore required:

Number of fixed housings	... no.
Number of camera units	... no.
Number of dummy units	... no.
Number of trailer-mounted housings	... no.

2 The Contractor shall supply install and maintain and remove on completion the TASCAR specified in Appendix 1/26 and in this Appendix at the following locations within the Works as shown on Contract Drawing number :

Northbound verge	Chainage
	Chainage
Southbound verge	Chainage
	Chainage
Central Reserve (CR)	Chainage
	Chainage

3 Parts of the TASCAR which are located within the central reserve will be rotated through 180 degrees at some point during the Works to observe the traffic flows being reversed together with any calibration etc.

Chief Officer of Police

4 The Chief Officer of Police in Appendix 1/26 is the Chief Officer of Police for *[give name of police district]*

Provision of Film

5 If cameras are supplied, the film specified in Appendix 1/26 *[will be provided by the Chief Officer of Police]* *[shall be supplied by the Contractor]* at the rate of one film per day of camera operation, plus ten which shall be supplied at the commencement.

Installation, Commissioning and Period of Operation

6 The secondary method of confirming the speed calculation of the equipment provided, which is required in Appendix 1/26 paragraph 52, shall be to Contract Drawing number Cameras sited on the nearside of the carriageway shall be installed and commissioned prior to 24 hour lane closures being put into operation. Cameras sited in the central reserve shall be installed and commissioned not later than 12 hours after installation of the contraflow. Both sets of cameras shall then remain in continuous operation until a Certificate of Completion has been issued for the whole of the Works. At the end of the period of operation required under the Contract, the equipment shall remain the property of the Contractor.

Reinstatement of Surfaces

7 Reinstatement of verge areas shall consist of backfilling any hole(s) with acceptable material to Clause 601 up to a level 100mm below specified finished levels. The remaining 100mm thickness shall be filled with topsoil Class 5B to Clause 601.

8 Reinstatement of paved footway areas shall consist of backfilling any holes with sub-base Type 1 to Clause 803 and compacting adequately such that this terminates 65 mm below specified finished levels. The remaining 65 mm thickness shall be backfilled with a 50 mm thick layer of dense macadam (20 mm aggregate) to Clause 906 covered by 15 mm thickness of dense macadam wearing course (6 mm aggregate) to Clause 909. The wearing course shall extend not less than 150 mm beyond the hole which has been backfilled and shall be keyed into existing surfacing by its prior excavation to a depth not greater than 15mm.

9 Reinstatement of carriageway surfaces shall include, but not be limited to, removal from the pavement surface of the secondary speed check markings specified in Appendix 1/26, paragraph 52 and in paragraph 6 above. This shall be done either on removal of the TASCAR or on completion of the Works.

NG SAMPLE APPENDIX 1/2NI: (05/01) VEHICLES FOR THE OVERSEEING ORGANISATION

Type (as defined below)	Number Required	Period Required	Cleaning Frequency
A			
B			
C			
D			

Type “A” 8/12 Seat Station Wagon

The vehicle is to be suitable for off-road use, have 4 wheel drive, power steering and be supplied in a white or yellow colour. The vehicle shall be free from markings identifying any company associated with the Contract. The equipment shall include:

Fire extinguisher, heater and demister, hazard flashing unit, heavy duty suspension, spare wheel, fuel filler cap lock, bonnet lock and spare wheel lock, internal and external mirrors, mud flaps, link mats front and rear, mudshield for front and rear brakes, rubber pads for clutch and brake pedals, interior sun visors, gearbox covers, tow rope, towing hooks front and rear, laminated windscreen, wire mesh guards for side, tail, stop and flasher lamps, covers for universal joints, sign boards reading ‘Road Maintenance’ or where appropriate ‘Motorway Maintenance’ in accordance with Diagram 7404 of Schedule 12, Part V of the Traffic Signs Regulations (Northern Ireland) 1997 on the rear of the vehicle (the lettering shall be the largest x height that can be accommodated out of the following heights: 37.5, 50, 62.5, 75 or 100 mm), retroreflective red and fluorescent yellow chevrons on the rear of the vehicle and a roof mounted amber flashing light bar fitted in accordance with paragraph 2.3.7.4 of Chapter 8 of the Traffic Signs Manual and the Road Vehicles Lighting Regulations

Type “B” Long Wheelbase Station Wagon

The vehicle shall be free from markings identifying any company associated with the Contract. The vehicle and equipment shall be as for Type A with the following variations:

Link mats and heater shall be supplied for the front only. The vehicle shall be adapted for CBR testing.

Type “C” Short Wheelbase Station Wagon

The vehicle and equipment is to be as type B but not adapted for CBR testing.

Type “D” 4-Door Estate Car

The vehicle shall have a carrying capacity of at least 0.25 tonne, a minimum ground clearance (unladen) of 150 mm and independent suspension.

The vehicle shall be finished in white or yellow colour and shall be free from markings identifying any company associated with the Contract. The equipment shall include:

Reversing lamp, fire extinguisher, luggage rack complete with straps suitable for carrying survey equipment, sign boards and roof mounted amber flashing light bar and red and yellow chevrons as above.

NG SAMPLE APPENDIX 1/20NI: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 1: Information to be provided by the compiler

Requirements for Recovery Vehicle Operation

1 Recovery Vehicles to be Provided

1.1 *[Compiler: Include here details of circumstances when recovery vehicles are to be provided.]*

1.2 Heavy recovery vehicles:

- (a) ... no. heavy recovery vehicle(s) shall be provided, each having a crew of at least two operatives.
- (b) A heavy recovery vehicle shall comply with the following:
 - (i) Be a recovery vehicle with not less than three axles, capable of towing by means of an underlift a loaded 44 tonnes vehicle up a slope of 4 °C and shall comply with all appropriate current legislation. The vehicle shall be fitted with either a 10 tonne single power winch or two power winches of not less than 8 tonne each. All equipment shall be power operated with SWL indicated and with operating levers/buttons clearly marked for operational use.
 - (ii) Be equipped with chains, wire ropes and shackles suitable for the recovery of a fully-laden 44 tonnes GVW vehicle. All chains, wire ropes and shackles shall have test certificates and/or stamped showing the SWL, be free from snags, excess stretching and wear.
 - (iii) Have seating for not less than two adult passengers (in addition to the recovery operatives).
 - (iv) Be conspicuous, for example by marking with suitable tape (not less than 125 mm wide) to sides and rear of the vehicle.
 - (v) The heavy recovery vehicle(s) shall be fitted with the following as a minimum requirement:
 - (a) 1 no. amber lightbar to comply with the Road Vehicles Lighting Regulations (Northern Ireland) 2000.
 - (b) 2 no. fully adjustable lights to illuminate both the sides and rear of the vehicle.
 - (c) 2 no. fire extinguishers (1 No. 6 kg (nett) dry powder; 1 No. 9 litre (nett) aqueous film forming foam).
 - (d) 1 no. 1-10 person first aid kit to include disposable surgical gloves.
 - (e) 2 no. 10 m 12 tonne nylon straps.
 - (f) 2 no. 30 m x 13 mm polypropylene rope.
 - (g) 1 no. 44 tonne straight tow pole.
 - (h) 1 no. 44 tonne cranked tow pole.
 - (j) 10 no. highway cones 750 mm height.
 - (k) 1 no. proof load tested crane.
(Overlift proof test-static 7.5 tonnes, underlift proof test-static 7.0 tonnes.)
 - (l) 1 no. suitable socket spanner set including AF/Metric and BA sizes.
 - (m) 1 no. suitable tool kit.
 - (n) 2 no. 12 tonne bottle jacks.

- (o) 1 no. suitable wheelbrace to fit HGVs in common use and a torque wrench.
- (p) 1 pair of jump leads (24 volt).
- (q) 1 no. explosion and flameproof hand lamp.
- (r) 1 no. crowbar.
- (s) 1 no. copper hammer.
- (t) The necessary fittings for connection from the air braking system of a broken-down or accident-damaged vehicle to the air braking system of the heavy recovery vehicle.
- (u) 1 no. broom and shovel.
- (v) 2 no. wheel chocks of HGV size.
- (w) 4 no. suitable lengths of wood block skidding.
- (x) 1 no. rear lighting board incorporating 'On Tow' legend in lettering of not less than 70 mm on conspicuously coloured background to conform with the Road Vehicles Lighting Regulations (Northern Ireland) 2000. The board shall be fitted with lights, reflectors and indicators. When required the recovery vehicle index number or trade licence plate shall be fitted.
- (y) 1 no. sledge hammer - 7lbs minimum.
- (z) 1 no. ADR (HAZCHEM) chart.
- (aa) 50 kg of dry fine sand stored in a waterproof container.
- (vi) The heavy recovery vehicle(s) shall also carry as a minimum requirement:
 - (a) 4 no. 'D' shackles SWL 12 tonnes each.
 - (b) 4 no. 'D' shackles SWL 3 tonnes each.
 - (c) 2 no. suitable length chains SWL 12 tonnes each.
 - (d) 2 no. suitable length chains SWL 5 tonnes each.
 - (e) 2 no. suitable length chains SWL 3 tonnes each.

NOTE: All lifting chains and equipment must be fully certified by an independent competent person to comply with all current legislation. Shackles listed in (vi) (a) and (b) should be stamped with the appropriate SWL. Equivalent wire ropes may be substituted for chains listed in (vi) (c), (d) and (e).

- (vii) The heavy recovery vehicle(s) shall carry, and use when necessary, equipment designed and manufactured for the purpose of locking the steering of the broken-down or accident-damaged vehicle in order to tow it safely in a reverse direction.
- (viii) The heavy recovery vehicle(s) shall carry equipment to enable the recovery crew to remove the drive line or shafts of the broken-down or accident-damaged vehicle.
- (ix) The heavy recovery vehicle(s) shall carry blocks with a SWL of 8 tonnes, 1 No. per winch and 2 No. on boom (crane) wires.

1.3 Light Recovery Vehicle

- (a) ... no. light recovery vehicle(s) shall be provided, each having a crew of not less than one operative.
- (b) A light recovery vehicle shall comply with the following:
 - (i) Be capable of carrying or towing, by means of an under lift, a vehicle weighing 2800Kg up a slope of 4°C and shall comply with all appropriate current legislation.
 - (ii) Be capable of recovering motor cycles
 - (iii) Be capable of recovering trailers (ie caravans, boat trailers, horse boxes, etc.)

- (iv) Have seating capacity for four adult passengers (in addition to the recovery operatives).
- (v) Be conspicuous, for example, by marking with suitable tape (not less than 125 mm wide) to sides and rear of the vehicle.
- (vi) The light recovery vehicle(s) shall be fitted with the following as a minimum requirement:
 - (a) 1 no. amber lightbar to comply with the Road Vehicles Lighting Regulations 2000.
 - (b) 2 no. fully adjustable lights to illuminate both the sides and rear of the vehicle.
 - (c) 2 no. fire extinguishers (1 No. 6 kg (nett) dry powder; 1 No. 9 litre (nett) aqueous film forming foam).
 - (d) 1 no. 1-10 person first aid kit which should include disposable surgical gloves.
 - (e) 1 no. 30 m x 13 mm polypropylene rope.
 - (f) 1 no. 6 tonne straight tow pole.
 - (g) 10 no. highway cones 750 mm height.
 - (h) 1 no. proof load tested winch and/or spectacle lift.
 - (j) 1 no. suitable socket set including AF/Metric and BA sizes.
 - (k) 1 no. suitable tool kit.
 - (l) 1 no. 3 tonne bottle or trolley jack.
 - (m) 1 no. suitable wheelbrace to fit cars and light goods vehicles in common use.
 - (n) 1 pair of jump leads (24 volt).
 - (o) 1 no. explosion and flameproof hand lamp.
 - (p) 1 no. crowbar.
 - (q) 1 no. quick change towing hitch suitable for 50 mm, 2 inch or jaw type fittings.
 - (r) 1 no. broom and shovel.
 - (s) 1 no. wheel chock of light commercial size.
 - (t) 2 no. suitable lengths of wood block skidding.
 - (u) 1 no. rear lighting board incorporating 'On Tow' legend in lettering of not less than 70 mm on conspicuously coloured background to conform with the Road Vehicles Lighting Regulations (Northern Ireland) 2000. The board shall be fitted with lights, reflectors and indicators. When required the recovery vehicle index number or trade licence plate shall be fitted.
 - (v) Total lift facility - 2800kg slideback deck (7.6 m minimum) or heavy duty dollies.
 - (w) 50 kg of dry fine sand stored in a waterproof container.
- (vii) The light recovery vehicle(s) shall also carry as a minimum requirement:
 - (a) 4 no. 'D' shackles SWL 3 tonnes each.
 - (b) 2 no. suitable length wire ropes SWL 3 tonnes each.
 - (c) 2 no. ratchet jacks SWL 6 tonnes each, or hydraulic equivalent.
 - (d) 1 No. suitable towing trolley.

NOTE: All lifting ropes and equipment must be fully certified by an independent competent person to comply with all current legislation. An equivalent chain may be substituted for the wire rope listed in (vii) (b).

- (viii) The light recovery vehicle(s) shall carry, and use when necessary, equipment designed and manufactured for the purpose of locking the steering of the broken-down or accident-damaged vehicle in order to tow in a reverse direction.

2 Inspection Requirements

2.1 The vehicle

The contractor shall ensure that all recovery vehicles are maintained in such condition that all times the vehicles conform to the requirements of the Road Traffic Order and regulations made there under, and the Road Vehicles Lightning Regulations, so as to be fit to be used on the Road. Evidence of the roadworthiness shall be by successful completion of an inspection by the Freight Transport Association, conducted not less than 14 days not more than 28 days before the vehicles are required,

If the duration of the works exceeds 6 months, the Contractor shall arrange for all recovery vehicles to be inspected by the Freight Transport Association at not less than 6 monthly intervals.

2.2 Lifting equipment

All lifting equipment shall be fully certified by an independent competent person to comply with all current legislation.

2.3 Reports

A copy of each inspection report shall be:

- (a) provided for the Overseeing Organisation.
- (b) kept in the recovery vehicle.

2.4 Record form

The Contractor shall submit weekly to the Overseeing Organisation duplicate record forms which log the regular checks made on each recovery vehicle. A sample form is given in Sheet 2 of this Appendix.

3 Locations for Recovery Vehicles

[Compiler: State here details of locations for recovery vehicles together with any specific requirements such as need for hardstandings.]

4 Communication System

In addition to the requirements of Appendix 1/3, the Contractor shall:

- (a) provide a secondary 'back up' communications system (e.g. mobile telephone, 2-way radio link or land line) between the recovery base station(s) and all recovery vehicles, and
- (b) provide an emergency telephone and line at the recovery base station(s) for the sole use of emergency calls. Where possible, the link between the recovery base station(s) and the police shall be by direct land line.

The Contractor shall be responsible for all associated equipment and payment of fees to operate the system which shall be established and fully tested prior to the start of the Works.

[Compiler: Provide here details of specific communication system requirements].

5 Location(s) for Vehicle Removal

[Compiler: Insert details of location(s) to which broken-down or accident-damaged vehicles should be removed, and the facilities to be provided at those locations. These locations should take into account safety, security and the availability of a telephone.]

6 Explanatory Leaflet

The Contractor shall ensure that the recovery vehicle operatives issue leaflets to the drivers of vehicles requiring assistance, before recovery commences. These shall have been prepared in liaison with the police and in accordance with Sheet 3 of this Appendix, and have been approved by the Overseeing Organisation before issue to the recovery firm.

7 Limits of Service

[Compiler: Give details of the length of carriageway over which free recovery service will operate, including any specific requirements to cover slip roads, side roads etc.]

8 Requirements for Recovery Personnel

(a) Suitability: It is the responsibility of the Contractor to ensure that all personnel involved with vehicle recovery are suitable to work with 'vulnerable' motorists.

(b) Training: The Contractor shall ensure that all personnel involved with vehicle recovery shall hold a certificate certifying successful completion of an appropriate vehicle recovery course. A copy of each certificate shall be provided to the Overseeing Organisation not less than 14 days before the commencement of the works.

(c) Personal Protective Equipment: In addition to the provisions identified in the Health and Safety risk assessment conducted by the Contractor, the following items will be provided for each crew member of the recovery vehicle:

- (i) Safety Helmet CE marked to EN 397.
- (ii) Reflective Safety Garment complying with sub-Clause 117.18 of the Specification.
- (iii) Boots with steel reinforcement toecaps and/or safety footwear in accordance with MSA EN 345.
- (iv) Suitable gloves with the appropriate CE mark.
- (vi) Protective Goggles in accordance with BS 2092.

Note: All Personal Protective Equipment should be stored and maintained in good, clean condition.

(d) Identification: The Contractor shall ensure that all personnel involved with vehicle recovery are issued with the following:

- (i) An identity card which incorporates the name of the recovery contractor (or the Contractor), and the name and a photograph of the holder. This card must be available for inspection at all times and a copy must be submitted to the Overseeing Organisation prior to the commencement of the operative working.
- (ii) A reflective Safety Garment (referred to in (c) (ii) above) which prominently displays the Contractor's name.

(e) Working hours:

[Compiler: Include maximum hours to be worked by recovery operatives: (For example, 12 hours on duty with the provision that no work should be undertaken in the following 12 hour period).]

9 Record Form

The Contractor shall submit weekly to the Overseeing Organisation completed duplicate record forms which log the assistance given by the recovery vehicle and their operatives. Sample forms are given in Sheet 4 of this Appendix.

NG SAMPLE APPENDIX 1/20NI: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 2: Information to be provided by the Contractor

FORM FOR 'RECOVERY VEHICLE DAILY CHECK SHEET'

RECOVERY VEHICLE DAILY CHECK SHEET							
Week Commencing:							
Driver's Name:	Vehicle Type/Registration No:			Mileage:			
Driver to initial against check list below:							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
OIL LEVEL							
WATER							
ENGINE							
CLEANLINESS – interior							
CLEANLINESS – exterior							
WIPER/WASHERS							
TYRES							
LIGHTS							
Driver's Report (detail any problems):							
Action Taken (to solve above problems):							
Date:				Supervisor's Signature:			
COMPLETED SHEET TO BE RETURNED TO OVERSEEING ORGANISATION EACH WEEK							

NG APPENDIX 1/20NI: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 3: Information to be provided by the Contractor

LEAFLET FOR ISSUE BY RECOVERY VEHICLE OPERATIVES TO DRIVERS OF ALL BROKEN-DOWN OR ACCIDENT-DAMAGED MOTOR VEHICLES

Name of Scheme:

[Compiler: Insert accurate name of the scheme before the issue of tender documents]

Vehicle Recovery Service - Explanatory Leaflet authorised by the Department for Regional Development, Roads Service for issue to drivers of broken-down and accident-damaged motor vehicles within the above works.

Leaflet to be distributed by recovery vehicle operatives of the appointed recovery firm on behalf of the Department for Regional Development, Roads Service.

1. The roadworks operations commence at the "Roadworks Ahead - 2 miles" sign and end at the "Roadworks End" sign. *[Compiler: See Note 1 below]*
2. The recovery service provided along the extent of the roadworks operations is free.
3. Vehicles will be recovered clear of the roadworks operations tounless otherwise directed by the police. *[Compiler: See Note 2 below]*
4. It will then be at the discretion of individual drivers of broken-down or accident-damaged vehicles requiring assistance to arrange for assistance or the removal of their vehicle to a garage of their choice. The operators of the free recovery service do not make such arrangements.

A list of local garages is given below:

.....
.....

Assistance will also be given by telephoning *[Compiler: See Note 3 below]*

If a motorway emergency telephone is used, the police will assist.

[Notes to compiler:

- (1) *If different, replace with the appropriate limits of service for the Works.*
- (2) *The chosen location should take into account safety, security and the availability of a telephone.*
- (3) *The telephone number should be agreed with the police prior to the commencement of the Works.]*

NG SAMPLE APPENDIX 1/20NI: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 2: Information to be provided by the Contractor

FORM FOR 'RECOVERY VEHICLE DAILY CHECK SHEET'

RECOVERY VEHICLE DAILY CHECK SHEET							
Week Commencing:							
Driver's Name:		Vehicle Type/Registration No:			Mileage:		
Driver to initial against check list below:							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
OIL LEVEL							
WATER							
ENGINE							
CLEANLINESS – interior							
CLEANLINESS – exterior							
WIPER/WASHERS							
TYRES							
LIGHTS							
Driver's Report (detail any problems):							
Action Taken (to solve above problems):							
Date:				Supervisor's Signature:			
COMPLETED SHEET TO BE RETURNED TO OVERSEEING ORGANISATION EACH WEEK							

NG SAMPLE APPENDIX 1/20NI: ^(05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 4 (continued)

VEHICLE RECOVERY LOGSHEET (2 of 2) [Scheme name]			Recovery Vehicle:		Week Ending:/...../.....		Sheet No:	
Date & Time	Type of Vehicle	Registration No.	Name and Address of Driver or Firm	Location of Breakdown	Nature of Breakdown	Recovery Operator's Name		

MANUAL OF CONTRACT DOCUMENTS FOR ROAD WORKS
VOLUME 2 NOTES FOR GUIDANCE ON THE SPECIFICATION FOR ROAD WORKS

SERIES NG 100

PRELIMINARIES

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NATIONAL ALTERATIONS OF THE OVERSEEING ORGANISATIONS OF MALTA

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denotes a Clause or Sample Appendix which has a substitute National Clause or Sample Appendix for one or more of the Overseeing Organisations of Malta.

PRELIMINARIES

NG 101 Temporary Accommodation and Equipment for the Overseeing Organisation

1 This Clause will generally need to be supplemented by drawings cross-referenced in Appendix 1/1. In addition, Appendix 1/1 should indicate:

- (i) accommodation and commencement date, if different from sub-Clause 101.2, and/or removal date.
- (ii) the size and nature of accommodation needed;
- (iii) all the required furniture and fittings, equipment (including surveying) supplies, definitive quantity of consumables, drainage facilities and other services. The Appendix should also include the standards of artificial lighting intensity and the minimum room temperature to be maintained during stated hours, including weekends where required.

2 The accommodation, furnishings and fittings and equipment provided should be in good condition, but unless there is any particular reason need not be new.

3 The provision of special temporary accommodation may be unnecessary in some instances where suitable existing property can be used. In such instances details of the property should be described in Appendix 1/1 together with the terms under which the property can be made available.

4 Appendix 1/1 should indicate, when applicable, the accommodation requirements (which may be either portable or in existing

premises) needed by the Overseeing Organisation to supervise major components of the Works likely to be manufactured and tested off Site.

5 Testing equipment to be listed in Appendix 1/1 should only include that to be used by the Overseeing Organisation for tests which are necessary to ensure compliance with the Specification. In particular, the list should include equipment for carrying out tests on samples described in Appendix 1/6, having regard to laboratory accreditation requirements where appropriate.

6 It should be noted that laboratory accreditation for tests becomes invalid where test equipment is defective, therefore the Contractor should take prompt action to repair, replace and/or recalibrate any test equipment requiring such attention.

7 When the Contractor erects temporary accommodation on land which is part of the Site or adjoining the Site (ie. has a common boundary with it) planning permission for the erection of the temporary accommodation is deemed to have been granted for the duration of construction operations.

NG 102 Vehicles for the Overseeing Organisation

1 This Clause will need supplementing by Appendix 1/2 which should describe the number and type of vehicles and indicate the period for which each vehicle is required.

2 Vehicles should not be described by proprietary names; if they cannot otherwise be described, the words 'or equivalent'

should be added. New vehicles should only be required where the nature of the Works and Contract period make it essential.

3 The frequency that the Overseeing Organisation's vehicles are to be cleaned by the Contractor should be described in Appendix 1/2.

NG 103 Communication System for the Overseeing Organisation

1 When a communication system is required this should be stated in Appendix 1/3, together with requirements specific to the Contract which should include:

- (i) Type of equipment required.
- (ii) Location of base station if necessary.
- (iii) Number and description of sets, (including spare batteries and charging apparatus) required for:
 - (a) installation in vehicles, stating that hands free kits shall be provided;
 - (b) portable use.
- (iv) If a radio communication system is to be used the radio frequency should be obtained from the Overseeing Organisation.

2 The scale of provision should bear some relation to the length of the scheme and should not normally exceed one set per kilometer of a road scheme in addition to the base set, although variations may be necessary where particular problems of control arise.

3 When there are particular reasons for requiring the communication facilities earlier than the normal 4 weeks from the date for commencement of the Works (eg. on major maintenance contracts where traffic management measures need to be commenced early after the Contract has been awarded) this should be stated in Appendix 1/3.

NG 104 Standards, Quality Assurance, Agreement Certificates and Other Approvals Standards

1 Where there is no declaration of equivalence in respect of a proposed alternative standard, the Overseeing Organisation should ascertain whether or not the proposed standard lays down levels of safety, suitability and fitness for purpose equivalent to those required by the specified standard. The Overseeing Organisation may also need to seek advice from the designer. The factors underlying the purpose of the specified standard and their criticality should be evaluated for each application. If the proposed standard only differs from the specified standard in a way not essential to the underlying purpose it should be considered equivalent. Similarly, if the proposed standard contains such factors but in a different technical form which achieves the same purpose as the specified standard, it should be considered equivalent.

Quality Assurance

2 A contract specific Quality Plan should be prepared by the Contractor, which should be as brief as possible but cover all the topics in the "Model Requirements". (See NG Sample Appendix 1/24). The quality plan should include the requirements listed in the quality

plans contained in the relevant quality management schemes described in Appendix A of the Specification for Road Works.

3 National Sector Schemes for Quality Management in Road Works are being developed, as a partnership, by all sides of the road industry to interpret BS EN ISO 9002 : 1994 as it applies to a particular road activity/industry within Malta. Changes to scheme structure and requirements are being incorporated in the light of revisions to the standard in the shape of BS EN ISO 9001 : 2000.

4 National QMSS have generally been developed from schemes that were originally operated by individual certification bodies accredited by the MSA or ADT.

5 National QMSS were developed, and are complementary to and interpret BS EN ISO 9002 : 1994, but do not duplicate this standard. They are designed to:

- (i) provide an industry benchmark;
- (ii) ensure that all processes are planned;
- (iii) provide a basis for continuous improvement;
- (iv) focus on quality as an objective;
- (v) reduce costs for client and supplier;
- (vi) provide and maintain a properly trained and competent workforce;
- (vii) involve all sides of industry in scheme ownership within a partnership framework;
- (viii) ensure that Certification Bodies use auditors with technical knowledge

and experience of the sector concerned; and

- (ix) promote confidence in quality management systems by provision of a robust transparent system.

6 MSA and ADT are advised on each sector scheme by a separate Technical Advisory Committee (TAC). Each TAC interprets ISO 9002 : 1994 in relation to the requirements of their particular activity. The TAC comes to a consensus on the minimum levels of workmanship, services, products, testing, and the training and competency of operatives needed to meet specification requirements, as well as auditor qualification. These details are contained in the individual Sector Scheme Documents (SSDs).

7 After reaching consensus on the SSD, the final draft is then submitted to MSA and ADT for final scrutiny as a sector scheme before being accepted. MSA particularly check which organisations have participated in the development of the scheme, the interpretation of ISO 9002 : 1994, especially the training elements and the auditor qualifications for the certification bodies. Following this scrutiny and the making of any necessary amendments, the document is then published by MSA. MSA provide copies to MSA accredited certification bodies that wish to participate in the scheme for a sector activity, and to the relevant TAC chairpersons. These organisations and the relevant chairpersons are then responsible for circulating copies to their respective suppliers and committee members.

8 Implementation of a new scheme or an amendment to a scheme is bound by time constraints. For a completely new scheme, the implementation period must allow for the accreditation of the certification bodies

by MSA and then subsequent registration of suppliers by the certification body. This is unlikely to be less than 9 months. Where a scheme is amended, the implementation period must allow suppliers time to update their quality system and be assessed against the requirements. This period will not be less than 6 months, which should generally be sufficient for certification bodies to notify suppliers of the changes so that they can be included in their quality system prior to their next surveillance assessment.

9 When needed, the schemes include a requirement for a supplier to provide, for approval by the Customer, a quality plan prior to commencement of work. This will include contract specific method statements where applicable. The plan and statements should be reviewed during the currency of a contract, and may also be audited subsequently by the certification body during a surveillance or reassessment visit.

10 Each scheme is reviewed, at least annually, by the appropriate TAC. The review takes account of feedback on the performance of the scheme including perceived deficiencies, comments received from users of the scheme and the effect that new standards or codes of practice may have on the scheme. This allows the scheme to develop naturally and provides for continuous improvement.

11 Individual technical advisory committees are overseen by the ADT. This group provides a forum for discussion on the effectiveness of the sector schemes and co-ordinates developments so that they can be uniformly taken forward by each of the technical advisory committees. It is also the venue where dialogue with MSA and the certification bodies on the application of the schemes is discussed. One of the main aims of the group is to promote the schemes

throughout the country so that only certificated suppliers are used.

12 National QMSS provide a major opportunity for Clients to review their procurement policies, contract procedures and supervision responsibilities, enabling savings to be made in manpower and compliance testing without comprising quality.

13 The introduction of harmonised European Standards includes requirements for factory production control and attestation of conformity. This will vary from self-certification by the manufacturer to approved third party product certification process. Currently, the European Commission has set up a Notified Bodies Group which has been charged with the responsibility of interpreting European Standards where third party certification is included in a standard. QMSS are seen as complementary to this process.

14 Suppliers' quality management schemes listed in Appendix A and product certification schemes in Appendix B comply with MSA EN ISO 9002 : 1994, and are third party certificated by a certification body satisfying the requirements of EN 45012 or EN 45011 and accredited for the scheme. MSA uses EN 45011 and EN 45012 as part of the criteria for assessment so certification bodies accredited satisfy the requirements of these European Standards. Each Supplier should prepare a Quality Plan covering the topics in the "Model Requirements" in addition to any requirements included in relevant National QMSS documents cited in Appendix A.

15 For listed schemes, other than National QMSS, Overseeing Organisations should consider the critical factors which form the basis of the acceptability of the listed

scheme when ascertaining whether or not a proposed alternative quality management scheme or product certification scheme is equivalent. The Overseeing Organisation should check that certification of the proposed quality assurance scheme has been undertaken by an independent body. Such bodies are those accredited by MSA for certification body accreditation, or similar bodies in other Member States of the European Economic Area. For organizations which have achieved certification under National Sector Schemes for Quality Management in Road Works, registration on the QA Register forms part of the requirements of the scheme. It should be noted that not all third party certification bodies are accredited for all their activities. In the case of product certification schemes, equivalence of testing facilities may have to be checked.

16 To date only a few quality management schemes have been adopted by the ADT. It is intended to list other recognized schemes when these become established and enough firms are registered to ensure adequate competition within a geographical region. It should be noted that firms may be registered for part only of some schemes.

17 The Overseeing Organisation should retain the copy certificates of conformity provided in compliance with Clause 104 as evidence of the operation of quality management schemes and product certification schemes. Certificate issued in

respect of National Sector Schemes for Quality Management in Road Works will include reference to the specific sector scheme or will be included on an attached schedule to the certificate.

18 Some of the National QMSS enquire that operatives successfully complete specific training and/or competency assessment. These achievements are recognized as registered operatives and foremen are required to carry registration skill cards, which indicate status and categories of work that the holder can carry out. Each card carries a photograph of the holder. The Overseeing Organisation should check the cards against the holder and also check the validity of cards with the issuing Authority. Table NG ½ provides a summary of national sector scheme requirements for registration/skill cards.

Table NG 1/2: Summary of National Sector Scheme Requirements for Registration/ Skill Cards

Scheme	Operative/ Erectors	Foreman/ Lead Operative/ Lead Erectors	Issuing Authority
2A – Fencing	Required	Required	MSA/ ADT
2B – Vehicle Restraint Systems	*	Required	MSA/ ADT
4 – Timber Preservation	Not applicable **	Not applicable **	MSA/ ADT
6 – Lightning Column manufacture supply and verification	Not applicable	Not applicable	MSA/ ADT
7 – Application of road marking and road studs	Required (NVQ level 2 or Certified Operative)	Required (NVQ level 2 or Certified Operative)	MSA/ ADT
12A – Static Temporary Traffic Temporary	Required	Required	MSA/ ADT
12B – Static Temporary Traffic Temporary	Required	Required	MSA/ ADT
12C – Mobile Lane Closures	Required	Required	MSA/ ADT
13 – Surface Dressing	Not Required	Not Required	MSA/ ADT
14 – Asphalt Production	Not required	Not required	MSA/ ADT

* To be implemented for operatives from December 2001

** (plant operatives required to hold NVQ)

19 The need for inspecting of manufacturer's premises and the testing of goods and materials subject to a quality management scheme or product certification scheme should be reviewed. If the Overseeing Organisation has reasonable confidence in the operation of a quality management scheme or product certification scheme, it can substantially reduce the level of inspection and testing or in some cases eliminate it. It should be noted that a quality management scheme differs from a product certification scheme by being based solely on written management procedures. Such schemes do not guarantee the quality of the actual product or workmanship. In the case

of product certification schemes, the goods and materials have already undergone independent testing. Nevertheless if the Overseeing Organisation is not satisfied with a product appropriate testing should be undertaken. If the performance of a quality assurance scheme is not satisfactory the certification body should be informed in writing.

MSA/ ADT

20 The Overseeing Organisation may accept equivalent certificates issued by Members of the European Union of Agrément (UEAtc).

Statutory Type Approval

21 Statutory type approval is granted by the ADT. Products which have obtained statutory type approval are listed in Advice Note SA1 (MCHW 0.3.1). Where the Contractor designs part of the Works and makes application for approval, he should forward the information to the Overseeing Organisation in sufficient time for approval to be given, taking into account the programme for the Works. Where statutory type approval is given, one copy of the approval certificate should be returned to the Contractor.

Statutory Authorisation

22 Statutory authorisation is granted by the ADT. Where the Contractor designs part of the Works and makes application for authorisation, he should forward the information to the Overseeing Organisation in sufficient time for authorisation to be given, taking into account the programme for the Works. Where statutory authorisation is given, one copy of the authorisation should be returned to the Contractor.

Type Approval/Registration

23 Type approval/registration is given by the Overseeing Organisation. Products which have obtained type approval and registration are listed in Advice Note SA1 (MCHW 0.3.1). Where the Contractor makes application to use work, goods or materials which are claimed to have an equivalent type approval/registration of the national roads authority of another Member State of the European Economic Area, he should forward the information to the Overseeing Organisation in sufficient time for consideration to be given, taking into account the programme for the Works.

Where type approval/registration is given, one copy of the approval certificate should be returned to the Contractor.

Provision of Information

24 The Overseeing Organisation should check that all information and certificates are valid. Where certificates relate to a particular batch, it is important to ensure that the goods or materials incorporated in the Works form part of that batch.

25 Frequently there is a need for the Contractor to submit working and fabrication drawings to the Overseeing Organisation. The compiler should include in Appendix 1/4 relevant details of all works (eg. steelwork, parapets, diaphragm wall details, waterproofing details, traffic signs, lighting, bearings, piles, precast concrete, joints, environmental barriers, corrugated steel buried structures, combined drainage and kerb systems) for which he requires working or fabrication drawings to be prepared by the Contractor, together with the minimum periods for submission of the drawings prior to commencement of the related works.

26 Where Proposed Equivalent Work, Goods and Materials (PEQs) are required to have statutory or type approval/registration, this can take a considerable time to evaluate and may not be possible within the timescale of the Contract. The Overseeing Organisation should inform the Contractor of the likely timescale together with an assessment of whether it is possible to achieve approval within the time available. Guidance on the evaluation of proposed equivalent work, goods and materials offered by the Contractor purporting to have levels of safety, suitability and fitness for purpose equivalent to those specified in the

Contract is given in Advice Note SA2 (MCHW 0.3.2).

NG 105 Goods, Materials, Sampling and Testing Goods and Materials

1 Samples of goods and materials should be retained until the completion of the Works.

Sampling and Testing

2 The compiler should refer to MCHW 0.3.3 (SA 3) before determining the extent of testing by the Overseeing Organisation and by the Contractor. It is not intended that all the testing (appropriate to the Contract) specified in the Specification for Road Works should necessarily be undertaken by the Contractor. The compiler should consider carefully and decide which of the specified tests would be better undertaken by the Overseeing Organisation. The Specification requires those tests marked ‘†’ in Table NG 1/1 to be undertaken by the Contractor and this requirement should not normally be changed.

3 Details of testing to be carried out by the Contractor and test certificates to be supplied should be abstracted selectively from Table NG 1/1 and scheduled in Appendix 1/5 to enable tenderers where appropriate to allow for these in their rates and prices as no separate items (except for proof loading of piles) should be contained in the Bill of Quantities, unless there has been an agreed departure from the Method of Measurement (see MCHW 4.2, Chapters I, II and III, Note 7 ‘Testing’). The Contractor may propose that testing be carried out on his behalf by a testing laboratory, manufacturer or supplier.

4 The testing detailed in Table NG 1/1 is not

necessarily exhaustive and other tests may be required. Where Contract-specific Clauses contain testing requirements, details should be scheduled in Appendix 1/5 or 1/6 as appropriate.

5 The frequencies of testing marked ‘*’ in Table NG 1/1 are given for general guidance and are only indicative of the frequencies that may be appropriate. The compiler should determine the frequencies to be used for the Contract, taking into account all relevant factors and circumstances such as size, location, time for completion, QA schemes. Where a British Standard or Specification Clause number is listed, the frequency of testing is specified therein and should not normally be changed.

6 Details of provision and delivery of samples by the Contractor for testing by the Overseeing Organisation should be scheduled in Appendix 1/6, to enable tenderers where appropriate to allow for these in their rates and prices as no separate items for supplying samples should be contained in the Bill of Quantities, unless there has been an agreed departure from the Method of Measurement (see MCHW 4.2, Chapters I, II and III, Note 7 ‘Testing’). The compiler should avoid duplication of testing wherever possible.

7 Where a part of the Permanent Works is to be designed by the Contractor and the associated materials and workmanship are to be tested by the Contractor, the compiler should ensure that the tests scheduled in Appendix 1/5 cover all the options permitted by the design specification. Similarly, where a part of the Permanent Works designed by the Contractor is to be tested by the Overseeing Organisation, the samples scheduled in Appendix 1/6 should cover all the permitted options. The same considerations apply where the Contractor

selects materials from a range of permitted options (eg. type of pavement, safety fencing, pipes for drainage and ducts).

8 It is the policy of the Overseeing Organisations to require the use of testing laboratories accredited for certain tests and sampling by the MSA/ ADT for laboratory accreditation for on Site and off Site testing and sampling. Test results which are required to be MSA accredited are indicated in Table NG 1/1.

9 In cases where the Contractor has sublet his testing obligations, the following should be noted. The time requirements in sub-Clause 105.2 of the Specification are of the essence and the Contractor has an obligation under the Contract to ensure that his subcontractor complies with sub-Clause 105.2, inter alia.

Test Certificates

10 Appendix 1/5 should indicate, where appropriate, the requirement for a test certificate for each test or series of tests carried out by the Contractor, supplier or manufacturer.

11 British Standards which specify tests are usually written in a form in which test requirements are a matter between the supplier or manufacturer and the purchaser. The Contractor is the purchaser in this context and sub-Clause 105.3 requires him to obtain test certificates provided for in a British Standard (or other standard or specification) where stated in Appendix 1/5.

NG 106 Design of Permanent Works by the Contractor General

1 Appendices 1/10 and 1/11 should include for each structure, structural element or

feature listed a design specification (or design specifications where a choice is offered) incorporating any relevant Appendices, Standards or other requirements appropriate to the design. A Designated Outline should be shown on the Drawings for each structure to be designed by the Contractor and each structure for which a choice of designs is offered. Advice on the Designated Outline is given in Standard SD 4 (MCHW 0.2.4).

Structures

2 The Contract should be compiled in accordance with Standard SD 4 (MCHW 0.2.4) in respect of:

- (i) Each structure for which a design (based on a proprietary manufactured structure) is to be submitted by the Contractor. (These structures should be listed in Appendix 1/10 (A).)
- (ii) Each structure for which the Overseeing Organisation has prepared a (nonproprietary) design but for which a proprietary manufactured structure is a suitable option. (These structures should be listed in Appendix 1/10 (B).)

Examples of structures for which the suitability of proprietary systems should be considered are:

- environmental barriers;
- drains (exceeding 0.9 m diameter);
- crib walling;
- precast concrete box culverts (up to 8 m span);

- corrugated steel buried structures (0.9 to 8 m span);
- reinforced earth structures;
- anchored earth structures;
- footbridges;
- small span underbridges (up to 8 m span).

3 The compiler should ensure that each design specification includes an outline Approval in Principle form as referred to in Standard BD 2 or the Technical Approval Scheme adopted by the Overseeing Organisation and Advice Note BA 32.

4 The design certificate, completed by the Contractor, should be forwarded to the Technical Approval Authority for acceptance, together with the check certificate. On receipt of the countersigned certificates, one copy should be returned to the Contractor.

Lighting Columns and Brackets and Closed Circuit Television (CCTV) Masts

5 Clause 1301 requires the Contractor to propose lighting columns and brackets and CCTV masts which have been designed by the manufacturer (and checked by a checking consultant) in accordance with Standard BD 2 or the Technical Approval Scheme adopted by the Overseeing Organisation and Series 1300. The Overseeing Organisation should ensure that the design and check certificates provided comply with these requirements and where a sign is to be fitted to a lighting column, with the requirements of sub-Clause 1207.13.

Structural Elements and Other Features

6 The compiler should ensure that structural elements and other features based on

proprietary products have not been specified in the Contract. Such elements and features should be designed by the Contractor, or where appropriate, by the manufacturer and proposed by the Contractor. Such elements and features, examples of which are given below, should be listed in Appendix 1/11:

- combined drainage and kerb systems;
- linear drainage channels;
- ground anchorages for anchored structures;
- piles;
- bridge bearings;
- bridge expansion joints;
- parapets.

7 Non-proprietary structural elements and other features to be designed by the Contractor should also be listed in Appendix 1/11. Examples of such elements are:

- foundations to environmental barriers;
- foundations to lighting columns.

NG 107 Site Extent and Limitations on Use

1 The extent of the Site should normally be shown on the Drawings but for schemes where traffic management involves temporary traffic signs outside the area of the Works it may be more appropriate to describe the extent of the Site in Appendix 1/7. Where the Site is shown on the Drawings, the drawing numbers should be stated in Appendix 1/7.

2 Where the Contractor is responsible for temporary traffic signs giving advance warning of the Works, those areas of road necessary for the installation, maintenance and removal of advance signs, cones and road markings should be included in the Site, with the agreement of the roads authority.

3 Any limitations on the use of the Site, for example restrictions on the use of verges and paved areas that have been coned off adjacent to traffic, should be described in Appendix 1/7.

NG 108 Operatives for the Overseeing Organisation

1 The number and function of operatives required by the Overseeing Organisation should be included in Appendix 1/8.

NG 109 Control of Noise and Vibration Noise

1 Where it is envisaged that construction or reconstruction might involve noise disturbance, the Overseeing Organisation should have informal discussions with the Local Authority during the scheme preparation and, where possible, an informal agreement to a noise control system should be concluded.

2 The noise control requirements informally agreed with the Local Authority should be described in Appendix 1/9 together with any specific requirements of the Overseeing Organisation which are not covered by BS 5228 : Parts 1, 2 and 4 or by the Local Authority.

3 Appendix 1/9 should state that the Local Authority requirements are given as a guide

to the Contractor, and it is for the Contractor to decide whether to seek the Local Authority's consent to his proposed method of work and to the steps he proposes to take to minimize noise.

4 Local Authorities have powers to control pollution by imposing requirements as to the way in which work is to be carried out and, in particular:

- (i) the plant or machinery which is, or is not, to be used;
- (ii) the hours during which work may be carried out;
- (iii) the level of noise which may be emitted.

Guidance on noise control legislation is given in BS 5228 : Part 2.

Vibration

5 Any requirements for the control of vibration other than that due to blasting for excavation should be included in Appendix 1/9. Vibration limits for blasting are given in Clause 607, but may be varied as in Appendix 6/3.

NG 110 Information Boards

1 The compiler should provide in Appendix 1/21 details of any specific requirements, and cross-refer to drawings of the information boards required for the Works. Whenever possible information boards should be erected within the road boundary, consistent with the safety of road users and although planning permission is not required for trunk roads the Local Planning Authority should be informed of the proposal to erect them as a matter of courtesy. The permission

of the Local Authority is required for information boards erected on a non-trunk road. Safety fencing should be detailed at the site of information boards where appropriate.

2 Contractor's advertising boards should not be located with advance direction signs or traffic management signs except when associated with information boards. Planning permission for advertisements on construction sites is covered by MEPA and ADT regulations.

NG 112 Setting Out

1 Generally on large schemes a pre-construction survey is undertaken by the Overseeing Organisation to confirm the co-ordinates and levels of permanent ground markers (PGMs) and permanent bench marks (PBMs). The Overseeing Organisation should ensure that missing ones are replaced and new ones provided where required to ensure that there is a sufficient number immediately adjacent to the Works.

2 The compiler should include in Appendix 1/12 particulars of the setting out details which are available. This will usually include:

- (i) Co-ordinates and levels of PGMs, PBMs.
- (ii) Offset information.
- (iii) Cross-section details.
- (iv) Computerised data.

3 Normally it is not necessary to supply each tenderer with all this information, but it should be made available for inspection.

Once the Contract is awarded, the details should be given to the Contractor, who is responsible for setting out.

4 No specific tolerances are given for setting out. The construction tolerances given in the Specification relate to the agreed lines and levels of the Works.

5 The Contractor should check the co-ordinates and levels of PGMs and PBMs before setting out and the Overseeing Organisation may check the setting out as the work proceeds.

6 Any specific requirements for setting out should be given in Appendix 1/12.

7 Any special requirements regarding the level of information on existing details to be recorded by the Contractor should be given in Appendix 1/12.

NG 113 Programme of Works

1 Appendix 1/13 should describe the Overseeing Organisation's requirements for the programme to be submitted in accordance with the Conditions of Contract and all supplementary information related to the programme that may be required.

2 The Contract may require the Overseeing Organisation to approve this programme and in this respect it is often appropriate that a schedule of output and resources to support all activities shown in the programme is requested.

3 Contractors will vary in the detail into which they break down the activities of the programme. It should be remembered that there is little to be gained from requiring the Contractor to provide a programme in more detail than is his usual practice for

construction projects of similar complexity. This is likely to lead to the submission of a programme which although feasible soon becomes out of date as the work progresses.

4 Regardless of how carefully the Overseeing Organisation vets the programme, it is likely to require amendment as the work progresses. The aim should be for the programme to always represent the Contractor's current working programme throughout the Contract. This may require updating of the programme throughout the duration of the Contract. It is recommended that the Contractor should be requested to update the programme if necessary to match progress meetings.

NG 114 Payment Applications

1 Appendix 1/14 should describe the Overseeing Organisation's requirements for applications for payment from the Contractor, unless described elsewhere within the Conditions of Contract. Standard requirements are described in NG Sample Appendix 1/14.

NG 115 Accommodation Works

1 Accommodation works should be described in Appendix 1/15, indicating where appropriate the periods for completion together with the requirements on individual plots for the benefit of each owner, lessee or occupier. Where accommodation works are not known at the time of tender, Appendix 1/15 should state where land reference plans and schedules can be inspected. Details of accommodation works that have been agreed after compilation of Appendix 1/15 should be available for reference where described therein.

NG 116 Privately and Publicly Owned Services or Supplies

1 Generally the Overseeing Organisation will make preliminary arrangements with the Statutory Undertakers for the alteration of services and supplies affected by the Works. It should also, where possible, make similar arrangements for the alteration of other publicly and privately owned services and supplies.

2 The above particulars should be contained in Appendix 1/16 and include details of any advance contracts, agreements and pre-ordered material.

3 The position of all known services and supplies should be shown on the Drawings, cross-referenced in Appendix 1/16.

4 Appendix 1/16 should include details of motorway communications and/or other motorway systems which may be affected by the Works together with details of any necessary alterations or temporary alternative provisions.

NG 117 Traffic Safety and Management

1 When major reconstruction or maintenance work is carried out on roads carrying a heavy flow of vehicles, for which the Overseeing Organisation is the roads authority, particularly where contraflow traffic management is intended or envisaged, the Contractor may be required to undertake maintenance functions on such roads within the Site. If so, this should be stated, together with a list of these functions, in Appendix 1/17. The limits of the road to be maintained should be stated together with the timescale during which the Contractor is responsible for maintenance.

2 Where contraflow traffic operation is specified by the Overseeing Organisation for which crossovers are to be designed by the Contractor full design requirements should be given in Appendix 1/17. Where crossovers are specified in Appendix 1/17 the Overseeing Organisation should ensure that the ADT has been consulted, and list in Appendix 1/17 any maintenance functions to be carried out by the Contractor. When crossovers are proposed by the Contractor, they may be constructed only if the ADT agree. The police should also be consulted. The Contractor will agree details of construction and maintenance with the roads authority and Clause 117 requires him to inform the Overseeing Organisation of these details. The compiler should state in Appendix 1/17 the timescale for submission and making of any statutory orders needed before work can commence.

3 If, in addition to routine maintenance functions, the Contractor is to be required when requested by ADT to repair accidental or wilful damage to any road within the Site for which that authority is responsible (including any central reserve crossover specified by the Overseeing Organisation), full details should be stated in Appendix 1/17. The Overseeing Organisation should ensure that the ADT has been consulted.

4 Legally, it is the ADT's responsibility to maintain the roads and that the Contractor was employed to carry out or supervise the maintenance of the roads. However, compensation for breach of contract may be obtainable from the Contractor if damages are paid by the ADT because of a failure in maintenance due to fault by the Contractor.

5 It is essential that all traffic safety measures are in accordance, where applicable, with the requirements and advice

given in Chapter 8 of the Traffic Signs Manual and the associated amendments detailed in Annex B of Advice Note TA 61, Standard TD 49, Advice Note TA 63, Advice Note TA 64 and any other relevant requirements. Chapter 8 of the Traffic Signs Manual is not a specification, and in many instances provides guidance and options. In such circumstances Appendix 1/17 should clearly indicate any specific requirements. The Contractor's programme for traffic management and site access/egress should take into account the views of the police and the ADT.

6 It may be necessary to erect, alter, cover, uncover and take down advance direction signs and other similar signs to be compatible with the state of the Works. The responsibility for this should be stated in Appendix 1/17. Where the Contractor is to be responsible, the areas of road affected by advance signs, cones and road markings should be included in Appendix 1/7 as forming part of the Site (see NG 107.2).

7 Authorisation of non-prescribed signs or temporary traffic signals should be obtained through the Overseeing Organisation giving at least 28 days' notice. (This time period can vary.) Any other requirements which are likely to be needed should be included in Appendix 1/17.

8 The compiler should state in Appendix 1/17 the timescale for the Contractor to submit his traffic management proposals. The Contractor should also ensure that necessary steps have been or are being taken to obtain any statutory orders required from the appropriate authority. Details of these orders should be stated in Appendix 1/17.

9 Appendix 1/17 should state the length of notice required for the making of orders

necessitated by the Contractor's proposals, or if he wishes to vary the agreed measures.

10 Before the Contractor commences work on a road, or reopens a closed road, he should ensure that the police and road authority agree with the proposals and are satisfied with the state of the road to be reopened.

11 Any requirements for temporary lighting should be included by cross-reference to Appendix 14/3.

12 The x heights of the lettering on vehicle sign boards of 37.5, 50, 62.5, 75, 100 and 150 mm relate to the lower case and the capital sizes are 52.4, 70, 87.5, 105, 140 and 210 mm in height.

13 The compiler should detail in Appendix 1/17 the roads and private rights of way which are to be kept open, and those for which orders have been obtained for their closure.

Driver Information Signs at Roadworks

14 Driver Information Signs are for use on roads that are the Overseeing Organisation's responsibility and where closure of traffic lanes is required for maintenance, new works or improvement schemes. Advance signs will give warning of road works ahead, and provide information about the nature and duration of the Works. Signs located within the road works will provide information about work in progress when a lane is closed and there may appear to be no activity. These signs will be used in addition to scheme notice boards where required. Authorised legends are given in Table 1/1. Appendix 1/17 should state where driver information signs are required and should include details of required variations to the

legends of Table 1/1, which shall be agreed with the Overseeing Organisation.

TASCAR

15 Where a Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Roadworks (TASCAR) is to be provided in accordance with the sub-Clause 117.32, it is desirable to include the following in the Instructions for Tendering:

'The Contractor's attention is drawn to Specification sub-Clause 117.32 together with Appendices 1/17, 1/26 and 1/27 which require the provision and maintenance of a Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Roadworks (TASCAR) which will be operated under the control of the Chief Officer of Police for the *[give name of police district as specified in Appendix 1/27]* and regularly maintained under the Contract at the expense of the Contractor in accordance with standards required by the Home Office in accordance with current legislation for traffic enforcement.'

NG 118 Temporary Diversions for Traffic

1 The definition of the term 'temporary diversion for traffic' is included in Volume 4 of the Manual of Contract Documents for Road Works, Section 1, Chapter IV, Series 100, Paragraph 1(c).

Temporary Diversions for Traffic Specified by the Overseeing Organisation

2 The Overseeing Organisation should ensure that:

- (i) all temporary diversions for traffic required for reasons of safety or practicality, including any structures, have been specified in Appendix 1/18;
- (ii) details of their construction and maintenance, together with any constraints, have been agreed with the ADT, and described in Appendix 1/18;
- (iii) where applicable, licences or other rights to operate on land not owned by the Overseeing Organisation have been obtained and such land has been included in Appendix 1/7 as forming part of the Site;
- (iv) the necessary orders have been or will be made by the appropriate authority.

3 If, in addition to routine maintenance functions, the Contractor is to be required to repair accidental or willful damage to any temporary diversion for traffic specified by the Overseeing Organisation at the request of the road authority responsible for that diversion, full details should be stated in Appendix 1/18.

4 Where the Contractor is required to design a temporary diversion for traffic, or any temporary structures, design requirements should be stated in Appendix 1/18.

5 If the ground over which the diversion route is to be provided is not to be reinstated to its original condition on completion of the Works this should be stated in Appendix 1/18 together with details of any treatment required.

Temporary Diversions for Traffic Proposed by the Contractor

6 If the Contractor proposes temporary diversions for traffic, they may be implemented only if the appropriate authority agree and the police have been consulted.

7 The compiler should state in Appendix 1/18 the timescale for submission of any statutory orders which would need to be made where required by the Contractor's proposals.

8 The Contractor will agree details of construction and maintenance with the appropriate authority and Clause 118 requires him to inform the Overseeing Organisation of the details.

NG 119 Routing of Vehicles

1 Appendix 1/19 should contain where applicable the Overseeing Organisation's specific requirements. These should include details of:

- (i) Routing of vehicles to and from the Site;
- (ii) The use of the Permanent Works by construction traffic;
- (iii) Traffic control required for machinery and plant crossing public roads and notice required before this can be implemented;
- (iv) Procedures to be adopted in complying with the Conditions of Contract to enable the Contractor to satisfy the Overseeing Organisation of the adequacy of his proposals.

NG 120 Recovery Vehicles for Breakdowns

1 If recovery vehicles for breakdowns are required in the Contract because of the Works interfering with roads carrying a heavy flow of vehicles, this should be stated in Appendix 1/20 together with requirements specific to the Contract which should include:

- (i) Number, category of vehicle and period required. Vehicle categories are:
 - (a) Heavy recovery vehicles;
 - (b) Light recovery vehicles; A list of equipment to be provided for each vehicle should be given in Appendix 1/20.
- (ii) Location(s) where the recovery vehicle(s) shall be sited.
- (iii) Location(s) to which broken-down or accident-damaged vehicles shall be removed and facilities to be provided at those locations.
- (iv) Details of equipment for communication.

2 The Overseeing Organisation should provide a suitable printed leaflet for the Contractor to hand out to the drivers of broken-down or accident-damaged vehicles prior to assistance being provided. Appendix 1/20 should specify a sample leaflet (see Sheet 3) which should include the following information:

- (i) Definition of roadworks operations. This is usually between the 'Roadworks Ahead-2 miles sign and the 'Road Works End' sign.

- (ii) Location to which the vehicle is to be towed.
- (iii) A statement that the recovery service is free and is limited to the area of roadworks operations (as (i) above) and between that and the location to which the vehicle is to be towed (as (ii) above).
- (iv) A statement that it will be at the discretion of individual drivers to arrange for assistance or the removal of their vehicle to garages of their choice from the location to which it has been towed.
- (v) Telephone numbers of local garages, produced following liaison with the police, which may assist with onward recovery. Where the location for depositing recovered vehicles is adjacent to an operational emergency roadside telephone, the leaflet should advise that the emergency telephone may be used to gain police assistance.
- (vi) That the operatives of the recovery vehicles do not make arrangements with private garages for the repair of vehicles.

NG 122 Progress Photographs

1 When required, Clause 122 will need supplementing by Appendix 1/22, describing the number of, and interval between visits and the number, size, type and finish of photographs required.

2 The compiler should include in Appendix 1/22 the designation of the person who should accompany the photographer to

ensure that only relevant photographs are taken.

3 Photographs should be taken as a record of any procedures or features which are, or could be, the subject of a third party claim or complaint eg. Works which by their nature could generate considerable quantities of dust.

NG 123 Not Used

NG 124 Health and Safety Restrictions, Precautions and Monitoring

1 Clause 124 will be supplemented by Appendix 1/23 which should describe any limitations on the Contractor's method of working or monitoring requirements when using substances hazardous to health such as silane, bridge deck waterproofing systems, paints, where these are used in locations which could result in a risk to members of the public.

2 Where protective clothing or other safety apparatus in relation to the specified use of substances hazardous to health is required for the Overseeing Organisation's staff, this should be listed in Appendix 1/1.

3 Further information and advice on the use of specified substances hazardous to health may be obtained from the Overseeing Organisation.

NG 125 Temporary Closed Circuit Television (CCTV) System for the Monitoring of Traffic

1 The Overseeing Organisation should consult with the police force before specifying a temporary CCTV system. The police requirements for a dedicated communications link should be obtained and included in Appendix 1/25.

2 The Overseeing Organisation should specify supplementary cameras at areas such as interchanges, entrances to and exits from contraflow, etc.

TABLE NG 1/1: (05/01) Typical Testing Details

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 300					
306	Permanent fencing				Quality management scheme applies
	Concrete components	Cover to reinforcement	1 per consignment (maximum 1 per 100 components) (BS 1722)		<i>[Tests/samples should not normally be required]</i>
308	Gates and stiles				Quality management scheme applies
	Reinforced concrete posts	Cover to reinforcement	1 per consignment (maximum 1 per 100 components) (BS 3470)		<i>[Tests/samples should not normally be required]</i>
308 & 311	Preservation of timber	Full sapwood penetration.	As required in sub-Clause 311.2(v)	Required for each batch	Quality management scheme applies <i>[Tests/Samples should not normally be required]</i>
Series 400					
402	Welding	Welding procedures (Manufacturer's tests)	(Every seven years)		Quality management scheme applies
		Welder qualification (Manufacturer's tests)	As required in sub-Clause 402.5(iii)		
		Production testing (Manufacturer's tests)	As required in sub-Clause 402.5(iv)		
	Welded joints	Destructive testing	<i>[See sub-Clause 402.5(v)]</i>		<i>††[See NG 402(N)]</i>
	Wire rope terminals	Tensile tests (Manufacturer's tests)	(Annually and when production technique changed)	Required	To provide evidence of tests by a testing laboratory
403	Anchorage and attachment systems for use in drilled holes	Ultimate tensile load (Manufacturer's tests)		Required	To provide well attested and documented evidence <i>[See NG 403.5]</i>
404	Anchorage in drilled holes	Loading test on site	As required in Appendix 4/1		†
	Post foundations				<i>[See NG 404.3]</i>

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 500					
501	Pipes for drainage and service ducts				
	Vitrified clay	[See Note 1]			Product certification scheme applies [Note 1. Additional manufacturer's tests are provided for in the relevant BS but should not normally be required.]
	Concrete-PC/SRC	[See Note 1]		[See Note 2]	
	Concrete-Prestressed				
	Iron-cast				[Note 2. Certificates are provided for in the relevant BS but should not normally be required except for pipes which are not quality marked by a UKAS accredited body listed in Appendix B of SHW.]
	Iron-ductile			[See Note 2]	
	PVC-U				
	GRP				
	Plastics. See Table 5/1				
	Corrugated steel	(Manufacturer's tests)		Required (AASHTO)	
	Corrugated steel bitumen protection	Not exceeding 900 mm dia			
	Other materials			Required	BBA certification (or equivalent) applies
503	Pipe bedding	Grading	1 per 500 tonnes (min of 3)*		[Appropriate tests/samples for soundness and frost heave should be scheduled where required]
		Soluble sulfate content (N)	1 per source*		
		10% fines value (N)			
505	Filter medium backfill	Plastic index (N)	1 per source*		[Appropriate tests/samples for soundness and frost heave should be scheduled where required]
		10% fines value (N)			
		Soluble sulfate content (N)			
		Grading	1 per 500 tonnes*		Washing and sieving method to be used
		Permeability (N)	1 per source*		
506	Sealing existing drains				[Appropriate tests/samples should be scheduled where not included under other Clauses]
	Concrete				
	Grout				

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 500 (continued)					
507	Chambers				Product certification scheme applies
	Precast concrete	[See Note 1]			
	Corrugated galvanized steel	(Manufacturer's tests)		Required	Product certification scheme applies
	Manhole steps			[See Note 2]	
	Steel fitments				
	Covers, grates and frames	[See Note 1]		[See Note 2]	Product certification scheme applies
	Cover bolts	[See Note 1]		[See Note 2]	Quality management scheme applies
508	Gullies and pipe junction				Product certification scheme applies
	Precast concrete	[See Note 1]			
	Clay				
	Cast iron and steel	[See Note 1]		[See Note 2]	
509	Watertightness of joints	Air test	All pipelines with watertight joints [As required in Appendix 5/1 for partly watertight joints]		
512	Backfill to pipe bays	Grading	1 per 50 tonnes (min of 3)*		[Appropriate tests/samples for soundness and frost heave should be scheduled where required]
		Soluble sulfate Content (N)	1 per source*		
513	Permeable backing to earth retaining structures	Plastic index (N)	1 per source*		[Appropriate tests/samples for soundness and frost heave should be scheduled where required]
		Soluble sulfate content (N)			
		10% fines value (N)			
		Grading	1 per 200 tonnes (min of 3)*		
		Permeability (N)	1 per source*		
	Precast hollow concrete blocks	(Manufacturer's tests)		Required	
514	Fin Drains	(Manufacturer's tests)		Required	BBA certification (or equivalent) applies

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 500 (continued)						
515	Narrow filter drains					
		Geotextile, pipes and fittings	(Manufacturer's tests)		Required	BBA certification (or equivalent) applies
		Granular fill	Plastic index (N)	1 per source*		
			10% fines value (N)			
			Soluble sulfate content (N)	1 per 200 tonnes (min of 3)*		
			Grading			
		Permeability (N)	1 per source*			
516	Combined drainage and kerb systems		Load test	A minimum of 1 test and not less than 1 test per 1000 m for each type and source	Required	Certification that the systems comply with Clause 516 is required
517	Linear drainage systems		Load test	A minimum of 1 test and not less than 1 test per 1000 m for each type and source	Required	Certification that the systems comply with Clause 517 is required
518	Thermoplastics structured wall pipes and fittings		(Manufacturer's tests)		Required	BBA certification (or equivalent) applies
Series 600						
601, 631 to 637, 640	Acceptable material					[For recycled aggregate, see sub-Clauses 601.12 and 601.18]
	Class	General Description				
	1	General granular fill	Grading/uniformity coefficient	Twice a week*		
			mc/MCV (N)	2 per 1000 m³ up to max of 5 per day*		
			SMC of chalk (N)	Twice a week*		
			1C only	10% fines value (N)		
	2	General cohesive fill	Grading	Twice a week*		
			mc/MCV/PL Undrained shear strength (N)	2 per 1000 m³ up to max of 5 per day*		
			SMC of chalk (N)	Twice a week*		
			Bulk density (pfa) (N)	2 per 1000 m³ up to max of 5 per day*		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 600 (continued)					
	Class	General Description			
	3	General chalk fill	mc (N)	2 per 1000 m ³ up to max of 5 per day*	
			SMC (N)	Daily*	
	4	Landscape fill	Grading/mc/MCV (N)	Daily*	
	5	Topsoil	Grading	Daily*	
	6	Selected granular fill	Grading/uniformity coefficient	1 per 400 tonnes*	
			PI/LL (N)	Daily*	
			10% fines value/SMC (N)	Weekly*	
			omc/mc, mc or MCV (N)	1 per 400 tonnes*	
			Organic matter/water soluble or total sulfate content (N)	Weekly*	
			pH/chloride ion content (N)	Weekly*	
			Resistivity (N)	[As required]	
			Undrained and drained shear parameters (N)	[As required]	[Cross-reference should be made to any requirements in Appendix 6/1]
	7	Selected cohesive fill	Grading/mc/MCV/ bulk density (N)	1 per 400 tonnes*	
			SMC of chalk (N)	Twice a week*	
			PI/LL (N)	Daily*	
			Organic matter/total or water soluble sulfate content (N)	Twice a week* or daily where sulfates are expected.	
			Total sulfur content (N)	Twice a week* or daily when sulfides are expected.	
			pH/chloride ion content (N)	Weekly*	
			Resistivity (N)	[As required]	
			Undrained and drained shear parameters (N)	[As required]	[Cross-reference should be made to any requirements in Appendix 6/1]
			Permeability (N)	[As required]	

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 600 (continued)						
	Class	General Description				
	8	Miscellaneous fill	mc/MCV (N)	Daily*		
	9	Stabilised materials	Pulverisation	1 per lane width per 200 m length*		
			mc/MCV (N)			
			Bearing ratio (N)			
	Pulvenised fuel ash		Chemical analysis <i>[As appropriate to properties stated in Table 6/1 or Appendix 6/1]</i>	1 per consignment*		
	Furnace bottom ash		Grading	1 per 300 tonnes*		
	Fill adjacent to cementitious material or metallic items		Soluble sulfate content (N)	1 per 400 tonnes or per location if less than 400 tonnes*		
602	Earthworks material beneath surface of a road or paved central reserve (i) Off site source (ii) On site source	Frost heave (N)	 1 every four months* As required			
609 621	Geotextiles	Tensile load Permeability Pore size	1 per 400 square metres* 		<i>[Requirements should be given in Appendix 6/5 or 6/9 as appropriate]</i>	
612	Compaction of fills					
	Method compaction	Field dry density (N)	<i>[As required]</i>			††
	End product compaction	Optimum mc (2.5 kg rammer/vibrating hammer method) (N)	Each class or sub class of material*	†		
		Field dry density (N)	1 per 400 tonnes*	†		
614	Cement stabilisation to form capping	Rate of spread of cement	1 per 500 square metres of cement spread*			
615 641 643	Lime stabilisation to form capping	Rate of spread of lime Available lime content	1 per 500 square metres of lime spread* Each source of lime weekly during stabilisation operation*		†	

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments	
Series 600 (continued)						
622 638 639	Earthworks for reinforced soil and anchored earth structures	Redox potential	5 locations within the affected area*		†	
		Drainage layers	Grading		1 per 400 tonnes*	
			Chemical analysis			
		Reinforcing elements	Coeff. of friction		Each type of element with each type of fill*	
			Anchor elements			
624	Ground anchorages	Proof loading	As required in Appendix 6/10		†	
626	Gabions					
	Fill	Grading	1 per 400 tonnes*			
		10% fines value (N)				
	Geomesh	[As appropriate to properties stated in Appendix 6/10]	1 per 400 square metres*			
	PVC coated wire			Required (ASTM G23)		
642	Earthworks materials for corrugated steel buried structures	Constrained soil modulus (M*)	3 on each side of each structure*			
Series 700						
710	Constituent materials in recycled aggregate	Quality control	Checks are to be carried out by the Contractor in accordance with the procedure set down in 'Quality Control - Production of Recycled Aggregates' and with those in this Clause		The quality control procedure should be in accordance with the 'Quality Control – Production of Recycled Aggregates' published by Construction Research Communications (CRC). The results of all quality control checks shall be delivered promptly to the Overseeing Organisation on request.	
711	Overbanding and inlaid crack sealing systems			Required	BBA certification (or equivalent) applies	

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 800					
801	Unbound, hydraulically bound and other sub-base material (other than slag) adjacent to cement bound materials, concrete pavements, structures or products	Soluble sulfate Content (N)	1 per 400 tonnes or per location if less than 400 tonnes*		
	Blastfurnace slag	Bulk density (N)	1 per 500 tonnes*		
		Stability (N)			
		Sulfur content (N)			
	Steel slag	Bulk density (N)	1 per 500 tonnes*		
	Sub-base and roadbase material beneath surface of a road or paved central reserve	Frost heave (N)	1 per source*		
803	Granular sub-base material Type 1	Grading	1 per 400 tonnes*		[Where required-See NG 803.5]
		Plastic index (N)	1 per source and then monthly*		
		10% fines value (N)			
		Soundness (N)	1 per source*		
		Water absorption (N)	[As required]		
804	Granular sub-base material Type 2	Grading	1 per 400 tonnes*		[Where required-See NG 804.5]
		Plastic index (N)	1 per source and then monthly*		
		CBR (N)			
		OMC/mc (N)			
		Density (N)			
		10% fines value (N)			
		Soundness (N)	1 per source*		
		Water absorption (N)	[As required]		
805	Slag Bound Materials				
	Aggregates	Grading	1 per 400 tonnes*		
		Soundness (N)	1 per source*		
		Water absorption (N)	[As required]		
806	Granular sub-base material Type 4	Grading	1 per 400 tonnes*		
		Recovered bitumen content (N)	1 per 400 tonnes*		
		OMC/mc (N)	1 per 400 tonnes*		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900					
901, 925, 937, 938	Aggregates for bituminous materials				National quality management sector scheme applies.
		Hardness	10% fines value (N)	Monthly*	
			Impact value (N)	Monthly*	
		Durability	Soundness (N)	1 per source*	[Where required-See NG 901.2]
			Water absorption (N)	[As required]	
		Cleanness	Sieve test (mass passing 75 micron sieve) (N)	Monthly*	Washing and sieving method to be used
		Shape	Flakiness index (N)	Monthly*	
		Blastfurnace slag	Soundness (N)	Once every 4 months	
			Bulk density (N)	1 per 500 tonnes*	
			Stability (N)		
			Sulfur content (N)		
		Steel slag	Bulk density	1 per 500 tonnes*	
	Coarse aggregate for wearing courses	PSV (N)	1 per source*		
		AAV (N)	1 per source*		
	Binders for bituminous materials	Penetration (N)	1 per 750 tonnes*		National quality management sector scheme applies.
		Softening point (N)	1 per 750 tonnes*		:
		[Other BS tests]	[As required]		1
	Bituminous mixtures	Grading (N)	For Audit Test purpose only		i
		Binder Content (N)			1
903 to 912, 914, 916, 925, 926, 930, 932 to 938, 942, 943, 946 to 948					i
					i
					1
					i
					1
					i
					1
					i
					1
					i

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900 (continued)					
929	Roadbase and Basecourse Macadams	In situ air void content (N)	[As required]		
		Refusal air void content (N) (PRD Test)			
		Binder volume (N)			
		Grading (N)			
		Binder content (N)			
911	Rolled asphalt wearing course (design mix)	Stability value (N)	1 per source*		National quality management sector scheme applies
		Flow value (N)			
		Density (N)			
915 925	Coated chippings	Grading (N)	1 per stockpile*		Not required for coated chippings for surface dressing to Clause 919
		Binder content (N)	1 per stockpile*		
		Flakiness index (N)	1 per source*		
		PSV (N)	1 per source*		
		AAV (N)	1 per source*		
		Hot sand test (N)	1 per source*		
		Rate of spread (N)	[As required]		
921	Surface texture	BS 598 : Part 105 Sand Patch (N)	BS 598 : Part 105		
924	High friction surfaces	Quality control checks	As required in sub-Clause 924.5	Required	BBA HAPAS Roads and Bridges certification (or equivalent) applies
		System coverage	As required in sub-Clause 924.6		
	Aggregate	PSV (N)	1 per source* and as required for coated chippings in Clause 915.3	Required	

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900 (continued)					
937	Stone mastic asphalt binder course and regulating course				National quality management sector scheme applies.
		Binder drainage test	In accordance with BS DD 232		
938	Porous asphalt surface course				National quality management sector scheme applies.
		Relative hydraulic conductivity	In accordance with Clause 938		
		Modified binder storage stability	In accordance with Clause 941		
		Binder drainage test	In accordance with BS DD 232		
942	Thin surface course systems				National quality management sector scheme applies.
		Binder drainage test	In accordance with BS DD 232		
943	Rolled asphalt wearing course (performance-related design mix)				National quality management sector scheme applies
		Grading (N)	[As required]		
		Binder content (N)			
		Density (N)			
		Wheel-tracking rate (N)			
		Wheel-tracking rut depth (N)			
		Air voids content			
944	Performance-specified roadbase				National quality management sector scheme applies

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900 (continued)					
918	Slurry surfacing incorporating microsurfacing				
	Binder				
		Product Identification	Per product per source	Required	Tests are expected to be repeated every two years
		Vialit cohesion	Per product per source	Required	Tests are expected to be repeated every two years
		Rate of spread	For each machine	Required	Not more than 6 weeks prior to start of work
		Penetration at 25°C and 5°C (N)	Every manufactured batch		Manufacturer's QA test results may be submitted
	Aggregates	Polished stone value (N)	Source approval	Required	Less than 6 months prior to work
		Aggregate abrasion value (N)	Source approval	Required	Less than 6 months prior to work
		Grading (N)	1 per 200 tonnes		
	System	TAIT or BBA/HAPAS		Required	
920	Bond coats, tack coats and other bituminous sprays				
	Binder	Product identification	1 per product per source	Required	Tests are expected to be repeated every two years
		Vialit cohesion	1 per product per source	Required	Tests are expected to be repeated every two years
		Accuracy of spread	1 for each binder and sprayer per month	Required	Not more than 6 weeks prior to start of work and one per month
		Rate of spread	1 per week		
		Penetration at 25°C and 5°C (N)	Every manufactured batch		Manufacturer's QA test results may be submitted

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 900 (continued)					
919 922	Surface Dressing				National quality management sector scheme applies
	Binder				...
					...
					...
					...
					...
		Product Identification	1 per product per source	Required	Tests are expected to be repeated every two years
		Vialit cohesion (N)	1 per product per source	Required	Tests are expected to be repeated every two years
		Accuracy of spread	1 for each binder sprayer per week	Required	Not more than 6 weeks prior to start of work and one per week
		Rate of spread	Every 1000 linear metres initially		Frequency to be reduced to daily after 3 satisfactory results, but not less than 1 test per site
		Penetration at 25°C and 5°C (N)	Every batch		For cut back binders as supplied, manufacturer's QA viscosity test results may be submitted.
	Chippings	Polished stone value (N)	Source approval	Required	Less than 6 months prior to work
		Aggregate abrasion value (N)	Source approval	Required	Less than 6 months prior to work
		Grading (N)	1 per 200 tonnes		
		Binder content (N)	1 per 200 tonnes		Coated chippings only
		Flakiness index (N)	1 per 200 tonnes		
		Accuracy of spread (N)	1 for each chipping spreader for every change of chipping size or source	Required	Initial test not more than 6 weeks prior to start of work
		Rate of spread	Every 500 linear metres initially		Frequency to be reduced to daily after 3 satisfactory results, but not less than 1 test per lane per site
	System	TAIT or BBA/HAPAS		Required	
	Rollers	Spray bars working	Before work starts and daily during works		
950	Depressions				...

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1000					
1001 1030 1035 1044	Cement				Quality management and product certification schemes apply
	Portland cement CEM I				Tests and test certificates are required
	Portland blastfurnace cement				
	Blastfurnace cement CEM III/A				
	Portland pfa cement CEM II/B-V				
	Pozzolanic cement CEM IV/A				
	Portland cement with microsilica				
	Pulverised-fuel ash			Required (BS 6610)	
	Ground granulated blast furnace slag				BBA Roads and Bridges Certificate required for microsilica
	Admixtures				Tests and test certificates are required. Product certification schemes apply to pfa and slag.
	Aggregates				
		Soundness value (N)	1 per source*		[Where required-See NG 1001.19]
		Water absorption (N)	[As required]		
		Flakiness index (N)	Monthly*		
		Shell content (N)	1 per source*		
		10% fines value (N)	Monthly*		
		Grading (N)	Daily*		
		Chloride content (N)	Weekly (1 per source for CBM Aggregate)		Washing and sieving method to be used for CBM aggregate [See also NG 1001.20-23]
	Flint coarse aggregate containing white flints	Water absorption (N)	3 per source thereafter weekly		
	Sand (ie fine aggregate)	Acid-soluble material (N)	Monthly*		Not required for CBM Aggregate
	Blastfurnace slag	Bulk density Stability Sulfur content (N)	1 per 500 tonnes*		
	Pulverised-fuel ash			Required (BS 3892: Part 2)	

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1000 (continued)					
1002 1003 1004 1044	Concrete	Air content test (N)	As required in Table 10/8		Product certification scheme applies
		Density of in situ Concrete cores (N)	3 per 1200 m		
		Cube strength (N)	As required in Table 10/8		
1005	Workability	Compacting factor (N)	As required in Table 10/8		[See also sub-Clause 1005.2]
		Vebe (N)			
		Slump (N)			
1011 1012	Dowel bars Tie bars			Required (BS 4449)	Product certification scheme applies
	Dowel bars and supporting cradles	Load test	1 per arrangement*		
	Sheathed dowel bars	Bond stress	4 bars		
	Cranked tie bars (coated)	Bend test	4 bars*		
		Salt fog cabinet	4 bars*		
1015	Joint filler board	Weathering test	3 per source		Normally undertaken by manufacturer
		Compression and recovery	4 per source		
		Extrusion	1 per source		
	Cork filler board	Immersion in water	2 per source		
		Immersion in acid	2 per source		
1016 1017	Applied sealants			Required (BS 2499) (BS 5212: Part 1) (BS 4254)	
		Initial Penetration	1 per 1000m or 1 per day		
		Resilience	1 per 1000m or 1 per day		
	Compression seals			Required (ASTM) (BS 2752) (BS 4443: Part 4)	
		Compression set	1 per type of seal*		
		Immersion in oil	1 per type of seal*		
	Self expanding cork seal	Tests specified in Clause 1017	1 per type of seal*		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 1000 (continued)						
1026 1044	Surface texture		Sand patch (N)	1 per day (set of 10)*		
1027	Aluminised curing compound		Efficiency index	1 per source*		
1030	Wet lean concrete		Density	As required in Table 10/8		
			Cube strength (N)			
1036 to 1040	Cement bound material		Laboratory wet density (N)	1 per cube		
			In situ wet density (N)	As required in Clause 1040		
			Cube strength (N)	As required in Clause 1040		
		CBM 1 and 1A CBM 2 and 2A	Immersed cube strength (N)	5 per mix		
1043	Foamed Concrete		Cube strength (N)	2 cubes per 12 m³		
Series 1100						
1101	Precast concrete kerbs, channels, edgings and quadrants		Transverse strength	Minimum of 3 per 1000 units of each product (BS 7263: Part 1)		
			Water absorption			
1102	In situ asphalt kerbs		Grading	1 test per 500 metres laid*		
			Binder content			
1104	Precast concrete flags		Transverse strength	Minimum of 3 per 1000 units of each product (BS 7263: Part 1)		[Appropriate tests/samples should be scheduled where not included under other Clauses]
			Water absorption			
	Bedding	Granular material				
		Mortar				
1107	Concrete block paving		Compressive strength	16 per 5000 blocks (BS 6717: Part 1)		
1108	Clay pavers		Transverse breaking load	Minimum of 10 per 10000 pavers (BS 6677: Part 1)		
			Skid resistance	Minimum of 5 per 10000 pavers (BS 6677: Part 1)		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1200					
1202	Permanent traffic signs			Required <i>[where considered appropriate]</i>	Quality management scheme applies. Certification that the traffic signs capable of passing the tests in BS 873 : Part 1 is required
1207	Anchorage in drilled holes to supports of traffic signs	Loading test on site	<i>[As required]</i>		
1210	Holding down bolts and anchorages to bases of permanent bollards			Required <i>[where considered appropriate]</i>	Certification that the holding down bolts and anchorages are capable of complying with the performance requirements of BS 873 : Part 3 is required
1212	Road Markings				National quality management sector scheme applies. Procedures are given in MSA EN 1824
		Tests specified in MSA EN 1824		Required	
1214	Permanent traffic cones and traffic cylinders			Required	Certification that permanent traffic cones and cylinders have been tested and comply with BS 873 : Part 8 is required
		Tests specified in BS 873: Part 8	2 of each size and category/type*		† <i>[Where required]</i>
	Flat traffic delineators			Required	Certification that FTD's have been tested and comply with Clause 1214 is required
		Tests specified in Clause 1214	<i>[As required]</i>		† <i>[Where required]</i>
	Other traffic delineators			Required	Certification that the delineators have been tested and comply with Clause 1214 is required
		Tests specified in Appendix 12/4	<i>[As required]</i>		† <i>[Where required]</i>
	Temporary cones, cylinders, FTD's and other delineators			Required	Certification that at least 1 in 500 of any batch of cones, cylinders, FTD's and other delineators to be used in the Temporary Works have passed the tests in Clause 1214 as appropriate is required

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1200 (continued)					
1217	Traffic signals				Quality management scheme applies. Statutory type approval of equipment applies
	Cables				[Special sample tests to BS 6346 should be scheduled where appropriate] Product certification scheme applies
	Controllers [Other equipment]	Test specified in Appendix 12/5	Each controller before delivery to Site and again after installation		
	Cabling	Tests a, b, c, e, f, g, h, j as defined in sub-Clause 1424.2	Each traffic signals installation	Required	Certification that the installation complies with BS7671 (the IEE Wiring Regulations) is required
1218	Detector loops				
	Cable			Required	Certification that completed cables comply with specification TR 2029 is required
	Epoxy resin			Required [where considered appropriate]	Certification that the epoxy resin complies with specification MCH 1540 is required
	Feeder cable			Required	Certification that completed cables comply with specification TR 2031 is required
	Joints	Pull test (4 kgf)	Each crimp		
	Installation	Series resistance	Each loop	Required	Certification in accordance with specification MCH 1540 is required
		Insulation resistance			
		Inductance			
Series 1300					
1305	Anchorage for use in drilled holes	Tensile load (Manufacturer's tests)		Required	To provide well attested and documented evidence
1306	Anchorage in drilled holes to columns with flange plates	Loading test on site	[As required]		†
1310	Welding	Welding procedures (Manufacturer's tests)	(Every seven years)		Quality management scheme applies
		Welder qualification (Manufacturer's tests)	(Sub-Clauses 1310.1 and 1310.2 (7.1.3))		
		Production testing (Manufacturer's tests)	(Sub-Clauses 1310.1 and 1310.2 (7.1.4))		
	Welded joints	Destructive testing	[See sub-Clause 1310.1 and 1310.2 (7.1.5)]		†† [(N) See NG 1310]

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1300 (continued)					
1313	GFRP laminates	Loss on ignition	1 per 200 production columns		
		Colour fastness	1 per batch		
		Electric strength			
		Water absorption			
		Impact strength			
1314	Brackets for laminated GFRP lighting columns				
	Polyurethane foam	Bulk density	1 per batch		
		Surface hardness			
		Apparent bulk density	2 per batch		
		Impact strength			
		Flexural stress			
Series 1400					
1421	Cable				[Special sample tests to BS 6346 should be scheduled where appropriate] Product certification scheme applies
1424	Lighting Units	Tests specified in Clause 1424	Each unit	Required	† Product certification scheme applies Certification that the installation complies with BS7671 (the IEE Wiring Regulations) is required
	Networks	Tests specified in Clause 1424	Each network	Required	† Certification that the installation complies with BS7671 (the IEE Wiring Regulations) is required

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1500					
1506	Copper communications cable			Required	Certification that each completed cable complies with specification TR 2150 or TR 2158, as appropriate, is required.
	Optical fibre communications cable			Required	Certification that each completed cable complies with specification TR 2151 or TR 2159, as appropriate, is required.
	Coaxial communications				Certification that each completed cable complies with specification TR 2152 or TR 2160, as appropriate, is required.
	Energy cable			Required	Certification that each completed cable complies with specification TR 2153 or TR 2161, as appropriate, is required.
1513	Cable Joint Enclosures	Test specified in Clause 1513.12	Each CJE	Required	† Certification that the CJE satisfies the air pressure test is required.
1518	Coaxial and copper communications and power cable	Tests specified in specification MCG 1022 or MCG 1099, as appropriate	Each cable (Stage 1) As required in Appendix 15/1 (Stage 2)		† Results to be reported in accordance with MCG 1022 or MCG 1099, as appropriate.
	Optical fibre communications cable	Tests specified in specification MCG 1055 or MCG 1099, as appropriate	Each cable (Stage 1) As required in Appendix 15/1 (Stage 2)		† Results to be reported in accordance with MCG 1055 or MCG 1099, as appropriate.
1522	Motorway System				
	Steel posts			Required (BS 6323)	
1526	Electrical Installations	Tests specified in BS 7671	Each installation	Required	† Certification that the installation complies with BS 7671 (the IEE Wiring Regulations) is required.
1530	Cable ducts	Test specified in MSA EN 50086-1, 2 and 4	Each supplier	Required	Current British Board of Agrément Certificate is required.
1533	Cable ducts				
	Mandrel test	Test specified in Clause 1533	Each duct	Required	† Certificate that each length of duct between chambers satisfies the mandrel test is required.
	Air test	Test specified in Clause 1533	Each duct	Required	† Certificate that each length of duct between chambers satisfies the air test is required.

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1600					
1601	Soil samples In situ soil tests				<i>[Appropriate soil tests should be scheduled where required]</i>
1602 to 1606 1610 to 1615	Concrete Grout Reinforcement Prestressing Steelwork Welding Protection against corrosion				<i>[Appropriate tests/samples should be scheduled where not included under other Clauses/Series]</i>
1606	Coatings for protection against corrosion	Adhesion	As required in Appendix 16/6		
1607	Reduction of friction on piles				<i>[Particular requirements detailed in Appendix 16/7 should be scheduled]</i>
1608 1616	Integrity testing Dynamic testing				<i>[Particular requirements detailed in Appendix 16/8 or 16/16 should be scheduled]</i>
1609	Static load testing of piles				<i>[Testing of preliminary piles should not be scheduled in Appendix 1/5 Particular requirements detailed in Appendix 16/9 should be scheduled]</i>
1612	Self hardening slurry mixes				<i>[Particular requirements detailed in Appendix 16/12 should be scheduled]</i>
1617	Instrumentation				<i>[Particular requirements detailed in Appendix 16/17 should be scheduled]</i>
1618	Support fluids	To be proposed by the Contractor			<i>[Particular requirements detailed in Appendix 16/18 should be scheduled]</i>

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 1700						
1702 1703 1704	Cement	Portland			Required (BS 12)	Certificate to be provided monthly* for each type of cement
		Portland - Blastfurnace			Required (BS 146)	Quality management and product certification schemes apply
		Sulfate-resisting Portland			Required (BS 4027)	
		Portland pulverised-fuel ash			Required (BS 6588)	
		Low heat Portland			Required (BS 1370)	
		High Slag blastfurnace			Required (BS 4246)	
	Pulverised-fuel ash		Colour index	Monthly*	Required (BS 3892: Part 1)	Certificate to be provided monthly* Product certification scheme applies
	Ground granulated blastfurnace slag				Required (BS 6699)	Certificate to be provided monthly* Product certification scheme applies
	Cements (all types)		Chloride content	Monthly*		Tests to be carried out by the manufacturer and results included on the test certificates required above
	Pulverised-fuel ash		Sulfate content	Monthly*		
	Ground granulated blastfurnace slag		Acid-soluble alkali content	Daily (PC) Weekly (pfa ggbs)		
	Aggregates		Grading	1 per delivery (min 1 weekly per source)		Results of routine control tests by the manufacturer/supplier to be provided Product certification scheme applies
			Shell content (N)	Monthly*		
			Flakiness index (N)	Monthly*		
			10% fines value (N)	Monthly*		
			Drying shrinkage (N)	Yearly		
			Chloride content (N)	Daily or as otherwise agreed		
	Blastfurnace slag		Sulfate content (N)	Monthly*		
			Bulk density (N)	1 per 500 tonnes*		
			Stability (N)	1 per 500 tonnes*		
			Sulfur content (N)	1 per 500 tonnes*		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1700 (continued)					
	Water	Tests specified in BS 3148	<i>[As required]</i>		<i>[See also sub-Clause 1702.3]</i>
		Chloride content	Monthly*		
		Sulfate content	Monthly*		
		Acid-soluble alkali content	Weekly*		
	Admixtures	Chloride content	1 per consignment	Required (BS 5075)	
		Sulfate content	1 per consignment		
Acid-soluble alkali Content		1 per consignment			
1707	Concrete	Cube strength (N)	Prestressed concrete-two cubes from 10 m³ or 10 batches whichever represents the lesser volume		Contractor to cast and test sufficient additional cubes to demonstrate cube strength before transfer †
			Reinforced concrete-two cubes from 20 m³ or 20 batches whichever represents the lesser volume		
			Mass concrete-two cubes from 50 m³ or 50 batches whichever represents the lesser volume		
			Additional cubes for special purposes		<i>[Tests/samples should be scheduled as required See NG 1707.6]</i>
		Cube strength-special testing as described in Appendix 17/4 (N)	2 cubes from each of two samples of each batch	<i>[Requirements should be given in Appendix 17/4 as appropriate]</i>	
		Density	<i>[As required]</i>	<i>[Requirements should be given in Appendix 17/1 as appropriate]</i>	
		Modulus of elasticity			
		Fresh concrete	Workability (slump or compacting factor or Vebe) (N)	Each batch	
	Air content		Each batch		
	Cement content		<i>[As required]</i>		
	Water/cement ratio				

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1700 (continued)					
1709	Silane			Required for each delivery	Certification that the silane complies with Clause 1709 is required
		Refractive Index	Three samples		[See sub-Clause 1709.2(ii)]
		Trial panels, where required in the Contract			[See sub-Clause 1709.8]
1710	Concrete packing Mortar packing Epoxy resin bonding agent				[Appropriate tests/samples should be scheduled]
	Precast concrete manufactured off Site	Cube strength (Manufacturer's tests)			Contractor to make available records of tests by the manufacturer
1711	Grouting and Duct Systems for Post-tensioned tendons				CARES Scheme for Supply and Installation of Post-tensioned Systems In Concrete Structures or an equivalent scheme is required. Quality management and product certification schemes for cement apply
		Full scale trials, where required in the Contract			See sub-Clause 1711.1 and Appendix 17/6
		Air pressure tests			See sub-Clause 1711.3 and Appendix 17/6
		Duct assembly verification tests			See sub-Clause 1711.3 and Appendix 17/6
		Wall thickness of ducts after tensioning			See sub-Clause 1711.3 and Appendix 17/6. Contractor should provide evidence of testing
		Fluidity	See Table 17/9		See sub-Clause 1711.8 and sub-Clause 1711.9 and Table 17/10
		Bleeding			
		Volume change			
		Cube strength			
		Sieve			
		Sedimentation			
	Admixtures			Required	Quality management and product certification schemes apply. Data on their suitability, including previous experience should be made available. See sub-Clause 1711.9

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1700 (continued)					
1712	Reinforcement				Product certification scheme applies
	Steel bars			Required (BS 4449)	
	Steel wire			Required (BS 4482)	
	Steel fabric			Required (BS 4483)	
1713	Fabricated reinforcement			Required	Certification that fabricated reinforcement complies with the routine inspection/testing requirements of BS 8666 is required if the fabrication is not covered by a product certification scheme listed in Appendix B
1716	Reinforcement jointing systems	Permanent elongation Characteristic strength (Manufacturer's tests)		Required for each type of connection	BBA Roads and Bridges certificate or CARES certificate of product assessment or fully equivalent scheme apply
1717	Reinforcement metal arc welding	Welding procedure approval (BS 7123)	As required in BS 7123		[Where tests in addition to those specified in BS 7123 (tensile test and macroetch test) are required full details should be scheduled] Tests should be carried out by an independent testing body specified in BS 8666
		Welder approval (BS 7123)			
1718	Prestressing tendons				Product certification scheme applies
	Steel wire			Required (BS 5896)	
	Steel bar			Required (BS 4486)	
	Seven-wire strand			Required (BS 5896)	
	Prestressing steel (all types)	Proof load Breaking load Elongation Ductility Relaxation Modulus of elasticity	[As required]		†
	Super strand to BS 5896 or other than lowest strength 3-7 mm dia wires to BS 5896	0.1% proof load Breaking load	Each reel		†

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1700 (continued)					
1724	Post-tensioning anchorages	Tests in accordance with BS 4447 (Manufacturer's tests)			Contractor to make available records of tests by the manufacturer
1726	Stainless steel bar			Required (BS 6744)	
1727	Inspection and testing of structures and components				<i>[Tests should be scheduled as appropriate and requirements given in Appendix 17/4]</i>
Series 1800					
1801 1803	Structural steel to MSA EN 10025, MSA EN 10113, MSA EN 10137, MSA EN 10155, MSA EN 10210			Required	<i>[Give type of document required] [Options as appropriate should be listed in Appendix 18/1]</i>
	Structural steels to BS 7668			Required (BS 7668)	<i>[Options B26-B36 as appropriate should be listed in Appendix 18/1]</i>
	Stainless Steels to BS 970; MSA EN 10084, MSA EN 10087, MSA EN 10095, MSA EN 10277, and MSA EN 10278			Required (BS 970, MSA EN 10084, MSA EN 10087, MSA EN 10095, MSA EN 10277 and MSA EN 10278)	<i>[Inter-crystalline corrosion test should be scheduled where required]</i>
	Stainless steel to MSA EN 10029, MSA EN 10048, MSA EN 10051, MSA EN 10258, MSA EN 10259			Required (MSA EN 10029, MSA EN 10048, MSA EN 10051, MSA EN 10258 and MSA EN 10259)	(State condition of material if not softened condition. Give information required for test certificate as MSA EN 10029 MSA EN 10048 MSA EN 10051 MSA EN 10258 MSA EN 10259)
	Steel plate	Ultrasonic testing	<i>[As required]</i>		<i>[See guidance clause 3.1.4 of BS 5400 : Part 6]</i>

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1800 (continued)					
	Bolts, nuts and washers				Quality management scheme applies
	All types except high strength friction grip	Test specified in BS 4395: Part 2	As required in BS 4395: Part 2		
	High strength friction grip	Test specified in BS 4395: Part 1 or Part 2	As required in BS 4395: Part 1 or Part 2		[Tests/samples for the optional tests provided for in BS 4395: Parts 1 and 2 should be scheduled where required]
	Tension Control Bolts	Test specified in JSS II-09-1981 or BS 4395	As required in JSS II-09-1981 or BS 4395		
	Welding electrodes				
	Covered steel			Required (MSA EN 499)	
	Wire			Required (MSA EN756; MSA 760)	
	Welding				
	Welding procedures	Tests Specified in MSA EN 288:	As required in MSA EN 288: Part 3 And appendix 18/1		Results to be reported in accordance with Annex A of MSA EN 288 Part 3
	Welder qualification	Test Specified in MSA EN 287:	As required in MSA EN 287: Part 1 for each welder	Required MSA EN 287: Part 1	Certificate to be in accordance with Annex B of MSA EN 287 Part 1
	Butt weld 'run-off' plates	Destructive tests specified in MSA EN 5400: Part 6	As required in BS 5400 : Part 6		
	Butt welds and adjacent areas of steelwork	Non-destructive tests using methods to be agreed	As required in BS 5400 : Part 6 and the following: [As required]		[Full details should be scheduled. See clause 5.5.2 of BS 5400: Part 6 and its guidance clauses]
	Fillet welds	Non-destructive tests	[As required]		[Full details should be scheduled]
	Flame cutting and shearing	Tests to demonstrate procedures comply with BS 5400 : Part 6 and Appendix 18/1	As required in Appendix 18/1		
	Stud shear connectors	Fixing (BS 5400 : Part 6)	Each stud		
		Bending (BS 5400 : Part 6)	[As required]		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 1900					
1903	Abrasives	Grading	[As required]		†† [See NG 1903]
		Hardness			
1909	Galvanized coatings	Tests specified in MSA EN ISO 1461	[As required]		Method of sampling to be in accordance with Clause 1910
	Aluminium and zinc spray coatings	Test specified in MSA EN 22063	[As required]		Areas to be tested to be in accordance with Clause 1910
	Aluminium coating material			Required (MSA EN 1301)	
	Zinc coating material			Required (MSA EN 1179)	
	Sherardized coatings	Tests specified in BS 4921	[As required]	[Sampling procedure and any special adhesion requirements including test method should be scheduled]	
	Zinc electroplated coatings	Tests specified in BS 3382 : Part 2	[As required]		
	Plating to high strength friction grip and tension control bolts				[Special tests to detect hydrogen embrittlement should be scheduled where required]
1910	Metal spray coatings	Tensile test specified in MSA EN 22063	[As required]		†
		Grid test specified in MSA EN 22063	[As required]		†
1911	Paints				
	Samples 'A' and 'B'	Specific gravity	[See Clause 1911]		†† [See NG 1911] Samples will be selected in accordance with Clause 1911
		Colour match			
		Composition			
		Application characteristics			
Series 2000					
2003	Permitted waterproofing systems	[As required- See NG 2003]			Registration and BBA Roads and Bridges Agrément certification apply
	Additional bituminous protection	Tests specified in BS 594: Part 1	1 per 15 tonnes*		Sampling to comply with BS 594: Part 1
	Stability value	Test specified in BS 598: Part 107	1 per 15 tonnes*		
2004	Tar	Tests specified in BS 76	1 per source*		Sampling to comply with BS 76
	Cut back bitumen	Tests specified in BS 3690: Part 1	1 per source*		Sampling to comply with BS 3690: Part 1 [The viscosity test is normally sufficient]

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2100					
2101	Bridge bearings				
	Elastomeric bearings	Hardness	<i>[As required]</i>	Required (BS 5400 : Section 9.2)	<i>[Tests/samples should be scheduled only where tests are required on samples cut from a finished bearing]</i>
		Tensile strength			
		Elongation			
		Ageing			
		Compression set			
		Ozone resistance			
	Complete bearings	Tests specified in Appendix 21/1	As required in Appendix 21/1		
Series 2200					
2202	Metal parapets			Required (BS 6779: Part 1)	Quality management scheme applies
2204	Welding	Welding procedures (Manufacturer's tests)			<i>[(N) See NG 2204]</i>
		Welder qualification (Manufacturer's tests)			
		Production testing (Manufacturer's tests)			
	Welded joints	Destructive testing			
2207	Parapet posts	Production testing as specified in BS 6779 : Part 1 : 1998 (Manufacturer's tests)		Required	Certification in accordance with Clause 2207 is required
2208	Anchorage in drilled holes	Loading test on site	<i>[As required]</i>		Anchorage should hold a current BBA HAPAS Roads and Bridges Certificate
Series 2400					
2401	Masonry cement			Required (BS 5224)	Quality management scheme applies
		Chloride content	Monthly*		Test to be carried out by the manufacturer and results included on the test certificate
2402	Sand			Required per consignment (BS 1199 and 1200)	
		Chloride content	Monthly*		Test to be carried out by the manufacturer and results included on the test certificate

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2400 (continued)					
2403	Water	Tests specified in BS 3148	[As required]		
2404	Mortar admixtures			Required (BS 4887) (BS 5075)	
2405	Lime			Required (BS 890)	
2406	Bricks				
	Clay	(Soluble salt content Efflorescence Compressive strength Water absorption Initial rate of suction) (BS 3921)			[Tests/samples (in accordance with BS 3921) should be scheduled as required]
	Calcium silicate			Required (BS 187)	
	Concrete			Required (BS 6073 : Part 1)	
2407	Blocks				
	Clay	(Soluble salt content Efflorescence Compressive strength Water absorption Initial rate of suction) (BS 3921)			[Tests/samples (in accordance with BS 3921) should be scheduled as required]
	Concrete			Required (BS 6073 : Part 1)	
2408	Reconstituted stone				[Tests/samples (in accordance with BS 6457) should be scheduled as required]
2410 2411	Stainless steel				
	Wire/fabric			Required (BS 970 : Part 1)	
	Bars			Required (BS 6744)	
	Ready mixed mortars			Required (BS 4721)	
	Mortars	Tests specified in Appendix A1 of BS 5628 : Part 1 (1985)	1 set of tests per mix*		

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2500					
2501	Materials for corrugated steel buried structures exceeding 900 mm clear span or internal diameter				Type approval applies
	Steel components			Required as appropriate to the standard or specification listed in the type approval Certificate	
	Zinc coating				
	Protective coating				
	Paved invert system				BBA Roads and Bridges Certification applies
2502	Materials for reinforcing elements, prefabricated facing and capping units, and washers				BBA Roads and Bridges Certification applies
	Carbon steel strip			Required (BS 1449: Part 1 or BS EN 10025)	Silicon content and mechanical properties to be stated on the certificate
	Stainless steel strip			Required (BS 1449: Part 2)	Mechanical properties to be stated on the certificate
	Reinforcing bar for anchor elements			Required (BS 4449)	Tests scheduled under Clauses 1717 and 1909 are required for welding and galvanizing of anchor elements
	Materials for fasteners				
	Stainless steel			Required (BS 970: Part 1) (BS 6105)	
	Bolts, screws and nuts			Required MSA EN ISO 898, 24016, 24018, 24034	Tests scheduled under Clause 1909 are required for hot dip galvanizing
2503	Materials for pocket type reinforced brickwork retaining wall structures				
	Clay bricks	(Soluble salt content Efflorescence Compressive strength Water absorption Initial rate of suction) (BS 3921)	1 set of tests per type of brick*		Random sampling to BS 3921 to be employed

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2500 (continued)					
2504	Environmental barriers				Quality management scheme applies <i>[Appropriate tests/samples should be scheduled where not included under other Clauses]</i>
	Timber				
	Concrete				
	Steel				
	Brickwork				
	Other materials				
	Barriers	Sound absorption Sound insulation	As required in Appendix 25/4		<i>[See NG 2504 14 - 17]</i>
	Post foundations	Loading test on site	As required in Appendix 25/4		<i>[See NG 2504.12]</i>
2505, 2506	Drainage structures/buried rigid pipes for drainage structures Pipes for drains and culverts having diameters or clear span exceeding 900 mm				
	Vitrified clay	<i>[see Note 1]</i>			Product certification scheme applies <i>[Note 1. Additional manufacturer's tests are provided for in the relevant BS but should not normally be required.]</i>
	Concrete PC/SRC	(Manufacturer's test)			See sub-Clause 2506.28
	Iron	<i>[see Note 2]</i>			<i>Note 2. Certificate are provided for in the relevant BS but should not normally be required except for pipes which are not quality marked by a MSA accredited body listed in Appendix B of SHW</i>
	Corrugated steel	(Manufacturer's test)			Type Approval Certificate and BBA Roads and Bridges Certificate apply
Series 2600					
2601	Bedding mortar materials			Required for each batch	Certification in accordance with Clause 2601 is required
	Bedding mortar	Flow cone test	Each batch		† Laboratory tests
		Flow between glass plates			
		Compressive strength			
		Expansion test			
		Water absorption			
		Elastic stability	1 per source		
		Flow cone test Compressive strength	Each load		Site control tests

TABLE NG 1/1: Typical Testing Details (continued)

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
Series 2600 (continued)					
2604	Plastic coating to fencing posts, gates and ancillaries			Required (BS 172: Part 16)	Certification by powder manufacturer and coating applicator is required.
2607	Granolithic concrete				Testing to be in accordance with Clauses 1702, 1703, 1707 and 1710
Series 3000					
3001	General				Inspection Reports as required in Appendix 30/1
3005	Grass seeding, Wildflower seeding and turfing	Rate of spread of fertiliser	1 per 1000 square metres*		
		Rate of spread of seeding	1 per 1000 square metres*		
		Chemical analysis of fertiliser	1 per source*		††
		Grass seed germination and purity (Official Seed Testing Station tests)	1 per source and mix variety*	Required prior to sowing	†

Key

- † indicates a requirement in SHW for the test to be carried out by the Contractor; such tests should therefore be scheduled in Appendix 1/5.
- †† indicates a statement in SHW that the test may/will be carried out under the direction of the Overseeing Organisation; samples for such tests should therefore be required in Appendix 1/6.
- * indicates that the frequency of testing is given for general guidance and is only indicative of the frequency that may be appropriate (ie. no frequency is given in the SHW or reference documents). Where materials are known to be marginal or if initial test results show them to be such, the frequency of testing should be increased. Conversely where material properties are consistently in excess of specified minimum requirements or well below specified maximum limits, then the frequency of testing should be reduced.

(N) Indicates that an MSA accredited laboratory sampling and test report or certificate is required.

[Notes to compiler:

- 1. The above symbols apart from (N) are for guidance when preparing Appendices 1/5 and 1/6 and should not be reproduced in those Appendices.*
- 2. Other guidance is printed in italics and should likewise not be reproduced in Appendices 1/5 and 1/6. Appropriate Contract-specific requirements should be scheduled.]*

NG SAMPLE APPENDIX 1/1: ^(05/01) TEMPORARY ACCOMMODATION AND EQUIPMENT FOR THE OVERSEEING ORGANISATION

1 Accommodation Required

- | | | |
|--|---|----------------------------------|
| (i) Temporary initial accommodation |) | |
| (ii) Principal office |) | |
| (iii) Laboratory |) | |
| <i>[sufficient space to be allowed to retain samples of materials]</i> |) | Location (if appropriate |
| (iv) Subsidiary static office |) | and floor area to be |
| (v) Subsidiary portable office |) | inserted or referenced to |
| (vi) Off Site accommodation at |) | drawing numbers] |
| fabricator's or precaster's works |) | |

[Note: The compiler should bear in mind that all accommodation should satisfy the relevant requirements of current legislation on health, safety and welfare.]

2 Duration of Time Accommodation Required

[Include if the date when offices/laboratories are to be occupied and equipment is to be installed, tested and made operational is different from that stated in sub-Clause #101.2.

Include date all accommodation is vacated and removed.

Include time of day and number of days in week that accommodation is required.]

3 Fittings and Furnishings of Accommodation

[The details should include a list of consumable stores, surveying and testing equipment, first aid equipment and details of room temperature needed.]

#NG SAMPLE APPENDIX 1/2: (05/01) VEHICLES FOR THE OVERSEEING ORGANISATION

Type (as defined below)	Number Required	Period Required	Cleaning Frequency
A B C D			

1 Type "A" 8/12 Seat Station Wagon

The vehicle is to be suitable for off-road use, have 4 wheel drive, power steering and be supplied in white or yellow colour. The vehicle shall be free from markings identifying any company associated with the Contract. The equipment shall include:

Fire extinguisher, heater and demister, hazard flashing unit, heavy duty suspension, spare wheel, fuel filler cap lock, bonnet lock and spare wheel lock, internal and external mirrors, mud flaps, link mats front and rear, mudshield for front and rear brakes, rubber pads for clutch and brake pedals, interior sun visors, gearbox covers, tow rope, towing hooks front and rear, laminated windscreen, wire mesh guards for side, tail, stop and flasher lamps, covers for universal joints, sign boards reading 'Highway Maintenance' or where appropriate 'Motorway Maintenance' in accordance with Diagram 7404 of Schedule 12, Part V of the Traffic Signs Regulations and General Directions 1994 on the rear of the vehicle (the lettering shall be the largest x height that can be accommodated out of the following heights: 37.5, 50, 62.5, 75 or 100 mm), retroreflective red and fluorescent yellow chevrons on the rear of the vehicle and a roof mounted amber flashing light bar comprising at least two light sources fitted in accordance with paragraph 2.3.7.4 of Chapter 8 of the Traffic Signs Manual and The Road Vehicles Lighting Regulations.

2 Type "B" Long Wheelbase Station Wagon

The vehicle shall be free from markings identifying any company associated with the Contract. The vehicle and equipment shall be as for Type A with the following variations:

Link mats and heater shall be supplied for the front only. The vehicle shall be adapted for CBR testing.

3 Type "C" Short Wheelbase Station Wagon

The vehicle and equipment is to be as type B but not adapted for CBR testing.

4 Type "D" 4-Door Estate Car

The vehicle shall have a carrying capacity of at least 0.25 tonne, a minimum ground clearance (unladen) of 150 mm and independent suspension.

The vehicle shall be finished in white or yellow colour and shall be free from markings identifying any company associated with the Contract. The equipment shall include:

Reversing lamp, fire extinguisher, luggage rack complete with straps suitable for carrying survey equipment, sign boards and roof mounted amber flashing light bar and red and yellow chevrons as above.

NG SAMPLE APPENDIX 1/3: COMMUNICATION SYSTEM FOR THE OVERSEEING ORGANISATION

Type of equipment-.....

Location of base station (for radio communication system) - office for the Overseeing Organisation

Location of other sets-.....

Each portable set shall have a spare set of batteries

No.	Office/Laboratory	Vehicle	Personnel	Period Required

Frequency for radio communication system

BaseMHz

MobileMHz

NG SAMPLE APPENDIX 1/4: WORKING AND FABRICATION DRAWINGS

Series	Description of Work submission of drawings	Minimum period for

NG SAMPLE APPENDIX 1/5: (05/01) TESTING TO BE CARRIED OUT BY THE CONTRACTOR

- [Notes to compiler:*
- i) The scope of the testing covered in Table NG 1/1 should not be regarded as exhaustive. Routine tests carried out by manufacturers and suppliers in compliance with a British Standard or other standard or specification are not included but where a standard or specification makes provision for a test certificate this is indicated in the table.*
 - ii) Where tests are taken from British Standards which are undated in the Specification they should be checked to ensure that test requirements have not been altered by subsequent issues since the date of the last published national alteration to the SHW (see NG 004.2).*
 - iii) The schedule of tests for the Contract should be completed by selecting the tests and data from Table NG 1/1. Different frequencies and additional tests should be included as appropriate. Where the frequency of testing in Table NG 1/1 is given by reference to a Clause in the SHW, the frequency requirements of the Clause should be repeated in full in Appendix 1/5.*
 - iv) Where MSA Laboratory accreditation is required this should be indicated by the symbol (N) in the Test column. Sampling and associated tests where this should apply are indicated in Table NG 1/1.*
 - v) In the tabulation, include the same level of detail as is included in Table NG 1/1: Typical Testing Details]*

Clause No	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments

Notes:

- 1 Unless otherwise stated above, all sampling and testing in this Appendix shall be by the Contractor.
- 2 Tests comparable to those specified in this Appendix will be necessary for any equivalent work, goods or materials proposed by the Contractor (See sub-Clause 105.4).
- 3 (N) Indicates that an MSA accredited Laboratory sampling and test report or certificate is required
- 4 Unless otherwise shown in this Appendix tests for work, goods or materials as scheduled under any one Clause are required for all such work, goods or materials in the Works.
- 5 Cube strength tests are not required for concrete complying with Clause 2602.
- 6 Unless otherwise shown in this Appendix test certificates for work, goods or materials as scheduled under any one Clause are required for all such work, goods or materials in the Works.

NG SAMPLE APPENDIX 1/6: (05/01) SUPPLY AND DELIVERY OF SAMPLES TO THE OVERSEEING ORGANISATION

[Notes to compiler:

- i) Give details of the samples, including source samples, to be provided or made available by the Contractor for testing by the Overseeing Organisation and the locations to which they are to be delivered. Where MSA Laboratory accreditation for sampling is required this should be indicated by the symbol (N) in the 'Sample Description' column. Samples where this should apply can be determined from subsequent testing requirements. Tests which required accreditation are indicated in Table NG 1/1*
- ii) In this case of testing by the Overseeing Organisation, it is intended that column 3, 'Frequency of Sampling', is obtained by reference to Table NG 1/1 but see sub-Clause 105.7.*
- iii) Compilers should consider whether the Appendix can be realistically completed in such a way as to properly indicate that the requirements can be met by use of the transport for the Overseeing Organisation to carry samples, leaving the Contractor to provide only small quantities of replacement materials. Excessive complication is often found to be unnecessary.]*

Clause No. or Series	Sample Description	Frequency of Sampling	Delivery Location	Comments

Notes:

- 1 Samples comparable to those specified in this Appendix will be necessary for any equivalent work, goods or materials proposed by the Contractor (See sub-Clause 105.6).
- 2 Unless otherwise shown in this Appendix samples of work, goods or materials as scheduled under any one Clause are required for all such work, goods or materials in the Works.
- 3 Unless otherwise scheduled under Clause 2602 samples of concrete complying with that Clause are not required.
- 4 (N) indicates MSA laboratory accreditation required for sampling

NG SAMPLE APPENDIX 1/7: SITE EXTENT AND LIMITATIONS ON USE

[Note to compiler: Include details as appropriate, under the following headings:]

1 Extent of the Site.

[Cross-reference should be made to the Drawings where appropriate.

Include areas of highway for advance signing and coning by the Contractor where relevant.]

2 Limitations on the Use of the Site.

[Cross-reference should be made to Appendix 1/23 where appropriate.]

NG SAMPLE APPENDIX 1/8: OPERATIVES FOR THE OVERSEEING ORGANISATION

Operatives Required	No.	Period Required
Chainman/Driver Driver/Laboratory Handyman		

SAMPLE APPENDIX 1/9: CONTROL OF NOISE AND VIBRATION

Noise

- 1 The Local Authority has informally agreed that the following measures would be acceptable and these are given as a guide; however it is for the Contractor to decide whether to seek the Local Authority's formal consent to his proposed methods of work and to the steps he proposes in order to minimise noise.
- 2 The normal working hours within the Site shall be Monday to Friday between ... and ... hours and Saturday between ... and ... hours, with no working on Sundays or public holidays. Exceptionally, consent for work outside these hours may be given after any necessary consultation. ... days' notice is required from the Contractor when seeking such consent.
- 3 The noise levels (see Note (i) below) scheduled below for periods outside the normal working hours will only be permitted when consent has been given to exceptional working.
- 4 The ambient noise level, Leq (see Note (ii) below) from all sources when measured 2.0 m above the ground at noise control stations numbers 1 to ... on Drawing Numbers shall either not exceed the appropriate level given in the Schedule or not exceed by more than 3dB(A) the existing ambient noise level, Leq (see Note (iii) below), at the control station measured over the same period, whichever level is the greater. The maximum sound level at any noise control station shall not exceed the level given in the Schedule. Exceptionally the Contractor may be given permission to carry out works which exceed the noise levels in the Schedule, provided that ... days' notice of the date and timing of these works is given to the Overseeing Organisation and the Contractor demonstrates that he intends to take all reasonable measures to mitigate the noise nuisance. After consultations with the Local Authority and any other interested bodies a decision will be given within ... days of receipt of the notice.

Schedule		Total Noise Levels at Control Stations		
Period	Hours	Ambient Noise Level, Leq Measured at Control Station: dB(A)	Period of Hours over which Leq is applicable	Maximum Sound Level (see Note (iv) below) measured at Control Station: dB(A)
Mondays to Fridays Saturdays All unattended plant outside normal working hours				

Notes:

- (i) Noise levels relate to free field conditions. Where noise control stations are located 1 m from facades of buildings, the permitted noise levels can be increased by 3 dB(A).
- (ii) The ambient noise level, Leq, at a noise control station is the total Leq from all the noise sources in the vicinity over the specified period.
- (iii) The existing ambient noise level, Leq, at a control station is the total Leq from all the noise sources in the vicinity over the specified period prior to the commencement of the Works.
- (iv) Maximum sound level is the highest value indicated on a sound level metre which meets the requirements of MSA EN 60651 Type 1 or 2 set to SLOW response and frequency weighting A or on an integrating – averaging sound level metre to MSA EN 60804.

Vibration

[Note to compiler: Include here:]

- (i) Locations where vibration limits are to be complied with.
- (ii) Limits of vibrational amplitude and resultant peak particle velocity.
- (iii) Requirements for instrumentation and monitoring.
- (iv) Overseeing Organisation's arrangements for Contractor to monitor vibration in property off Site.

NG SAMPLE APPENDIX 1/10: STRUCTURES TO BE DESIGNED BY THE CONTRACTOR

[Note to compiler: List under (A) the structures to be designed by the Contractor and under (B) the structures for which a choice of designs is offered, ie. structures for which the Contractor may propose a design if he elects not to construct the design prepared by the Overseeing Organisation. The design specifications and any special requirements should either follow immediately after the table or be cross-referenced to other Appendices.]

Structure	Location	Design Specification
(A)		
(B)		

NG SAMPLE APPENDIX 1/11: STRUCTURAL ELEMENTS AND OTHER FEATURES TO BE DESIGNED BY THE CONTRACTOR

[Note to compiler: List here the structural elements and other features to be designed by the Contractor. The design specifications and any special requirements should either follow immediately after the table or be cross-referenced to other Appendices.]

Element	Location	Design Specification

NG SAMPLE APPENDIX 1/12: SETTING OUT AND EXISTING GROUND LEVELS

1 The information given below will be available for inspection during the tender period at:

Regional/Agent/Consultant's Office

Address

Tel No.

and will be supplied to the Contractor at the commencement of the Works.

[Note to compiler: Include here details of the setting out information that is available.]

- 2 Specific requirements for setting out.
- 3 References to drawings or schedules quoting existing ground levels [III.1].
- 4 Level of information on existing detail to be recorded by the Contractor.

NG SAMPLE APPENDIX 1/13: ^(05/01) PROGRAMME OF WORKS

1 The Contractor shall provide the programme in a form of a network diagram/bar chart [delete as appropriate] produced as a result of a 'critical path analysis' and must abide by the constraints below. It shall show the level of detail appropriate to each stage of the Works and all activities and restraints, each of which shall be given a short title. All events shall be numbered and annotated with earliest and latest event dates.

2 At the time of presentation of the programme the Contractor shall also provide a mass-haul diagram showing his intended earthworks movements and locations and capacities of anticipated plant and other resource input.

3 Schedule of Constraints

[The constraints known at tender stage should be inserted here. Typical constraints, including those that could have been commitments by the Employer, are as follows:]

- (i) Work to privately and publicly owned services and supplies *[although this is usually agreed informally giving the Contractor latitude in determining his programme]*.
- (ii) Possession (rail, property, etc).
- (iii) Traffic safety and management including notice requirements.
- (iv) Restrictions arising from the use of substances hazardous to health.
- (v) Provision of environmental protection prior to the main construction operations (environmental barriers, etc).
- (vi) Trials and demonstrations in advance of main construction.
- (vii) Completion of the communications installation 8 weeks before the date for completion of the Works.
- (viii) Compliance with technical approval procedures in relation to structures designed by the Contractor, including awaiting approvals, resubmissions and modifications.
- (ix) (05/01) Date, day and time limitations for surface treatments *[918.1, 919.1, 922.1, eg not on market days or at rush hour]*. *[Note to compiler: Any limitations on availability should be included in this Appendix]*.
- (x) (05/01) The Contractor shall demonstrate to the Overseeing Organisation that he has available in a suitably located stockpile an adequate supply of surface dressing chippings which will enable him to not only commence the Works on the due date, but will enable him to progress the work at such a rate as will ensure compliance with the Programme of Works including traffic management.

4 The level of detail should be not less than the following:

Level 1

Within 21 days after the acceptance of Tender and any subsequent revision

- (i) Each bridge.
- (ii) Earthworks-each cutting and embankment.
- (iii) Roadworks-in lengths not exceeding 1.0 km for main route and for each side road, link road and slip road:
 - (a) Fencing
 - (b) Site clearance
 - (c) Topsoil strip
 - (d) Drainage (pre-earthworks and second stage)
 - (e) Sub-base

- (f) Subgrade improvement layer
- (g) Roadbase or concrete paving
- (h) Surfacing.
- (iv) Major privately and publicly owned services and supplies.
- (v) Traffic management measures including operation of site accesses, plant crossings and temporary diversions for traffic.

Level 2

At least four weeks before the commencement of any item of work:

- (i) For each bridge:
 - Piling
 - Substructure
 - Superstructure
 - Finishes
- (ii) Roadworks:
 - As for Level 1 but intervals not exceeding 200 m and including lighting, signing, soiling and seeding, road marking, cabling and communications equipment.
- (iii) All public alterations or additions to privately and publicly owned services and supplies.

Level 3

Further breakdown of items and other details as may be required.

NG SAMPLE APPENDIX 1/14: PAYMENT APPLICATIONS

The payment applications submitted to the Overseeing Organisation in accordance with the Conditions of Contract by the Contractor shall, whenever dealing with matters covered by the Bills of Quantities, be set out under Part and Section headings similar to those in the Bills of Quantities and shall separately identify each item and specify quantity, unit, rate and value. Items not described in Bills of Quantities but appropriate for inclusion as measured work shall be shown at the end of the relevant section or under section headings as appropriate indicating quantity, unit rate and value. In respect of all other matters referred to in the Conditions of Contract the Contractor shall separately show in the statement quantities, units and rates of goods and/or materials and also details of any other matters to which he considers himself entitled. The Contractor shall allow the Overseeing Organisation to inspect invoices for goods or materials included in the statement as may be required.

NG SAMPLE APPENDIX 1/15: ACCOMMODATION WORKS

1 Copies of Land Reference Plans and Schedules (*together with details of accommodation works already determined) will be available for inspection during the Tender period at:

Regional/Agent/Consultant's Office.....

Address.....

Tel No.....

and will be supplied to the Contractor before the commencement of the Works. Further information will be provided in respect of accommodation works when this has been agreed.

2 Details of accommodation works already determined are as follows:

*[*Delete where details are included]*

NG SAMPLE APPENDIX 1/16: PRIVATELY AND PUBLICLY OWNED SERVICES AND SUPPLIES

- 1 This Appendix contains details of services and supplies affected by the Works, details of preliminary arrangements that have been made with Statutory Undertakers and others for the alteration of services and supplies affected by the Works, and details of any orders already placed.
- 2 The Contractor shall make arrangements with the Statutory Undertakers and others concerned, for the co-ordination of his work with all work which needs to be done by them or their contractors concurrently with the Works. Compliance with the periods of notice given in this Appendix does not relieve the Contractor of his obligations.
- 3 Private services to individual properties have not generally been listed or shown on the Drawings. The Contractor shall make arrangements with the Statutory Undertakers and others concerned for the phasing of all necessary disconnections and diversion of private services affected by the Works.
- 4 Disconnected apparatus shall be removed by the Contractor only with the prior consent of the Authority concerned.
- 5 The names, addresses and telephone numbers of the authorities serving in the locality are listed below.

Names	Address Tel No.	Contact
Statutory Undertakers		
Other Authorities		

6 Services and Supplies Affected by the Works

Location	Description	Group*	Drawing No.	Notice Required to Commence	Time for Completion
Statutory Undertakers					
Other Authorities/ Bodies/Individuals					

*

- A Work expected to be completed before the commencement of the Works.
 - B Work required after commencement of the Works which does not require prior work by the Contractor.
 - C Work required after commencement of the Works which does require prior work by the Contractor.
 - D Work expected to be in progress at the commencement of the Works.
 - E Work to be wholly undertaken by the Contractor.
- 7 *[Note to compiler: Insert here details of any other preliminary arrangements that have been made and/or details of any orders already placed]*

6 Services and Supplies Affected by the Works

Location	Description	Group*	Drawing No.	Notice Required to Commence	Time for Completion
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 - D Work expected to be in progress at the commencement of the Works.
 - E Work to be wholly undertaken by the Contractor.
- 7 *[Note to compiler: Insert here details of any other preliminary arrangements that have been made and/or details of any orders already placed]*

NG SAMPLE APPENDIX 1/17: ^(05/01) TRAFFIC SAFETY AND MANAGEMENT

[Note to compiler: The following should be inserted in the Appendix as appropriate and extended when required:]

1 Traffic Safety and Management Requirements

[When the Contractor is not required to submit traffic management proposals or to supply sign faces, posts or fixings, this should be stated.]

- (i) Phasing of Works *[include details of traffic orders that have been or are being made]*.
- (ii) Drawings showing traffic management layout, including:
 - (a) Position of traffic signals.
 - (b) Width of lanes.
 - (c) Working areas.
 - (d) Safety zones.
 - (e) Crossovers *[include construction details, and geometrical design required where this has not been shown on the Drawings]*.
 - (f) Running lane for emergency vehicles.
 - (g) Location for emergency vehicles.
- (iii) Timing of operations.
- (iv) Road lighting requirements (Appendix 14/3).
- (v) Requirements for Temporary Emergency Telephones.
- (vi) Whether a traffic safety and control officer is required *[117.19]*.
- (vii) Restriction arising from the use of substances hazardous to health *[crops - reference should be made to Appendix 1/23]*
- (viii) A Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Roadworks (TASCAR) shall be provided in accordance with Appendix 1/26 and Appendix 1/27 *[117.32]*.

The Contractor's attention is drawn to the need to assess the risks and develop and operate safe working practices when vehicles and plant are reversing on Site, whether or not they are on part of the highway. Rule 129 of The Highway Code 1993 is relevant but the Contractor's practices and procedures should take account of the different conditions, which will obtain on Site.

The responsibilities of the Traffic Safety and Control Officer and of his nominated deputy shall also include the following matters:

- (1) Monitoring, with the assistance of sufficient mobile personnel and of sufficient other suitable and appropriate aids, the flow of traffic within the area and within the period defined for the operation of the vehicle recovery service;
- (2) Ensuring that, within 5 minutes of the occurrence of an incident, as defined below, resulting in stationary vehicle(s) on a highway open to the public, the incident is reported to the vehicle recovery service;
- (3) Recording and logging all incidents and all movements of recovery vehicles and, when called, all movements of the emergency services. For the purposes of this Appendix, an "incident" is defined as a shed load, vehicle breakdown, vehicle abandonment or traffic accident, whether or not the latter involves personal injury.

2 Maintenance Requirements

- (i) Crossovers
- (ii) Ramps
- (iii) Highways
- (iv) Timescale for responsibility if different from sub-Clause 117.7

3 Notice Requirements

Notice required by the Overseeing Organisation in order to arrange for:

- (i) amending or making traffic orders
- (ii) authorising of non-prescribed signs
- (iii) authorising temporary traffic signals
- (iv) moving signs to be compatible with the state of the Works as described in sub-Clause 117.11.

4 Details of Events That Could Have a Bearing on the Works

[These could include such events as:]

Motor shows,
Race meetings,
Football fixtures, and
Highway reconstruction work being carried out in the vicinity.

5 Highways, Private Roads, and Other Ways Affected by the Works

Description	Predicted 24 Hour Annual Average Daily Traffic AADT	Eighty Five Percentile Speed of Cars (mph)	Speed Limit (mph) if Proposed <i>[State whether Mandatory or Advisory]</i>	Type(s) Of Traffic Control	Special Facilities <i>[Pedestrian, Equestrian etc.]</i>	Whether to be Kept Open or Closed

Note: Particulars of temporary diversions for traffic are contained in Appendix 1/18.

Highways including footpaths, cycle tracks and bridleways, described above or listed in Appendix 1/19 are the responsibility of:

Authority.....

Address.....

Tel No.....

6 Driver Information Signs at Roadworks

- (i) Requirements for the use of Driver Information Signs
- (ii) Required variations to legends

NG SAMPLE APPENDIX 1/18: (05/01) TEMPORARY DIVERSIONS FOR TRAFFIC

[Note to compiler: The following should be inserted in the Appendix as appropriate and extended when required:]

1 Temporary Diversions for Traffic Specified by the Overseeing Organisation

(i) Highways Open to Vehicles

Description	Drawing No. or Ref.	Construction/ Design Requirements*	Maintenance Requirements (including timescale for responsibility)	Remarks (including Constraints and Reinstatement details)
Major				
Minor				

(ii) Other Highways and Private Rights of Way

Description	Drawing No. or Ref.	Existing Usage	Construction/ Design Requirements*	Maintenance Requirements (including timescale for responsibility)	Remarks (including Constraints and Reinstatement details)
Footpaths					
Cycle Tracks					
Bridleways					
+ Private means of Access					

Note: Particulars of traffic are contained in Appendix 1/17.

[This could include a schedule of different forms of construction and geometrical design required where this has not been shown on the Drawings.]*

+ Not always a need to define individual accesses, particularly in urban situations. Reference can be made to road names or other appropriate means of identification.]

(iii) Temporary Structures Specified by the Overseeing Organisation

[Give full particulars, including outline Approval in Principle forms where appropriate, if temporary structures are to be designed by the Contractor.]

2 Temporary Diversions Proposed by the Contractor

(i) Notice Requirements [118.6]

(ii) Details of any Constraints

NG SAMPLE APPENDIX 1/19: ROUTEING OF VEHICLES

[Note to compiler: Insert details as appropriate under the following headings:]

- (i) Permitted Access Routes To and From the Site

[A list of drawings showing the permitted access routes and details of temporary traffic signs.]

- (ii) The Use of the Permanent Works by Construction Traffic

[The requirements with which the Contractor must comply in submitting details under the Conditions of Contract.]

- (iii) Movement of Machinery and Plant Across Public Roads

[The requirements for the provision of haul route traffic signals, the equipment for which requires the approval of the Secretary of State.]

- (iv) Temporary Structures for Construction Traffic Spanning Areas Used by the Public

[Detail to which temporary structures must be designed including, in the case of structures spanning a public highway, the requirement for the Contractor to follow the technical approval procedures contained in Standard BD 2. In the case of structures spanning a railway, river or canal, the requirements of the appropriate authority should be given.]

#NG SAMPLE APPENDIX 1/20: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 1: Information to be provided by the compiler

Requirements for Recovery Vehicle Operation

1 Recovery Vehicles to be Provided

1.1 *[Compiler: Include here details of circumstances when recovery vehicles are to be provided.]*

1.2 Heavy recovery vehicles:

- (a) ... no. heavy recovery vehicle(s) shall be provided, each having a crew of at least two operatives.
- (b) A heavy recovery vehicle shall comply with the following:
 - (i) *Be a recovery vehicle with not less than three axles, capable of towing by means of an underlift a loaded 44 tonnes vehicle up a slope of 4 °C and shall comply with all appropriate current legislation. The vehicle shall be fitted with either a 10 tonne single power winch or two power winches of not less than 8 tonnes each . All equipment shall be power-operated with SWL indicated and with operating levers/ buttons clearly marked for operational use*
 - (ii) Be equipped with chains, wire ropes and shackles suitable for the recovery of a fully-laden 44 tonnes GVW vehicle. All chains, wire ropes and shackles shall have test certificates and/or stamped showing the SWL, be free from snags, excess stretching and wear.
 - (iii) Have seating for not less than two adult passengers (in addition to the recovery operatives).
 - (iv) Be conspicuous, for example by marking with suitable tape (not less than 125 mm wide) to sides and rear of the vehicle.
 - (v) The heavy recovery vehicle(s) shall be fitted with the following as a minimum requirement:
 - (a) 1 no. amber lightbar to comply with The Road Vehicles Lighting Regulations 1989.
 - (b) 2 no. fully adjustable lights to illuminate both the sides and rear of the vehicle.
 - (c) 2 no. fire extinguishers (1 No. 6 kg (nett) dry powder; 1 No. 9 litre (nett) aqueous film forming foam).
 - (d) 1 no. 1-10 person first aid kit to include disposable surgical gloves.
 - (e) 2 no. 10 m 12 tonne nylon straps.
 - (f) 2 no. 30 m x 13 mm polypropylene rope.
 - (g) 1 no. 44 tonne straight tow pole.
 - (h) 1 no. 44 tonne cranked tow pole.
 - (j) 10 no. highway cones 750 mm height.
 - (k) 1 no. proof load tested crane. (Overlift proof test -static 7.5 tonnes, underlift proof test -static 7.0 tonnes.)
 - (l) 1 no. suitable socket set including AF/Metric and BA sizes.
 - (m) 1 no. suitable tool kit.
 - (n) 2 no. 12 tonne bottle jacks.
 - (o) 1 no. suitable wheelbrace to fit HGVs in common use and a torque wrench.
 - (p) 1 pair of jump leads (24 volt).
 - (q) 1 no. explosion and flameproof hand lamp.

- (r) 1 no. crowbar.
- (s) 1 no. copper hammer.
- (t) The necessary fittings for connection from the air braking system of a broken-down or accident-damaged vehicle to the air braking system of the heavy recovery vehicle.
- (u) 1 no. broom and shovel.
- (v) 2 no. wheel chocks of HGV size.
- (w) 4 no. suitable lengths of wood block skidding.
- (x) 1 no. rear lighting board incorporating 'On Tow' legend in lettering of not less than 70 mm on conspicuously coloured background to conform with the size, colour and type illustrated by Diagram 5, Section B, Schedule 19 of the Road Vehicles Lighting Regulations, 1989. The board shall be fitted with lights, reflectors and indicators. When required the recovery vehicle index number or trade licence plate shall be fitted.
- (y) 1 no. sledge hammer - 7lbs minimum.
- (z) 1 no. ADR (HAZCHEM) chart.
- (aa) 50 kg of dry fine sand stored in a waterproof container.
- (vi) The heavy recovery vehicle(s) shall also carry as a minimum requirement:
 - (a) 4 no. 'D' shackles SWL 12 tonnes each.
 - (b) 4 no. 'D' shackles SWL 3 tonnes each.
 - (c) 2 no. suitable length chains SWL 12 tonnes each.
 - (d) 2 no. suitable length chains SWL 5 tonnes each.
 - (e) 2 no. suitable length chains SWL 3 tonnes each.

NOTE: All lifting chains and equipment must be fully certified by an independent competent person to comply with all current legislation. Shackles listed in (vi) (a) and (b) should be stamped with the appropriate SWL. Equivalent wire ropes may be substituted for chains listed in (vi) (c), (d) and (e).

- (vii) The heavy recovery vehicle(s) shall carry, and use when necessary, equipment designed and manufactured for the purpose of locking the steering of the broken-down or accident-damaged vehicle in order to tow it safely in a reverse direction.
- (viii) The heavy recovery vehicle(s) shall carry equipment to enable the recovery crew to remove the drive line or shafts of the broken-down or accident-damaged vehicle.
- (ix) The heavy recovery vehicle(s) shall carry blocks with a SWL of 8 tonnes, 1 No. per winch and 2 No. on boom (crane) wires.

1.3 Light Recovery Vehicle

- (a) ... no. light recovery vehicle(s) shall be provided, each having a crew of not less than one operative.
- (b) A light recovery vehicle shall comply with the following:
 - (i) Be capable of carrying or towing, by means of an underlift, a vehicle weighing 2800Kg up a slope of 4 °C and shall comply with all appropriate current legislation
 - (ii) Be capable of recovering motor cycles.
 - (iii) Be capable of recovering trailers (ie caravans, boat trailers, horse boxes, etc.)
 - (iv) Have seating capacity for four adult passengers (in addition to the recovery operatives).
 - (v) Be conspicuous, for example, by marking with suitable tape (not less than 125mm wide) to sides and rear of the vehicle.

- (vi) The light recovery vehicle(s) shall be fitted with the following as a minimum requirement:
- (a) 1 no. amber lightbar to comply with The Road Vehicles Lighting Regulations 1989.
 - (b) 2 no. fully adjustable lights to illuminate both the sides and rear of the vehicle.
 - (c) 2 no. fire extinguishers (1 No. 6 kg (nett) dry powder; 1 No. 9 litre (nett) aqueous film forming foam).
 - (d) 1 no. 1-10 person first aid kit which should include disposable surgical gloves.
 - (e) 1 no. 30 m x 13 mm polypropylene rope.
 - (f) 1 no. 6 tonne straight tow pole.
 - (g) 10 no. highway cones 750 mm height.
 - (h) 1 no. proof load tested winch and/or spectacle lift.
 - (j) 1 no. suitable socket set including AF/Metric and BA sizes.
 - (k) 1 no. suitable tool kit.
 - (l) 1 no. 3 tonne bottle or trolley jack..
 - (m) 1 no. suitable wheelbrace to fit cars and light goods vehicles in common use.
 - (n) 1 pair of jump leads (24 volt).
 - (o) 1 no. explosion and flameproof hand lamp.
 - (p) 1 no. crowbar.
 - (q) 1 no. quick change towing hitch suitable for 50 mm, 2 inch or jaw type fittings.
 - (r) 1 no. broom and shovel.
 - (s) 1 no. wheel chock of light commercial size.
 - (t) 2 no. suitable lengths of wood block skidding.
 - (u) 1 no. rear lighting board incorporating 'On Tow' legend in lettering of not less than 70 mm on conspicuously coloured background to conform with the size, colour and type illustrated by Diagram 5, Section B, Schedule 19 of the Road Vehicles Lighting Regulations 1989. The board shall be fitted with lights, reflectors and indicators. When required the recovery vehicle index number or trade licence plate shall be fitted.
 - (v) Total lift facility - 2800kg slideback deck (7.6 m minimum) or heavy duty dollies.
 - (w) 50 kg of dry fine sand stored in a waterproof container.
- (vii) The light recovery vehicle(s) shall also carry as a minimum requirement:
- (a) 4 no. 'D' shackles SWL 3 tonnes each.
 - (b) 2 no. suitable length wire ropes SWL 3 tonnes each.
 - (c) 2 no. ratchet jacks SWL 6 tonnes each, or hydraulic equivalent.
 - (d) 1 No. suitable towing trolley.

NOTE: All lifting ropes and equipment must be fully certified by an independent competent person to comply with all current legislation. An equivalent chain may be substituted for the wire rope listed in (vii) (b).

- (viii) The light recovery vehicle(s) shall carry, and use when necessary, equipment designed and manufactured for the purpose of locking the steering of the broken-down or accident-damaged vehicle in order to tow in a reverse direction.

2 Inspection Requirements

2.1 The vehicle

The Contractor shall ensure that all recovery vehicles are maintained in such condition that at all times the vehicles conform to the requirements of the Road Traffic Act and Regulations made thereunder (Construction and Use and Road Vehicle Lighting Regulations) so as to be fit to be used on the road. Evidence of this roadworthiness shall be by successful completion of an inspection by the Vehicle Inspectorate or Freight Transport Association, conducted not less than 14 days nor more than 28 days before the vehicles are required.

If the duration of the works exceeds 6 months, the Contractor shall arrange for all recovery vehicles to be inspected by the Vehicle Inspectorate or Freight Transport Association at not less than 6 monthly intervals.

2.2 Lifting equipment

All lifting equipment shall be fully certified by an independent competent person to comply with all current legislation.

2.3 Reports

A copy of each inspection report shall be:

- (i) provided for the Overseeing Organisation.
- (ii) kept in the recovery vehicle.

2.4 Record form

The Contractor shall submit weekly to the Overseeing Organisation duplicate record forms which log the regular checks made on each recovery vehicle. A sample form is given in Sheet 2 of this Appendix.

3 Locations for Recovery Vehicles

[Compiler: State here details of locations for recovery vehicles together with any specific requirements such as need for hardstandings.]

4 Communication System

In addition to the requirements of Appendix 1/3, the Contractor shall:

- (a) provide a secondary 'back up' communications system (e.g. mobile telephone, 2-way radio link or land line) between the recovery base station(s) and all recovery vehicles, and
- (b) provide an emergency telephone and line at the recovery base station(s) for the sole use of emergency calls. Where possible, the link between the recovery base station(s) and the police shall be by direct land line.

The Contractor shall be responsible for all associated equipment and payment of fees to operate the system which shall be established and fully tested prior to the start of the Works.

[Compiler: Provide here details of specific communication system requirements].

5 Location(s) for Vehicle Removal

[Compiler: Insert details of location(s) to which broken-down or accident-damaged vehicles should be removed, and the facilities to be provided at those locations. These locations should take into account safety, security and the availability of a telephone, see Chapter 1.3 of Volume 1 of the Trunk Road Maintenance Manual.]

6 Explanatory Leaflet

The Contractor shall ensure that the recovery vehicle operatives issue leaflets to the drivers of vehicles requiring assistance, before recovery commences. These shall have been prepared in liaison with the police and in accordance with Sheet 3 of this Appendix, and have been approved by the Overseeing Organisation before issue to the recovery firm.

7 Limits of Service

[Compiler: Give details of the length of carriageway over which free recovery service will operate, including any specific requirements to cover slip roads, side roads etc].

8 Requirements for Recovery Personnel

(a) Suitability: It is the responsibility of the Contractor to ensure that all personnel involved with vehicle recovery are suitable to work with 'vulnerable' motorists.

(b) Training: The contractor shall ensure that all personnel involved with vehicle recovery shall hold a certificate certifying successful completion of an appropriate vehicle recovery course. A copy of each certificate shall be provided to the Overseeing Organisation not less than 14 days before the commencement of the works.

(c) Personal Protective Equipment: In addition to the provisions identified in the Health and Safety risk assessment conducted by the Contractor, the following items will be provided for each crew member of the recovery vehicle:

- (i) Safety Helmet CE marked to EN 397.
- (ii) Reflective Safety Garment complying with sub-Clause 117.18 of the Specification.
- (iii) Boots with steel reinforcement toecaps and/or safety footwear in accordance with MSA EN 345
- (iv) Suitable gloves with the appropriate CE mark.
- (v) Protective Goggles in accordance with BS 2092.

Note: All Personal Protective Equipment should be stored and maintained in good, clean condition.

(d) Identification: The Contractor shall ensure that all personnel involved with vehicle recovery are issued with the following:

- (i) An identity card which incorporates the name of the recovery contractor (or the Contractor), and the name and a photograph of the holder. This card must be available for inspection at all times and a copy must be submitted to the Overseeing Organisation prior to the commencement of the operative working.
- (ii) A reflective Safety Garment (referred to in (c) (ii) above) which prominently displays the Contractor's name.

(e) Working hours:

[Compiler: Include maximum hours to be worked by recovery operatives: (For example, 12 hours on duty with the provision that no work should be undertaken in the following 12 hour period).]

9 Record Form

The Contractor shall submit weekly to the Overseeing Organization completed duplicate record forms which log the assistance given by the recovery vehicle and their operatives. Sample forms are given in Sheet 4 of this Appendix.

#NG SAMPLE APPENDIX 1/20: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 2: Information to be provided by the Contractor

FORM FOR 'RECOVERY VEHICLE DAILY CHECK SHEET'

RECOVERY VEHICLE DAILY CHECK SHEET							
Week Commencing:							
Driver's Name:	Vehicle Type/Registration No:			Mileage:			
Driver to initial against check list below:							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
OIL LEVEL							
WATER							
ENGINE							
CLEANLINESS – interior							
CLEANLINESS – exterior							
WIPER/WASHERS							
TYRES							
LIGHTS							
Driver's Report (detail any problems):							
Action Taken (to solve above problems):							
Date:				Supervisor's Signature:			
COMPLETED SHEET TO BE RETURNED TO OVERSEEING ORGANISATION EACH WEEK							

#NG APPENDIX 1/20: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 3: Information to be provided by the Contractor

LEAFLET FOR ISSUE BY RECOVERY VEHICLE OPERATIVES TO DRIVERS OF ALL BROKEN-DOWN OR ACCIDENT-DAMAGED MOTOR VEHICLES

Name of Scheme:

[compiler: Insert accurate name of the scheme before the issue of tender documents]

Vehicle Recovery Service - Explanatory Leaflet authorised by the Highways Agency for issue to drivers of broken-down and accident-damaged motor vehicles within the above works.

Leaflet to be distributed by recovery vehicle operatives of the appointed recovery firm on behalf of the Highways Agency.

1. The roadworks operations commence at the "Roadworks Ahead - 2 miles" sign and end at the "Roadwork End" sign. *[compiler: See Note 1 below]*
2. The recovery service provided along the extent of the roadworks operations is free.
3. Vehicles will be recovered clear of the roadworks operations tounless otherwise directed by the police. *[compiler: See Note 2 below]*
4. It will then be at the discretion of individual drivers of broken-down or accident-damaged vehicles requiring assistance to arrange for assistance or the removal of their vehicle to a garage of their choice. The operators of the free recovery service do not make such arrangements.

A list of local garages is given below:

.....
.....

Assistance will also be given by telephoning *[compiler: See Note 3 below]*

If a motorway emergency telephone is used, the police will assist.

[Notes to compiler:

- (1) *If different, replace with the appropriate limits of service for the Works.*
- (2) *The chosen location should take into account safety, security and the availability of a telephone, see Chapter 1.3 of Volume 1 of the Trunk Road Maintenance Manual.*
- (3) *The telephone number should be agreed with the police prior to the commencement of the Works.]*

SHEET 4: Information to be provided by the Contractor

LAYOUT FOR 'VEHICLE RECOVERY LOGSHEET'

[illegible]

*P - Police **Y - Tow/Lift #C - Car M/C - Motorcycle
F - Fire Service R - Restart V - Van
A - Ambulance F - False Call HGV - Heavy Goods Vehicle

#NG SAMPLE APPENDIX 1/20: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 4 (continued)

[illegible]

NG SAMPLE APPENDIX 1/21: INFORMATION BOARDS

[Note to compiler: Include here the locations and details of information boards, or cross-references to the drawings giving the information.]

NG SAMPLE APPENDIX 1/22: PROGRESS PHOTOGRAPHS.

The designation of the person to accompany the photographer.

Location	Type	No.	Aerial/Ground	Frequency Required	Remarks

NG SAMPLE APPENDIX 1/23: RISKS TO HEALTH AND SAFETY FROM MATERIALS OR SUBSTANCES

[Note to compiler: Details should be inserted in the Appendix as appropriate under the following headings:]

- (i) Restrictions in relation to traffic management measures. *[These should include need for additional safety zones or lane closures.]*
- (ii) Restrictions in relation to working practices. *[These should include conditions in relation to wind speed and direction, night working and restrictions in relation to traffic conditions ie. working to stop when adjacent traffic speed falls below a specified level.]*
- (iii) Measures to be taken to protect members of the public. *[These should include measures such as screening and signing.]*
- (iv) Monitoring to be undertaken by Contractor. *[Depending on substances or processes, air quality monitoring may be required where traffic, pedestrians or properties are adjacent to or close to the Works. Details of requirements should be given.]*

[Note to compiler: Further information on the need for specific requirements may be obtained from the Overseeing Organisation.]

NG SAMPLE APPENDIX 1/24: QUALITY MANAGEMENT SYSTEM

[Notes to compiler:

- 1 *The Overseeing Organisation must be consulted before preparing this Appendix.*
- 2 *When the main Contractor is required to institute a quality management system, Appendix 1/24 shall be completed as indicated below.]*

1 (05/01) The Contractor shall institute and operate a quality management system complying with BS EN ISO 9002 : 1994 and Clause 104. The quality management system shall be described in a Quality Plan that shall be submitted to the Overseeing Organisation for its acceptance.

The Quality Plan shall cover the following items:

- (i) Contractor's organisation and management
 - (ii) Contractor's method statements and construction procedures
 - (iii) Contractor's construction quality control
 - (iv) Suppliers' Quality Plans
- (for each of the quality management schemes listed at Appendix A)

2 Quality Plans shall conform with the requirements tabulated in this Appendix, as follows:

[Compiler to insert "Model Requirements"]

3 Items i) and iii) of the Quality Plan shall be submitted to the Overseeing Organisation for its acceptance not later than* days after award of the Contract.

[normally 21 days]*

The Contractor shall submit other parts of the Quality Plan prior to commencement of any related work or activity and to a timetable included in item i).

4 Method statements are required for the works listed below:

[Note to compiler: Guidance regarding the activities requiring method statements is at Note 1 Guidance Notes to item ii) of the Model Requirements].

GUIDANCE NOTES

Numbers cross refer

- 2 *An annotated chart is an effective means of illustrating the organisational relationships.*
- 3 *These will include the roles commonly Attributed to the Contracts Manager, Site Agent/Contractor's Project Manager, Management Representative for Quality, Sub-agents, General Foreman, foreman, Chief and Senior Engineers and Contract Quantity Surveyor.*

CONTRACTOR'S ORGANISATION AND MANAGEMENT

This section of the Quality Plan shall include:

- 1 Definition of the Contract and its documentation.
- 2 The organisation of the Contract, including the line of command and communication links between parties involved in the Contract.
- 3 Names, roles, responsibilities and authority of principals and key personnel.

GUIDANCE NOTES

- 4 *e.g meetings with the police, statutory undertakers, local authorities, landowners and others.*
- 5 *Particular reference is to be made to the main Contractor's staff responsible for subcontracted activities.*
- 6 *This must include the assessment of the subcontractor's quality assurance and quality control capabilities, the identification and implementation of additional controls needed on them to fulfil the Contractor's obligations in respect of quality assurance, monitoring arrangements and the review and acceptance of 'deliverables'.*
- 8 *Adequate time shall be allowed for the Overseeing Organisation to examine these plans prior to commencement of the activity.*
- 9 *Suppliers QPs are required for schemes listed in Appendix A of the SHW. Suppliers' QPs should be based on the model.*

CONTRACTOR'S ORGANISATION AND MANAGEMENT

- 4 Control of liaison and meetings with third parties.
- 5 Identification of the Contractor's own staff responsible for overseeing each major activity.
- 6 The main Contractor's control of subcontracts.

- 7 Document control.
- 8 Programme for submission of method statements and Suppliers Quality Plans.

The Quality Plan shall identify procedures (which may be a part of the Contractor's general procedures) that cover the topics listed below. Copies of these procedures shall be made available to the Overseeing Organisation on request.

- 9 The quality plans for subcontractors and suppliers of work, goods and materials which are the subject of quality management schemes.
- 10 Procedure for the preparation, review and adjustment of programmes for the effective progression of the Works and the recording of this.
- 11 Control and approval of purchases of materials.
- 12 Control of off-site activities (where appropriate).
- 13 Procedures for the regular review and recording by the Contractor of the quality of the Works.
- 14 Control of personnel selection, based on their care, skill and experience.
- 15 Management review/audits to monitor and exercise adequate control over the implementation of the quality plan.
- 16 Any other relevant item.

GUIDANCE NOTES

Numbers cross refer

- 1 *Method statements are required for the Principal activities e.g.*
 - *demolition & site clearance*
 - *safety fencing - probably subject to a Supplier's QP*
 - *drainage*
 - *earthworks - sub-divided as appropriate*
 - *landscaping*
 - *pavement construction - for each layer: flexible construction, or*
 - *each operation for rigid*
 - *each structure - by its main elements*
 - *lighting and communications cabling*
 - *each traffic management operation*
 - *sensitive/complex accommodation works*
 - *major service diversions*
 - *special activities, e.g. treatment of contaminated land, major temporary works, items of public interest/concern*

Method statements may be quite brief but should describe each stage of the construction, identify the plant and materials to be used, temporary works, safety measures, working space considerations, and where appropriate the requirements for skilled labour and/or special supervision etc.

Where work is subject to environmental control, e.g. temperature, noise control, working hours, traffic conditions etc, these should be stated.

Hold points should be identified i.e. the stages at which checks are necessary before continuing. The authority for release of the hold point shall be identified.

- 2 *These procedures invoked by method statements will typically include, from the quality controls required by the contractor's construction quality control:*
 - *Control, identification and traceability of materials, including any material or samples temporarily or otherwise removed from site for testing or other reasons.*
 - *Procedure for the prevention of inadvertent use, installation or covering up of non-conforming work.*
 - *Other corporate and/or contract-specific work instructions to be applied.*

CONTRACTOR'S METHOD STATEMENTS AND CONSTRUCTION PROCEDURES

This section of the Quality Plan shall include:

- 1 Detailed method statements for each major activity whether directly controlled or subcontracted.

The method statements shall identify hold points and invoke:

- work instructions
- quality control procedures
- compliance testing/inspection arrangements
- and work acceptance procedures

for all activities that might affect the quality of the permanent and temporary works.

- 2 Identify the relevant construction procedures in the Contractor's own Quality Management System (and provide copies on request).

GUIDANCE NOTES

Numbers cross refer

- 1 *These statements will normally be expected to include:*
 - (i) *the responsibility for the initiation and updating of the Quality Plan.*
 - (ii) *responsibility of the 'Management Representative' for quality for monitoring compliance with it.*
 - (iii) *responsibility for the adequacy of the quality records produced.*
- 5 *These controls should include their identification, traceability requirements, control of document issues and their status.*

They should also include the control of documents recording the verification review, approval, release and amendment of the works.
- 6 *These should also identify 'hold points'.*
- 7 *These procedures should identify the proforma and/or database to be used for recording the inspection and test results, and the proforma to be used for recording the certification of compliance of all items of the Works by authorised key personnel. Each submission should be separately identified.*
- 8 *These procedures should include options for identification of non-conforming work and proposals for reworking and remedial work*
- 9 *Reference should be made to those records listed in the SHW Appendix H.*

CONTRACTOR'S CONSTRUCTION QUALITY CONTROL

This section of the Quality Plan shall include:

- 1 Statement of the Contractor's organisation for quality control.

The quality plan shall identify procedures (which may be a part of the Contractor's general procedures) that cover the topics listed below. Copies of these procedures shall be made available to the Overseeing Organisation on request.
- 2 Arrangements for 'receiving' and 'in-process' testing.
- 3 Control of test laboratories.
- 4 Control of test, measuring and inspection equipment.
- 5 Document control.
- 6 Procedure for monitoring and recording the inspection, test and approval status of the constructed/installed work.
- 7 Procedures for tests and inspections for the purpose of the Contractor certifying that prior to covering up, each part of the Works is complete and conforms to the Contract.
- 8 Procedure for the review of work submitted for review but not accepted as conforming to the Contract.
- 9 (05/01) Procedure for the collation of quality records as identified in MSA EN ISO 9002 : 1994 and provision of copies when requested be the Overseeing Organisation.

GUIDANCE NOTES

Numbers cross refer

- 2 *An annotated chart is an effective means of illustrating the organisation structure.*

This must address all activities, including those sublet. Names of any subcontractors and suppliers involved in the production shall be provided.
- 3 *It is important for the Overseeing Organisation to be aware of the Supplier's quality control procedures, in order to decide on its own level of inspection and testing.*
- 4 *The Suppliers shall provide evidence that the training and experience requirements given in the appropriate Quality Assessment Schedule are being met. CVs may be appropriate.*
- 6 *Each piece or bundle of delivered product shall be indelibly marked and where appropriate, the lot identification shall be included on each package.*
- 7 *Instructions for repair of damaged products may be needed.*
- 8 *These shall include documents to demonstrate the achievement of the requirement standard, e.g. site logs, records of visits, records of verification, review and release, certificates of conformity and records of all design modifications to products and specifications.*

SUPPLIERS QUALITY PLANS

The Quality Plan shall include:

- 1 Definition of the product or service to be provided.
- 2 The organisation of the Supplier describing the line of command and stating the name of the senior manager responsible for the contracted Work and the name of the Supplier's on-site Management representative. Contact addresses, telephone numbers etc shall be provided.
- 3 *Identification of the relevant parts of the Supplier's quality system relevant to the product or service being provided. (Copies to be provided to the Overseeing Organisation on request).
- 4 The control of personnel selection (at works and on site), including special requirements for skilled personnel e.g. certification of welders, training of operatives, experience requirements etc.

Specific procedures for the following:

- 5 *Receipt and examination of certificates of conformity and test results for purchased products.
- 6 *Product identification and traceability.
- 7 *Handling, storage, packaging and delivery to site and storage and handling on Site.
- 8 Quality records,

Items marked * where available and appropriate, copies of the Supplier's quality system/general procedures may be acceptable.

NG SAMPLE APPENDIX 1/25: ^(05/01) TEMPORARY CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM FOR THE MONITORING OF TRAFFIC

[Note to compiler; Where this system is required the following details should be inserted and extended where necessary:]

- 1** Requirements for Temporary Closed Circuit Television (CCTV) system:
 - (i) The periods when the CCTV is required and operational requirements;
 - (ii) Locations of supplementary cameras;
 - (iii) Details of dedicated link to Police Control Office.

NG SAMPLE APPENDIX 1/26: (05/01) TEMPORARY AUTOMATIC SPEED CAMERA SYSTEM FOR THE ENFORCEMENT OF MANDATORY SPEED LIMITS AT ROADWORKS (TASCAR)

General

- 1** The Contractor shall supply, install, maintain in conjunction with the Chief Officer of Police and remove on completion the Temporary Automatic Speed Camera System for the Enforcement of Mandatory Speed Limits at Roadworks (TASCAR) as described in this Appendix and in Appendix 1/27. Wherever 'the Chief Officer of Police' occurs in this Appendix it shall be construed to refer to the Chief Officer of Police named in Appendix 1/27. The Contractor shall ensure that the System is completely installed and fully operational from the time defined in Appendix 1/27 and that it remains in operation for the duration of the Contract unless otherwise specified in Appendix 1/27.
- 2** The TASCAR equipment shall consist of a detection and measuring device, camera/image recording device, flash (or other ancillary lighting) unit and dummy units, all of which shall be fully compatible and capable of being located in pole-mounted housings which shall themselves be capable of either fixed root or trailer mounting, all of which shall be provided as part of the Contract. If a trailer mounted system is supplied it shall be fitted with retractable de-mountable wheels. The scope shall include but not be limited to all equipment, poles, housings and power supplies. The quantities of equipment required are specified in Appendix 1/27.
- 3** The Contractor shall arrange for the provision of a 240v AC single-phase mains electrical supply of adequate power capacity to all components of the system. Alternatively, he may provide an equivalent supply from a local electrical generator or generators which shall be used only for this purpose. Such generator(s) shall have electric start mechanisms and be adequately regulated as to voltage and frequency to suit the accuracy requirements of the equipment provided for TASCAR and be capable of running constantly for 48 hours without refuelling at an output of not less than 16.0 kVA at 0.8 power factor, or equivalent output. All generators shall be housed in vandal-proof containers and be securely locked. One set of keys shall be provided to the Overseeing Organisation for them to provide to the Chief Officer of Police.
- 4** As a prescribed device under the provisions of the Road Traffic Act 1991, all equipment shall conform as a minimum to the requirements of the Home Office "The Speedmeter Handbook" (Second Edition) issued by the Police Scientific Development Branch (PSDB), Publication No 27/92, and have received 'type approval' from the Secretary of State at the Home Office. All equipment shall be so maintained by the Contractor throughout the period that the TASCAR is required to be provided, as specified in Appendix 1/27.
- 5** The number of monitoring sites required for this Contract is specified in Appendix 1/27. All equipment necessary to bring the sites into operation shall be provided by the Contractor.
- 6** All electrical connections shall be easily disconnected and reconnected without the use of tools. All male plugs/ports shall be provided on the transportable equipment and all female plugs/ports shall be provided on the static equipment.
- 7** The Contractor shall be responsible for the design of the System which shall be approved by the Overseeing Organisation and the Chief Officer of Police before installation commences. The Contractor shall contact the Chief Officer of Police to determine the full design and operating requirements to enable his design to be equivalent to and compatible with the system of the Chief Officer of Police.

Camera and Control Unit

- 8** The camera and control unit shall be designed so that it is portable and easily transferable between housings. They shall be capable of operating both on a 240v AC single-phase mains supply and on a nominal 12v DC supply, at the choice of the operator.

9 The camera and control unit shall be designed such that they can be accurately positioned and firmly located within the housing. The camera mounting shall be designed so that the operator can only mount the camera in a previously calibrated position.

10 The camera unit shall be capable of taking either one or two colour photographs per offence with the operator having the facility to select the required option. If selecting the 'two photograph' option, the operator shall also have the facility to vary the interval between frames in 0.1 second steps, within the range 0.5 seconds to 1.0 seconds.

11 A video camera unit, if supplied, shall have the facility of producing one, or two or more, colour images per offence at a displayed fixed interval apart, one of which may be selected by the operator. The operator shall also have the facility to vary the interval between recorded images in 0.1 second steps within the range 0.5 seconds to 1.0 seconds.

[Compiler: This paragraph and paragraphs 13, 27 and 28 may be omitted if so agreed with the Chief Officer of Police. If this is done put instead "11 Not used." otherwise all the paragraphs will require renumbering and cross-references will need careful amendment and checking.]

12 The camera shall be so designed that the image of the target vehicle will be shown in the context of its surroundings while the registration number of the captured vehicle will also be legible in its context, in all but exceptionally adverse lighting and weather conditions. eg. a minimum resolution of 10 pixels per character in the case of a video image.

13 A video camera unit, if supplied, shall have a first stage storage medium from which it will be possible to recover a complete image not less than 24 months later without deterioration of the said image.

[Compiler: This paragraph and paragraphs 11, 27 and 28 may be omitted if so agreed with the Chief Officer of Police. If this is done put instead "13 Not used." otherwise all the paragraphs will require renumbering and cross-references will need careful amendment and checking.]

14 The camera unit shall use colour film of the specification, including type and speed, which shall have been approved in writing by the Chief Officer of Police, which approval will be copied to the Overseeing Organisation. The camera shall have automatic exposure control and be adjustable for film speeds in the range of not less than 21-27 DIN (100-400 ASA). Each film shall be capable of recording 800 frames. The quantity and supplier of film shall be as specified in Appendix 1/27. The Chief Officer of Police will arrange for processing.

15 Each camera unit shall be fitted with a magazine that is capable of containing and operating with a roll of film 30 metres or less in length. Two such magazines shall be supplied with each camera.

16 Each photograph or video image of any violation shall have an information block superimposed upon it. The operator shall have the ability to introduce manuscript data into the information block. The minimum automatically recorded and displayed information for each offence shall be:

- (i) Date of violation - displayed in Day, Month, Year;
- (ii) Time of violation - displayed in Hours, Minutes, Seconds;
- (iii) Speed of offending vehicle;
- (iv) Site identification code;
- (v) Offence number;
- (vi) Film number;
- (vii) Time interval between images.

17 If a segmented display is used, it shall only be displayed as a single image. Each element shall confirm the information block requirements of paragraph 16 above.

18 Any data collected by the camera unit shall be recorded onto a 'smart card' via a smart card reader to be supplied as part of this Contract. The format of the smart card file shall be compatible with the existing card reader interface of the Chief Officer of Police.

19 The TASCAR shall have the ability to distinguish between cars and long vehicles, with the operator being able to select an independent speed threshold for either vehicle type, within the range 13 mph - 140 mph in 1 mph steps, above which any offence will be photographed.

20 The control unit shall be capable of recording and showing on a counter the total number of vehicles monitored and the total number of offences above an operator-specified speed threshold within the speed range specified in paragraph 19 above. Any speed measurement shall be visually displayed on the unit.

21 The system shall be self-calibrating following a single operator action. The resulting checks should show clearly if any faults are present. If a segmented display is provided there shall be a facility to check that all segments are functioning. The system shall not be capable of operation while any fault exists.

Detection Unit

22 The detection unit shall be designed so as to be portable and easily transferable between housings; it shall also be capable of both fixed and mobile operation. It shall be capable of operating both on a 240v AC single-phase mains supply and on a nominal 12v DC supply, at the choice of the operator.

23 A radar unit, if supplied, shall be designed so that it can be accurately positioned and firmly located within the housing. The radar unit mounting shall be such that the radar can only be installed by the operator in a previously determined position so that the radar will measure vehicle speeds, across the carriageway or in a specific traffic flow, at a preset angle. If a trailer mounting is being supplied then a sighting device shall also be provided.

24 The radar frequency shall be $24.1 \text{ GHz} \pm 25 \text{ MHz}$.

25 The detector unit shall be capable of undertaking not less than 2 measurements per second.

26 If radar is proposed as the detection/measuring device, the operator shall have the facility to select receding or approaching vehicles for monitoring.

27 The Contractor may submit for consideration full technical and operational details of any alternative 'across-the-road' or traffic flow specific system which has been type-approved in accordance with paragraph 4 above and which he proposes offering to provide as a detection/measuring device. eg. laser, piezo, inductive loop.

[Compiler: This paragraph and paragraphs 11, 13, and 28 may be omitted if so agreed with the Chief Officer of Police. If this is done put instead "27 Not used." otherwise all the paragraphs will require renumbering and cross-references will need careful amendment and checking]

28 Any detection system/measuring device using two or more inductive loops, piezo cable or similar medium shall include a facility for the operator to enter/vary the detector spacing as part of the setup procedure.

[Compiler: This paragraph and paragraphs 11, 13, and 27 may be omitted if so agreed with the Chief Officer of Police. If this is done put instead "28 Not used." otherwise all the paragraphs will require renumbering and cross-references will need careful amendment and checking]

Flash Unit or Ancillary Lighting Unit

29 A flash unit or ancillary lighting unit shall be provided for each monitoring site.

30 The flash unit or ancillary lighting unit shall be designed so as to be portable and easily transferable between housings and shall also be capable of mobile operation. It shall be capable of operating both on a 240v AC single-phase mains supply and on a nominal 12v DC supply, at the choice of the operator. Alternatively, a mobile flash or lighting unit may be supplied for operation outside the fixed housing.

31 The flash or ancillary lighting unit shall be synchronised to operate with the camera and shall be adjustable so that as a minimum there shall be a Low, Medium and High setting. The power of a flash unit shall be not less than 100 watts on the Low setting and not less than 200 watts on the High setting. The flash unit or ancillary lighting unit shall be capable of being readily switched off.

32 The flash unit shall be designed to operate at intervals of not less than 0.5 seconds.

33 The unit shall be designed so that it can be accurately and firmly positioned within the housing, and the mounting so designed that the operator can only locate the flash or ancillary lighting unit in a previously fixed position.

34 The flash or ancillary lighting unit shall be capable of manual operation, for testing purposes.

Dummy Equipment

- 35 The dummy equipment shall be designed to be portable and easily transferable between housings.
- 36 Dummy units shall be designed so that each can be accurately and firmly located within the housing.
- 37 Dummy units shall operate such that they are indistinguishable from a camera unit and shall appear so unless the housing is open.
- 38 Dummy units shall be capable of manual operation for testing purposes.
- 39 Dummy units shall be capable of recording and showing on a counter the total number of vehicles monitored and the total number of offences above a threshold speed which is specified by the operator within the speed range specified in paragraph 19 above.

Street Furniture

- 40 The housing and pole shall be of robust construction and shall include security-locking mechanisms to prevent unauthorised access or operation. All access to any hinge mechanism, or securing bolt, shall only be via the security locks. Any security lock accessed from ground level shall itself have an additional cover which requires a further piece of equipment for removal eg. Allen key. The supplier shall provide proof that all parts exposed to the weather shall, as a minimum, comply with the requirements of IEC 529: 1976 IP Rating 555 for protection against dust and water ingress and mechanical impact.
- 41 The housing shall be vandal resistant. It shall be mounted on a pole at a height of not less than 2.5 metres above the verge or pavement surface. When the camera unit is mounted there shall be an unrestricted view from the camera of the section of carriageway to be monitored.
- 42 The housing shall be designed so that all elements of the monitoring equipment can be easily installed and removed by one person. All units shall be positively located within the housing. An optional facility to mask the flash or the ancillary lighting unit shall be available for external attachment to the housing.
- 43 The housings which are within the central reserve, or other locations specified in Appendix 1/27, shall be capable of being turned through 180 degrees \pm 5 degrees on the supplied pole. The Contractor shall provide a pole with a suitable mechanism to enable the direction of the camera housing to be reversed to a pre-calibrated orientation into which it can be locked. The camera shall be calibrated when in each of the two differing orientations. The locating mechanism shall be such that the housing can be set and locked in not less than two positions each of which has been pre-calibrated. An automatic switching mechanism shall be provided such that electrical power shall not be available to any unit located within the housing whilst the housing is not locked into either one of these two pre-calibrated positions. When turning the housing to an alternative monitoring position, the housing shall only be capable of returning to its original position by reversing the direction of travel ie. rotational movement greater than 180 degrees shall not be possible.
- 44 The housing or pole shall provide facilities for the termination of all external interconnections. Any terminations not accommodated within the housing or pole shall be secured against unauthorised access or operation as required in paragraph 40 above.
- 45 The camera pole and its support shall comply with BE Agreed Endorsement No. 1/94 for its design and structural certification. The Contractor shall supply the Overseeing Organisation with not less than 2 no. copies of the certified drawings of the pole and its supports. It shall be of a design that provides for the housing to be lowered and accessed from ground level while maintaining its upright position and orientation relative to its operational direction such that the operator can undertake all test procedures facing the section of carriageway to be monitored.
- 46 Security keys shall be supplied in the ratio of one set per monitoring site. Such keys shall be of a pattern unique to the Chief Officer of Police. A minimum of 2 no. keys shall be required to gain access to the automatic speed camera system at each monitoring site. The keys shall be provided to the Overseeing Organisation for them to provide to the Chief Officer of Police. The Overseeing Organisation will maintain a record of all keys received from the Contractor, the equipment and locations to which they relate and the dates of their handing over to the Chief Officer of Police, their return by them and their handing over to the Contractor, or otherwise, at the Completion of the Contract.

Installation

47 The Contractor shall install the equipment required under this Appendix and Appendix 1/27 at the monitoring locations specified in Appendix 1/27 and in accordance with any particular installation requirements in Appendix 1/27.

48 The Contractor shall install the poles in the individual monitoring locations within highway limits as instructed by the Overseeing Organisation and shall carry out reinstatement of the surface as directed by, and to the satisfaction of, the Overseeing Organisation and as specified in Appendix 1/27.

49 The Contractor shall attach the housings to the poles in the positions specified and shall install, connect and commission the remainder of the equipment as required.

50 All cables and cores shall be clearly identified at every termination point or jointing. Identification shall comply with TCSU 1 Section 5.

51 Any ducting, loop or peizo installation shall be carried out to the following Specifications:

[compiler: List of specifications should be obtained from the Overseeing Organisation]

Reusable joints shall be used between loop tails and feeder cables.

Commissioning and Acceptance

52 The Contractor shall be responsible for the commissioning of the TASCAR as a whole, including secondary checks and the calibration of each piece of equipment, including ensuring its correct operation. As part of this, the Contractor shall provide a secondary method of confirming the speed calculation of the equipment provided as shown on the Contract Drawing specified in Appendix 1/27. This method shall be approved by PSDB and involve a different principle which shall be used to verify the primary speed measurement.

53 The commissioning of the TASCAR shall be carried out by the supplier of the System in the presence of, and for acceptance by, the Chief Officer of Police and shall be in accordance with any particular requirements in Appendix 1/27. The Contractor shall give the Overseeing Organisation not less than 4 days clear notice of his intention to carry out this work, to allow for a designated representative of the Chief Officer of Police to attend. Commissioning certificates shall be provided to the Overseeing Organisation and shall include one pair of photographs or video images for acceptance by the Chief Officer of Police as part of the commissioning and acceptance procedure of the System.

Operation and Maintenance

54 The TASCAR operator will be the Chief Officer of Police and his delegated officers. Once the TASCAR has been commissioned, the repositioning of the monitoring equipment between the housings will be the responsibility of the Chief Officer of Police as operator. He will also be responsible for the loading and unloading of the film and for locating and relocating the trailer unit, if supplied. The Contractor shall furnish whatever assistance is requested by the Chief Officer of Police through the Overseeing Organisation to carry out these tasks

55 The Contractor shall provide the Overseeing Organisation with a log showing the locations of all the speed limit and repeater signs relative to existing marker posts. A repeater sign shall be positioned such that one is visible in each photograph.

56 The Contractor and his supplier shall maintain the System as specified in paragraphs 1 and 4 above and in Appendix 1/27.

NG SAMPLE APPENDIX 1/27: ^(05/01) TEMPORARY AUTOMATIC SPEED CAMERA SYSTEM FOR THE ENFORCEMENT OF MANDATORY SPEED LIMITS AT ROADWORKS (TASCAR) - PARTICULAR REQUIREMENTS

Scope - Locations and Quantities

1 The number of monitoring sites required for the TASCAR on this Contract is ... no. The following ancillary equipment is therefore required:

Number of fixed housings	... no.
Number of camera units	... no.
Number of dummy units	... no.
Number of trailer-mounted housings	... no.

2 The Contractor shall supply install and maintain and remove on completion the TASCAR specified in Appendix 1/26 and in this Appendix at the following locations within the Works as shown on Contract Drawing number :

Northbound verge	Chainage
	Chainage
Southbound verge	Chainage
	Chainage
Central Reserve (CR)	Chainage
	Chainage

3 Parts of the TASCAR which are located within the central reserve will be rotated through 180 degrees at some point during the Works to observe the traffic flows being reversed together with any calibration etc.

Chief Officer of Police

4 The Chief Officer of Police in Appendix 1/26 is the Chief Officer of Police for *[give name of police district]*

Provision of Film

5 If cameras are supplied, the film specified in Appendix 1/26 *[will be provided by the Chief Officer of Police]* *[shall be supplied by the Contractor]* at the rate of one film per day of camera operation, plus ten which shall be supplied at the commencement.

Installation, Commissioning and Period of Operation

6 The secondary method of confirming the speed calculation of the equipment provided, which is required in Appendix 1/26 paragraph 52, shall be to Contract Drawing number Cameras sited on the nearside of the carriageway shall be installed and commissioned prior to 24 hour lane closures being put into operation. Cameras sited in the central reserve shall be installed and commissioned not later than 12 hours after installation of the contraflow. Both sets of cameras shall then remain in continuous operation until a Certificate of Completion has been issued for the whole of the Works. At the end of the period of operation required under the Contract, the equipment shall remain the property of the Contractor.

Reinstatement of Surfaces

7 Reinstatement of verge areas shall consist of backfilling any hole(s) with acceptable material to Clause 601 up to a level 100mm below specified finished levels. The remaining 100mm thickness shall be filled with topsoil Class 5B to Clause 601.

8 Reinstatement of paved footway areas shall consist of backfilling any holes with sub-base Type 1 to Clause 803 and compacting adequately such that this terminates 65 mm below specified finished levels. The remaining 65 mm thickness shall be backfilled with a 50 mm thick layer of dense macadam (20 mm aggregate) to Clause 906 covered by 15 mm thickness of dense macadam wearing course (6 mm aggregate) to Clause 909. The wearing course shall extend not less than 150 mm beyond the hole which has been backfilled and shall be keyed into existing surfacing by its prior excavation to a depth not greater than 15mm.

9 Reinstatement of carriageway surfaces shall include, but not be limited to, removal from the pavement surface of the secondary speed check markings specified in Appendix 1/26, paragraph 52 and in paragraph 6 above. This shall be done either on removal of the TASCAR or on completion of the Works.

NG SAMPLE APPENDIX 1/2NI: (05/01) VEHICLES FOR THE OVERSEEING ORGANISATION

Type (as defined below)	Number Required	Period Required	Cleaning Frequency
A			
B			
C			
D			

Type “A” 8/12 Seat Station Wagon

The vehicle is to be suitable for off-road use, have 4 wheel drive, power steering and be supplied in a white or yellow colour. The vehicle shall be free from markings identifying any company associated with the Contract. The equipment shall include:

Fire extinguisher, heater and demister, hazard flashing unit, heavy duty suspension, spare wheel, fuel filler cap lock, bonnet lock and spare wheel lock, internal and external mirrors, mud flaps, link mats front and rear, mudshield for front and rear brakes, rubber pads for clutch and brake pedals, interior sun visors, gearbox covers, tow rope, towing hooks front and rear, laminated windscreen, wire mesh guards for side, tail, stop and flasher lamps, covers for universal joints, sign boards reading ‘Road Maintenance’ or where appropriate ‘Motorway Maintenance’ in accordance with Diagram 7404 of Schedule 12, Part V of the Traffic Signs Regulations (Northern Ireland) 1997 on the rear of the vehicle (the lettering shall be the largest x height that can be accommodated out of the following heights: 37.5, 50, 62.5, 75 or 100 mm), retroreflective red and fluorescent yellow chevrons on the rear of the vehicle and a roof mounted amber flashing light bar fitted in accordance with paragraph 2.3.7.4 of Chapter 8 of the Traffic Signs Manual and the Road Vehicles Lighting Regulations

Type “B” Long Wheelbase Station Wagon

The vehicle shall be free from markings identifying any company associated with the Contract. The vehicle and equipment shall be as for Type A with the following variations:

Link mats and heater shall be supplied for the front only. The vehicle shall be adapted for CBR testing.

Type “C” Short Wheelbase Station Wagon

The vehicle and equipment is to be as type B but not adapted for CBR testing.

Type “D” 4-Door Estate Car

The vehicle shall have a carrying capacity of at least 0.25 tonne, a minimum ground clearance (unladen) of 150 mm and independent suspension.

The vehicle shall be finished in white or yellow colour and shall be free from markings identifying any company associated with the Contract. The equipment shall include:

Reversing lamp, fire extinguisher, luggage rack complete with straps suitable for carrying survey equipment, sign boards and roof mounted amber flashing light bar and red and yellow chevrons as above.

NG SAMPLE APPENDIX 1/20NI: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 1: Information to be provided by the compiler

Requirements for Recovery Vehicle Operation

1 Recovery Vehicles to be Provided

1.1 *[Compiler: Include here details of circumstances when recovery vehicles are to be provided.]*

1.2 Heavy recovery vehicles:

- (a) ... no. heavy recovery vehicle(s) shall be provided, each having a crew of at least two operatives.
- (b) A heavy recovery vehicle shall comply with the following:
 - (i) Be a recovery vehicle with not less than three axles, capable of towing by means of an underlift a loaded 44 tonnes vehicle up a slope of 4 °C and shall comply with all appropriate current legislation. The vehicle shall be fitted with either a 10 tonne single power winch or two power winches of not less than 8 tonne each. All equipment shall be power operated with SWL indicated and with operating levers/buttons clearly marked for operational use.
 - (ii) Be equipped with chains, wire ropes and shackles suitable for the recovery of a fully-laden 44 tonnes GVW vehicle. All chains, wire ropes and shackles shall have test certificates and/or stamped showing the SWL, be free from snags, excess stretching and wear.
 - (iii) Have seating for not less than two adult passengers (in addition to the recovery operatives).
 - (iv) Be conspicuous, for example by marking with suitable tape (not less than 125 mm wide) to sides and rear of the vehicle.
 - (v) The heavy recovery vehicle(s) shall be fitted with the following as a minimum requirement:
 - (a) 1 no. amber lightbar to comply with the Road Vehicles Lighting Regulations (Northern Ireland) 2000.
 - (b) 2 no. fully adjustable lights to illuminate both the sides and rear of the vehicle.
 - (c) 2 no. fire extinguishers (1 No. 6 kg (nett) dry powder; 1 No. 9 litre (nett) aqueous film forming foam).
 - (d) 1 no. 1-10 person first aid kit to include disposable surgical gloves.
 - (e) 2 no. 10 m 12 tonne nylon straps.
 - (f) 2 no. 30 m x 13 mm polypropylene rope.
 - (g) 1 no. 44 tonne straight tow pole.
 - (h) 1 no. 44 tonne cranked tow pole.
 - (j) 10 no. highway cones 750 mm height.
 - (k) 1 no. proof load tested crane.
(Overlift proof test-static 7.5 tonnes, underlift proof test-static 7.0 tonnes.)
 - (l) 1 no. suitable socket spanner set including AF/Metric and BA sizes.
 - (m) 1 no. suitable tool kit.
 - (n) 2 no. 12 tonne bottle jacks.

- (o) 1 no. suitable wheelbrace to fit HGVs in common use and a torque wrench.
- (p) 1 pair of jump leads (24 volt).
- (q) 1 no. explosion and flameproof hand lamp.
- (r) 1 no. crowbar.
- (s) 1 no. copper hammer.
- (t) The necessary fittings for connection from the air braking system of a broken-down or accident-damaged vehicle to the air braking system of the heavy recovery vehicle.
- (u) 1 no. broom and shovel.
- (v) 2 no. wheel chocks of HGV size.
- (w) 4 no. suitable lengths of wood block skidding.
- (x) 1 no. rear lighting board incorporating 'On Tow' legend in lettering of not less than 70 mm on conspicuously coloured background to conform with the Road Vehicles Lighting Regulations (Northern Ireland) 2000. The board shall be fitted with lights, reflectors and indicators. When required the recovery vehicle index number or trade licence plate shall be fitted.
- (y) 1 no. sledge hammer - 7lbs minimum.
- (z) 1 no. ADR (HAZCHEM) chart.
- (aa) 50 kg of dry fine sand stored in a waterproof container.
- (vi) The heavy recovery vehicle(s) shall also carry as a minimum requirement:
 - (a) 4 no. 'D' shackles SWL 12 tonnes each.
 - (b) 4 no. 'D' shackles SWL 3 tonnes each.
 - (c) 2 no. suitable length chains SWL 12 tonnes each.
 - (d) 2 no. suitable length chains SWL 5 tonnes each.
 - (e) 2 no. suitable length chains SWL 3 tonnes each.

NOTE: All lifting chains and equipment must be fully certified by an independent competent person to comply with all current legislation. Shackles listed in (vi) (a) and (b) should be stamped with the appropriate SWL. Equivalent wire ropes may be substituted for chains listed in (vi) (c), (d) and (e).

- (vii) The heavy recovery vehicle(s) shall carry, and use when necessary, equipment designed and manufactured for the purpose of locking the steering of the broken-down or accident-damaged vehicle in order to tow it safely in a reverse direction.
- (viii) The heavy recovery vehicle(s) shall carry equipment to enable the recovery crew to remove the drive line or shafts of the broken-down or accident-damaged vehicle.
- (ix) The heavy recovery vehicle(s) shall carry blocks with a SWL of 8 tonnes, 1 No. per winch and 2 No. on boom (crane) wires.

1.3 Light Recovery Vehicle

- (a) ... no. light recovery vehicle(s) shall be provided, each having a crew of not less than one operative.
- (b) A light recovery vehicle shall comply with the following:
 - (i) Be capable of carrying or towing, by means of an under lift, a vehicle weighing 2800Kg up a slope of 4°C and shall comply with all appropriate current legislation.
 - (ii) Be capable of recovering motor cycles
 - (iii) Be capable of recovering trailers (ie caravans, boat trailers, horse boxes, etc.)

- (iv) Have seating capacity for four adult passengers (in addition to the recovery operatives).
- (v) Be conspicuous, for example, by marking with suitable tape (not less than 125 mm wide) to sides and rear of the vehicle.
- (vi) The light recovery vehicle(s) shall be fitted with the following as a minimum requirement:
 - (a) 1 no. amber lightbar to comply with the Road Vehicles Lighting Regulations 2000.
 - (b) 2 no. fully adjustable lights to illuminate both the sides and rear of the vehicle.
 - (c) 2 no. fire extinguishers (1 No. 6 kg (nett) dry powder; 1 No. 9 litre (nett) aqueous film forming foam).
 - (d) 1 no. 1-10 person first aid kit which should include disposable surgical gloves.
 - (e) 1 no. 30 m x 13 mm polypropylene rope.
 - (f) 1 no. 6 tonne straight tow pole.
 - (g) 10 no. highway cones 750 mm height.
 - (h) 1 no. proof load tested winch and/or spectacle lift.
 - (j) 1 no. suitable socket set including AF/Metric and BA sizes.
 - (k) 1 no. suitable tool kit.
 - (l) 1 no. 3 tonne bottle or trolley jack.
 - (m) 1 no. suitable wheelbrace to fit cars and light goods vehicles in common use.
 - (n) 1 pair of jump leads (24 volt).
 - (o) 1 no. explosion and flameproof hand lamp.
 - (p) 1 no. crowbar.
 - (q) 1 no. quick change towing hitch suitable for 50 mm, 2 inch or jaw type fittings.
 - (r) 1 no. broom and shovel.
 - (s) 1 no. wheel chock of light commercial size.
 - (t) 2 no. suitable lengths of wood block skidding.
 - (u) 1 no. rear lighting board incorporating 'On Tow' legend in lettering of not less than 70 mm on conspicuously coloured background to conform with the Road Vehicles Lighting Regulations (Northern Ireland) 2000. The board shall be fitted with lights, reflectors and indicators. When required the recovery vehicle index number or trade licence plate shall be fitted.
 - (v) Total lift facility - 2800kg slideback deck (7.6 m minimum) or heavy duty dollies.
 - (w) 50 kg of dry fine sand stored in a waterproof container.
- (vii) The light recovery vehicle(s) shall also carry as a minimum requirement:
 - (a) 4 no. 'D' shackles SWL 3 tonnes each.
 - (b) 2 no. suitable length wire ropes SWL 3 tonnes each.
 - (c) 2 no. ratchet jacks SWL 6 tonnes each, or hydraulic equivalent.
 - (d) 1 No. suitable towing trolley.

NOTE: All lifting ropes and equipment must be fully certified by an independent competent person to comply with all current legislation. An equivalent chain may be substituted for the wire rope listed in (vii) (b).

- (viii) The light recovery vehicle(s) shall carry, and use when necessary, equipment designed and manufactured for the purpose of locking the steering of the broken-down or accident-damaged vehicle in order to tow in a reverse direction.

2 Inspection Requirements

2.1 The vehicle

The contractor shall ensure that all recovery vehicles are maintained in such condition that all times the vehicles conform to the requirements of the Road Traffic Order and regulations made there under, and the Road Vehicles Lightning Regulations, so as to be fit to be used on the Road. Evidence of the roadworthiness shall be by successful completion of an inspection by the Freight Transport Association, conducted not less than 14 days not more than 28 days before the vehicles are required,

If the duration of the works exceeds 6 months, the Contractor shall arrange for all recovery vehicles to be inspected by the Freight Transport Association at not less than 6 monthly intervals.

2.2 Lifting equipment

All lifting equipment shall be fully certified by an independent competent person to comply with all current legislation.

2.3 Reports

A copy of each inspection report shall be:

- (a) provided for the Overseeing Organisation.
- (b) kept in the recovery vehicle.

2.4 Record form

The Contractor shall submit weekly to the Overseeing Organisation duplicate record forms which log the regular checks made on each recovery vehicle. A sample form is given in Sheet 2 of this Appendix.

3 Locations for Recovery Vehicles

[Compiler: State here details of locations for recovery vehicles together with any specific requirements such as need for hardstandings.]

4 Communication System

In addition to the requirements of Appendix 1/3, the Contractor shall:

- (a) provide a secondary 'back up' communications system (e.g. mobile telephone, 2-way radio link or land line) between the recovery base station(s) and all recovery vehicles, and
- (b) provide an emergency telephone and line at the recovery base station(s) for the sole use of emergency calls. Where possible, the link between the recovery base station(s) and the police shall be by direct land line.

The Contractor shall be responsible for all associated equipment and payment of fees to operate the system which shall be established and fully tested prior to the start of the Works.

[Compiler: Provide here details of specific communication system requirements].

5 Location(s) for Vehicle Removal

[Compiler: Insert details of location(s) to which broken-down or accident-damaged vehicles should be removed, and the facilities to be provided at those locations. These locations should take into account safety, security and the availability of a telephone.]

6 Explanatory Leaflet

The Contractor shall ensure that the recovery vehicle operatives issue leaflets to the drivers of vehicles requiring assistance, before recovery commences. These shall have been prepared in liaison with the police and in accordance with Sheet 3 of this Appendix, and have been approved by the Overseeing Organisation before issue to the recovery firm.

7 Limits of Service

[Compiler: Give details of the length of carriageway over which free recovery service will operate, including any specific requirements to cover slip roads, side roads etc.]

8 Requirements for Recovery Personnel

(a) Suitability: It is the responsibility of the Contractor to ensure that all personnel involved with vehicle recovery are suitable to work with 'vulnerable' motorists.

(b) Training: The Contractor shall ensure that all personnel involved with vehicle recovery shall hold a certificate certifying successful completion of an appropriate vehicle recovery course. A copy of each certificate shall be provided to the Overseeing Organisation not less than 14 days before the commencement of the works.

(c) Personal Protective Equipment: In addition to the provisions identified in the Health and Safety risk assessment conducted by the Contractor, the following items will be provided for each crew member of the recovery vehicle:

- (i) Safety Helmet CE marked to EN 397.
- (ii) Reflective Safety Garment complying with sub-Clause 117.18 of the Specification.
- (iii) Boots with steel reinforcement toecaps and/or safety footwear in accordance with MSA EN 345.
- (iv) Suitable gloves with the appropriate CE mark.
- (vi) Protective Goggles in accordance with BS 2092.

Note: All Personal Protective Equipment should be stored and maintained in good, clean condition.

(d) Identification: The Contractor shall ensure that all personnel involved with vehicle recovery are issued with the following:

- (i) An identity card which incorporates the name of the recovery contractor (or the Contractor), and the name and a photograph of the holder. This card must be available for inspection at all times and a copy must be submitted to the Overseeing Organisation prior to the commencement of the operative working.
- (ii) A reflective Safety Garment (referred to in (c) (ii) above) which prominently displays the Contractor's name.

(e) Working hours:

[Compiler: Include maximum hours to be worked by recovery operatives: (For example, 12 hours on duty with the provision that no work should be undertaken in the following 12 hour period).]

9 Record Form

The Contractor shall submit weekly to the Overseeing Organisation completed duplicate record forms which log the assistance given by the recovery vehicle and their operatives. Sample forms are given in Sheet 4 of this Appendix.

NG SAMPLE APPENDIX 1/20NI: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 2: Information to be provided by the Contractor

FORM FOR 'RECOVERY VEHICLE DAILY CHECK SHEET'

RECOVERY VEHICLE DAILY CHECK SHEET							
Week Commencing:							
Driver's Name:		Vehicle Type/Registration No:			Mileage:		
Driver to initial against check list below:							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
OIL LEVEL							
WATER							
ENGINE							
CLEANLINESS – interior							
CLEANLINESS – exterior							
WIPER/WASHERS							
TYRES							
LIGHTS							
Driver's Report (detail any problems):							
Action Taken (to solve above problems):							
Date:				Supervisor's Signature:			
COMPLETED SHEET TO BE RETURNED TO OVERSEEING ORGANISATION EACH WEEK							

NG APPENDIX 1/20NI: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 3: Information to be provided by the Contractor

LEAFLET FOR ISSUE BY RECOVERY VEHICLE OPERATIVES TO DRIVERS OF ALL BROKEN-DOWN OR ACCIDENT-DAMAGED MOTOR VEHICLES

Name of Scheme:

[Compiler: Insert accurate name of the scheme before the issue of tender documents]

Vehicle Recovery Service - Explanatory Leaflet authorised by the Department for Regional Development, Roads Service for issue to drivers of broken-down and accident-damaged motor vehicles within the above works.

Leaflet to be distributed by recovery vehicle operatives of the appointed recovery firm on behalf of the Department for Regional Development, Roads Service.

1. The roadworks operations commence at the "Roadworks Ahead - 2 miles" sign and end at the "Roadworks End" sign. *[Compiler: See Note 1 below]*
2. The recovery service provided along the extent of the roadworks operations is free.
3. Vehicles will be recovered clear of the roadworks operations tounless otherwise directed by the police. *[Compiler: See Note 2 below]*
4. It will then be at the discretion of individual drivers of broken-down or accident-damaged vehicles requiring assistance to arrange for assistance or the removal of their vehicle to a garage of their choice. The operators of the free recovery service do not make such arrangements.

A list of local garages is given below:

.....
.....

Assistance will also be given by telephoning *[Compiler: See Note 3 below]*

If a motorway emergency telephone is used, the police will assist.

[Notes to compiler:

- (1) *If different, replace with the appropriate limits of service for the Works.*
- (2) *The chosen location should take into account safety, security and the availability of a telephone.*
- (3) *The telephone number should be agreed with the police prior to the commencement of the Works.]*

NG SAMPLE APPENDIX 1/20NI: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 2: Information to be provided by the Contractor

FORM FOR 'RECOVERY VEHICLE DAILY CHECK SHEET'

RECOVERY VEHICLE DAILY CHECK SHEET							
Week Commencing:							
Driver's Name:		Vehicle Type/Registration No:			Mileage:		
Driver to initial against check list below:							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
OIL LEVEL							
WATER							
ENGINE							
CLEANLINESS – interior							
CLEANLINESS – exterior							
WIPER/WASHERS							
TYRES							
LIGHTS							
Driver's Report (detail any problems):							
Action Taken (to solve above problems):							
Date:				Supervisor's Signature:			
COMPLETED SHEET TO BE RETURNED TO OVERSEEING ORGANISATION EACH WEEK							

NG SAMPLE APPENDIX 1/20NI: (05/01) RECOVERY VEHICLES FOR BREAKDOWNS

SHEET 4 (continued)

VEHICLE RECOVERY LOGSHEET (2 of 2) [Scheme name]			Recovery Vehicle:		Week Ending:/...../.....		Sheet No:	
Date & Time	Type of Vehicle	Registration No.	Name and Address of Driver or Firm	Location of Breakdown	Nature of Breakdown	Recovery Operator's Name		

SERIES NG 200

SITE CLEARANCE

Contents

<i>Clause</i>	<i>Title</i>	<i>Page</i>
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NG 203	Explosives and Blasting	2
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SITE CLEARANCE

NG 201 Clearing

1 A schedule of buildings and structures to be demolished, or partially demolished, should be included in Appendix 2/1. The locations should be indicated in the Appendix and clearly marked on the Drawings (with reference numbers for cross identification with the Bill of Quantities where appropriate). Parts of buildings as foundations below ground which are to be removed (as an earthworks operation) should be indicated as such on the Drawings.

2 Generally, disused soil and surface water pipes over 1 m depth below formation should be left undisturbed, and need only be sealed as specified. There will, however, be occasions, particularly with the larger pipes (say 375 mm diameter and over) and when there is evidence of possible collapse, when it may be considered that steps should be taken to avoid any subsidence. In this case the alternatives include:

- (i) Excavation to remove pipe and refill trench with suitable material;
- (ii) Grouting with a mixture of cement and pfa in accordance with Clause 506.

Requirements should be stated in Appendix 2/2, when necessary.

3 Where the general site clearance item is to be used in the Bill of Quantities the Drawings should include a plan indicating by shading or hatching the area(s) to be measured as general site clearance. Where sections of general site clearance are markedly different in character, eg. woodland, these should be separately identified on the Drawings.

4 The Drawings should clearly indicate any area of grassland or woodland, individual tree or shrub, required to be preserved, eg. for landscaping purposes or because of Tree Preservation Orders.

5 The recovery of existing material should be considered on all types of contracts. Appendix 2/3 should be used to list materials which are to be retained and stored by the Contractor for re-use on the Site, or delivered to a store nominated in the Appendix for future use elsewhere.

NG 202 Not Used

NG 203 Explosives and Blasting

1 Where blasting for demolition of structures or removal of tree stumps is to be permitted, details should be given in Appendix 2/4. This should include, or refer as necessary to, guidance on the Local Authority's requirements for control of noise and vibration given in Appendix 1/9. Further guidance is given in NG 607.

NG 204 Hazardous Materials

1 Where site clearance could involve the handling and disposal of hazardous materials (eg. asbestos) the compiler should have discussions with the Environment Agency, appropriate environmental health authority and/or the Health and Safety Executive and include in Appendix 2/5 any specific requirements and/or, as a guide, measures which would be acceptable to them. The extent of any hazardous materials should be identified in Appendix 2/1.

SITE CLEARANCE

NG SAMPLE APPENDIX 2/1: (05/01) LIST OF BUILDINGS, ETC, TO BE DEMOLISHED OR PARTIALLY DEMOLISHED

[Note to compiler: (05/01) List the buildings and structures to be demolished or partially demolished, together with any further requirements.]

Address	Description	Drawing NO.	Ref. No.	Requirements

[The column headed 'Requirements' is available for including such instructions as:]

- (i) Restrictions on when buildings, etc. can be demolished, or partially demolished.
- (ii) Any particular precautions to be taken during demolition.
- (iii) Extent of demolition.
- (iv) Method of filling voids.
- (v) Material to be retained.
- (vi) Treatment of adjoining properties, waterproofing, etc.
- (vii) Identification of any hazardous materials, cross referenced to Appendix 2/5.

NG SAMPLE APPENDIX 2/2: FILLING OF TRENCHES AND PIPES

[Note to compiler: If it is wished to vary the requirements of sub-Clause 201.3, state the particulars in this Appendix.]

Examples are:]

- (i) Removal of pipes, services, etc. over 1 m below formation.
- (ii) Filling of pipes over 1 m below formation.
- (iii) Backfilling of trenches.
- (iv) Retention of pipes, services, etc. within 1 m of formation.

NG SAMPLE APPENDIX 2/3: RETENTION OF

MATERIAL ARISING FROM SITE CLEARANCE

[Note to compiler: The following is a list of more common materials arising from site clearance and should be amended and developed as appropriate.]

Description	Location	Delivered to:	Requirements
Kerbs, quadrants Paving Setts Chamber covers Gully gratings & frames Gates and fencing Safety fence components Traffic signs Bollards Road studs Traffic signals Road lighting columns Luminaires Electrical equipment Communications equipment Cables Timber arising from trees			

[The column headed 'Requirements' is available for including such instructions as:]

- (i) Disconnection of electrical supplies.
- (ii) Transportation of equipment.
- (iii) Stacking/storage of material.
- (iv) Reinstatement of voids left by removal of equipment.

NG SAMPLE APPENDIX 2/4: EXPLOSIVES AND BLASTING

[Note to compiler: Insert the following text as appropriate, amended and extended as required:]

- 1 The Contractor's attention is drawn to the measures for the control of noise and vibration which are included in Appendix 1/9.
- 2 Explosives shall not be used in the following locations:

.....
.....

NG SAMPLE APPENDIX 2/5: HAZARDOUS MATERIALS

[Note to compiler: Insert, where appropriate, the following text, amended and extended as required:]

- 1 The environmental health authority and/or the Health and Safety Executive have given/agreed the following specific requirements for dealing with the hazardous materials identified in Appendix 2/1:

Drawing Number	Reference Number	Specific Requirements by <i>[insert name and address]</i>

SERIES NG 300

FENCING

Contents

<i>Clause</i>	Title	Page
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NG 302	Requirements for Temporary and Permanent Fences	2
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NG 308	Gates and Stiles	5
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NG	Sample Appendix	8

FENCING

NG 301 Not Used

NG 302 Requirements for Temporary and Permanent Fences

1 Clause 302 sets out the action to be taken by the Contractor, drawing particular attention to the requirements for temporary fencing in all situations where he does not provide permanent fencing immediately.

2 There may be specific temporary fencing requirements for a particular location during the construction period, eg. to isolate a semi-permanent diversion of a public right of way or a Statutory Undertaker's works or Apparatus. Such fencing should be shown on the Drawings. The Contractor is obliged to provide all temporary fences required for safety and security as a result of his particular method of working, and maintain such temporary fencing during the period of the Works.

NG 303 Temporary Fencing

1 A range of temporary fencing has been included which will cover the majority of situations arising where permanent fencing is not immediately erected.

2 The types of fencing have been selected from the range in BS 1722 and are of a quality which will provide a fence strong enough to protect property and be economical in

repetitive use when the need arises. The high standard should encourage the immediate provision of permanent fencing, although this is not always practical because of the possibility of damage to the permanent fencing during the progress of the Works.

3 The height of the fence in the range selected may have to be increased or, it may be considered excessive for the purpose it has to perform. Any further requirements or relaxation should be described on the Drawings.

NG 304 Timber Quality

1 Stress grading rules are based on rectangular sections but it is permissible to process trapezoidal sections for fencing, without re-grading, from rectangular sections, as long as the processing does not remove more than 10% of the cross-sectional area. Alternatively the trapezoidal section may be machine graded using machine settings applicable to the thickness and largest width dimension of the trapezoid.

2 Advice on the identification of suitable species for preservation treatment of posts and rails can be found in BS 5589.

NG 305 Not Used

NG 306 Permanent Fencing

1 Only one type of wooden fence, and one type of dropper fence have been chosen within the British Standard range and these are shown in the RCD. This national standardisation avoids

the need to keep a multitude of stocks and enables suppliers and fencing sub-contractors to hold stocks of material to the correct dimensions for new and replacement purposes.

2 The types of fence in the RCD should be sufficient to meet all environmental and amenity factors and the chosen design which should be decided after consultation with the Overseeing Organisation should fit visually into each distinctive stretch of country, each situation having its appropriate type of fence. Wherever a change of fence type is made, the transition point should be carefully selected to coincide with a convenient feature which will give a logical reason for the change in fence design.

3 Where a motorway is bordered by farm land, (the Overseeing Organisation in Malta) undertakes in the fencing covenant to provide and maintain a sufficient fence or wall, to provide cattle and sheep(including lambs) and, at the request of the vendor, horses and pigs, from straying on the motorway. Although motorway fences are sited on Road land it is not always possible to carry out the erection within the boundary. Consideration should be given to obtaining an easement so that the erector can encroach on the adjoining land both for initial erection and any subsequent maintenance, including the maintenance of mesh provided for the security of animals such as badgers.

4 Where additional stock proofing is required; the following options should be considered;

- (i) Timber Fence

Fencing wire stapled to the field side of the fence as follows:

- (a) one barbed wire above the top rail;
- (b) two lower wires, barbed or plain as described, one below the bottom rail and the other between that rail and the next above; alternatively, a fifth timber rail may be provided as shown in the RCD

(ii) Dropper Pattern Fence

- (a) one barbed wire fixed, with tie wires every 450 mm, to the top wire of the 1.35 m fence;
- (b) one barbed wire fixed as in (a) to the third from top wire of the 1.35 m fence;
- (c) provision of a 1.80 m fence when there is a possibility of there being deer on adjacent land but;
- (d) provision of a 2.10 m fence when deer are on adjacent land in large numbers.

However, the views of the landowner should be sought before deciding on the position of barbed wire because practice varies over the country.

If horses are being contained it may not be satisfactory to fix barbed wire at a low level.

5 The requirement for spacing straining posts at intervals not exceeding 300 m and intermediate posts at 7.5 m centers for dropper pattern fences should be waived in the following circumstances:

- (i) Undulating ground. When the fence

line is straight but varies in level, straining posts should be provided at the summits and valleys of the slopes and the requirement for these additional straining posts should be stated in Appendix 3/1 or on the Drawings.

When the ground is uneven under the line of the fence it is suggested that the ground be trimmed, particularly if the fence is desired to be shockproof, and that this requirement be included in Appendix 3/1.

- (ii) Horizontal alignment. When the alignment of the carriageway is on a horizontal curve, the curve cannot be followed with dropper pattern fencing. In such cases the distance between the straining posts should be divided into a series of straights, depending on the sharpness of curvature, and turning posts should be erected at each change of direction. For instance with the desired minimum radius of 1020 m it is suggested that 3 turning posts be included between straining posts at 75 m centres. The angle of change of direction at a turning post should not be more than 135°.

The land take should reflect the need to erect this type of fence in a series of straights.

- (iii) Sharp change of direction. It is recommended that two straining posts be provided instead of using one

6 Wire dropper fencing will often have been chosen because of its capacity to blend into the landscape, and so plastic coated wire and posts have been chosen as the standard. The fittings should also be unobtrusive; preferred fittings are included in the RCD.

In choosing the fittings required the following points should be noted and where appropriate included in Appendix 3/1:

- (i) The fittings on intermediate posts should allow the strained wires to be free running.
- (ii) The size of the holes drilled in the posts should be to the appropriate dimensions for the fittings chosen and surplus holes should be filled with grommets.
- (iii) Plastic coated wire which has exposed galvanizing should be painted with plastic paint.
- (iv) External ratchets, droppers and other fittings should be coated with plastic paint.
- (v) Breaks in straining wires can be repaired by untensioning, fixing a wire vice fitting, as shown on the RCD, and retensioning.

7 The Drawings should show where fencing is required, and the position, length and height for each type of fence. Appendix 3/1 should include any further details required.

8 Foundations to posts for wooden post and rail fences can be either rammed backfill or concrete mix ST 2, unless otherwise specified in Appendix 1/15 or Appendix 3/1 (see RCD Drawings H3 and H15).

9 Where fencing for the protection of planted areas is required, the type of fence may be

selected from the options shown on HDC Drawing Numbers H3, H39, H40, H43 and H44. Where animal security fencing is required, an appropriate mesh can be selected from RCD Drawing Numbers H46, H47 and H48. The choice of mesh shall have regard to the need to minimise the number of fences and the number of mesh attachments.

10 If the fence is to be secured against rabbits and/or badgers, the method should be described in Appendix 3/1, together with the method of securing the turned-out portion of the fence. The location of the fence should be given careful consideration such that access for installation and future maintenance is available. Option (iv) is the least effective barrier to rabbits but it may be necessary to specify this, for example, where it has not been possible to obtain the relevant easement to the side of the fence facing the rabbit harbourage.

NG 307 Permanent Fencing for Accommodation Works

1 Landowners select the type of fencing for boundaries except those on motorway schemes. Nevertheless they should be encouraged to choose a type from the RCD or BS 1722, which, if it has to contain stock must be adequate for the purpose. Agreed requirements should be described in Appendix 1/15, or shown on the Drawings.

NG 308 Gates and Stiles

1 The location and details of construction of gates and stiles should be shown on the Drawings. Reference should be made to the RCD wherever possible. Where access gates are to be provided in a length of fencing that incorporates wildlife mesh, the underside of the gate shall include security measures such as a concrete plinth.

NG 309 Not Used

NG 310 Not Used

NG 311 Preservation of Timber

1 Where natural durability is to be used to ensure the required service life without treatment, reference should be made to MSA EN 350-2 which classifies different timber species according to their natural durability. European standards also provide methods for the specification of preservative-treated timber. These are presented in terms of the results of the treatment rather than the process used to treat the timber. The preservatives to be used are described in terms of their performance in test rather than the composition of the formulation. MSA EN 335-1 defines service environments for timber in use in terms of biological hazard classes and these are used to describe preservative types. A hazard class 4 preservative is used to protect timber in ground contact and therefore satisfies all the mandatory test requirements specified for such a preservative in MSA EN 599-1. However, there are additional optional tests included in MSA EN 599-1 to give greater assurance of performance. Clause 311 includes one of these, namely the ground contact field test described in BS 7282, as an additional requirement. The results of the treatment are specified according to the requirements of MSA

EN 351-1 by defining the penetration and retention of the preservative in the treated wood and the sampling system that must be used to demonstrate compliance.

2 Inspection of the timber before preservative treatment is of the utmost importance and arrangements should be made for this to be carried out for each scheme. The extent of permitted defects generally is defined in the relevant British and European Standards indicated in Clause 304. Rejection of timber due to defects affected by moisture content, ie. 'checks' and 'splits' can only be enforced when the timber is within the specified moisture content range. This is only certain before preservation treatment and before the timber is subjected to the uncontrolled conditions on Site. It is not satisfactory to inspect the material for quality control on delivery to Site except in respect of physical defects which are unaffected by moisture content.

3 Since the level of protection afforded by preservative treatment is now defined by required levels of retention and penetration in the treated timber, it is no longer necessary to include methods of treatment in the specification. However, it is anticipated that vacuum/high pressure methods of treatment will be required to achieve the retentions and penetration specified. Equally, the moisture content of the timber can be critical when attempting to treat timber in this way to the specified requirements. It is, therefore, advisable to ensure that the timber is at a moisture content of 28% or less before preservative treatment is carried out. To achieve this moisture content,

freshsawn timber should be cut to the required sizes and open-stacked, preferably under cover, for a period that will depend on climate, weather and timber species. Alternatively, the timber can be kiln dried.

4 If timber moisture content is to be assessed, the moisture meter offers a quick practical and convenient method (see prEN 13183-2). Electrical resistance-type moisture meters should always be used in accordance with the manufacturer's instructions. Meters should be suitably calibrated before each use against a calibrated meter or oven-dried sample.

5 The moisture meter test results can be confirmed by oven-drying tests (see prEN 13183-1). This is particularly desirable in any case where there is the possibility of dispute. However, the non-destructive method of sampling (moisture meter method) should normally be used.

6 Quality control at all stages of the process is essential. Clause 7 of MSA EN 351-1 contains recommendations on suitable factory production control procedures. Normally, direct testing shall be used to check compliance with penetration and retention specifications. MSA EN 351-1 includes definitions of permeable and resistant timbers, enabling the AQL to be established. MSA EN 351-2 includes guidance on the sampling scheme and the penetration pass/fail criteria for different AQLs. To demonstrate that the specified sapwood retention has been achieved, the analytical zones (i.e complete sapwood portion) of all the borings taken to determine penetration should be combined and converted to an appropriate homogeneous form for chemical analysis. For all penetration and retention determinations suitable methods of analysis are required.

7 If a CCA preservative has been applied, a spray reagent (described in BS 5666 : Part 2)

can be used to detect its presence and to reveal the extent of the penetration in the samples taken for this purpose. Suitable methods of analysis to determine the retention of CCA preservatives are described in BS 5666 : Part 3. If creosote has been applied, its dark colour provides the necessary indicator of its presence and penetration. A method of analysis to determine retention is described in EN 12490. For other preservatives, suitable methods of analysis should be obtained from the preservative manufacturer.

8 If the manufacturer has demonstrated to the satisfaction of the specified that a safe relationship exists between the achievement of the required penetration and retention and measurable features of the treatment process, the manufacturer can use these measurable features to demonstrate compliance. In MSA EN 351-1 this is referred to as the indirect method. However, if this approach is established, the manufacturer shall demonstrate the correctness of the relationship to the specified during random, unannounced checks initiated by the specified.

9 If the indirect testing approach is established and the treatment process parameters are used to demonstrate compliance, the only way to ensure that each treatment process has been carried out as required is to witness the treatment. If exceptionally this is not done, it is necessary to accept the assurance of the treated, embodied in a certificate of treatment that should be provided with each batch. It may be that a batch of inspected timber, because of variations in the Contractor's programme, is sent to

another scheme. In such cases, suitable arrangements should be made regarding inspection of the subsequent batch destined for the initial scheme.

10 Timber should not be dispatched to site until it is at least surface dry. When "wet" timber is received on site, it should be stacked on cross-bearers, with crossbearers between bundles and not used within seven days of being treated. Treatment with a water-borne preservative saturates and swells the timber. If subsequent drying is carried out too rapidly, extensive splitting can occur. To prevent this, slow drying, preferably under controlled conditions, is essential. The degree of necessary drying is largely dependent on the local prevailing weather conditions.

11 If there is any doubt over the quality of preservation in a treated batch supported by indirect testing, the direct testing system can be applied.

NG 312 Painting of Timber Fences, Gates, Stiles and Posts

1 Appendix 1/15 should contain the details of accommodation works required in the Contract and should include the type and colour of paint required for fencing and gates. If preservation treatment is not required this should also be stated.

2 Requirements for the use of water borne acrylic paints or alkyd-acrylic paint instead of oil based paints should be given in Appendix 3/1.

3 Paint containing non-toxic constituents should be specified for use where the painted surfaces are accessible to animals.

NG SAMPLE APPENDIX 3/1: FENCING, GATES AND STILES

[Note to compiler: Include here:]

1 Temporary Fencing

- (i) Requirements for temporary fencing if different from requirements of sub- Clause 302.1 and 303.1.
- (ii) Timing of removal of temporary fencing if different from sub-Clause 302.2.
- (iii) Requirements for any preservation treatment to temporary fencing. *[303.3]*

2 Timber Quality

- (i) Requirements for timber if different from the requirements of sub-Clause 304.2.

3 Fittings

- (i) Requirements for bolts, screws and nuts if different from the requirements of sub-Clause 305.1.

4 Permanent Fencing: Wooden Fencing, Gates and Stiles including Planting Works Fencing

- (i) Flowing alignment and trimming ground to regular level on fence line.
[Location. Only included when necessary.]
- (ii) Requirements for joining permanent fencing to existing hedges, fences and to other structures if different from the requirements of sub-Clause 306.1.
- (iii) Details of additional stockproofing required. *[Location and details]*
- (iv) Details of painting required *[Only included when the compiler wishes to specify painting specifically.]*
- (v) Concrete surround to base of posts. *[Location. Included when the compiler wishes to specify concrete footings for post and rail fencing as shown on RCD drawing no. H3]*

and H15.]

- (vi) Details of type of Planting Works Fencing. *[Location and details]*
- (vii) Details of security treatment below wildlife mesh. *[Location and details]*

5 Permanent Fencing: Wire Dropper Fencing

- (i) Flowing alignment and trimming ground to regular level on fence line. *[Location. Only included when necessary.]*
- (ii) Requirements for joining permanent fencing to existing hedges, fences and to other structures if different from the requirements of sub-Clause 306.1.
- (iii) Details of additional stock proofing required. *[Location and details]*
- (iv) Requirements for painting with plastic paint in accordance with sub-Clause 306.3.
- (v) Zinc coated wire only. *[Only included when departing from standard zinc and plastic coating]*
- (vi) Details of fittings required. *[Preference is for hidden ratchet and wire vice an droppers and other fittings painted with plastic paint.]*
- (vii) Spacing of posts and requirement for turning posts. *[Location.]*

6 Wire Mesh to Permanent or Existing Fencing

- (i) Details of wire mesh attachments to fencing including the appropriate side of an existing fence to which the mesh is fixed. *[Location and details]*
- (ii) Treatment of turned out portion of netting. *[Location and details]*

7 Badger Gates

- (i) Details of requirements for badger gates including whether two-way gates are required. *[Location and details]*

8 Fenced Tree Guards

- (i) Details of requirements for fenced tree guards. *[Location and details]*

9 Preservation of Timber

- (i) Details of preservative to be used if different from sub-Clause 311.2(i). *[Location and details]*

10 Other

- (i) Colour of plastic coating to high tensile wire. *[2605.3]*

SERIES NG 400

SAFETY FENCES, SAFETY BARRIERS AND PEDESTRIAN GUARDRAILS

Contents

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SAFETY FENCES, SAFETY BARRIERS AND PEDESTRIAN GUARDRAILS

NG 401 Performance Criteria for Safety Fences and Safety Barriers General

1 The safety fences and barriers described in this Series and in the RCD: Section 2 are deemed to meet the criteria given in Clause 401. Other fences and barriers may be acceptable provided they comply with Clause 401 and Clause 104.

2 Standard layouts and details, including fabrication requirements for safety fences and safety barriers are shown in the RCD: Section 2.

3 The use of Double Rail Open Box Beam (DROBB) safety fence requires additional clearance distances.

NG 402 Components for Safety Fences and Safety Barriers

Contract Drawings

1 Appendix 4/1 should contain a schedule of all the safety fences and barriers required in the Contract. Where operational needs do not determine this choice, the type of safety fence already provided on adjacent lengths of Road should be considered and/or advice sought from the Overseeing Organisation. The Contract should include the relevant drawings shown in the RCD: Section 2.

2 The Drawings should also show the type of intermediate post foundation, (ie. standard driven, long driven, or concrete), which has been selected on the basis of assumed, or wherever possible, tested ground conditions. Where it is anticipated that Wire Rope Safety Fencing may be used attention is drawn to the smaller reaction

plate used with this type of fence and the effect on the lateral resistance of the fence post should be considered.

Welding

3 Prior to the anticipated start of delivery of safety fence components, the Contractor should obtain copies of the most recent certified destructive test reports covering those component types to be supplied under the Contract.

4 Sample components and/or joints for destructive testing should be selected by a Welding Inspector certified by the Certification Scheme for Weldment Inspection Personnel (CSWIP) or equivalent. Selection should be made taking into account the manufacturer's inspection reports, previous destructive test reports and observations of current production practice on similar component types. Where practicable samples should be selected on the basis that they represent the lower end of quality in the production batch. Particular attention should be given to any features which could adversely affect the true throat size or the mechanical properties of the materials.

5 Sample components and/or joints selected for destructive testing should be indelibly marked and dispatched to a testing laboratory appropriately accredited by MSA for such tests.

6 The following points should be considered when ascertaining the acceptability of components subject to destructive testing:

- (a) When conducting destructive testing, each length of weld between weld ends or changes of direction should be

sectioned at intervals not exceeding 100 mm. One side of each section should be ground, filed, finished or machined to a finish equivalent to that produced by a 120 grit paper complying with BS 871, so that the actual throat and leg dimensions can be measured and any discontinuities exposed. One nick break test in accordance with BS 709 on a length of weld of not less than 50 mm shall be made for each joint type on each component. Additional sections and nick break tests may be required in cases of borderline acceptance. Non-compliance with the imperfection acceptance levels of MSA EN 288 : Part 3 should be recorded. Noncompliance with the requirements of sub-Clause 402.5 should be cause for rejection, except that in sub-Clause 402.5 (iv) (a) the throat and leg dimensions should be the true rather than the apparent dimensions.

- (b) One representative section from each joint type for each type of component should be prepared for macro-examination. A hardness survey should be done where any of the parent material thickness exceeds 20 mm. An additional macro-examination should be made of each non-conforming weld.

7 The results of the destructive tests including macrographs should be reported and a certified copy sent to the manufacturer. In the event of non-conformances being found, the Contractor and manufacturer should be notified as soon as possible. The test specimens, uniquely identified by hard stamped marks should be returned to the manufacturer's works.

NG 403 Installation of Safety Fences

1 The principal types of safety fences and

barriers recommended for use on major roads are classified according to their functional properties. The Overseeing Organisation should be consulted when considering whether safety fences or safety barriers should be provided.

2 Further information on the general design and use of safety fences and barriers may also be obtained from the Overseeing Organisation.

3 Adjustments to line and level of safety fences at connections to bridge parapets may be necessary as noted in the RCD: Section 2.

Anchorage and Attachment Systems

4 Examples of the evidence required by sub-Clause 403.9(i) include (a) the results of testing to BS 5080 by a testing laboratory accredited by MSA for such test or (b) a Certificate from any UEAtc member together with the results of testing to the European Union of Agrément Directive for Assessment of Anchor Bolts MOAT No. 42 (adapted to include only anchorage types permitted by the Specification). If the 4 week time period required by sub-Clause 403.9 is unrealistic then the appropriate time period should be stated in Appendix 4/1.

5 Anchorages for securing surface mounted posts which utilise drilled holes have been known to fail due to either the lack of cleanliness of the hole or the excessive tolerance in the size of the hole. The manufacturer of the anchorages should provide details of the maximum tolerances permitted and the evidence submitted in accordance with sub-Clause 403.9(i) should show that these are satisfactory when installed in holes having these tolerances.

6 Where anchorages and attachment systems are used, the bolts or nuts should be tightened adequately, in accordance with the manufacturer's instructions, to ensure that

effective shear transfer will occur between the post baseplate and the base. In addition, it is important to ensure an adequate length of thread engagement. The surrounding concrete should be appropriately reinforced to prevent shear cone failure, particularly where anchorage is close to the edge of the concrete.

7 Where safety fence posts are to be installed on bridge decks an anchorage and attachment system should be used. Care should be taken to avoid damaging bridge deck waterproofing systems when installing anchorages in drilled holes. Normally, an anchorage and attachment system which avoids this problem should be used. In exceptional circumstances, where damage to the waterproofing is unavoidable a compatible sealing system agreed with the Overseeing Organisation to prevent ingress of water and avoid corrosion should be provided.

8 Where safety fence posts are installed on hardened central reserves, the preferred method is by the use of cast-in post sockets. The filler, where used, should prevent the ingress of water and detritus and should be easily removable. Alternatively a sealing cap approved by the Overseeing Organisation may be used.

NG 404 Site Testing

Anchorage in Drilled Holes

1 The anchorage test results should be included with the as-built records.

Post Foundations

2 Testing should be carried out at the location where the posts are to be installed and at a time when the ground is likely to have least resistance.

3 Appendix 4/1 should identify whether the Overseeing Organisation or the Contractor will provide the test equipment and carry out the tests, and details of the test posts and foundations should be shown on the Drawings where appropriate.

NG 405 Not Used

NG 406 Not Used

NG 407 Not Used

NG 408 Not Used

NG 409 Wire Rope Safety Fence

1 Tensioning of interwoven ropes to achieve the correct level of tension throughout the length of the rope may be difficult when there is a tight radius and close post spacing. It has been found that the correct level of tension may be obtained by applying a tensile force of 120% of that required and vibrating the wires by gently tapping the posts with a soft faced mallet. This accelerates the creep and distribution of the tensile force by reducing the friction between the posts and the interwoven ropes. When a tensile force of between 100% and 120% is recorded along the whole length of the rope the procedure is complete.

2 Turnbuckles should be lubricated before assembly to facilitate adjustment and/or removal during maintenance or repair of the safety fence.

NG 410 Not Used

NG 411 Concrete Safety Barriers

1 Temporary Vertical Concrete Safety Barriers (TVCB(80)) as shown in the RCD: Section 2 are for use during construction and maintenance works where the road is subject to a speed limit not exceeding 80 km/h.

2 Temporary Vertical Concrete Safety Barriers can be provided by:

- (i) The Contractor as part of Temporary Works and remaining his property.
- (ii) The Contractor but becoming the property of the Overseeing Organisation on completion of the Works.
- (iii) The Overseeing Organisation for the Contractor's use during the Works.

Appendix 4/1 should state which of the above applies, and where appropriate, details of locations from which they can be collected and/or returned.

3 A Temporary Vertical Concrete Barrier (TVCB (110)) with enhanced performance suitable for use with a speed limit not exceeding 113 km/h is also available.

Details of this type of barrier may be obtained from the Overseeing Organisation. Such use should be agreed with the Overseeing Organisation on a site specific basis.

4 A Temporary Higher Vertical Concrete Barrier (THVCB) suitable for the protection of bridge piers and temporary structural supports is available for use where the road is subject to a speed limit not exceeding 80 km/h. Details of this type of barrier may be obtained from the Overseeing Organisation. Such use should be agreed with the Overseeing Organisation on a site specific basis.

5 A Permanent Higher Vertical Concrete Barrier (HVCB) suitable for the protection of bridge piers and other structures/locations is available for use where the road is subject to a speed limit not exceeding 113 km/h. Details of this type of barrier may be obtained from the Overseeing Organisation. Such use should be agreed with the Overseeing Organisation on a site specific basis.

NG 412 Pedestrian Guardrails

1 The type and the location of pedestrian guardrails should be described in Appendix 4/2.

NG SAMPLE APPENDIX 4/1: SAFETY FENCES AND SAFETY BARRIERS

Sheet 1

[Note to compiler: Include here:]

1 The locations of safety fences and barriers are shown on Drawings Nos
[generally the 1:500 or 1:1000 Site Plans]

2 The layout details for safety fences and safety barriers are shown on Drawings Nos
[RCD: Section 2 Drawings should be utilised where possible]

3 Fabrication and erection requirements for safety fences are shown on the following Series of Drawings. Appendix 0/4 gives the full list of these Drawings included in the Contract:

Tensioned Corrugated Beam (TCB) Safety Fence	RCD: Section 2, - GA and SF Series
Open Box Beam (OBB) Safety Fence	RCD: Section 2, - GA and SF Series
Double Rail/Single Sided Open Box Beam (DROBB) Safety Fence	Available from Overseeing Organisation
Untensioned Corrugated Beam (UCB) Safety Fence Series	RCD: Section 2, - GA and SF Series
Combined Open Box Beam (OBB) Safety Fence and Environmental Barrier	RCD: Section 2, - EOB 38 Series
Wire Rope (WR) Safety Fence	Promoter's approved drawings
Rectangular Hollow Section (RHS) Safety Fences	RCD: Section 2, - RHS47 and RHS48 series

4 Concrete Safety Barriers

[Note to compiler: State here:]

- (i) Who is to provide Temporary Vertical Concrete Safety Barrier (TVCB).
- (ii) Type of Temporary Vertical Concrete Safety Barrier to be used.
- (iii) Location for removal of Temporary Vertical Concrete Safety Barrier on completion of the Works.
- (iv) Location(s) from which Temporary Vertical Concrete Safety Barrier is to be collected and returned by the Contractor if provided by Overseeing Organisation.

SAMPLE APPENDIX 4/1: SAFE TY FENCES AND SAFETY BARRIERS

Sheet 2

5 Schedule of Safety Fences and Barriers

Safety Fence/ Barrier Type	Location & Start Chainage (m)	Finish Chainage (m)	Position on Cross) Section	Length (m)	End Termination Connection Detail		Foundation Type	Post Spacing (m)	Other Comments
					At Start	At Finish			

NOTE: eg. Road name

NG SAMPLE APPENDIX 4/1: SAFETY FENCES AND SAFETY BARRIERS

Sheet 3

- 6 Other Details *[to be included as required]*
- (a) Any special requirements for materials, fabrication and installation
 - (b) Any special requirements for post spacings, lengths of closing beams or mounting brackets
 - (c) Any special welding of components required
 - (d) Any non-standard connections to bridge parapets, other safety fences, barriers or other structures
 - (e) Any requirements for non-standard posts
 - (f) Any special requirements for setting out details
 - (g) Any requirements for special beam or attachment fabrications for use on radii
 - (h) Any special requirements, including locations, for expansion joints in safety fences
 - (i) Details of testing requirements for anchorages and attachment systems, posts and foundations *[cross referenced in Appendix 1/5]*
 - (j) Whether cast-in post sockets are to be filled after erection *[403.6]*.

Schedule of Safety Fences and Safety Barriers

[Note to compiler: Schedule within Appendix 4/1 all the safety fences and barriers required using the headings on Sheet 2]

NG SAMPLE APPENDIX 4/2: PEDESTRIAN GUARDRAILS

[Note to compiler:

Details should be given here of locations and type of pedestrian guardrails required. Cross-reference may be made to the Drawings where appropriate.

DRAINAGE AND SERVICE DUCTS

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DRAINAGE AND SERVICE DUCTS

NG 501 Pipes for Drainage and Service Ducts

1 Pipes can be made of materials that deflect relatively little under load before cracking (rigid pipes) or of materials that will tolerate large deflections under load before inward buckling occurs (flexible pipes). Flexible joints enable either type of pipe to take up differential settlement within the ground.

2 The Specification includes a wide range of pipe materials. The Contractor should normally be offered in Appendix 5/1 the full selection of alternative pipe and bedding combinations determined in accordance with Advice Note HA 40 as detailed in the RCD for pipes up to 900 mm internal diameter. The required pipe stiffness and impact resistance for plastics pipes should be specified in Appendix 5/1. The requirements for thermoplastics pipes and fittings will normally be as in Clause 518 with raw material and quality control requirements as in NG 518. Piped culverts up to 900 mm internal diameter shall be specified in Series 500. Drains, box culverts, piped culverts (and other drains) of clear span or internal diameter exceeding 900 mm are subject to Overseeing Organisation's technical approval and shall comply with Series 2500. A box culvert should not be specified where either a (concrete) box culvert or a (corrugated steel) piped culvert would be technically acceptable. Wherever possible, the Contractor should be offered a choice and the Overseeing Organisation should be consulted during the scheme preparation. Box culverts, piped culverts (and other drains) of clear span or internal diameter exceeding 900 mm are structures subject to the Overseeing Organisation's technical approval. Care should be taken to ensure that there are no inconsistencies between any specific requirements included in an outline Approval in Principle form and the general requirements of Series 500. Where necessary, Contract-specific amendments should be included in Appendix 0/1 or 0/2 to achieve consistency. Most of the pipes included in the Specification will normally be satisfactory from the hydraulic flow capacity factor. However some products, especially corrugated pipes, can vary from the norm (e.g. clay/ concrete) and between manufacturers. The effect of a rougher pipe should be considered on the system as a whole and not just on the length in question. A pipe that is

not acceptable on a straight exchange basis may be acceptable if diameters on adjacent lengths are adjusted. Appendix 5/1 should provide the basis on which the Contractor is to submit his proposals for pipe types and makes.

3 Any tendency to attack by acidic ground water or sulphates present in the backfill or the ground should be taken into account when the use of concrete, asbestos cement, steel or iron pipes is being considered for inclusion in the schedule of acceptable alternatives in Appendix 5/1. The advice described in Clause NG 1704 should be considered regarding the risk of thaumasite sulphate attack on concrete used in drainage. When acid soils (pH less than 6.5) are encountered, expert advice should be sought. There is some evidence that pipes made of sulphate-resisting cement and asbestos cement pipes will tolerate a pH as low as 6.0. The limiting value may be reduced to pH 5.5 when a bitumen coating is applied to the pipe. Sulphate attack on concrete is dealt with in Building Research Establishment Digest 363. Asbestos cement pipes will tolerate the same order of sulphates as concrete made from sulphate-resisting cement. More detailed information may be obtained from the manufacturers. Protection to the lower third of the inside of corrugated steel piped culverts by means of an asphalt or in situ concrete coating will be required where stones and rocks are likely to be carried by the flow. Iron pipes are treated with a pitch or bitumen coating and have high durability in most soils, but when acid conditions are known to be present the additional protection of a polyethylene sleeve is desirable. Clay, GRP, pitch fibre and PVC-U pipes are resistant to a wide range of groundwater chemicals.

4 For corrugated steel pipes of lock seam fabrication with a diameter not exceeding 900 mm, the specification of metal thickness should be given in Appendix 5/1. The tables issued by manufacturers recommend thicknesses that correspond to the diameter and depth of fill above the pipe.

5 Pipes of more than one type within any individual drain or service duct between consecutive chambers will be exceptional. Whatever the circumstance giving rise to the proposal, consideration should be given to whether the joint between the two pipes

will provide an appropriately watertight joint and a smooth inner transition for rodding purposes.

6 Plastics pipes may deteriorate after a long period in sunlight. Where pipes have been manufactured and stored before being delivered to the Site, it may be necessary for the Contractor to cover them until they are installed.

7 Any individual cable duct under a road may have to accept a power or communication cable although these are normally placed in separate ducts. Certain pipe materials have been excluded from the Specification for use as ducts because cables cannot be readily drawn through them. Clauses NG 518, NG 1421 and NG 1530 give further information on the use of ducts for electrical work. Ducts should be scheduled in a similar way to pipes in Appendix 5/2. Any special requirements of Statutory Undertakers etc. should be stated clearly.

8 Trenchless and minimum dig installation is the means of installing, replacing and renovating pipes, ducts and small tunnels with minimal or no excavation from the surface. MCHW 5, Series 8000 covers the requirements for trenchless and minimum dig installation of highway drainage, service ducts, sleeves and culverts up to and including 900 mm nominal internal diameter or width. The information required from the designer/compiler that will detail the performance required from the trenchless installation should be given in NG Sample Appendix 80/1 (MCHW 5.8.3).

NG 502 Excavation for Pipes and Chambers

1 In the preparation of Appendix 6/3, it may be considered appropriate to permit battering of slopes where this would not affect adversely the Permanent Works or the basis of structural design of the pipe/ trench.

2 In the event of excavation to a greater depth than necessary the Contractor is obliged to reinstate. The use of mix ST1 concrete to remedy excess excavation should be restricted to areas where compaction is impracticable. Where the floor of the trench passes through a localised area of disturbed and uncompacted soil or softened clay further excavation and replacement with appropriate material may be required to allow pipe laying to proceed.

3 Where pipes are to be installed beneath heavily trafficked existing roads, etc, where it is undesirable that the existing ground surface should be disturbed, consideration should always be given to the possibility of inserting the pipe by suitable thrustboring or jacking processes.

NG 503 Bedding, Laying and Surrounding of Pipes

1 Pipe bedding material should be readily obtainable since a wide grading envelope is permitted including most gradings complying with BS 882. It needs to flow readily and compact uniformly, thus a low coefficient of uniformity is necessary. In order to make savings in coarser granular materials a sand bed may be adopted. Surround to pipes should be in bedding material or acceptable material (Class 8) as appropriate to the alternatives shown in the RCD. Coarse granular material may consist of natural aggregate, recycled coarse aggregate, recycled concrete aggregate, artificial or blended combinations of these aggregates, which satisfy the requirements of the specification.

2 A distinction is to be made between the requirements of bedding, haunching and surrounding and those of backfilling. The former comprise all operations of trench fill up to a level 300 mm above the top of the barrel of the pipe. Backfilling constitutes the remaining operations up to ground level in verges and on ground and up to formation or sub-formation level under carriageways. Work above formation level constitutes construction or reinstatement of the pavement (see NG 706).

3 Concrete surround should be used exceptionally, e.g. for protection of pipes against mechanical damage from subsequent operations after construction of the pipeline and where remedial measures due to over excavation are required. Protection of existing pipes where necessary may take the form of a concrete arch or slab above the pipe.

NG 504 Jointing of Pipes

1 Pipe joints for surface water drains, unlike foul drains, do not always have to be completely watertight. Small amounts of seepage as allowed in sub-Clause 509.7 can be tolerated particularly where pipes are laid in cuttings or below the water

table. However, joints in pipes in soils that are predominantly fine sands or coarse silts should have watertight joints to prevent soil particles passing through the joint into the pipe leaving voids on the outside of the pipe. Where fine sands or coarse silts might be a problem but the more expensive rubber ring flexible joint is unwarranted, consideration can be given to certain proprietary wrap type joints that are available. These may also be specified where root penetration needs to be prevented. Requirements should be given in Appendix 5/1.

2 Most watertight joints will be flexible joints although rigid joints are occasionally used on clay pipes. In and under embankments, or if differential settlement is expected in compressible soils subject to non-uniform loading, then flexible joints and (except for pipes below the water table laid in non-erodible soils) watertight joints should be specified. The maximum length of pipe between flexible joints may have to be limited where considerable movement is expected. The limits of the exclusions should be shown in Appendix 5/1.

3 Culverts are generally considered to be drains but they do not necessarily require watertight joints. Where watertight joints are required for culverts this should be stated in Appendix 5/1.

NG 505 Backfilling of Trenches and Filter Drains

1 Type A material is intended for sub-soil drainage. The Specification allows a wide range of materials so that local sources may be used as far as possible. When soils to be drained require a particular grading of filter aggregate it can be specified under the heading Type C in Table 5/5. The design should be based on knowledge of local sources of supply that give guidance on the design of filter materials. Type B material is intended for use where the drain is designed to intercept surface water flowing to the pipe. Grit from the carriageway may slowly block this type of filter and it may require cleaning or replacement periodically. Where filter drains are located close to carriageways and are likely to be overrun by traffic, methods of preventing the problem of 'stone scatter' should be considered. Some possible solutions are shown on RCD Drawing Number B15.

2 Filter drains can be constructed by machines that excavate the trench, support the sides, lay the pipe

and backfill with filter material in one operation. The trench is normally constructed with a semi-circular floor providing a most effective support to the pipe without further bedding. As contamination of the filter material is minimized by the supporting shutter attached to the machine a much narrower trench than that achieved by conventional excavation is possible.

NG 506 Not Used

NG 507 Chambers

1 Concrete chambers, precast or cast in situ against forms, do not require strengthening with additional concrete surround. Access shafts in precast concrete should be strengthened, however, as a protection against loads from backfilling operations. Brick chambers, including shafts do not need a concrete surround for strengthening. It may however be necessary to backfill with concrete where space is insufficient to permit compaction of one of the earthwork's acceptable materials. Inspection chambers are those that can be maintained from the surface and do not need to be entered. The types of brick to be used for brick chambers, and beneath chamber frames, in normal circumstances are specified in Clause 2406. Where a different type of brick is required this should be described in Appendix 24/1. Any brickwork upon which chamber frames are seated shall be properly constructed.

2 Safety precautions require that chamber covers have a minimum opening as shown on the RCD Drawings where personnel may be required to enter completely. In carriageways, hard shoulders and verges, chamber covers, frames and gratings should be at least Class D400. Where, exceptionally, covers have to be located in areas subjected to large numbers of high-speed heavy goods vehicles, Class E600 chamber covers, frames and gratings should be considered. Advice may be sought from the Overseeing Organisation. It will normally be expected that the minimum frame depth is 150 mm. When specifying cover types, Compilers should have regard to the weight of each element of the cover so that it could be lifted safely and should review the measures available to prevent covers falling into the chamber when being removed. Reference should be made to the HSE Manual Handling Operations Regulations 1992 guide 'Guidance on Regulations L/23 1998', where appropriate.

3 It may be necessary, due to constraints in pipe lengths to vary the lengths of the articulated section described in sub-Clause 507.17. However, the principle of having the joint nearest the chamber as close as possible to the chamber and the next joint positioned so as to give an effective length of intervening articulated pipe, free from constraint by the trench bottom, should be maintained.

4 MSA EN 124 makes no reference to coatings. Many manufacturers apply a coating in order to prevent discolouration of the castings while in stock or in transit. However, BS 7903: 1997 states that short term coatings offer no lasting product enhancement and any surface oxidation of the cast iron has no detrimental effect upon its use.

NG 508 Gullies and Pipe Junctions

1 Trapped gullies are essential only on connections to combined or foul drains in urban areas or on roads where traps are regularly and frequently emptied. In terms of pollution there is little difference in water quality between the flow through trapped or untrapped gullies although a trapped gully would normally retain the contents of a vehicle's sump in the event of an accident.

2 Where concrete trapped gullies are cast in situ using a permanent plastic mould, the part forming the trap should be equal in all respects to that of precast concrete or clay gullies.

3 Any brickwork upon which gully frames are seated should be properly constructed.

NG 509 Testing and Cleaning

1 Requirements for drain testing should be specified in Appendix 1/5. The air test does not indicate the location of any large leaks that may be present. A water test may follow the failure of an air test.

2 Fall of the test water level may be due to one or more of the following causes:

- (i) Absorption by pipes or joints.
- (ii) Excessive sweating of pipes or joints.
- (iii) Leakage from defective pipes or joints or plugs.
- (iv) Trapped air.

Some pipes absorb more water or trap more air at the joints than others. Allowance should be made

for this by adding water to maintain the test head for appropriate periods. While the aim should be to commence the test period proper 2 hours after filling, the appropriate period may best be determined by conferring with the pipe manufacturers.

3 Closed circuit television (CCTV) inspection is a suitable alternative to the mandrel test and should always be used on foul sewers and connections to sewers. To avoid subsequent disputes it is essential to liaise with the drainage authority when checking connections to existing sewers to ensure acceptability of the work and to determine the extent of the survey required on existing sewers.

4 The test for partly watertight joints must be carried out before the pipe is laid because the water escaping from the joint has to be measured. The purpose of the test is to prove that the joint does not leak so excessively as to cause piping in any granular surround.

NG 510 Surface Water Channels and Drainage Channel Blocks

1 Requirements for these should be included in Appendix 5/3 and be compatible with the RCD.

NG 511 Land Drains

1 The Works are likely to disturb and render ineffective existing drainage systems in adjoining land; it will therefore be necessary for the Contractor to carry out without delay any such temporary or permanent remedial works as may be described in Appendix 5/1. The ideal arrangement for land drainage remedial works is that the system of drainage of land adjoining the road should be separate from the road drainage so that the reinstatement of the system is on the owner's land and the matter falls to be dealt with by the District Valuer as a matter of accommodation works. When such arrangements are not practicable or the cost is excessive, the existing land drainage system should be linked with the drainage system of the road.

NG 512 Backfilling to Pipe Bays and Verges on Bridges

1 Any special filling material, e.g. Lightweight material, should be described by providing additional information on the Drawings, cross-referenced in Appendix 5/1.

NG 513 Permeable Backing to Earth Retaining Structures

1 For granular backing, Type C has been added to allow for the design of a filter compatible with the particular type of filling to be employed adjacent to the structure. It is recognised that the use of Type A will not always meet the piping and permeability ratio criteria.

2 Fin drains are not allowed as permeable backing to structures because it is not yet possible to demonstrate that any of them will have the required design life of 120 years.

NG 514 Fin Drains

1 These consist of a core, which will allow the free drainage of water entering through geotextile filters on the outside of the core. The core may consist of nets, webs, grids or preformed plastic sheets or strips. Some restrict entry through one side or confine water entering to part of the cross-sectional area of the core. Any such restrictions should be taken into account in assessing the flow characteristics of the drain. Fin drains are intended for subsurface drainage, as shown in the RCD, to remove and keep out water from the road structure. They are provided to remove surface infiltration from the pavement layers, to prevent infiltration from shoulders, medians and verges into the pavement, and sometimes to cut off shallow groundwater seepage. They thus act as low-capacity filter drains. In normal circumstances, the Contractor should be permitted the choice of any of the types shown in the RCD. If however, for engineering reasons, exclusion of a particular type is required, this should be stated in Appendix 5/4. The minimum values for mechanical and hydraulic properties given in Clause 514 are intended for this particular usage and may not be relevant to fin drains used elsewhere. Additionally, the Clause requires specification of the pore size distribution of the geotextile and the inflow and discharge capacity of the fin drain determined for the site conditions.

2 The pore size for the geotextile should be selected using filtration criteria to be compatible with the adjacent soil or construction layer in order to prevent the occurrence of piping. The following soil retention criteria may be used in determining O_{90} . Other criteria are available.

Uniformity Coefficient of d_{60}/d_{10} soil	Woven and Melt-bonded Geotextiles	Needle-punched Geotextiles
1 to 50	$O_{90}/d_{50} = 1$ to $O_{90}/d_{50} = 3$	$O_{90}/d_{50} = 4$ to $O_{90}/d_{50} = 6$
> 50	$O_{90}/d_{90} < 1$ or $O_{90}/d_{50} < 3$	$O_{90}/d_{90} < 1.8$ or $O_{90}/d_{50} < 6$

$d = n\%$ size in base soil ($n\%$ is finer)

$O = 90\%$ opening (pore) size of geotextile (90% of openings are smaller)

In general, it will be sufficient to specify only the maximum value of O_{90} that will satisfactorily retain the adjacent soil particles, as the minimum O_{90} size will be governed by the permeability requirements in sub-Clause 514.4. Geotextiles will usually be in contact with variable surface soil deposits, as well as the more uniform materials composing the pavement, and great accuracy in specification may not therefore be feasible. The finest O_{90} relevant to the various soil deposits likely to be encountered may be specified. An O_{90} value of 1mm should be considered as the upper limit even with large grained soils. With cohesive fine-grained soils such as clays the use of the above criteria will result in such small pore sizes that sufficient water flow cannot be obtained. In such cases the cohesion of the soil particles themselves is relied upon to prevent piping and a maximum O_{90} value of 250 microns may be chosen. Dispersive silts can present particular problems and in these cases the O_{90} value may be less than 250 microns: however, the value to be specified should be carefully considered in order both to avoid piping and to ensure sufficient long-term flow. The British Standard test to determine pore sizes (sub-Clause 514.4) is inappropriate for some geotextiles, such as needle-punched materials, if more than 20% of the glass beads are retained in the fabric. Pore sizes must then be obtained by other means such as wet sieving.

3 Sub-Clause 4(v) of Clause 514 requires the designer to specify the flow rate normal to the geotextile wrapping to the filter drain. The specified flow rate should incorporate a margin of safety to allow for the impeded flow due to the adjacent core of the fin drain (or the filter material in a narrow filter drain) as described in sub-Clause 13 of Clause 514. It should also incorporate a substantial margin to allow for the reduction of flow with time due to clogging. The long-term flow

through a geotextile in contact with the coarse gravel may not differ significantly from the short-term flow measured in the standard test. In contrast, the long-term flow through a geotextile in contact with a dispersive silt may be one thousand times smaller than the short-term flow. There is some evidence that chemical or biological leachates may also cause severe clogging. Different rates of flow into the two sides of the fin drain may be specified, for example, if the water flows from the verges are expected to be very different to those from the pavement structure. A value of 10 litres/m²/sec is suggested for use against the granular sub-base and capping specified in Series 800. Very much smaller values are adequate for soils and backfills other than coarse gravels, and possibly dispersive silts or contaminated sites. It should be appreciated that, because of such long-term effects, these flow rates should not be used to determine the in-plane design requirements of the fin drain.

4 Sub-Clause 5 of Clause 514 requires specification of the in-plane flow capacity of the fin drain. This design capacity should allow for infiltration through the pavement and verges and any other source of ground water ingress. Until more accurate means of establishing infiltration rates through the pavement are available a value not less than the mean intensity of a one year 2 hour rainfall should be assumed. The fin drain Type 5 of Drawing F18 in the RCD acts both as a filter drain and a carrier pipe. Thus in-plane flow must be specified for flow both along the drain parallel to the road edge and near-vertically down the drain. For all other drain types, only near-vertical downward flow need be specified. Fin drain Type 10 in Drawing F21 should either have an impermeable side or be covered by an impermeable membrane unless no significant blocking of the core will occur during the slip forming of the channel. Fin drains are normally laid at constant depth below the carriageway and their gradient will therefore follow that of the road. Drainage capacities should be designed for these gradients and outfall lengths determined accordingly. For drain Type 5 the flow rates that are stated in Appendix 5/4 should be the capacity required linearly extrapolated to the standard gradients in Table 5/8. Where fin drains utilise a pipe, capacities may be obtained from hydraulic tables and the required diameter specified.

5 Sub-Clause 9 of Clause 514 specifies the use of as-dug material for trench backfill. If this material when compacted is sufficiently less permeable to affect the efficiency of the drain, or contains stones larger than about 100mm, which could damage the

drain, an alternative material compatible with the geotextile should be used.

6 Proper functioning of the fin drain and its ancillary components depends critically on adequate installation and joining procedures. Fin drains can be problematical during construction phase for the following reasons.

- i They do not provide immediate drainage for the unpaved sub-base.
- ii They are not designed for surface water flows.
- iii Fine particles transported by surface water or vehicles may clog the filter or silt the drain.
- iv They may be damaged by the passage of construction traffic. Appropriate protection measures must be taken, e.g. polythene sheeting, temporary drainage channels, or warning fence. Alternatively, the drains may be installed towards the end of the construction phase.

7 All fin drains and their constituents must be the subject to an approval by the ADT which certifies the values achieved for the specified properties when tested in accordance with Clause 514. Fin drains are available in a variety of configurations with different types of core structure. In addition, several tests described in Clause 514 are modified British Standard tests or have been developed especially for the Specification and as yet there is little experience of their use. These two factors mean that some variation or interpretation of the test method may sometimes be necessary. The Malta Transport Authority will agree details of any appropriate variations in the specified test methods following consultation with the manufacturer. It is intended that whenever the Contractor proposes the use of any fin drain or constituent material he must consult the Malta Transport Authority to confirm that the material complies with the Contract requirements.

NG 515 Narrow Filter Drains

1 Narrow filter drains are intended for use as edge of pavement sub-surface drains and are suitable alternatives to fin drains for this purpose. Both types have the same requirements of performance and the guidance given in NG 514 is equally applicable to determining the soil retention and permeability criteria of the geotextile used in narrow filter drains and to the discharge capacity of the drain. In normal circumstances, the Contractor

should be permitted the choice of any of the types shown in the RCD. If however, for engineering reasons, exclusion of a particular type is required, this should be stated in Appendix 5/4.

2 In drain Type 8 the filtration function is achieved by a granular filter material and geotextile sock and in Type 9 by means of a geotextile wrapping to the drain. Both filters should be designed to be compatible with the adjacent soil or construction layer. For the Type 8 drain granular material the value of D₁₅ to be specified (Table 5/8) should be based on the criteria D₁₅F less than or equal to 5 x D₈₅S (TRRL Report LR346) where D₈₅S is the sieve size passing 85% by weight of the adjacent soil. The geotextile sock round the pipe is a second stage filter where it is required to retain the particles of the first stage granular material. However, the pipe when laid in the narrow trench may have insufficient granular surround for fully effective first stage filtration to be achieved. Pore sizes for the sock material should therefore be designed to also retain the finer soil particles outside the trench.

3 The specification for granular material in Table 5/8 is intended to permit the widest range of available material to be used. These limits have been set to reduce the risk of damage to the geotextile, to avoid gap grading of the filter material and to ensure an adequate degree of permeability. For the material as specified a minimum value of permeability of about 1×10^{-4} m/second which is similar to that obtained by a clean coarse sand may be assumed. A higher permeability will rarely be necessary but if required it may be specified in Appendix 5/4.

4 Narrow filter drains require protection during the construction phase similar to that provided for fin drains (see NG 514.6).

5 The geotextiles used in narrow filter drains require ADT certification (see NG 514.7).

NG 516 Combined Drainage and Kerb Systems

1 The Drawings should show the location and gradient(s) of the combined drainage and kerb system, the position of access, silt trap, outfall and end units together with the position and invert level of the surface water outfall connection. The position of any movement joints required in the

system should be shown (e.g. at joints in bridge decks or concrete carriageways). Details of any ducts, cabling, etc., required to pass under the kerb should be shown. The extent of the work to be designed by the Contractor should be clearly defined.

2 Combined drainage and kerb systems should be scheduled in Appendix 1/11 and cross-reference made to the design requirements given in Appendix 5/5.

3 Advice on the location of Class C and Class D systems is given in sub-Clause NG 517.1.

NG 517 Linear Drainage Channel Systems

1 The linear drainage channels specified in Clause 517 may be used in trunk roads including arterial roads. Class D channels are designed to withstand loadings of all types of road vehicle that are permitted on trunk roads including arterial roads. Class C channels shall only be installed in locations, which are protected from direct traffic loading, e.g. in areas behind safety fencing. The range of slot dimensions permissible within Clause 517 is not compatible with safe usage by cyclists and pedestrians, and units with slot dimensions described in Clause 517 should not be used in areas subject to such traffic.

2 The Drawings should show the location of the linear drainage systems and the positions of the surface water outfall chambers into which the systems are to outfall. The position of any movement joints required in the system should be shown (e.g. at joints in bridge decks or concrete carriageways). Details of any ducts, cabling, etc., required to pass under the systems should be shown. The extent of the work to be designed by the Contractor should be clearly defined.

3 Linear drainage channel systems should be scheduled in Appendix 1/11 and cross-reference made to the design requirements given in Appendix 5/6.

4 Variations to stated dimensions might be considered provided that the product will meet the requirements of this specification.

5 A system comprising units which may be otherwise too small to accommodate design flows without surcharge may be acceptable in conjunction with the provision of additional intermediate or

upstream chambers subject to the following requirements:

- a) Intermediate chambers should be compatible with the standards of the chambers shown on the Drawings and any longitudinal drains connecting such chambers should also be connected into the intermediate chambers.
- b) Not more than one intermediate chamber should be permitted between the upstream and downstream chambers of any drain shown on the Drawings.
- c) Not more than one additional chamber should be permitted upstream of each upstream chamber shown on the Drawings.

NG 518 Thermoplastics Structured Wall Pipes and Fittings

General

1 Where thermoplastics structured wall pipes and fittings are included in the schedules of permitted alternatives in Appendix 5/1, the material properties required of the different pipe materials should be specified by the manufacturer in the format given in Appendix 5/7. The third party certification body verifies these properties against the declared specification. Fulfilment of the performance requirements in conjunction with maintaining the material specification should provide the required durability for the product (i.e. a minimum life of 45 years).

Materials

2 Most thermoplastics are stable against common chemicals found in ground water and in surface water runoff. Further details on the suitability of a particular compound can be found in CP 312: 1976. The pipes and fittings should be protected against prolonged exposure to sunlight and it may be necessary for the Contractor to cover the pipes prior to installation.

Dimensions

3 Dimensions should be measured in accordance with prEN ISO 3126 and should fulfil the requirements of sub-Clause 518.3 and the declared specification (see Appendix 5/7).

Appearance

4 The bore of the pipe fittings should be smooth to allow the correct choice of Manning's coefficient for hydraulic design of the system.

Structured Wall Pipe

5 Table 5/9 gives the requirements for structured wall pipes. Where reference is made to British, European or International Standards, these standards should be consulted to discern the relevant test conditions for the product. Where no standard test method is available, the test method is described in sub-Clauses 518.11 to 518.13. Additional information is given in Table NG 5/1.

Fittings

6 As stated in sub-Clause 5 of this Clause the standards should be consulted to discern the relevant test conditions for the product against the requirements given in Table 5/10.

Installation and Handling

7 Care should be taken to prevent changes in line or level when placing the surround material over the pipe crown, as there is the possibility of flotation (see also sub-Clause 503.4). Compaction levels of all side fill and backfill material must be closely monitored as these have a direct impact on the ground settlement and pipe deflection characteristics. Special precautions may be necessary where the system is subject to high construction loading such as spreader plates.

8 Installation and compaction of the pipe and surround is key to the performance and durability of the system. The pipe must be installed to line and level and any pipe that is out of shape should not be installed. The change in shape could be caused by, longitudinal bending, mechanical damage or deformation under lifting and installation. Larger diameter pipes and fittings must be handled with care, as they are more likely to suffer impact damage especially at lower temperatures. Reference should be made to the HSE Manual Handling Operations Regulations 1992 guide 'Guidance on Regulations L/23 1998', where appropriate, and care taken whilst using mechanical plant especially near to trench walls. The manufacturer must supply the weight per metre of the pipe and from this information the Contractor is able to assess the lifting needs for installation of the pipe.

TABLE NG 5/1 Additional Information for Structured Wall Pipe

Property	Additional Information
General	Quality control and identification
Ring Stiffness	Manufacturer's minimum specification in required for calculation to MSA EN 1295
Creep Ration	Manufacturer's maximum specification is required for calculation to MSA EN 1295. Note: the long-term ring stiffness used for design purposes is the two-year stiffness and is calculated by dividing the ring stiffness by the creep ratio.
High Volume low pressure flushing	A pass is deemed to also establish satisfactory performance at high volume and low pressure.
Longitudinal bending	To reduce the possibility of problems caused by handling on site.
Impact resistance at 0°C	The d50 striker is non-standard
Impact resistance at 23°C	For quality control only
Rodding resistance	To simulate effects of drain rodding.
Creep at elevated temperatures (ducts)	To stimulate the effect of exposure to high temperatures that may occur in power cable ducts
Resistance to point loads (ducts)	Simulate sharp aggregate penetration

Note 1: When carrying out calculations to MSA EN 1295 the minimum value for stiffness and the maximum value of creep ratio should be used in order to establish the long-term stiffness. For example, a pipe might have a declared minimum stiffness of 4.5 and a maximum declared creep ratio of 3.8. The long-term stiffness would be $4.5/3.8 = 1.18 \text{ kN/m}^2$. Site-specific calculations, in accordance with MSA EN 1295, can be used to establish that the long-term deformation will be less than 5% and the safety factor against buckling greater than two.

Test Method for Longitudinal Bending

9 The test is intended to eliminate very flexible pipe (e.g. coilable pipe) and pipe which is so weak that it might deform whilst being handled on site.

10 The two level support blocks at least 250 mm wide and of sufficient height to allow the pipe to sag over its length without touching the ground could consist of standard building blocks stood on their ends.

Test Method for Rodding Resistance (Internal Puncture)

11 The test is intended to simulate damage which might be caused by the ferrule of a drain cleaning rod being impacted against the inside of the pipe or fitting during cleaning operations and is intended to ensure the structural integrity of the inner layer. A segment of pipe or a section from a fitting is subjected to impact on its internal surface whilst fully supported by its external surface.

Test Method for Resistance to Sharp Objects

12 The test is intended to simulate the effect of penetration due to sharp aggregate and is intended to exclude ducts with particularly thin wall section.

NG SAMPLE APPENDIX 5/1: DRAINAGE REQUIREMENTS

[Note to compiler: This should include:]

1 the basis of the hydraulic design of the system on which the Contractor shall submit his proposals for pipe types and makes [501.3];

2 a schedule of permitted alternative pipe and bedding combinations; [which should be determined in accordance with Advice Note HA 40] [503.3] and list of pipelines to be constructed other than in a trench [608.8];

3 grading requirements for filter drain material Type C.

4 values of pipe stiffness class, creep ratio and impact resistance for thermoplastics pipes;

5 plate thicknesses for bolted segmental plate pipes [501.4(i)] and minimum plate thickness for corrugated steel pipes of lock seam fabrication if different from sub-Clause 501.4;

6 whether corrugated steel pipes are to have additional protection of hot-applied bitumen [501.5];

7 where sulphate-resisting Portland cement is required for concrete pipes [Table 5/1];

8 pipe classification to BS 5480 for GRP pipes for drainage [Table 5/1];

9 laying method for corrugated coilable perforated pipes [503.2]

10 details of materials if differing from the requirements of sub-Clause 503.3(v);

11 whether joints in surface water drains shall be watertight or partly watertight [504.2];

12 where rigid joints may be used [504.3]

13 backfilling requirements differing from sub-Clause 505.2; references to drawings giving locations where backfilling is required to a level other than that specified in sub-Clause 505.6;

14 where saddles may be used [508.7 and 508.7NI]

15 material classification for backfilling filter drains and permeability requirements including test details [509.8];

16 references to drawings showing requirements for connecting existing drains to new drains and details of special connecting pipes [506.1];

17 requirements for sealing, removal or grouting of existing drains [506.3];

18 details of connecting existing land drains [511.1];

19 whether severed mole drains are to be intercepted by construction of a land drain [511.4];

20 requirements for backfilling mole channels if different from the requirements of sub-Clause 511.4;

21 references to drawings that show chamber types [507.1];

22 requirements for concrete to cast in situ chambers if differing from the requirements of sub-Clause 507.4;

23 particular requirements for corrugated galvanized steel chambers [507.5];

24 requirements for testing chambers for foul drains for water tightness [507.8] and foul drain surveys by video camera [509.5];

25 details of chamber covers, gratings and frames [507.9] and details for special duty covers for use in carriageways [507.13]; requirements for minimum waterway area to gratings for catch pits [507.14];

26 the classes and sizes of cast iron and steel gully gratings [508.4];

27 requirements for gully gratings if different from the requirements of sub-Clause 508.5;

28 requirements for setting existing covers and gratings to level if different from the requirements of sub-Clauses 507.18 and 508.8;

29 whether gullies are to be trapped or untrapped [508.1]; details of in situ concrete gullies [508.3];

30 references to drawings showing requirements for filling to pipe bays and verges if different from the requirements of sub-Clause 512.1;

31 requirements for permeable backing if different from the requirements of sub-Clauses 513.1 and 513.2;

32 requirements for the cleaning of chambers, gullies and drains [509.5];

33 requirements for cleaning of existing drainage systems - Clause 520;

34 requirements for rapid setting bedding materials and the locations where they will be required [507.18].

NG SAMPLE APPENDIX 5/2: SERVICE DUCT REQUIREMENTS

[Note to compiler: This should include:]

1 details of duct construction [503.5] [cross-reference should be made to RCD drawing no. I2 where appropriate];

2 a schedule of service duct requirements [similar to those in Appendix 5/1 for pipes];

3 details of permanent marker blocks and location posts required for service ducts [505.7] [cross-reference should be made to RCD drawing no. II where appropriate].

4 colour coding of ducts [Refer to 501.7, 518.4 and Health and Safety Executive booklet HS (G) 47];

5 references to drawings which show chamber types [501.8].

NG SAMPLE APPENDIX 5/3: SURFACE WATER CHANNELS AND DRAINAGE CHANNEL BLOCKS

[Note to compiler: State here specific requirements cross-referring to drawing numbers where appropriate, including RCD drawings listed in Appendix 0/4]

NG SAMPLE APPENDIX 5/4: FIN DRAINS AND NARROW FILTER DRAINS

[Note to compiler: This should include:]

1 Permitted alternative types of fin drain and narrow filter drain.

[Normally the choice of type of fin or narrow filter drain should be left to the Contractor.]

2 Drawing references showing locations.

3 The maximum permissible O90 determined from the pore size distribution curve of the geotextile [514.4(iv) and 515.3].

4 The permeability of the geotextile [514.4(v) and 515.3].

5 The long-term in-plane flow for fin drains [514.5].

6 Pipe diameters [514.10 and 515.6].

7 Trench backfill material for fin drain if not as-dug material [514.9].

8 D15 particle size for granular material in narrow filter drain Type 8 [515.5].

9 Permeability of granular material in narrow filter drains where required [515.5].

10 Maximum drain slope angle if different from 15° [514.10 and 515.6].

11 Dimensions of fin drains and narrow filter drains if different from the requirements of sub-Clauses 514.10 and 515.6.

12 References to drawings and/or schedules that show required levels [514.11 and 515.7].

NG SAMPLE APPENDIX 5/5: COMBINED DRAINAGE AND KERB SYSTEMS

[Note to compiler: Include here:]

1 Drawing references showing locations, etc.

2 Limiting dimensions:

(i) Maximum width and depth of units [if applicable].

(ii) Kerb up-stand.

(iii) Kerb profile [if applicable].

(iv) dimensions of side-entry inlets of units to be used in or adjacent to porous asphalt [516.3].

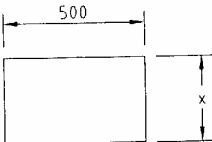
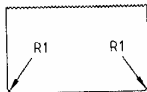
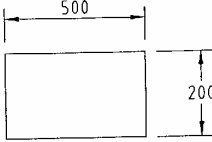
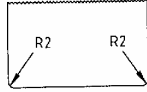
3 Strength requirements [units should be specified as Class D or Class C. Class D units shall be used where there is a possibility of impact from all types of road vehicle that are permitted on trunk roads including motorways. Class C units shall only be

installed in locations that are protected from direct traffic loading, e.g. in areas behind safety fencing.].

4 Hydraulic design parameters
[roughness coefficients should not be specified].

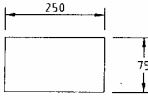
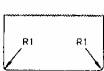
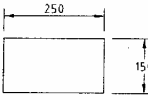
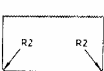

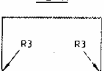
5 Class of concrete or mortar bedding/surround.

Table 1: Dimensions of Test Blocks

For testing channel units of dimensions as shown in Figures 1 and 2 following	
$b \leq 200\text{mm}$	$b > 200\text{mm}$
 <p>PLAN</p>  <p>ELEVATION $R1 \leq 3\text{mm}$</p>	 <p>PLAN</p>  <p>ELEVATION $R2 \leq 3\text{mm}$</p>

x = overall width of the channel unit

Table 1: Dimensions of Test Blocks (continued)

For testing gratings and covers of channel units of dimensions as shown in Figures 1 and 2		
$b < 200\text{mm}$	$200\text{mm} \leq b \leq 300\text{mm}$	$b > 300\text{mm}$
 <p>PLAN</p>  <p>ELEVATION $R1 \leq 3\text{mm}$</p>	 <p>PLAN</p>  <p>ELEVATION $R2 \leq 3\text{mm}$</p>	 <p>PLAN</p>  <p>ELEVATION $R3 \leq 3\text{mm}$</p>

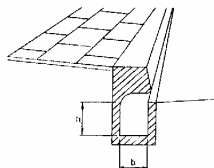


Figure 1 (example)

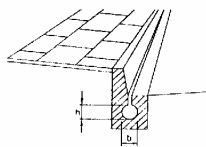


Figure 2 (example)

Note: Figures 1 and 2 indicate an assembly with a kerb type profile and having a continuous or intermittent inlet.

NG SAMPLE APPENDIX 5/6: LINEAR DRAINAGE CHANNEL SYSTEMS

[Note to compiler: Include here:]

1 Drawing references showing locations, etc.

2 Limiting dimensions:

- maximum width and depth of units [517.4 and 517.18]
- dimensions of side-entry inlets of units to be used in or adjacent to porous asphalt [517.7]

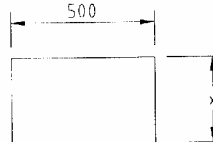
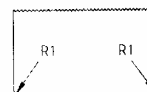
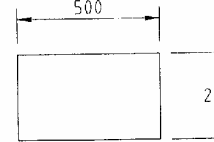
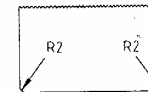
3 Hydraulic design parameters [517.1 and 517.3]
[roughness coefficients should not be specified].

4 Class of concrete bedding/surround.

5 Any special fittings required [517.9].

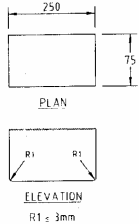
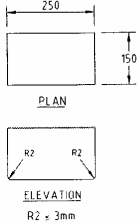
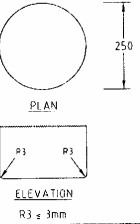
6 Dimensions of test blocks [Table 1 following].

Table 1: Dimensions of Test Blocks

For testing channel units of dimensions as shown in Figures 1 and 2 following	
$b \leq 200\text{mm}$	$b > 200\text{mm}$
 <p>PLAN</p>  <p>ELEVATION $R1 \leq 3\text{mm}$</p>	 <p>PLAN</p>  <p>ELEVATION $R2 \leq 3\text{mm}$</p>

x = overall width of the channel unit

Table 1: Dimensions of Test Blocks (continued)

For testing gratings and covers of channel units of dimensions as shown in Figures 1 and 2		
$b < 200\text{mm}$	$200\text{mm} \leq b \leq 300\text{mm}$	$b > 300\text{mm}$
		

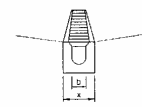


Figure 1 (example)
System with grating

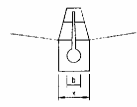


Figure 2 (example)
System with closed profile and
continuous or intermittent inlet slot
on top

Note: Fig. 1 indicates a typical non-integral grating system. Dimensions apply similarly to integral grating system.

NG SAMPLE APPENDIX 5/7: THERMOPLASTIC STRUCTURAL WALL PIPES AND FITTINGS

Information to be provided by the Contractor

The Contractor shall provide the following information, in accordance with sub-Clause 518.2, for the range of pipes and fittings (to be verified by the Certification body - see sub-Clause 518.15):

1 Technical drawings showing dimensions and tolerances including sealing rings and weight per metre, together with properties, as specified in sub-Clauses 518.3 and 518.5.

2 Material specification, as required in sub-clause 518.2:

Table 1:Unplasticised polyvinyl-chloride(PVC-U)

Property	Test method reference	Specification
Tensile Properties	MSA EN 638, ISO 527	
Vicat	MSA EN 727	
Longitudinal reversion	MSA EN 743	
K-value	MSA EN 922	
PVC Content	MSA EN 1905	
Density	ISO 1183, ISO 4451	
Heat Reversions	ISO 12091	
Effects of heating (injection moulded fittings only)	MSA EN 763	

Table 2: Polyethylene (PE)

Property	Test method reference	Specification
Tensile Properties	MSA EN 638, ISO 527	
Oxygen induction time	MSA EN 728	
Melt flow rate	ISO 1133	
Density	ISO 1183, ISO 4451	
Melt Flow Rate	ISO 4440	
Heat Reversion	ISO 12091	
Effects of heating (injection moulded fittings only)	MSA EN 763	

Table 3: Polypropylene (PP)

Property	Test method reference	Specification
Tensile Properties	MSA EN 638, ISO 527	
Oxygen induction time	MSA EN 728	
Melt flow rate	ISO 1133	
Density	ISO 1183, ISO 4451	
Heat Reversion	ISO 12091	
Effects of heating (injection moulded fittings only)	MSA EN 763	

EARTHWORKS

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EARTHWORKS

NG 600 Introduction

1 The Notes for Guidance on this Series are intended to assist in the preparation of the Contract. The design of the earthworks and selection of limits for soil properties for their construction will follow the ground investigation. Advice on these and other matters is available from the Overseeing Organization and the Design Manual for Roads and Bridges (DMRB). Experience in the construction of road schemes has shown that certain materials may be utilized as 'acceptable' materials although processing, where appropriate, will be necessary to render unacceptable materials 'acceptable'. Appendix 6/1 should describe the requirement for processing of unacceptable material where this has been identified as appropriate. Unless there are specific reasons, the means of processing should be left to the Contractor. The aim should be to minimise the import of materials both for economic and environmental reasons and to allow use in fill areas those materials likely to arise in the cuttings as far as the earthworks design permits. However, since the Contractor, for economic reasons, should normally be left the choice of using Site-arising or imported materials, the Contract should not normally indicate from where on Site materials are to be obtained for the various zones of fill (but see also 6(ii) below). Certain selected fills will normally have to be imported.

2 The term 'rock' is used in the Specification to describe a constituent of certain selected fills having durability and strength requirements and also to describe material in cutting faces and formations requiring special methods of trimming or regulation.

3 Particular requirements, not specifically stated in the SRW, for the Class of fill materials to be used or permitted, or for work to be undertaken should be included in Appendices 6/1 to 6/13. Additional Appendices may be used if necessary (see NG 000).

4 It is necessary to show the full extent of formation and where there is capping, the sub-formation. Most road configurations will be catered for by the appropriate cross-section and edge detail drawings contained in the Road Construction Details. These drawings should normally be used without modification and incorporated in the

Contract by reference (in Appendix 0/4). In cases where they do not cover the work involved, Contract-specific drawings may be necessary which should be discussed with the Overseeing Organisation.

5 Appendix 6/1 should list only the properties needed to meet design requirements, omitting those which are unnecessary, e.g. either mc or MCV, not both.

6 Tenderers should be given the fullest available information about the materials to be excavated. The following should be included, as appropriate:

- (i) any strata or deposits designated as Hard Material;
- (ii) the in situ material properties, related as far as possible to the general material description and the properties used for acceptability in Table 6/1, taken from the borehole logs or test pits, which may be re-plotted on the drawings of the long-sections of cuttings and below embankments where excavation will be required;
- (iii) the total net volume of each cut (neglecting bulking or shrinkage) including:
 - (a) estimated net volume of Class 5A material to be removed;
 - (b) estimated net volume of acceptable material;
 - (c) estimated net volume of unacceptable material above and below formation level including the volume to be processed to render it acceptable;
 - (d) the Class and estimated net volume of fill to replace any excavation required below formation level;
- (iv) the total net volume of fill in each fill area (neglecting bulking or shrinkage) including:

- (a) estimated net volume of topsoil to be removed, if any;
- (b) estimated net volume of unacceptable material below existing ground level to be removed including the volume to be processed to render it acceptable;
- (c) the Class and estimated net volume of fill required above and below existing ground level;
- (d) the Class, location and estimated net volume of capping material required or stabilisation of subgrade to form capping.

NG 601 Classification, Definition and Uses of Earthworks Materials and Table 6/1:

Acceptable Earthworks Materials: Classification and Compaction Requirements

1 The key to the use of materials both arising on Site and imported lies in Table 6/1. These materials have been classified into 9 principal Classes and sub-divided for compaction purposes or because of particular properties or applications.

2 Classes 1 and 2, general fills, comprise the greater part of the materials normally encountered and which are satisfactory as fill in most embankment construction. They incorporate chalk except when it is likely to be degraded by normal construction plant when it is designated in Appendix 6/1 as Class 3 general fill; it can be excluded that this material will be found in Malta.

3 Classes 4 and 5 are for landscaping and topsoiling respectively.

4 Classes 6 to 9 selected fills all have a special role.

5 Many schemes will use only a few of the Classes in Table 6/1 and it will be unusual for every Class of material to be used on an individual scheme.

6 Further sub-division of the Classes in Table 6/1 may be appropriate e.g. 2A into 2A1 and 2A2 in order to obtain the better use of materials by zoning.

7 Appendix 6/1 should include the relevant limits of acceptability for fill materials referred to in Table 6/1.

NG 602 General Requirements

1 Special requirements for determining acceptability, e.g. who classifies and where, and whether trial pitting is required, should be stated in Appendix 6/1 (see also NG 631). The Engineer should retain the obligations for classification of earthworks materials unless, following consultation with the Overseeing Organization, the Engineer decides that the Contractor should have the obligations for classifying earthworks materials; these obligations include sampling and testing in accordance with the contract.

2 All topsoil above cuttings and below embankments should normally be stripped for re-use with the depths of excavation given in Appendix 6/8 verified when stripping. There is frequently less topsoil in wooded areas than expected and this should be recognised when estimating volumes of topsoil.

The Overseeing Organisation should be consulted concerning requirements for surplus topsoil, which should be stored whenever practicable rather than disposed of by the Contractor. Storage areas should be shown on the Drawings and details given in Appendix 6/8.

3 The Drawings should indicate where battering of excavations for foundations and trenches is permitted and details should be given in Appendix 6/3. It should not be unnecessarily restricted; in some instances it might be preferable so as to avoid leaving a wedge of material loosened by excavation. Where battering is permitted, the requirements for benching prior to backfilling and compaction should be shown on the Drawings and details given in Appendix 6/3.

4 Where groundwater is to be lowered as a design requirement, or to make wet unacceptable material into acceptable material where a shortfall in earthworks volumes is likely, the location and extent of such operations should be shown on the Drawings. These should be cross-referenced in Appendix 6/1.

NG 603 Forming of Cuttings and Cutting Slopes

1 The Drawings should show all changes in cross-section for cuttings and any requirements for limiting the extent of undercutting of slopes and toes of cuttings, making use of Appendix 6/3 as necessary.

2 Requirements for pre-split blasting, a technique for minimising overbreak and instability, should be stated in Appendix 6/3 for any substantial rock cuttings, where blasting will be permitted (See NG 607). Requirements for exposed cutting faces should be described in Appendix 6/3. Advice on specification requirements for pre-split blasting can be obtained from TRRL report LR 1094.

NG 604 Excavation for Foundations

1 The lines and levels of foundation excavations should be shown on the Drawings together with any blinding concrete, and its mix reference, to Clause 2602.

2 The Drawings should indicate where the requirement in Clause 602 for not battering excavations for foundations can be relaxed and details should be given in Appendix 6/3 (see NG 602).

NG 606 Watercourses

1 Cross-sections for all work in connection with existing or new watercourses (which includes all ditch work) should show the extent of all treatment and other requirements. See NG Sample Appendix 6/3.

NG 607 Explosives and Blasting for Excavation

1 Blasting needs should be considered in relation to the likely disturbance to the environment and remaining material beyond the cutting face. Where blasting is likely to lead to savings in excavation costs, preconstruction consultation with all who may be affected is a pre-requisite to permitting blasting in Appendix 6/3. Further guidance will be found, including benefits of pre-contract blasting trials during ground investigations, in TRRL report RR 53.

NG 608 Construction of Fills

1 The Drawings should show locations and particular requirements for selected fills and general fills in specific zones including any additional subdivisions of Classes in Table 6/1.

2 The Drawings should also show how, where permitted, embankments may be initially constructed other than to their full width and to steeper batter slopes. These should be cross-referenced in Appendix 6/3.

3 Staged construction and any surcharging of embankments and benching should also be shown, with requirements for any instrumentation in Appendix 6/12.

4 The Drawings should show each change in cross-section of fills.

NG 609 Geotextiles Used to Separate Earthworks Materials

1 This Clause includes minimum properties for geotextiles used to separate earthworks materials except for durability where tests have yet to be developed to an acceptable standard. Evidence of longevity is, however, required from the Contractor.

2 The minimum life stated in Appendix 6/5 should relate to the main function of the geotextile. For example, if used beneath an embankment it should exceed the time for primary consolidation of the underlying soil. Rate of sampling should be given in Appendix 6/5 together with any other requirements.

3 The tests in this Clause may be used for specifying geotextiles for other purposes, using appropriate values of properties, by means of a different Appendix, eg. If used in strengthened embankments to Clause 621, Appendix 6/9 should be used. The requirements for a separating layer may however be quite different from those for other uses and the tests may need modification or extension. Advice may be obtained from the Overseeing Organisation.

4 The Drawings should show details of returns for anchorages and turn-ups at edges. Laps which are described in Clause 609.5 or Appendix 6/5 should not be shown on the drawings unless there are

overruling design considerations for requiring laps at a particular location within the construction.

NG 610 Fill to Structures

1 The required or permitted alternative Classes of material to be used should be stated in Appendix 6/6 for each structure together with their locations and extent, and any requirements for benching, cross referring to Drawings where necessary. The acceptable limits of material properties for these Classes should be stated in Appendix 6/1. Choice of acceptable limits, e.g. c and ϕ or c' and ϕ' should depend on design assumptions and where they are used, values for moisture content or MCV (Moisture Content Value) may be unnecessary.

2 With cohesive materials having plasticity limits within those specified in Table 6/1, it is important to avoid compaction at moisture contents dryer than the eventual equilibrium moisture content, as swelling may still arise. For this reason both maximum and minimum levels of m_c , MCV and shear strength should be specified in Appendix 6/1 with the aim of avoiding significant increases in moisture content following construction whilst still requiring shear strengths pertinent to the design of the structure.

3 Lias Clay should only be used as fill to structures where it may be compacted to a low density. Any subsequent swelling pressure on wetting would then be reduced by volume changes. Therefore, Lias Clay should not be used where more rigorous control of density is required such as under pavements on compacted fill or on the approach to bridge abutments. The designer should take full account of any swelling pressure likely to occur. TRL project reports PR 72 and 152 should be referred to before using Lias Clay. Appendix 6/6 should strictly limit the use of Lias Clay as described above.

NG 611 Fill above Structural Concrete Foundations

1 Full details of extent and type of permitted materials for filling above structural concrete foundations should be shown in Appendix 6/6.

NG 612 Compaction of Fills

1 Method compaction will be used for the majority of earthworks. Table 6/4 compaction should

produce a minimum state of compaction equal to 10% air voids at an m_c at the dry limit for acceptability. The m_c at which 10% air voids or less would be achieved is roughly equivalent to a maximum MCV of 12.5 for cohesive soils (Classes 2 and 7) and 5% or less will be achieved at MCV 11.5 or less. With granular soils the equivalent MCV will be higher e.g. for a well graded sand an MCV of 14.5 will achieve 10% air voids or less.

2 Density testing of the materials to be used will be necessary in order to comply with an end-product specification.

3 DIN 18196 in English language is to be found in the library of the Roads Directorate.

NG 613 Sub-formation and Capping

1 Capping is a construction method to be found in British Standards. It can be considered as an option as the pavement design according to the Directives for the Standardisation of Pavements for Traffic Areas (Edition 2000) follows the German approach which requires E_{v2} minimum values on formation level.

2 The permitted constituents and material properties of capping materials for use on fills or in cutting have been drawn up to meet the requirements of sub-grade stiffness and strength used in Standard HD 25, which assume a capping CBR of 15% and, varying capping thickness depending on sub-formation to achieve the required E_{v2} modules. The Specification does not require minimum CBR, (except for bearing ratios in stabilised capping) of capping or sub-formation but such tests by the Overseeing Organisation may be useful to provide feedback on the long-term performance of pavements. See also NG 614 and NG 615.

3 The Contract, either on Contract-specific Drawings or in Appendix 6/7, should state if capping is required and in which locations. They should also show the required thicknesses of capping (including any details of sub-formation having a different slope to the formation above it e.g. at flat areas of transition). Also permitted options for Classes of capping related to the properties of the material likely to form the subformation should be described.

As an example a sub-formation of cohesive fill should have the option of:

- (i) the whole thickness of capping formed in Class 9D (cohesive material Class 7E lime stabilised) or, part Class 9D overlain with Class 6F1, 6F2 or 6F3; or
- (ii) Class 6F1, 6F2 or 6F3 material each forming the whole or sandwiched.

Other combinations, again depending on likely subformation material, should be investigated e.g.:

- (i) Class 9A overlain with 6F1, 6F2 or 6F3; and
- (ii) multi-stabilised layers.

The lateral extent of capping/sub-formation should also be shown. See NG 600.5.

Appendix 6/7 should show the minimum thickness of capping or sub-base to be placed for weather protection, where the fill characteristics do not require the full thickness immediately.

4 Where the sub grade CBR value, respectively the subgrade E_{v2} is estimated to be of a value requiring capping for one type of pavement (eg. rigid or rigid composite) but not for others permitted for the same length of road, this should be allowed for in Appendix 6/7.

NG 614 Cement Stabilisation to Form Capping

1 Cement stabilization of Class 6E granular materials with 2% cement, or of Class 7F silty cohesive material with the appropriate cement content to form Class 9A, Class 9B or Class 9C capping should be included as an option where laboratory tests or pre-Contract trials show it to be feasible. High contents of fine materials (silt and clay) will require more cement to achieve the required E_{v2} value.

2 When the Overseeing Organisation wishes to include the option of Class 9A or Class 9B, or Class 9C capping and there are doubts as to the sufficiency of 2% cement, the results of any trials or testing should be made available to the tenderers, reference being made to them in Appendix 6/7. Notwithstanding the above, Appendix 6/7 should state that demonstration areas will be required to be constructed where layers of Class 9A or 9B material greater than 250 mm thickness are to be compacted.

NG 615 Lime Stabilisation to Form Capping

1 Lime stabilisation using 2.5% of available lime will, if compacted at the correct MCV give sufficient long-term strength for a capping. The appropriate lower value of MCV for Class 9D and of mc or MCV for Class 7E, (to be stated in Appendix 6/1), which will give an adequate strength and safety factor, may be determined from laboratory tests.

2 Additional tests for rate of spread may be required to ensure that no less than the minimum lime quantity required is provided at any point on the material being treated. If adopted, the requirements should be included in Appendix 6/7.

3 The upper limit of MCV for Class 9D material has been established as 12 for a wide range of glacial tills and some over consolidated clays. The limits of MCV should be confirmed during the ground investigation. Higher values than 12 may lead to swelling after compaction and should be avoided if possible.

NG 616 Preparation and Surface Treatment of Formation

1 Where it is known that formations of rock will arise which cannot achieve the tolerances of sub-Clause 1 of Clause 616 the requirement to meet sub-Clause 4 should be stated in Appendix 6/7 and located on the Drawings.

NG 617 Use of Sub-formation or Formation by Construction Plant

1 The Overseeing Organisation may permit construction plant for the supply and deposition of sub-base to use formations of capping or of materials having similar characteristics, and this should be included in Appendix 6/7.

NG 618 Topsoiling, Grass seeding and Turfing

1 See Clause 602 and NG 602 relating to stripping, use and storing of topsoil.

2 Where the ground investigation indicates that existing topsoil which is to be stripped for topsoiling, has a high clay content, the requirements of sub-Clause 618.3 to limit excavation etc. from topsoil stockpiles which have been open to

prolonged rainfall should be invoked in Appendix 6/8 to prevent degradation. The 100 mm rainfall figure in sub-Clause 618.3 may also need to be revised but it should not be over-restrictive.

3 Weed control treatment should be carried out during a period of active growth before plants commence seeding and should not take place at times when rain is forecasted during the next 24 hours.

NG 619 Earthwork Environmental Bunds

1 Earthwork environmental bunds may, depending on land availability and height and whether they are to have a fabricated environmental barrier installed on them, be constructed in various ways, e.g. Normal embankment, strengthened embankment, reinforced earth structure, anchored earth structure, or be treated as a landscape area utilising Class 4 fills to Clause 620. In the latter case no reference to an earthwork environmental bund should be made so as to avoid confusion.

2 Full details of earthwork environmental bunds should be shown on the Drawings with any requirements for early construction shown in Appendix 6/9.

NG 620 Landscape Areas and Screening Mounds

1 Landscape areas and screening mounds are areas where the standards of construction of fills and their material quality can afford to be of a lower standard than for normal embankment construction.

2 General or selected fills should be allowed for Class 4 landscape fill with appropriate limits on material properties being stated in Appendix 6/1. These limits should draw in those materials, listed within Class U1 unacceptable material in Clause 601, which would be acceptable as landscape fill.

3 Landscape areas should be shown on the Drawings cross-referenced in Appendix 6/9.

4 Environmental bunds should not be constructed on landscape fill (Class 4) unless special foundations are provided or the fill is improved.

NG 621 Strengthened Embankments

1 Strengthening by interlayering geotextiles or geomeshes into an embankment or an embankment shoulder will resist the tendency for the outer edges to soften and slip after considerable time. This technique will reduce future maintenance costs and enable steeper slopes to be built. Embankments including, for example, earthwork environmental bunds may thus be built to a greater height within the available base width.

2 The properties of geotextiles (see NG 609) and geomeshes should be described in Appendix 6/9 together with construction requirements, cross-referring to Drawings where necessary.

NG 622 Earthworks for Reinforced Earth and Anchored Earth Structures

1 Classes of fill required or permitted and acceptability limits for their material properties, as referred to in Table 6/1, and Table 6/3 where appropriate, should be stated in Appendix 6/1 and identified on the Drawings. The thickness and types of drainage layer required or permitted should also be shown.

2 Drawings should show the maximum height to which fill may be placed above the wall during construction.

NG 623 Earthworks for Corrugated Steel Buried Structures

1 Acceptability limits for MCV, if required, for Class 6K (lower bedding) and Class 6M (surround) fills, as referred to in Table 6/1, should be stated in Appendix 6/1.

2 Where ground investigations have shown that the existing material adjacent to the location of the corrugated steel buried structure has a constrained soil modulus less than the value assumed in the design, or a corrosivity classification determined in accordance with UK Department of Transport Standard BD 12 at which corrosion of metal components could occur, the extent of additional width etc. of excavation should be shown on the Drawings. The Drawings should also show the extent of selected fill materials to be used for the construction of embankments over the structure.

3 Further details on the requirements for earthworks associated with corrugated steel buried structures are given in UK Department of Transport Standard BD 12.

NG 624 Ground Anchorages

1 Unless there are special reasons, the Contractor should design ground anchorages for anchored structures. Full requirements should be shown on the Drawings and described in Appendix 6/10.

2 BS 8081 can give further advice.

NG 625 Crib Walling

1 Outlines shown on the Drawings should allow for the full range of alternative systems. Design requirements should be given in Appendix 6/10, and the Overseeing Organisation should be consulted in formulating these.

2 Where the design retained height exceeds 1.5 m, an outline Approval in Principle form should be included in Appendix 6/10.

NG 626 Gabions

1 If extensive use is to be made of gabions Clause 626 may need extending by means of Appendix 6/10.

2 The Drawings should allow for the full range of alternative systems, except that plastic materials should not be permitted where there is a risk of damage by fire unless further protection is provided.

NG 627 Not Used

NG 628 Disused Mine Workings

1 Full requirements, including location, probing to determine extent, filling methods and materials, any grouting and details of mass or reinforced concrete caps should be described in Appendix 6/11.

NG 629 Instrumentation and Monitoring

1 Full requirements including all details of equipment position, depths, protection to pipe or cable connections, installation techniques, and

methods of calibration and reading should be described in Appendix 6/12.

NG 630 Ground Improvement

Dynamic Compaction

1 Only one system of dynamic compaction, end product or method, should be used in the Contract and the appropriate requirements should be listed in Appendix 6/13. Further advice may be obtained from the Overseeing Organisation.

Ground Treatment by Vibrated Stone Columns

2 Vibroreplacement is used in soft silts and clay soils to reduce their compressibility. The method uses a vibrator and air or water circulation to remove material to the required depth. This is subsequently replaced with granular fill to form a column up to 1.5m in diameter. The fill is placed through the annular space between the vibrator and the surrounding soil and compaction is achieved by vibration as the equipment is removed.

3 Vibrodisplacement is used in stronger clays and granular soils again to reduce compressibility. This method displaces the existing material and the vibrator is generally taken to the required depth of treatment then removed completely before backfilling. Some proprietary systems use a different method. Lifts of granular fill of the order of 1m are often used to achieve adequate compaction of the stone column.

4 In granular soils compaction will also occur in the ground around the vibrator. In cohesive soils this effect is not evident and the stone columns only serve to reinforce and stiffen the ground.

General

5 BS 8004: "Code of Practice for Foundations" provides some guidance on ground treatment using vibrated stone columns.

6 Guidance on the preparation of Appendix 6/13 for ground treatment by vibrated stone columns may be found in the following document:

Specification for Ground Treatment
Institution of Civil Engineers
Thomas Telford Limited, 1987

7 To enable ground treatment using vibrated stone columns to be considered, it is necessary to have relevant and sufficient geotechnical information available.

8 The Overseeing Organisation may design the ground treatment scheme by providing a method specification or the responsibility for the design may be placed on the Contractor in the form of a performance specification.

9 Where the Overseeing Organisation prepares a design, the method chosen must be based on a nonproprietary system. This does not, however, preclude the Overseeing Organisation from accepting an alternative proposal from the Contractor in the event that the Contractor has proprietary plant and equipment ideally suited to the project requirements. In the event that such a proposal is offered by the Contractor, it must be demonstrated that such a proposal can achieve treatment at least equal to the method originally specified by the Overseeing Organisation. Any proposal must be compatible with the site environment.

10 The Instructions for Tendering may require the Contractor to submit with the Tender the name of any ground treatment specialist he proposes to employ. This is to enable the Overseeing Organisation to assess the suitability of the ground treatment sub-contractor's methods. In general, if the Contractor wishes to change his sub-contractor after the Contract has been awarded, the Overseeing Organisation should be prepared to agree if he is satisfied that any alternative method of treatment is technically acceptable.

11 When a performance specification is adopted by the Overseeing Organisation, the details of the Specialist Contractor's proposed methods should be made available to the Overseeing Organisation. It is advisable to prepare the Contract Documents to include an item which will allow preliminary areas to be treated and tested to confirm compliance with the performance specification. It should be made clear that any necessary design changes to the ground treatment process would be the responsibility of the Specialist Contractor.

12 The purpose of requiring the Contractor to give early warning of ground conditions different from those expected from his interpretation of the ground investigation report is to enable the Overseeing Organisation to determine without delay whether

the Permanent Works will be affected. When such differences are reported, it may be desirable to obtain confirmation by having a supplementary ground investigation carried out.

13 The following information should be shown on the Drawings, as appropriate (cross-referenced in Appendix 6/13):

- Location of treatment, including any Preliminary Areas.
- Layout and minimum dimensions of stone columns, including estimated length.
- Any restrictions on the sequence of construction.
- Any other relevant information as identified in Table 6/7.
- Any preparatory works such as earthworks.

Materials

14 Appropriate material for forming stone columns is likely to be satisfied by any material complying with classes 6K, 6M, 6N or 6P (Table 6/1) or granular sub-base Type 2 (Clause 804).

15 If it is necessary to make up ground levels, prior to commencing the ground treatment, the Contract should specify granular material Class 1 (Table 6/1).

Method of Ground Treatment

16 Ground treatment by vibrated stone columns can use either the wet or dry process. The former method is more appropriate in weak silts and clay soils.

17 Where the wet process is used, the vibrator must be kept in the hole continuously during backfilling in order to ensure the stability of the walls of the hole.

18 Where the dry process is used, the ground to be treated must be sufficiently strong to keep the hole open until the backfilling process is complete. The Contractor should be asked to demonstrate that the hole is kept open whilst backfilling takes place, ensuring clean placement of a vibrated stone column from the base of the hole to the working surface. Alternatively, the Contractor may demonstrate that he has plant and equipment which allow feeding of backfill material to the base of the hole without removing the vibrator. Further

information on the method can be found in the reference in NG 630.6.

Design Considerations

19 The Overseeing Organisation may undertake design of the method of ground treatment or invite proposals from tendering Contractors.

20 Where a scheme is designed by the Overseeing Organisation, consultation with experienced geotechnical specialist Contractors is recommended. In conjunction with a detailed ground investigation, this approach should allow the selection of the most appropriate materials and column spacing. Columns are typically 1.0m in diameter although the maximum diameter depends on the properties of the existing ground. As a guide loads up to 300kN have been supported by columns formed in clays although this could be much less for weaker clays and soft silts.

21 Vibroreplacement is unlikely to be a successful means of treatment in cohesive soils with immediate undrained shear strengths less than 15kN/m². Similarly, this method of ground treatment is not recommended in organic silts and clays, deposits of peat or household refuse.

22 To complete a design for ground treatment by vibrated stone columns, the Overseeing Organisation or Contractor, as appropriate, will provide a specification in Appendix 6/13.

23 The Drawings and the specification in Appendix 6/13 will address the following aspects:

- (i) Method of Ground Treatment.
- (ii) Sources of material.
- (iii) Performance criteria (End product specification).
- (iv) Depth of treatment, spacing and size of columns.
- (v) Areas to be treated including any preparatory work such as levelling and grading of the existing site.
- (vi) Water supply and effluent/slurry disposal (wet process).
- (vii) Verticality and positional tolerances.
- (viii) Dealing with known and unforeseen obstructions.
- (ix) Site Control:
 - Records
 - Ground Heave
 - Overtreatment

Debris Surface Compaction

24 Performance criteria will apply to designs produced by the Overseeing Organisation or the Contractor as the case may be. Generally, load/displacement criteria will be developed for the proposed construction on the treated site and in situ testing should be designed to measure the performance. Appropriate tests are indicated in sub-Clauses 630.12, 13 and 14 and the Overseeing Organisation should decide on a testing frequency which will be representative of the entire treated area. The Overseeing Organisation should also determine if any other tests are appropriate and detail these in Appendix 6/13. It is strongly recommended that a trial area is included in the Contract, with in situ testing to assess performance. If necessary appropriate modifications can be made to the treatment process on review of preliminary area testing.

25 Depth of treatment, spacing and size of columns depend on the thickness and strength of the existing soils. Consultation with specialist geotechnical contractors is the recommended approach to ground treatment schemes designed by the Overseeing Organisation.

26 Where proposals are invited from Contractors, based on a performance specification, the Overseeing Organisation should appraise the Contractor's design with a view to verification by field testing in preliminary treatment areas. In the event that successful performance is achieved in preliminary treatment areas, these can be incorporated in the Permanent Works.

27 The Specification must clearly state that the Contractor is wholly responsible for the supply of clean water and the disposal of effluent and slurry arising from jetting and flushing operations.

28 Verticality and positional tolerances should be set by the Overseeing Organisation or Contractor, as appropriate. Generally, column centres should be within 150mm of the positions shown on the Contract Drawings. Top surfaces of columns should be finished between 0mm and +75mm from the specified levels. Overall design should allow for final levelling and compaction of the area of treatment as a whole to establish an even bearing surface. During the penetration stage, a maximum deviation of 1 in 20 from the vertical is normally permitted although endeavours should be made to

reduce this further if possible. However, it should be appreciated that unduly close tolerances will usually adversely affect the costs.

Obstructions

29 Known obstructions will need to be removed if treatment is required at such positions. Alternatively, it may be economically more viable to leave known obstructions in place and use other methods such as piling at these locations.

30 Unforeseen obstructions will necessitate either investigation and removal of the obstruction or modification of the layout of the ground treatment scheme.

Site Control

31 Site control of operations is essential in monitoring the correct installation and performance of the treatment. Records should be maintained as required in sub-Clause 630.20 with any further information detailed in Appendix 6/13. It is advisable that work is carried out under the control of a Specialist who is conversant with the methods to be used. Particular attention should be given to potential overtreatment recognised by either excessive heave of the ground or the addition of excessive backfill.

Testing of Ground Treatment

32 The performance criteria for treated ground should be stated in Appendix 6/13.

33 The Overseeing Organisation should specify types and frequencies of testing appropriate to the area to be treated and the type of construction proposed at the treated site. Sub-Clauses 630.12, 13 and 14 identify appropriate test methods.

34 Standard Penetration Tests, Dutch Cone Tests or dynamic cone penetration tests should be used before and after treatment between compaction centres to indicate increase in relative density. The spacing should be chosen to give a representative overall picture of the treated area. It is suggested that tests be undertaken at 10 m to 20 m centres depending on the size of the site.

35 It is recommended that a minimum testing frequency of one zone or plate test for each 2000m² of treated ground is adopted.

36 Ideally, trial areas should be treated and tested to establish performance (sub-Clause 630.15).

Records and Reports

37 The minimum requirements for records of treatment and testing are identified in sub-Clauses 630.19 and 20. Further information may be stipulated in Appendix 6/13 with regard to project specific needs.

Other Methods

38 Other methods of ground improvement such as vertical drains, vibro-flotation and vibrated concrete or lime columns should be detailed on the Drawings and listed in Appendix 6/13, where they are required.

NG 631 Earthworks Materials Tests

1 Where the limiting values of acceptability are determined from tests which are relatively time consuming, other tests may be considered for rapid evaluation during construction. For example moisture content determination may be obtained using quicker drying methods than are required by BS 1377 : Part 2 or nuclear moisture gauges may be permitted. See also NG 633.

2 Appendix 6/1 should state whether the Contractor or the Overseeing Organisation will be responsible for testing and, where the Contractor is responsible, the testing details should be given in Appendix 1/5 and cross-referenced in Appendix 6/1.

3 Where the Overseeing Organisation is carrying out testing Appendix 1/1 should list the apparatus and materials required, and Appendix 1/6 should list details of samples. For some unusual tests such as 300 mm and 60 mm shear box tests, redox potential and resistivity it may be more appropriate for testing to be carried out by a laboratory from abroad (e.g. Federal Highway Research Institute of Germany). The 300 mm shear box should not normally be required on Site.

4 See also NG 602.1.

NG 632 Determination of Moisture Condition Value (MCV) of Earthworks Materials

1 Appendix 6/1 should state whether the MCV/mc relationship of all imported material requiring an

MCV property should also be plotted and whether the rapid assessment procedure for material acceptability may be used.

NG 633 Determination of Undrained Shear Strength of Remoulded Cohesive Material

1 Where shear strength is used as the acceptability criterion, routine site testing may be more conveniently carried out by e.g. hand vane or hand penetrometer monitored by periodic triaxial test comparison to give adequate correlation. (See NG631)

NG 636 Determination of Effective Angle of Internal Friction (ϕ) and Effective Cohesion (c') of Earthworks Materials

1 For granular Class 6N, 6P, 6I and 6J materials, consistency of supply may be checked by comparing samples with the grading, particle shape, plasticity and other characteristics of the material used for the shear box test.

2 Where the results of control tests using the 60 mm shear box for Class 7C and 7D materials differ from the initial values obtained during the initial determination of fill properties by more than 20%, the variability should be investigated, and if necessary, further tests using the 300 mm box should be carried out to check that the material remains within the limits of acceptability.

NG 637 Determination of Resistivity (r_s) to Assess Corrosivity of Soil, Rock or Earthworks Materials

1 When laboratory tests are required, Appendix 6/1 (1/5) should state which of the three types of test described in BS 1377 : Part 3 should be employed.

2 For in situ tests

- (i) Proper contact between the electrodes and the fill should be obtained particularly where the electrode penetration is shallow.
- (ii) Tests should be carried out at the anticipated maximum natural moisture content in order to obtain the lowest resistivity.
- (iii) Locations should be chosen so as to cover the entire area of the structure, cutting, borrow pit or stockpile. The distance between locations should exceed three times

the maximum spacing of the electrodes but not be more than 50 m.

- (iv) The field testing procedure is not suitable for massive rock material which is to be crushed before use in the Permanent Works. In this case laboratory tests should be carried out on samples of crushed material using a procedure given in Appendix 6/1.

NG 638 Determination of Redox Potential (Eh) to Assess Corrosivity of Earthworks Materials for Reinforced Soil and Anchored Earth Structures

1 Appendix 6/1 should contain the following:

- (i) The number of tests to be carried out on each soil type and the locations within the area of the cutting or of the proposed borrow pit or stockpile. A minimum of five locations should be included. It is normally sufficient to test material at a depth of 1 m below original ground level. However, it will be necessary to test at lower levels where the type of material is known to vary with depth, and the depth of such tests should be given in Appendix 6/1.
- (ii) When possible, tests should be carried out at the anticipated maximum natural moisture content in order to obtain the lowest redox potential.
- (iii) The pH of the fill at each location should be determined before measuring redox potential. Where the pH of the fill lies outside the range 5.5 to 9.5, and it is known that it will remain so for the life of the structure, redox potential measurements may not be required since it is considered that micro-biological corrosion is unlikely to occur under these conditions.
- (iv) The field testing procedure is not suitable for massive rock material which is to be crushed before use in the Permanent Works. In this case laboratory tests should be carried out on samples of crushed material using a procedure given in Appendix 6/1.

NG 639 Determination of Coefficient of Friction and Adhesion between Fill and Reinforcing Elements or Anchor Elements for Reinforced Soil and Anchored Earth Structures

1 The test for reinforcing elements should be carried out for each type of element and each fill material proposed to be used.

2 Sub-Clause 639.5 for anchor elements is drafted so that such a test may be introduced in future when it is developed. Appendix 6/1 (1/5) should not require a test until that time.

NG 640 Determination of Permeability of Earthworks Materials

1 Details of tests for the permeability of soils and fills are given in BS 1377: Part 5 and Part 6. Details of a test for the horizontal permeability of road drainage layers are given in Advice Note HA 41.

NG 642 Determination of the Constrained Soil Modulus (M^*) of Earthworks Materials

1 BS 5930 gives further information on, and illustrations of, suitable plate loading test equipment.

2 Determination of M^* from Standard Penetration resistance test results and/or from the coefficient of volume compressibility is normally carried out during the ground investigation stage of a scheme from tests in and/or specimens obtained from boreholes through the existing ground. The ground investigation shall be designed to ensure that sufficient information is provided to determine the M^* of the existing ground. The plate loading test is the preferred method for determining the M^* of granular fill, during the construction stage to validate the design, but can also be used on existing ground of various soil types.

NG Sample Appendices

NG SAMPLE APPENDIX 6/1: REQUIREMENTS FOR ACCEPTABILITY AND TESTING ETC. OF EARTHWORKS MATERIALS

[Note to compiler: This should include:]

1 Acceptable limits for the fills in Table 6/1 appropriate to the Contract *[Table 6/1, 602.1 and 608.1]* and including:

- (i) permitted Classes where alternatives are listed in the Specification;
- (ii) those materials, which may be used for landscape fill Class 4 *[601.2(ii)]*;
- (iii) cross-references to Drawings showing location of 'zoning' of general and selected fills;
- (iv) additional sub-divisions of Classes in Table 6/1 required for the Contract;
- (v) alternative and additional requirements for triaxial and shear box tests *[633 and 636]*;
- (vi) Class 9D lime stabilised material *[615.5, 615.16]*.

2 Special requirements for determining acceptability, who classifies and where, and whether trial pitting is required *[602.1]*. *[Where the Contractor is responsible for testing, the tests required should be scheduled in Appendix 1/5 and cross-referenced here. Advice Note HA 44, gives further details.]*

3 Any requirement for processing to render unacceptable material Class U1 acceptable, cross-referring to Drawings where necessary, for each type of material to be processed and class of material to be produced. *[Wherever possible the means of processing should be left to the Contractor] [601.4].*

4 Requirements for groundwater lowering or other treatment *[602.17]*.

5 Minimum MCV required immediately before compaction for lime stabilised Class 9D material *[615.13]*.

6 Any permitted use of the rapid assessment procedure for material acceptability *[632.3]*.

7 Requirements (if any) for removal off site of excavated acceptable material or unacceptable material requiring processing *[602.3]* or retention of surplus material on site *[602.5]*.

8 Permitted use (if any) of acceptable or unacceptable material required to be processed for purposes other than for general fill *[602.4]*.

9 Requirements for In Situ Resistivity Tests *[637.2]*.

10 Requirements for In Situ Redox Potential Tests *[638.2 and 5]*.

11 Bearing ratio requirements for class 6R and 7I material *[643.6]*.

NG SAMPLE APPENDIX 6/2: REQUIREMENTS FOR DEALING WITH CLASS U2 UNACCEPTABLE MATERIAL

[Note to compiler: This should include:]

- 1** Drawing references for excavation and disposal of known Class U2 material.
- 2** Pre-agreed environmental requirements for disposal including specific sites (Local Authority etc.).
- 3** List of known hazardous materials likely to be encountered.
- 4** Methods of excavation, precautions and requirements for handling.
- 5** Special requirements for dealing with leachate and contaminated water.
- 6** Requirements for special drainage and for sealing exposed surfaces of contaminated materials.

NG SAMPLE APPENDIX 6/3: REQUIREMENTS FOR EXCAVATION, DEPOSITION, COMPACTION (OTHER THAN DYNAMIC COMPACTION)

[Note to compiler: This should include:]

- 1** The drawing numbers of all drawings which give related earthworks requirements including line and level.
- 2** Blasting for excavation:
 - (i) Whether blasting is required or is a permitted alternative to normal excavation methods [607.1].
 - (ii) Pre-split blasting requirements [603.4].
 - (iii) Locations where blasting is required or permitted [607.1].
 - (iv) Time limits when blasting can take place [607.1]. *[Ensure compatibility with Clause 109 and Appendix 1/9 requirements for noise and vibration].*
 - (v) Limits of vibrational amplitude and resultant peak particle velocity if differing from those in Clause 607.
 - (vi) Overseeing Organisation's arrangements for Contractor to monitor noise and vibration in property off Site.
- 3** Cutting faces - requirements for:
 - (i) Undercutting restrictions - extent and limitations for sequential excavation and backfilling, where Contractor is required to undercut slopes or toes of cuttings [603.2]. *[Note that where similar requirements exist for embankments e.g. where drainage excavations are close to the toe, these should also be covered in this Appendix].*
 - (ii) Clearing loose material, where no topsoiling is required, by airline hose including maximum pressure and nozzle arrangements [603.5(iv)].
 - (iii) Making face stable, where no topsoiling is required, including tolerances of irregularities in the cut face, depth of cut-back and thickness of cementitious material to be applied if different from

Clause 603, extent of cementitious material to be applied, location and type of reinforcement and details of weep holes. *[Rock bolting should be described in Appendix 6/10.]*

- (iv) Protecting face of soft or insecure material interlayered with rock, where no topsoiling is required, including depth of back and details of masonry infill.
- (v) Making good prior to topsoiling *[indicating which, if any, of the measures in 603.7 are required, and where.]*

4 Watercourses including ditches etc.

- (i) New or modifying old - details including protection, lining etc. *[606.1]*.
- (ii) Redundant - where draining and clearing required, extent of excavation and Classes of fill for their infilling *[606.4]*.

5 Embankment Construction:

- (i) Limits on oversteepening or in increase in width *[608.5]*.
- (ii) Stage construction of fills - details and rates of controlled filling *[608.6]*.
- (iii) Surcharging - details including time period, type of surcharge material, initial level of top of surcharge above designed formation or sub-formation *[608.7]*.
- (iv) Minimum thickness of capping or of sub-base as appropriate for weather protection of sub-formation or formation *[608.9(i)] [cross-referring to Drawings if necessary]*.
- (v) Description of location, class and thickness of starter layers *[608.2]*.

6 Compaction *[612]*:

- (i) General:
 - (a) Requirements if compaction not to comply with Clause 612 *[612.1]*.
- (ii) Method compaction:
 - (a) Locations where extra compaction in top 600 mm for Classes 1A, 1B, 2A, 2B, 2C and 2D is not required for full width of embankment or between outer extremities of verges. *[List Drawing Nos. of appropriate cross-sections (612.10(ii))]*.
 - (b) Requirements for compaction of drainage materials other than Class 6H.
 - (c) Frequency of field dry density testing *[612.9]*
- (iii) End-product compaction:
 - (a) Whether a nuclear surface density gauge is to be used or is permitted for measuring field dry densities *[612.16]*.

7 Limiting distance for deposition of materials referred to in sub-Clause 601.11 or 601.12.

8 Locations of excavations that are permitted to be battered and requirements for benching prior to backfilling and compaction *[602.12]*.

9 Locations where excavation supports are to be left in position [602.12 and 505.6].

10 Requirements for benching or shaping to natural or earthworks slope faces to receive fill [608.10]. Location of and benching requirements for cutting slopes to receive topsoil, and areas of cutting slopes which do not need harrowing or harrowing depth if not 50 mm [603.7].

11 Permitted variation (if any) in the maximum difference in fill level of Class 6M material on opposite sides of corrugated steel buried structures from 250 mm [623.7].

12 Contract-specific permitted depth of any protection layer over corrugated steel buried structures [623.13].

13 Contract-specific permitted mixing of excavated materials where a combination of acceptable and unacceptable material is revealed in excavations [602.6].

14 Fill to excavated voids or natural voids in excavation for foundations where ST1 concrete is not required or an alternative is permitted or required [604.1 and 2].

15 Additional requirements for corrugated steel buried structures [623.2] [cross-referring to Drawings if necessary].

NG SAMPLE APPENDIX 6/4: NOT USED

NG SAMPLE APPENDIX 6/5: GEOTEXTILES USED TO SEPARATE EARTHWORKS MATERIALS

[Note to compiler: This should include:]

1 Drawing references for locations where geotextiles are to be used in separation layers [609.1].

2 Whether the geotextiles are to be of synthetic or other fibres [609.1].

3 Minimum life expectancy [609.2].

4 Distribution and numbers of samples for subsequent testing [609.4].

5 Testing criteria if different from those in sub-Clause 609.4.

6 Details of laying and lapping if other than as in sub-Clause 609.5.

7 Number of tests on samples [609.8].

8 Length of time samples are to be kept by Contractor [609.7].

NG SAMPLE APPENDIX 6/6: FILL TO STRUCTURES AND FILL ABOVE STRUCTURAL FOUNDATIONS

[Note to compiler: This should include:]

1 Drawing references for fill to structures and fill above structural foundations.

2 Whether Classes 6N and 6P require full scale determination of stable slope, and value of slope if not 1 to 1.5 [610.6].

NG SAMPLE APPENDIX 6/7: SUB-FORMATION AND CAPPING AND PREPARATION AND SURFACE TREATMENT OF FORMATION

[Note to compiler: This should include:]

- 1** Drawing references which show locations where capping is required and its thickness *[613.1]* for each type of pavement.
- 2** Allowed surface level tolerance *[616.1]*.
- 3** Permitted Classes of capping singly and in combination *[613.2]*.
- 4** In cuttings and on embankments, the procedure to be adopted for construction of capping, or which alternatives are permitted *[613.7 and 613.8 respectively. This is mostly governed by material Classes in (3) above]*.
- 5** Drawing references [including use of appropriate Drawings, by reference, in ADT Road Construction Details which give shaping requirements for sub-formation. *[613.4]*].
- 6** Whether quicklime, hydrated lime or other form of lime should be used for lime stabilisation.
- 7** Locations where treatment of formation in accordance with sub-Clause 616.4(i) or 616.4(ii) is required.
- 8** Details of any additional tests for rate of spread of lime *[615.6]*.
- 9** Intervals for preparation and availability of chemical analysis reports if different to weekly *[615.4]*.
- 10** Preparation of formation on existing sub-base material *[616.6]*.
- 11** Requirements for cement type in lime and cement stabilisation *[643.5]*.
- 12** Requirements for alternative thickness of layers to be stabilised *[643.9]*.
- 13** Alternative treatment requirements for layers to be stabilised *[643.10 & 16]*.

NG SAMPLE APPENDIX 6/8: TOPSOILING, GRASS SEEDING AND TURFING

[Note to compiler: This should include:]

- 1** The compiler is required to designate on the Drawings, those areas of Class 5A material *[602.9. The compiler should be satisfied that such material is suitable for the landscape planting proposals]*.
- 2** Drawing references which show the locations where topsoil and vegetation is to be left in place and where topsoil is to be stripped as turf *[602.9]*.
- 3** Drawing references which show depths to which topsoil is to be stripped *[602.9]*.
- 4** Height limits of topsoil stockpiles permitted, if other than 2 m *[602.10]*.
- 5** Reference period of time for when topsoil can be stockpiled if different from sub-Clause 602.10.
- 6** Whether surplus topsoil is to be stored or disposed of by the Contractor. Details of topsoil storage areas such as location, height, contours and batter slopes *[602.11]*.

- 7 Whether imported topsoil Class 5B is required or permitted [618.2].
- 8 Details of topsoil treatment in areas to be turfed. Locations as detailed in Appendix 30/5 [618.4]
- 9 Permitted areas (if any) of non-removal and disposal off site of stones or other debris with dimensions greater than 100 mm equivalent diameter [618.4].
- 10 Thickness of topsoil to be deposited and when a tracked vehicle may not be used for spreading. [618.4(i)]
- 11 Whether the requirements of sub-Clause 618.3 apply *[only when majority of topsoil (Class 5A) to be stripped for re-use has high clay content, to avoid degradation following prolonged rainfall]*. Cumulative rainfall if not 100 mm.
- 12 References to drawings which show the areas to receive Treatments I, II or III.[618.5].
- 13 Thickness of topsoil to be deposited in Treatments I and II and when a tracked vehicle may not be used for spreading.[618.7(I)].
- 14 When hydraulic mulch seeding is not permitted for Treatment I.[618.5(i)].
- 15 List of areas of cutting slopes which do not need harrowing depth if not 50 mm. [618.6(ii)].
- 16 Rate of distribution of fertiliser to be raked in, if other than 75g/m^2 . [618.7(iv)(b)].
- 17 Rate of distribution of seed if different from sub-Clause 618.8(ii).
- 18 Measures for retaining turf on slopes. [618.9 (iv)].
- 19 Requirements for glass fibre or other material to form a retaining agent in hydraulic mulch seeding. [618.10(ii)].
- 20 Drawing references which show areas of grass not to be mown three times. [618.11].
- 21 Mowing plant requirements, if any. [618.11].
- 22 Seed mixture requirements which differ from those listed in Table 6/6 and drawing references showing areas where required. [618.14].

NG SAMPLE APPENDIX 6/9: EARTHWORK ENVIRONMENTAL BUNDS, LANDSCAPE AREAS, SCREENING MOUNDS, STRENGTHENED EMBANKMENTS

[Note to compiler: This should include:]

1 Earthwork Environmental Bunds

- (i) References to Drawings which show locations and which state type of construction [619.1, 2 and 3]:
 - (a) a normal embankment to Clause 608; if so whether method compaction to Clause 612 is required and which Method in Table 6/4 to adopt and Classes of fill permitted or required;
 - (b) a strengthened embankment to Clause 621; if so requirements as listed in 3 below;
 - (c) a reinforced or anchored earth structure to Clause 622; if so full details of construction.

- (ii) Requirements for early construction.
- (iii) Requirements for topsoiling and seeding/turfing.

2 Landscape Areas and Screening Mounds.

- (i) References to Drawings which show locations.
- (ii) If compaction to be 'method' to Clause 612 and if so which method in Table 6/4 to adopt.
- (iii) Details of contouring required.
- (iv) Locations where landscape areas may be constructed simultaneously with adjoining embankments.
- (v) Requirements for topsoiling and seeding/turfing.

3 Strengthened Embankments

- (i) Reference to Drawings which show locations, details of construction and Classes of fill.
- (ii) Requirements for strengthening materials. *[See NG 609.3].*

NG SAMPLE APPENDIX 6/10: GROUND ANCHORAGES, CRIB WALLING AND GABIONS

1 Ground Anchorages *[624]*

[Note to compiler: Include here:]

- (i) Design requirements. *[Where the design retained height exceeds 1.5 m. include the requirement for the design to comply with Standard BD 2 and the outline Approval in Principle form.]*
- (ii) References to Drawings showing installation and construction requirements, including:
 - (a) specifications for drilling, tendons, grouting and tensioning;
 - (b) proof loading, monitoring and re-tensioning;
 - (c) trial installations;
 - (d) rock bolting.

2 Crib Walling *[625]*

[Note to compiler: Include here:]

- (i) Design requirements. *[Where the design retained height exceeds 1.5 m, include the requirement for the design to comply with Standard BD 2 and the outline Approval in Principle form.]*
- (ii) References to Drawings showing locations and outlines.

3 Gabions *[626]*

[Note to compiler: Include here:]

- (i) References to Drawings showing locations and details including:
 - (a) additional requirements and type of mesh [626.1 and 3];
 - (b) core dia. and its BS for mesh if different from 626.3(i);
 - (c) properties of plastic geomesh, if permitted [626.3(ii)];
 - (d) size of mesh openings and gradings of fill [626.5].

NG SAMPLE APPENDIX 6/11: SWALLOW HOLES AND OTHER NATURALLY OCCURRING CAVITIES AND DISUSED MINE WORKINGS

[Note to compiler: This should include:]

- 1 Drawing references showing locations of voided ground or abandoned workings. [627 and 628].
- 2 Location methods for identifying and inspecting shallow workings or voids where required.
- 3 Requirements for bulk fill and methods of placement.
- 4 Grouting, types and procedures.
- 5 Details of excavation, clearance and flushing of soft infilling.
- 6 Details of other treatments or support requirements.
- 7 Requirements for concrete caps to voids or soft areas.
- 8 Requirements for inspecting, monitoring, clearing, flushing, filling, caps or other treatments of disused mine workings. [628.1].

NG SAMPLE APPENDIX 6/12: INSTRUMENTATION AND MONITORING

[Note to compiler: This should include:]

- 1 Drawing references showing locations and extent of instrumentation including that required for staged construction [(629.1 and 2 and 608.6). *Note: instrumentation and monitoring for blasting should be covered in Appendix 6/3 and for dynamic compaction in Appendix 6/13*].
- 2 Schedules of instruments by type and description with alternatives where possible.
- 3 Details of housings required.
- 4 Installation techniques.
- 5 Calibration requirements.
- 6 Protection to instruments, connections and housing.
- 7 Requirements for electric power.
- 8 Frequency of reading and method of reporting readings where the Contractor is required to carry out these tasks.

NG SAMPLE APPENDIX 6/13: GROUND IMPROVEMENT

[Note to compiler: This should include:]

1 Dynamic Compaction

- (i) Drawing references showing locations where dynamic compaction is required.
- (ii) For end-product: performance requirements in terms of tolerable further settlement after process has been completed.
- (iii) For method, the following where applicable:
 - (a) Special drainage requirements *[e.g. de-watering; 602.17]*.
 - (b) Class and thickness of granular layer.
 - (c) Mass, shape and contact area of pounder.
 - (d) Height(s) of drop and spacing of imprints.
 - (e) Number of drops.
 - (f) Arrangements and numbers of passes.
 - (g) Requirements, including class of material, for filling of imprints.
 - (h) Requirements for instrumentation, monitoring and testing.

2 Vibrated Stone Columns

[Note to compiler: include here:]

- (i) Whether the design has been prepared by the Overseeing Organisation or if the design is to be carried out by the Contractor to meet the Overseeing Organisation's performance specification.
- (ii) Drawing references showing locations where vibrated stone columns are required *[630.7]*.
- (iii) Materials to be used *[630.5 and 8]*
- (iv) Method of Ground Treatment and Testing of Treated Ground including
 - (a) wet or dry process *[630.4]*
 - (b) column layout *[630.4]*
 - (c) tolerances on columns *[630.7]*
 - (d) performance criteria *[630.9]*
 - (e) tests to be carried out *[630.12, 13, 14]*
 - (f) alternative tests permitted and testing frequency *[630.11]*
 - (g) additional information (if any) required *[630.20]*
- (v) Trial Areas including
 - (a) areas to be treated *[630.15]*
 - (b) tests to be carried out *[630.17]*
 - (c) testing frequency *[630.17]*

3 Other Methods

For other methods of ground improvement:

- (i) Drawing references showing location and type.
- (ii) Details of spacing, depth, size etc. referring to drawings if necessary.
- (iii) Specification details.

ROAD PAVEMENTS - GENERAL

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ROAD PAVEMENTS –GENERAL

NG 700 General

1 Advice on the construction and maintenance of roads is published in The Design Manual for Roads and Bridges (DMRB) Volume 7. Advice on the design of bituminous roads is published in the Directives for the Standardization of Pavements for Traffic Areas (Edition 2000).

NG 701 Pavement Construction

1 Unless otherwise agreed by the Overseeing Organisation all types of pavement construction according to subgrade conditions as defined in the Directives should be permitted as alternatives for traffic areas. Also the alternative component layers and layer materials within these types should wherever possible be permitted.

Where a restriction of pavement types and/or their component layers/materials is considered necessary for traffic areas details and justification are to be submitted to the Overseeing Organisation for approval.

2 The series of schedules presented in Appendix 7/1 should be completed and referenced to the Drawings.

3 Where the subgrade E_{v2} value is estimated to be of a value requiring capping to make construction works possible for one type of pavement but not for others permitted for the same length of carriageway this should be clearly shown on Schedule 3 in Appendix 7/1 and allowed for in Appendix 6/7.

NG 702 Horizontal Alignments, Surface Levels and Surface Regularity of Pavement Courses

1 All levels of pavement courses are related to the specified level of the final road surface. Tolerances and limits in levels and irregularity are given in Tables 7/1 and 7/3 respectively. These should be strictly enforced to maintain a good ride and constant thickness of material. As they are based on the capabilities of most pavers to lay to a level they do not allow for any intentional reduction of the pavement thickness.

2 Surface levels of different pavement courses should be measured at points on a grid described in Appendix 7/1 in order to be able to determine the thickness of each course from the successive measurement of levels at the grid points. The spacing of the grid should normally be 10m longitudinally. Transversely 3 points are measured (lane axle and the two 1/3 points). Where a greater degree of level control is required, e.g. at junctions of the carriageway with side roads, on slip roads and roundabouts, but not joints in the carriageway, the grid points should be at some lesser spacing. Measurement of surface levels at points on a grid does not mean that the surface can be outside the permitted tolerances at other points between the grid.

Thickness can also be determined by cores and non-destructive measuring.

3 The tolerances on surface levels of wearing courses, and concrete slabs are set in order to provide as good a ride as possible and avoid undulations of an individual or cyclic nature, which are of a wavelength outside the range detectable by the rolling straight-edge or equivalent apparatus. If, however, through a fault in the paving plant the whole surface as laid is consistently high over long lengths, it would be unnecessary to impose the limits of the true surface level tolerances, provided:

- (i) Clearances under bridges are adequate, and allow for overlays.
- (ii) The drainage of the carriage way is not impaired.
- (iii) All tolerances except those on the final road surface design level comply with the Specification.
- (iv) The area affected is of such length as to provide an acceptable ride.

4 The limits for surface regularity of sub-bases under concrete pavement surface slabs is necessarily less when the slabs are laid in a single layer and only compacted by surface compacting beams. With a standard surcharge and a fixed degree of compaction with such equipment, upward variations in the sub-base can be reflected in the surface when the concrete is fully compacted, whereas downward variations will result in lack of compaction locally. These tighter tolerances do not apply when internal vibration is used.

5 Two categories of road are given in Table 7/3, and for each different section of road the category must be stated in Appendix 7/1. The Overseeing Organisation will decide the category on the quality and quantity of traffic, on the road layout and potential speeds of traffic. Category B is generally is for low speed (under 50 km/h) roads. Table 7/3 does not apply to materials laid in accordance with Clause 918.

6 The surface should be thoroughly swept to remove extraneous matter before measurements are taken. All such measurements should be taken early, and any deficiencies in the pavement should be reported as soon as possible to allow the Contractor sufficient time to complete all remedial work and to allow for concrete to cure before opening the road to traffic. Some coarse textures can lead to incorrect readings if the surface is traversed too quickly by the rolling straight edge. Areas shown not to comply with the Specification should be rectified as soon as possible and checked by a 4 m straight-edge or, for longer lengths, by the rolling straight edge or equivalent apparatus.

7 Traces from profilometers are useful in picking out particular areas for remedial work from the whole stretch shown not to comply with the Specification by the rolling straight-edge or equivalent apparatus.

8 For rectifying concrete slabs use of a bump cutter with a long wheel base is essential to produce an even plane without local overcutting. Grinding down either side of depressions may improve the riding quality, if they are small. Deeper depressions should normally be rectified by cutting out and refilling.

NG 703 Weather Conditions for Laying of Unbound Granular and Cementitious Materials

1 Thermal insulation blankets laid on the finished concrete can enhance the rapidity of curing by the retention of heat. This is of benefit not only in cold weather, but also at other periods to accelerate the curing of the concrete slabs.

NG 704 Use of Surfaces by Traffic and Construction Plant

1 Under the Conditions of Contract the Contractor is responsible for care of the Works including the protection of the unbound courses and subgrade.

The Engineer will not know when drawing up the documents what materials, plant, methods and programme the Contractor will adopt.

2 As unbound sub-bases and unbound base courses are moisture susceptible and are unsuitable for construction traffic in wet periods, the Contractor's programme and methods of laying the asphalt base course and subsequent layers should take cognisance of this. Traffic running on unbound courses may also cause irreparable damage to the subgrade or capping. Protection of unbound courses against weather can best be achieved by laying the subsequent layers as soon as possible. Work should preferably be programmed so that the asphalt base course is applied before the unbound courses are wetted.

Any thickening shall be across the full width of that part of the pavement which is in new construction. If temporary haul roads are laid and later removed they must be placed so that drainage of the formation and sub-base surface is not impeded.

3 Where there is a need to open a section of concrete pavement or concrete base course to traffic early after placing the concrete, high strength mixes may be used. To estimate the time when the required strength may be achieved trial mixes should be tested at various early periods to establish a rate of strength development. These times can be confirmed by testing cubes which were placed alongside the pavement in moulds insulated around the sides. However, such results can only be used as expedient for the purpose and not for compliance with the Specification.

NG 705 General Requirements for Sub-bases and Base Courses

1 Clause 705 applies to all sub-base and base course materials whether unbound (800 Series), bituminous bound (900 Series) or cement bound (1000 Series).

NG 706 Excavation, Trimming and Reinstatement of Existing Surfaces

1 Clause 706 describes a method of excavation and reinstatement of existing paved and unpaved surfaces:

- (i) Where the Contractor is required to break into paved areas for the installation of utilities.
- (ii) Where the Contractor unavoidably has to break into work which he has carried out as part of the Works.
- (iii) Where he is required to break into paved areas existing prior to the Works being constructed.
- (iv) Where pavements are constructed to abut or join into existing pavements.

2 Instructions on the installation of utilities will be given in a “ Directive for Reinstatement of Openings in Roads” Up to then advice may be found in the “General Specification and Conditions for Trenching Works” dated April 1992.

3 As much information as possible should be provided in Appendix 7/2 and on the Drawings for 1(ii) and (iii) above, especially to show the areas and depth of pavement required to match levels between new and existing construction. The intention is to ensure that at least a new wearing course should be provided over the minimum area of existing pavement as this will avoid feathering below 40 mm thickness, after preparation of the existing surface by scarifying and planing. Where existing and new concrete pavements abut or join into each other it is normal practice to use a bituminous pavement between the two sections, details of which should be given in Appendix 7/2.

4 Paved areas already constructed as part of the Permanent Works should only be excavated when it is necessary to carry out the Permanent Works or

where no other practical means of completing the Permanent Works can be devised.

5 Advice and methods of reinstating pavements are given in the ‘Design Manual for Roads and Bridges. Volume 7 : Pavement Design and Maintenance : Section 4 : Pavement Maintenance Methods : Parts 1 and 2’.

Advice and methods of reinstating concrete pavements are given in the ‘Concrete Pavement Maintenance Manual’ published by the Concrete Society.

NG 708 Weather Conditions for laying of Hot Rolled Asphalt Wearing Course and Other Bituminous Pavement Layers

1 The term ‘light precipitation’ is considered as rainfall less than 0.5 mm per hour.

NG Sample Appendices

NG SAMPLE APPENDIX 7/1: PERMITTED PAVEMENT OPTIONS

SHEET 1 – FLEXIBLE OR FLEXIBLE COMPOSITE

[Note to compiler: Complete one sheet per option see NG 701.2]

1. Location [e.g. Chainage, Road Name, Carriageway Reference]
2. Grid for checking surface levels of pavement courses, if different from the requirements of sub-Clause 702.4:

Longitudinal dimension:
Transverse dimension:
3. Surface regularity [702.7]

Category of road: [A or B]
4. Requirements for determination of compaction level if different from the requirements of sub-Clause 901.18 and 927.1.
5. Requirements for hardness, durability and cleanness of aggregate if different from the requirements of sub-Clause 901.2.
6. Requirements for regulating course [907]

	<i>Clause</i>	<i>Material</i>	<i>Grade of Binder</i>	<i>Thickness</i>	<i>Special Requirements</i>
Wearing course			[see Note 2]		
Binder course					
Base course					
Sub-base					

TOTAL PAVEMENT THICKNESS: _____

NG SAMPLE APPENDIX 7/1: PERMITTED PAVEMENT OPTIONS

SHEET 1 – FLEXIBLE OR FLEXIBLE COMPOSITE (Continued)

[Notes to compiler:

1. Select the Clauses appropriate to option permitted and only state those required.
2. Grade of binder is to be specified only when different from grade 50/70

SHEET 2 – RIGID CONSTRUCTION

- 1 Location [e.g. Chainage, Road Name, Carriageway Reference]
- 2 Grid for checking surface levels of pavement courses, if different from the requirements of sub-Clause 702.4:

Longitudinal dimension:
 Transverse dimension:
3. Surface regularity [702.7]

Category of road: [Aor B]

Slab type	Slab Thickness	Max Transverse Joint Spacing (m)		Longitudinal Steel Reinforcement	Particular Requirements
		Contraction	Expansion		
Un-reinforced concrete surface slabs (URC)				None	1. Maximum transverse joint spacing maybe increased by 20% if limestone coarse aggregate is used throughout the depth of the slab.
Jointed reinforces concrete surface slabs (JRC)			 mm ² /m width	1. The range of reinfmt. and max transverse joint spacings corres. to slab thickness given and intermediate values may be interpolated. 2. Max transverse joint spacings may be increased by 20% if limestone coarse aggregate is used throughout the depth of the slab. 3. Transverse reinforcement [if required for differential settlement]
	Clause	Material		Thickness (mm)	
Sub-base					

NG SAMPLE APPENDIX 7/1: PERMITTED PAVEMENT OPTIONS

SHEET 2 – RIGID CONSTRUCTION (Continued)

Notes:

- 1 Concrete for surface slabs and roadbases shall be Grade C40 complying with Clause 1001.
- 2 Reinforcement shall comply with Clause 1008.
- 3 Capping is not required/is required as described in Appendix 6/7. *[Compiler to delete as appropriate]*.
- 4 References to drawings showing reinforcement layout and bay layouts at slip roads and junctions, if required

SHEET 3 – SUMMARY OF ALTERNATIVES

[Notes to compiler:

- 1 *Sheet 3 of appendix 7/1 may be used to summarise all the permitted types of pavement and inherent options as stated in sheet 1 and 2 of appendix 7/1*
- 2 *Where this summary is considered better placed on a Drawing, sheet 3 of appendix 7/1 should be omitted and sheets 1 and 2 should of Appendix 7/1 should be omitted and sheets 1 and 2 should cross- refer to the Drawing Number]*.

NG SAMPLE APPENDIX 7/2: EXCAVATION AND REINSTATEMENT OF EXISTING SURFACES

1. Locations of any trenches, pits, etc, which required to be excavated in existing paved surfaces in order to carry out works. Reference to any drawings giving further details. *[706.2]*
2. Locations and estimated areas of existing paved areas which require to be trimmed, regulated and reinstated to math levels where new and existing pavements abut. Reference to any drawings giving further details.*[706.5]*
3. Cross-section diagram of typical trench reinstatement in bituminous and concrete pavements giving details of materials.
4. Reference to drawings which show construction at junction between concrete pavements and between concrete and bituminous pavements.

NG SAMPLE APPENDIX 7/3: SURFACE DRESSINGS

[Note to compiler: Include here details of:]

Location:

Type of Binder *[919]*:

Grade of binder *[919]*:

Target rate of spread of binder *[919]*:

Chippings: Nominal size:
 Coated or uncoated:
 Minimum PSV:
 Maximum LAA:

Other special requirements:

NG SAMPLE APPENDIX 7/4: BITUMINOUS SPRAYS

[Note to compiler: Include here details of:]

Location:

Type of binder [920.2]:

Rate of spread:

Blinding material [920.10]:

NG SAMPLE APPENDIX 7/5: NOT USED

NG SAMPLE APPENDIX 7/6: BREAKING UP OR PERFORATION OF EXISTING PAVEMENT

[Note to compiler: Include here details of the treatment required, cross-referring to drawings as necessary:]

NG SAMPLE APPENDIX 7/7 TO 7/21: NOT USED

NG SAMPLE APPENDIX 7/22: REPAIRS TO POTHOLE

[Note to compiler: The following should be inserted in the Appendix appropriate and extended when required 949]

General

1. (i) All loose material shall be removed before filling the hole.
- (ii) All standing water shall be removed before filling the hole.
- (iii) The filling material shall be compacted by a suitable means.
- (iv) The surface of the compacted material shall be level with that of the adjacent road

Road Stud Holes

2. Fill road stud socket with 6mm bituminous instant road repair material or equivalent.

Holes in Paved Areas

3. (i) For holes less than 0.5m² - fill 6mm bituminous instant road repair material, cold asphalt or equivalent.
- (ii) For holes greater than 0.5m² - fill with 8mm nominal size asphalt concrete or asphalt concrete according to Clause 906
- (iii) Holes shall be backfilled with materials compacted to a compaction degree $\geq 97\%$ with a circular headed vibrating hammer in layers not exceeding 75mm thick.

ROAD PAVEMENTS - UNBOUND, HYDRAULICALLY BOUND AND OTHER MATERIALS.

Contents

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ROAD PAVEMENTS - UNBOUND, HYDRAULICALLY BOUND AND OTHER MATERIALS.

NG 800 General

1 Advice on the use of recycled materials and on design and construction of sub-bases and road bases is published in The Design Manual for Roads and Bridges (DMRB) Volume 7.

NG 801 General Requirements for Unbound, Hydraulically Bound and Other Materials

1 The permitted alternatives are Type 1 for unbound base courses and Types 1 and 2 granular material for sub-bases .

2. Compaction control is based on the relation $E_{v2}/E_{v1} < 2.2$ and may be carried out as a rule in case of soils and granular materials which don't contain plastic fines.

3 Sub-Clause 801.12 (viii) permits combinations of different types of compacting equipment provided each type contributes its correct proportion of the total compactive effort. Thus if a machine when operated singly is required in Table 8/1 to apply X passes and that same machine actually applies K passes, then the sum of the values of K/X for each of the types of plant used in combination should equal or exceed unity.

NG 802 Use of surfaces by Traffic and Construction Plant

4 Under the Conditions of Contract the Contractor is responsible for care of the Works including the protection of the base course, sub-base and sub-grade. The choice of permitted materials is intended to allow the Contractor to make the most economical use of available materials suitable for his method of construction. The contractor shall inform the Overseeing Organization if material of lower quality than required shall be used (e.g. type 4 instead of type 2 in foundation courses) because an increase of the design thickness might be necessary.

5 As some unbound sub-bases are moisture susceptible and are unsuitable for construction

traffic in wet periods, the Contractor's choice of sub-base should be related to the time of year and his programme and method for laying the base-course and subsequent layers. Long delays could be avoided by the use of cement bound material. Traffic running on the sub-base may cause irreparable damage to the subgrade or capping (subgrade improvement). Protection of the sub-base against weather can best be achieved by laying the subsequent layers as soon as possible.

6 Some sub-base and base course materials degrade during normal laying and compacting operations. If there is any doubt about degradation of the material during laying and compacting, then sampling points should be chosen for each material which will be representative of the quality of the laid material.

7 Under wet conditions some Type 2 granular sub-base material can rapidly deteriorate if used by construction traffic and the sub grade can be damaged by rutting, which could result in permanent soft spots. Type 2 granular sub-base material is suitable for its purpose if its moisture content is kept around the optimum value. Work should preferably be programmed so that the base course is applied before the sub-base is wetted.

8 Any thickening shall be across the full width of that part of the pavement that is undergoing new construction. If temporary haul roads are laid and later removed they must be placed so that drainage of the formation and sub-base surface is not impeded.

NG 803, NG 804 Granular Material Types 1 & 2

1 Clause 803 excludes all gravels from granular sub-base material Type 1 and current design requirements exclude granular sub-base material Type 2 in heavily trafficked pavements. Where local experience indicates that these materials can be used successfully, the Overseeing Organization may require that a Substitute Clause should be written to permit their use.

The inclusion of up to 12.5% natural sand in Type 1 is permitted at the discretion of the supplier to adjust the material grading.

2 The value of CBR required for materials to Clause 804 will depend upon traffic loading. For flexible roads carrying a traffic loading of more than 2 msa the sub-base strength should be at least an equivalent of CBR 30%. For traffic ranges below 2 msa the strength may be reduced to CBR 20%.

3 If more than 10% of the material is retained on a 20 mm sieve, the whole material can be assumed without test to have a CBR value of 30% or more. CBR tests should be carried out (when necessary) on specimens which are compacted at a density and moisture content which represent equilibrium conditions under the completed pavement. In most cases the moisture content and density specified in sub-Clause 804.3 will apply but where this is not so it will be necessary to specify separately the required values of density and moisture content for the CBR test. The density relating to a particular air voids content can be calculated using the formula given in BS 1377: Part 4. Compaction into the CBR mould should be carried out in such a way that the required density is obtained uniformly. The number of surcharge discs used in the CBR test should be equivalent to the weight of road construction above the sub-base.

4 The test procedure for the determination of optimum moisture content (OMC) in compliance with BS 5835 has been developed specifically for graded aggregates and gives more reproducible results than the vibrating hammer test of BS 1377: Part 4 for these materials. Whilst there is no specified moisture content for laying and compacting materials to Clause 803, in order to satisfy the requirements of sub-Clauses 801.10 and 803.3, it will be necessary to carry out these operations at optimum moisture content or thereabouts.

5 Routine water absorption tests should be made on the delivered material. If any result from these tests exceeds the declared value (d) by more than 0.5 i.e., $> (d + 0.5)\%$, further investigation will be required.

6 Sub-Clauses 803.2 and 804.2 describe requirements for material passing the 425-micron BS sieve. If the foreign materials component of recycled coarse aggregate or recycled concrete aggregate were to be 'clay lumps', the material may fail these tests and hence fail to meet the Specification.

NG 806 Granular Material Type 4

General

1 Trafficking trials of Type 4 granular sub-base material carried out by TRL have produced rut-depths well within the upper recommended limit of 30 mm.

Subject to experience in use, it may be possible to increase the asphalt content specified in Clause 806.2

Transport and Laying

2 When dry, Type 4 granular sub-base material exhibits a considerable resistance to compaction due to the friction of the bitumen coating. The addition of water has a significant effect on the state of compaction by reducing the friction between the bitumen-coated particles. Type 4 granular sub-base material should therefore be compacted at moisture contents close to the optimum as determined by the BS 5835 method. The test procedure for the determination of the OMC in compliance with BS 5835 has been developed specifically for graded aggregates and gives more reproducible results than the vibrating hammer test of BS 1377: Part 4 for these materials.

Material Properties

3 The particle size distribution of asphalt arisings is best described by the term 'lump size distribution' because of the binding effect of bitumen. The grading envelope obtained will be dependent on the duration of shaking, the temperature at which the determination is carried out and the grading of the mineral particles within the asphalt arisings. Agglomeration of lumps can occur in stockpiled material especially in hot weather or when the material is stored for long periods. It is important that, at the time of placing, the asphalt arisings comply with the specified lump size distribution and care should be taken to ensure that material taken from a stockpile is to the required grading. It may be necessary to demonstrate that the material actually placed in-situ meets the grading specification rather than to rely on tests carried out prior to laying. Lumps, or individual particles of aggregate separated by the planning process, should be angular in appearance. Rounded particles that can be present when using arisings containing

gravel aggregates can lead to difficulties in meeting the rutting criterion.

4 Particle durability in terms of the soundness test (BS 812: Part 121) might be necessary on extracted aggregate if the aggregates have not been tested prior to the introduction of bitumen.

5 Particle hardness in terms of the ten per cent fines test (BS 812: Part 111) might be necessary on extracted aggregate if the aggregates have not been tested prior to the introduction of bitumen.

6 The performance of unbound granular sub-bases is dependent on the bearing strength of the compacted material. The measurement of bearing capacity in terms of CBR has not been specified for Type 4 granular sub-base material.

The measurement of CBR on the Type 4 granular sub-base materials containing bitumen is problematic because the results are dependent upon

the temperature at the time of compaction, the temperature at the time of testing and the duration of loading. However, as the grading envelope ensures that less than 10% of the material is retained on the 20 mm sieve, it can be assumed without test that the material will have an adequate CBR value.

Trafficking Trial

7 A convenient test vehicle is a 3-axle tipper lorry loaded to a gross mass of 24 tonnes (1 pass is equivalent to 3 standard axles). The selection of the test vehicle however should reflect actual site conditions and the equivalent standard axle load should be calculated using the 4th power law.

i.e.:

$N = \text{sum of } (W/10)^4 \text{ for each axle in turn}$

Where: N = number of standard axles

W = axle load in tonnes

SERIES NG 900

ROAD PAVEMENTS – BITUMINOUS BOUND MATERIALS

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ROAD PAVEMENTS - BITUMINOUS BOUND MATERIALS

NG 900 General

1 Advice on the construction and maintenance of bituminous roads is published in The Design Manual for Roads and Bridges (DMRB) Volume 7.

Advice on the design of Bituminous roads is published in the Directives for the standardization of Pavements for Traffic Areas.

NG 901 Bituminous Courses

General

1 Current pavement design methods may give the Contractor a choice of pavements construction methods and of construction materials. The extent of this choice should be stated in Appendix 7/1 and the alternative materials identified by reference to the Specification Clause numbers.

Requirements included in Appendix 7/1 may include grade of binder and binder modifier and aggregate properties such as polished stone value, aggregate abrasion value, Los Angeles value and water absorption.

The requirements for bitumen grades in this edition of SRW refer to BS 3690, which has been superseded in December 2001 by BS EN 12591. The grades of bitumen specified in BS EN 12591 are different from those in BS 3690. Since the BS 3690 grades are not available after 31 December 2001, specifications for use after this date will need to call up the new grades. Advice on appropriate grades can be obtained from the Overseeing

Organisation. HD 36 gives guidance on aggregate properties for new bituminous surfacings.

Aggregates for Bituminous Materials

2 The use of natural, recovered unbound and artificial aggregates is permitted. In this context, recovered unbound aggregates are natural aggregates recovered from a previous use in an unbound form that satisfy the requirements of Clause 901.

Recovered aggregates with lower levels of Los Angeles value can be accepted, where these aggregates have given satisfactory service. It is expected that aggregates with a lower value than that specified could be acceptable for cement stabilization, foundation courses and base courses, provided the cleanness and durability criteria are satisfactory.

There is no current test procedure for cleanness other than the requirements for aggregates to meet the specified BS 594 part 1 and BS 4987 part 1 requirements for the fraction passing the 75 micron sieve. Provided the aggregates meet requirements for particle size distribution, based on the washing and sieving techniques of BS 812 part 103, it is considered the cleanness aspect of the aggregates will be acceptable.

However, the coarse aggregates should be checked to ensure they are not coated with clay or silt after having gone through the drying plant and before being coated with bitumen.

The soundness value test acc. BS812 part 121 should initially be used for

source approval of aggregates, and thereafter only in cases where their durability is suspect. Where experience indicates that an aggregate with a lower soundness value than 75 may be suitable, details of the aggregate and the appropriate soundness value should be inserted in Appendix 7/1. The soundness value test is not intended as a mandatory test for known durable aggregates. The water absorption test can be used as a routine check test of such aggregates. When required, details of the tests should be scheduled in Appendix 1/5.

A water absorption value of 4% or less for coarse aggregates is considered to indicate a satisfactory aggregate source. (This value may be exceeded by fine aggregates.) When absorption values of coarse aggregates exceed the recommended 4%, soundness tests should be carried out for compliance purposes.

Transporting, Laying and Compacting

3 The purpose of Clause 901 is to place reliance on mechanisation of operations to facilitate compliance with the thickness and surface regularity requirements, particularly of wearing courses, and to ensure operation of the paver is such that hand raking and making up of wearing course material is virtually eliminated, except at edges and joints. Hand-laying is also limited to places where operation of a paver is impracticable. Insulated trucks may not be required when weather conditions are favorable and where there is a short haul from mixing plant to laying site.

4 Clause 901 does not relate to laying waterproofing systems on bridge decks. The laying of hot paving materials on bridge deck waterproofing

systems should be adequately supervised to ensure the waterproofing system is not damaged by excessive heat. Stock piling of hot materials should take place off the structure or on suitably protected areas. Damage may be prevented if minimum temperatures (unloaded material) are observed.

5 There is no conclusive evidence to show all vibratory rollers provide consistently greater compaction than that achieved with conventional deadweight rollers in every case. It is desirable that compaction should be maximised so a requirement for site trials of vibratory rollers, proposed as an alternative to conventional deadweight rollers, is included. The trial should not only determine the required number of passes of the vibratory roller, but also the frequency and amplitude of the vibrating rolls and roller speed. Additional advice is included in TRRL Report LR 1102. Where evidence is provided by the Contractor to indicate a proposed vibratory roller will achieve adequate compaction, the evidence should be representative of the conditions likely to be encountered in the Works. Factors which are relevant include types of compacted material and source of aggregate, the thickness and temperature of layers and the condition of the proposed roller compared with that previously used.

6 The frequency and amplitude of vibrating roll and travelling speed of the roller which have been found to be satisfactory in the trials should be used for compaction.

Wearing courses are in principle to compact with high frequencies at low amplitudes, thicker layer (greater than 8 cm) mainly with low frequencies and higher amplitudes. Thin layers (below

2 cm) and wearing courses on rigid support should be compacted without vibration.

7 Compaction degree (PCD) is the ratio of the bulk density of core samples of laid material compared with the density of specimen compacted by the impact compactor. Requirements are laid down in Clause 927.

8 When reliance is placed on a method specification for the control of compaction of bituminous materials, close attention should be paid to the temperature of the material. BS 594 : Part 2, BS 4987 : Part 2 and Clauses 930, 932 to 936 lay down minimum temperatures at which compaction should be substantially complete. It will therefore be necessary to commence rolling at temperatures exceeding the minimum, making due allowance for weather conditions, which may affect the rate of cooling of the laid material. TRRL Report RR4 'Cooling of Bituminous Layers and Time Available for their Compaction' gives useful advice on the subject. For all practical purposes where material is tested for adequacy of compaction in accordance with Clause 929, the requirements should have been achieved above the minimum rolling temperature. Any subsequent rolling at temperatures below the minimum should only be necessary to remove roller marks and regulate the surface.

9 Compliance with sub-Clause 901.7 may not be possible when materials are used as regulating layers. Variable thicknesses will result which could be below the minimum specified in the British Standard.

10 Application of the tack coat to a layer with sufficient bitumen film on the surface may lead to a sliding layer

(displacements and uplifting of the upper layer)

NG 902 Reclaimed Bituminous Materials

1 Reclaimed bituminous materials include millings, planning, return loads from site and offcuts from bituminous layer joint preparation. Return loads can include bituminous materials rejected from site due to temperature problems or visual defects. Waste bituminous materials stockpiled at the plant may also be suitable.

2 To ensure homogeneity and consistency of the final product, all reclaimed materials should be granulated or crushed or similarly prepared before mixing with fresh aggregate and bitumen. It may be possible to add some planning and millings directly at the plant without any form of pre-treatment when the proportion added is less than 10%. Mix design is however necessary also in that case.

3 The requirements for trials, to ensure that the materials comply with the requirements of this Clause in addition to the requirements of this Series should be sufficient to ensure the materials are suitable for use in the pavement.

4 The environmental impact of recycling materials containing polymer-modified binder should be assessed, together with the properties of the mixture, and reported to the Overseeing Organization.

5 Reclaimed asphalt has to meet the requirements of EN 13108 – 8

6 The so called Optimum Bitumen Content will be calculated as the arithmetic mean for the stability plot (maximum), bulk specific gravity plot

(maximum) and the void content (4%) of Marshall specimen. The recommended binder content will be established under consideration of VMA, VFA and B_v at the upper limit of 5% content for wearing, binder and base courses. Air voids up to 6% or 7% may be permitted if it will be demonstrated to the Roads Directorate that the performance complies to the traditionally designed mixes. Extended mix design (wheel tracking test, fatigue tests etc.) may be necessary.

NG 903 Not Used

NG 904 Not Used

NG 905 Not Used

NG 906 Not Used

NG 907 Not Used

NG 908 Not Used

NG 909 Not Used

NG 910 Not Used

NG 911 Mix Design for Asphalt Concrete

1 The special requirements which are different from those of Clause 911 are included in Appendix 7/1.

2 The method of determining the design binder content for wearing course mixtures is described in MS-2. A minimum binder content is required by Clause 903 to clause 906 to achieve long term durability.

3 When Marshall specimen are prepared temperature of aggregate may be 170 °C and of bitumen may be 150 °C so that the compaction temperature 150+ 5 °C is respected. Mixing time can be assumed to be normally 3-5 minutes. Test property curves (MS-2) have to be established at least based on five bitumen content at a difference of 0.3% to 0.5 %.

4 Samples prepared from plant-produced material and tested in accordance with the procedures of MS2 may be not directly comparable with those obtained on laboratory prepared specimens. Verification of the recommended bitumen content after mixing of the first batch should be carried out.

5 The Contractor may usually be permitted to submit design proposals based on different aggregates and gradings. However, once that submission has been tested and proved satisfactory no change in composition or the properties of the constituent materials should be made until proposals for a new design have been tested and proved satisfactory.

6 Checks on production material will be carried before the mix design takes place.

NG 912 Not Used

NG 913 Not Used

NG 914 Not Used

NG 915 Not Used

NG 916 Not Used

NG 917 Cold milling (Planning) of Bituminous Bound Flexible Pavements.

1 Clause 917 relates to the milling of pavements on existing road carriageways. It is not relevant to the rectification of bituminous layers in new construction should be carried out in accordance with Sub Clause 702.10.

2 Warm milling is no longer carried out in practice. Standard milling is the scarifying of pavements or part of it. Milling depths up to 30 cm are possible acc. the type of milling machine.

Fine milling is the scarifying of courses to improve the road safety (rutting) or the levels. Milling depths up to 4 cm are possible acc. the type of milling machine. If the milled surface will be exposed to traffic the requirements to regularity are as follows:

- Construction Classes HD and I to III: $\leq 4\text{mm}$
- Construction Classes IV to VI: $\leq 6\text{mm}$

A special kind of milling is the milling of slits, grooves and trenchies. Widths of 2cm to 200cm and depths from 10cm upwards are possible.

3. Because of the grooves an upper, a lower and a mean milling depth can be determined. Payment is according the mean milling depth. Tolerances for the mean milling depth are the same like for the layer thickness of the asphalt course to be laid on the milled surface.

NG 918 Slurry Sealing

These notes include and extend in some respects the main points of advice and slurry sealing given in BS 434: Part 2.

Slurry sealing is useful for maintenance but not for reinstatement. Advice for thin layer with a laying weight of 10 to 30 Kg/m² (5mm to 15mm) using polymer modified bitumen emulsion can be found in the German Specification ZTV BEA-StB 98.

1 For works of magnitude the full control testing programme should be undertaken, but for a small area of work the Engineer may prefer to judge the material on the basis of the required field trials.

2 Grading of blended aggregates for 1.5mm and 3mm thick finished surface are given. In the event of a greater thickness being required the grading should be revised in consultation with the manufacturer of the particular process.

3 The usual additive used to control consistency, mix segregation and setting rate are Portland cement to BS 12 or hydrated lime to BS 890. However it is advisable to consult the emulsion manufacturer for advice on the pointed.

4 Techniques for mixing and laying vary according to the type of emulsion used and in some cases the use of cationic tack-coat Class K1-40 is recommended before laying the slurry. The machine should be equipped to give a light spray of water onto the track coat film just before the slurry is spread. After the slurry has set sufficiently it may be sometimes necessary to roll it with a multiwheeled

smooth tread rubber-tyed roller. The manufacture of the emulsion should be consulted on the desirability of rolling and also tack coating.

5 Variation in colour of the slurry seal, which can sometimes occur, should normally be self rectifying within 24 hours, but this period may be extended depending on weather conditions and traffic. With some processes using hydrated lime as the additive a degree of efflorescence can become apparent during the first 24 hours and persist of ram while afterwards. This is not an indication of uneven mixing of segregation and it should disappear after 2 to 3 weeks. Coloured slurry seals should be approved by the Overseeing Organisation.

6 Slurry seal made with emulsion specially formulated for the slurry seal process is sufficiently stable to form a free flowing slurry and is capable of sustaining this condition throughout the laying procedure adopted. Setting time of the mix may be within a few minutes or extended as desired. For less rapid setting slurry the emulsion should be Class A4 slow setting. This can be used where the rate of set is not important, i.e when work is being carried out on areas where the slurry can be expected to dry out normally before being subjected to traffic or rain.

NG 919 Surface Dressing

1 Before work commences, early consultation is necessary between the Engineer and the contractor on the method of working and the materials to be used. The weather and the nature of the surface dressed effect the choice of material to be used. As both these are variable, daily consultation between the Engineer and the Contractor are

advisable on choice and programme of work.

2 Remedial work to the existing road for example patching, should be carried out prior to surface dressing.

3 Cleaning of the existing road surface is extremely important. The binder will adhere only to the top layer of the material on which it is sprayed and if there is mud or dust then the surface dressing will fail rapidly through the lack of bond with the underlying structure.

4 Coating chippings with a thin film or binder improves adhesion of the chippings to the sprayed binder film and is particularly recommended when surface dressing heavily trafficked roads, difficult sites in unsettled or adverse weather conditions. When emulsion binders are used for surface dressing, the chippings should be uncoated.

5 Longitudinal joints should have slightly overlapped binder films obtained by leaving a wet edge approximately 100mm wide. Care should be taken to ensure that double chipping does not take place, as this will form a ridge. As the binder overlap is generally in a lightly trafficked location the additional thickness of binder is unlikely to be a problem.

6 Rolling shall be carried out by rubber coated vibratory steel rollers/ or pneumatic tyred rollers. The rollers shall have fully operating sprinkler systems, spraying water or other release agent onto the drum or tyres, so that if the chipping starts to move under the roller exposing binder, the sprinkles are available immediately.

7 Complaints about loose chippings left on carriageways are often received

from road users and representative organizations. So it is emphasized that the aftercare treatment should be strictly complied with by the contractor.

NG 920 Tack Coats and other Bituminous Sprays

Tack Coats

1 This Clause specifies tack coats for asphalt concrete, porous asphalt. Tack coats are not applied to the base below gussasphalt and stone mastic asphalt. Tack coats are applied prior to overlay to promote the development of a homogenous pavement structure. Bond is particularly important in highly stressed areas. Useful advice is provided in the Design Manual for Roads and Bridges (DMRB) Volume 7, HD 37.

2 Bond coats and tack coats promote adhesion between layers of material. Bond coats or tack coats should always be used on an old surface except in the rare cases where a Contractor can demonstrate that full bond between the new material and underlying old road will be developed. This is likely to occur only when the existing surface is uniform in texture, has free binder and is clean and free of all extraneous matter. Traditionally a tack coat using K1-40 emulsion at a rate of 0.35 to 0.55 l/m² has been used to add a little extra binder to an existing surface and is often adequate to initiate adhesion between layers.

3 Tack coats may sometimes need to be blinded with fine aggregate or sand, to prevent them from being picked up when being walked on or driven over, especially during periods of hot weather. Alternatively, ‘non-tack’ bond coats, which are available from

some suppliers, may be used. When these emulsions break, sometimes accelerated using proprietary breaking agents, the residual binder is not as tacky or sticky, only becoming so at the high temperatures associated with the asphalt overlay when they melt at the interface, thereby achieving a bond. These materials are useful for work in urban areas where foot traffic is sometimes unavoidable.

4 Rates of spread of binder should follow the British Standards as appropriate. Rates of spread may need to be altered for varying texture and porosity of the existing road (e.g. an increase by up to 50% may be necessary for scarified or open surfaces in comparison to fresh laid material and an increased rate at the kerb or road edge is beneficial to minimise water ingress where compaction by traffic is least. General guidance is given in Technical Data Sheets issued by the Road Emulsion Association of Great Britain.

5 Particular care is required when applying a bituminous surfacing to an existing concrete road as not all emulsions adhere well to concrete. It is likely that one specially formulated for this application will be needed. The adhesion of a bituminous surfacing to newly laid concrete is a special case and evidence of a satisfactory bond should be provided.

Bituminous Sprays

6 Bituminous sprays may be used to seal and protect earthworks, drainage media, recycled material and cement stabilization including cement-stabilised soil. The primary purpose is not necessarily to promote bond with an overlay, but to limit the evaporation or ingress of water and in cementitious materials, to facilitate proper curing.

Cementitious surfaces are alkaline and in warm summer conditions anionic emulsions may be more suitable than cationic emulsions. Anionic emulsions have an alkaline water phase and can penetrate the surface before breaking and are suitable when basic aggregate is used (e.g. limestone, basalt). Bituminous emulsions to BS 434 should be selected by the Contractor with advice from the manufacturer and by reference to Technical Data Sheets published by the Road Emulsion Association. It is important that the coverage of residual binder is uniform. Even small areas that remain unsealed will increase evaporation of water and in cementitious materials, cause premature drying that will inhibit curing. The surface of the sprayed area should normally be covered with light coloured aggregate to reduce the absorption of heat from the sun's rays and reduce water loss.

General

7 To enable the Overseeing Organisation to identify each product, the data required on the binder data sheet (Appendix 7/4) is to be provided by the Contractor.

NG 921 Surface Texture of asphalt concrete wearing Courses

Roughness – Skid Resistance

1 Crippling action between wheels and the surface depends essentially from surface roughness thickness of water film, properties and condition of tyres and also from the speed. Dry surfaces, have in general a sufficient skid resistance. Macro roughness and micro roughness determine the skid resistance of a wearing course.

Influence of Mix Composition

2 Amount and distribution of asphalt mortar (fine aggregate and binder) influence the skid resistance. High mortar content and the surface reduces the skid resistance. Mixtures composition in connection with laying condition and compaction equipment leads to surface texture whose skid resistance may change within the weeks or months after opening the traffic.

Main influence arrives from the aggregate. High traffic loading may reduce the skid resistance to a level, which is determined by the polish stone value of the aggregate acc BS812, Part 3.

3 Increased chipping content is favorable for the macro roughness and improves the skid resistance level for roads with high traffic volume and fast traffic. There is a tendency that wearing courses with reduced maximum grain size have a higher resistance to polishing. Initial skid resistance and skid resistance under traffic are highly influenced by the amount and quality of the middle and upper sand fraction. Type and grain size distribution of filler don't influence the skid resistance.

4 Type of bitumen doesn't influence the skid resistance. Higher amounts of bitumen than necessary to create a glue capacity of mortar and to cover aggregates reduce the skid resistance.

5 Wearing courses for higher traffic loading should be designed at the upper limit of the permissible void content.

6 Measures to increase the initial skid resistance are described in clause 901, Sub-Clause 19 and 20.

NG 922 Not Used

NG923 Not Used

NG 924 High Friction Surfaces

1 Experience has shown these surfacings to be highly effective in reducing traffic accidents on sites with high traffic density and skidding risk. Typical sites are the approaches to signal controlled junctions, to roundabouts and pedestrian crossings subject to a heavy flow of vehicles.

2 These surfacing are expensive, particularly if productivity is affected by the geometry of a site and the number of areas to be treated. The use of cheaper alternatives should be considered, if feasible, such as improved road signs and markings, improved street lighting, or surface dressing with a high PSV natural aggregate bonded with a binder capable of withstanding the braking forces generated, etc.

3 High friction surface treatments are now available based on a variety of binders, both thermosetting and thermoplastic. Depending on the type of binder, high PSV aggregates, most commonly calcined bauxite, are either broadcast over a pre-applied binder film or pre-blended with binder and the mixture applied. On heavily trafficked sites, the durability of different systems can vary greatly. Expected services life can be between 5 and 10 years.

4 Systems should only be installed on surfaces, which are dry hard and sound, and free from dust, oil excess bitumen or other contaminants that may cause lack of adhesion. Surfaces

not suitable for treatment include slurry surfacing incorporating micro surfacing, fatted and multilayer surface dressings and surface dressing over soft or unsound bases. Performance on concrete may not be as good as on bituminous surfacing and the suitability of a system should be checked by reference to the certificate.

5 High friction-systems are best applied to wearing courses that have been trafficked for some weeks prior to installation of the surfacing. For reasons that are not entirely understood, on occasion cracking which extends into the wearing course can be induced by the application of high friction surfacing. The risk of this occurring is much greater when the wearing course is newly applied and untrafficked. Provided the high friction surfacing is well bonded to the Overseeing Organisation, the cracking may be sealed using a suitable epoxy or similar resin and the high friction surfacing made good. Any cracks in excess of 0.5 mm are the liability of the contractor under the terms of the guaranteed required in Sub Clause 924.8.

6 The minimum polished stone value of the aggregate used in high friction surfacing systems, determined in accordance with BS 812: Part 114, to be specified in Appendix 7/1 can be obtained from HD36. As high friction surfacing systems are not considered to be a standard construction method, a PSV-Volume of 70 should be achieved and are applied in special cases like steep gradients, pedestrian crossings, traffic signals, approaches to roundabouts, etc...

NG 925 Testing of Bituminous Mixtures and Their Component Materials

Example 1 Thickness

Situation: -3.0cm wearing course instead of 4.0cm
-Tolerance: 10%

Price reduction:

-Unit price corrected for 3.0cm
- $P = 1.0/4.0 - 10\% = 25\% - 10\% = 15\%$
-Price reduction (additional)
 $A' = 3.75 \times 15\% = 56.25\%$

Price reduction:

Measuring point	1	5	1	1	2	2	3
U _i (mm)	10	8	7	9	7	7	10
P _i (mm)	6	4	3	5	3	3	6
P _i ² (mm ²)	36	16	9	25	9	9	36

$$\sum P_i^2 = 140$$

$$A = 0.6 \times 2.5 \times 2.5 \times 140 = \text{Lm}525.00$$

Example 2: Bituminous Content

Situation: -Bitumen content acc. mix design: 6.0%
-Mean value of 4 samples: 6.9%

Price reduction: Formula (2)
 $A' = 1/100 \times (0.4 \times 130 - 30) = 22\%$

Example 3: Compaction degree

Situation: -Required compaction degree $\geq 97.0\%$
-Achieved compaction degree: 95.2%
-UP : 2.0 Lm/m², area: 6000m²

Price reduction

$$A' = 1.8^2 \times 3/100 = 9.7\%$$

$$A = 0.097 \times 2.0 \times 6000 = \text{Lm}1164.00$$

Example 4: Regularity

Situation: -Measured regularity U_i
-Required value: 4mm (wearing course)
-UP: 2.5 Lm/m²
-B: 2.5m

ROAD PAVEMENTS – CONCRETE AND CEMENT BOUND MATERIALS

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ROAD PAVEMENTS - CONCRETE AND CEMENT BOUND MATERIALS

NG 1000 General

published by the
Concrete Society

1 Concrete and Cement Bound Materials for use in pavements are applied in Malta only for sub bases (CBM2, i.e. cement stabilization) footways, bus bays, backfilling of trenches and in special cases like steep slopes where asphalt laying is not possible. The series 1000 contains therefore clauses, which are not relevant for the time being but can be used if concrete pavements should be constructed. That means that mainly the clauses 1035 and 1037 (Cement Stabilization CBM 2) will be regularly applied. It might arrive that one of the other clauses can be applied analogously, for example: sealing of longitudinal cracks in asphalt pavements by sealing compounds. Lightweight concrete (also called lean mix) for backfilling of trenches is described in series 2600.

2 Advice on the design, construction and maintenance of concrete roads and for concrete mix design is published in Standards and Advice Notes and

Design: The Design Manual for Roads and Bridges (DMRB)

Construction: Mechanical Construction of Concrete Pavements and Ancillary Works, Concrete Society, Technical Report No. 45.

Mix Design: Design of Concrete Mixes, SO, 1988

Remedial Works: Concrete Pavement Maintenance Manual

Concrete Surfacing thicknesses of 15cm (Construction Class VI) to 30cm (Construction Class HD) are chosen according the type of base course which can be a cement stabilization, unbound material or an asphalt base course.

3 The pavement design requirements for concrete pavements should be based on the Design Manual for Roads and Bridges Volume 7 and shown in Appendices 7/1 and 10/1.

NG 1001 Grades of Concrete and Constituent Materials for Pavement Layers

1 Clause 1001 gives the requirements for materials and limits for mix proportions for designed concrete mixes in the form required in BS 5328.

2 Six grades of concrete are included to meet the needs of sub-bases, base courses with flexible surfacing, continuously reinforced concrete base courses with flexible surfacing and slabs in the pavement surface. Dry, roller compacted, concrete is specified in Clauses 1035 to 1041.

3 The grade for pavement surface concrete has been selected to provide greater durability for increasingly heavy traffic. Grade C30 is required normally for construction classes V and VI and grade C40 is required for construction classes HD to IV

4 In addition to Portland cement CEM I the term ‘cement’ includes other hydraulic binders such as combinations of CEM I and ground granulated blast furnace slag (ggbs) and pozzolanic cements such as blends of CEM I and pulverised-fuel ash (pfa), whether they are blended on site or manufactured by blending or intergrinding. These include Portland blast furnace cement, Portland CEM II/B-V cement and pozzolanic pfa cement.

5 Portland filler cement should not be used in the top 50 mm of the road surface, as this would increase the fine calcium carbonate content and lead to slipperiness. Micro-silica may be used with PC to obtain high early strength concrete.

6 For durability it is necessary to have a water/ cement ratio below 0.45 for pavement surface slabs. The water/cement ratio is defined as the ratio of free water to total cement content of the mix, which can include CEM I /ggbs or CEM I /pfa blends.

7 High early strength Portland cements should only be used where rapid construction is required. In such cases, insulation blankets will be required over the concrete to provide suitable curing conditions, which will reduce the risk of thermal cracking of the concrete.

8 High early strength cements and high cement contents may be used when there is a need to open a section of concrete pavement to traffic early. Prescribed mixes of fixed proportions may be used in rapid construction for high early strength concrete. The proportions of ingredients to be used should be decided by trial mixes which when tested provide the quality, workability and strength development required for the particular application.

9 Both CEM I /pfa and CEM I /ggbs concrete have a long-term increase in strength greater than CEM I concretes for the same 28-day strength and provide greater durability and resistance to chemical attack. However, there is evidence that concretes in the top 50 mm of a road pavement, which contain more than 25% pfa, or 35% ggbs are more likely to suffer from damage under freeze/thaw conditions, and is the reason the amount of pfa and slag is limited to these values. If pfa is included in the mix it permits lower water/cement ratios for a required workability, so providing denser concrete of lower permeability and greater durability.

Admixtures

10 Plasticisers can be used to reduce water in the mix, increase strength and maintain workability at the required level. They can be beneficial in mixes with blends of PC with ggbs or pfa, as the water reduction partially compensates for the loss of early strength.

11 Where low water/cement ratios are used to obtain C40 strength, retarders can be used in high summer temperatures, to ensure that the finishing processes can be completed in time.

Aggregates

12 The maximum size of aggregate allowed is 40 mm, but the contractor’s choice of size will depend on construction methods, and his ability to achieve surface regularity, properly constructed joints and correct alignment of dowels. Larger aggregate provides an advantage in producing a more stable concrete in the lower layer, while 20mm aggregate is preferable in the top

course for forming joints and achieving a good finish.

13 Although cracking due to alkali silica reaction (ASR) is rare in concrete pavements, identical requirements to those for structural concrete are specified. (See also NG 1704.)

14 The soundness test should be used for source approval for aggregates, the durability of which the Engineer considers questionable. It is not intended as a mandatory test for known durable aggregates. The water absorption test can be used as a routine check test of such aggregates.

15 The use of aggregate with high water absorption values is not desirable. There is a higher risk of alkali silica reaction in the presence of moisture in the porous aggregates. Details of the required tests should be scheduled in appendix 1/5.

Routine water absorption tests should be made on the delivered material. If any result from these tests exceeds the declared value (d) by more than 0.5 ie, $> (d + 0.5) \%$, further investigation will be required.

16 When recycled coarse aggregate or recycled concrete aggregate is used as an aggregate, grading variations and quality should be carefully monitored to ensure the requirements of Clause 1701, sub-clause 2 and Table 10/2 are achieved. Material quality should also be controlled by 10% fines value in BS882.

17 The test procedure for identifying and quantifying constituent materials in recycled aggregates is described in Clause 710.

18 When recycled coarse aggregate or recycled concrete aggregate is used, the maximum allowable proportion as part of the coarse aggregate should be determined from trial mixes.

19 The method of test for chloride ion content in recycled coarse aggregate and recycled concrete aggregate should differ from that for natural and artificial aggregates due to the potential chloride content within any adhering cement fractions which needs to be taken into account.

NG 1003 Density

1 Density is required to be measured at regular intervals during paving as well as the trial length. Until nuclear density meters are proven as acceptable for plastic concrete, cores will be required to be cut. To prevent undue damage to the slabs, cores should not be taken at points of high stress such as corners of slabs. The most desirable position for taking cores for routine density and inspection checks is as follows:

- (i) Between quarter points along the slab.
- (ii) Within 0.5 m of any longitudinal joint in a hard shoulder, hard strip or the least trafficked lane of the section being inspected.

2 Where cores contain tie bars or other reinforcement, allowance for the amount of steel should be made in any calculation of the density of the concrete.

3 As a rough rule for assessment of strength, 1% reduction in density equates to a 5% loss of strength of concrete.

4 Calculation of the theoretical maximum dry density (TMDD) of the concrete, for comparison with cores, should take into account the bound water due to the hydration of the cement. This will vary with the age of the concrete. In calculating the TMDD the mass of hydrated cement is found by multiplying the mass of cement in the fresh cement mix by a time factor (F) determined from the following Table NG 10/1:

TABLE NG 10/1: Time Factor (F) for Hydrated Cements and Cement Blends

Age (Days)	CEM 1	CEM 1/pfa	CEM 1/ggbs
1-3	1.13	1.11	1.07
> 3-7	1.15	1.14	1.12
> 7-91	1.19	1.17	1.17
> 91-365	1.22	1.22	1.21

5 The theoretical maximum dry density (TMDD) of the concrete shall be calculated from the formula:

$$\text{TMDD} = \frac{[(F \times W_1) + W_3 + W_4] \times 1000}{\frac{W_1}{P_1} + \frac{W_4}{P_4} + \frac{W_3}{P_3} + W_2}$$

Where

F = time factor for hydration of cement from Table NG 10/1

W1 = mass of cement (kg)

W2 = mass of total water (in aggregate + added) (kg)

W3 = mass of oven-dry sand (ie fine aggregate) (kg)

W4 = mass of oven-dry coarse aggregate (kg)

P1 = relative density of cement

P3 = apparent relative density of sand (ie fine aggregate)

P4 = apparent relative density of coarse aggregate

Note:

- (i) The apparent relative density and moisture content shall be determined in accordance with the method described in BS 812 : Part 2.
- (ii) Where more than one size of coarse aggregate is used then:

$$W_4 = W_a + W_b + W_c + \dots W_n$$

and

$$\frac{W_4}{P_4} + \frac{W_a}{P_a} + \frac{W_b}{P_b} + \dots \frac{W_n}{P_n}$$

Where W_n is the mass of oven-dry aggregate of a certain fraction and P_n is the apparent relative density of that certain fraction.

- (iii) Where blends of PC and ggbs or PC and pfa are used then:

$$W_1 = W_o + W_g \text{ or } W_1 = W_o + W_p$$

and

$$\frac{W_1}{P_1} = \frac{W_o}{P_o} + \frac{W_g}{P_g} \text{ or } \frac{W_1}{P_1} = \frac{W_o}{P_o} + \frac{W_p}{P_p}$$

where suffix o = PC
 g = ggbs
 p = pfa

values of Po = 3.12
 Pg = 2.90
 Pp = 2.00 are recommended

Table NG 10/2 gives a worked example of the determination of the theoretical maximum dry density (TMDD).

NG 1004 Quality Control of Concrete Strength

1 BS 5328: Part 4 is used as the basis for control testing of pavement concrete but the rate of sampling and testing has been modified.

2 The 7-day strengths are used to give early warning of the possibility of low results and any need for additional cement after 7 days can be verified by the test results at 28 days. The ratio between 7 and 28 days should be established on laboratory trial mixes, but once paving has started this ratio can be updated from the most recent test results of 7 and 28 days on the same batches.

3 When two radically different mixes are used in the slab in two-layer construction, the statistical check on strength results should be carried out on the mixes separately.

4 The average value of 4 results represents 600m² of work at the minimum specified rate of testing. If the Contractor wishes to reduce the area of pavement at risk he may wish to arrange for a higher rate of testing.

5 Cores may be taken and tested in compression and assessed in accordance with BS 6089 in order to assess whether (and how much) concrete should be rejected in the event of compression strengths of representative batches not meeting the specified value.

TABLE NG 10/2: Density of Concrete

Constituent	Batch† Weight kg	Moisture Content %	Water in Aggregate kg	Oven Dry Weight kg	Relative Density	Absolute Volume m ³	Mass Partially Hydrated Material kg
Cement	336			336	3.12	0.108	386.4**
Water	137					0.191††	
Sand (ie Fine aggregate)	689	4.7	30.9	658.1	2.63*	0.250	658.1
Coarse 40-20	657	1.2	7.8	649.2	2.60*	0.250	649.2
20-10	330	1.9	6.2	323.8	2.60*	0.125	323.8
10-5	221	4.1	8.7	212.3	2.62*	0.081	212.3
			53.6			1.005	2229.8
* Apparent Relative Density †† Volume of total water (water in aggregate + water added at mixer) ** Time Factor (F) of 1.15 used							
Theoretical Maximum Dry Density (TMDD)				= 2229.8 = 2219 kg/m ³ 1.005			
Minimum Dry Density Requirement of 97% (non-air entrained concrete)				= 2219 x 0.97 = 2152 kg/m ³			
Minimum Dry Density Requirement of 93%# (non-air entrained concrete)				= 2219 x 0.93 = 2064 kg/m ³			

Notes: In practice, the batch weights for air entrained and non-air entrained concretes are unlikely to be the same # 92% for 20 mm maximum size

NG 1005 Workability

1 The Compacting factor (CF) is a suitable workability test for most of the stiff mixes required for machine paving. The CF test or the Vebe test should be used on trial mixes of cohesive mixes, eg. when ggbs or pfa are used, to measure the effect of vibration for a range of CF values.

2 The optimum compacting factor at the paver will need to be reassessed at intervals depending on the climatic conditions.

3 Workability should be constant. A useful check on whether the workability is constant can be obtained by noting the power input to the mixer. If necessary, plasticising or retarding admixtures should be used to suit local or weather conditions.

4 The target values for CF will vary with the mixes and materials used and with the weather. Approximate values are:

- (i) single layer construction 0.80 - 0.85
- (ii) two layer construction
 - top layer 0.80 - 0.83
 - bottom layer 0.75 - 0.78

Low workabilities are required in the concrete to ensure that inserted dowel bars are retained in position. Higher workabilities are necessary to allow the texturing and finishing to be completed satisfactorily within the time available. In practice a compromise is required depending on the method of construction.

5 As consistently correct workability is of prime importance for the slab to meet the

requirements of the Specification, it is in the Contractor's interest to control it by frequent testing at the batcher so that adjustments can be made quickly before too much concrete is transported to the paver. Tests at the paver are also required to ensure that the concrete placed in the paver is within specified limits.

6 For small-scale works where ready mixed concrete is used, no water other than any amount required to produce the specified workability, should be added to the truck mixer drum before discharge. No additional water should be permitted in concrete which has been in transit for more than two hours.

NG 1006 Trial Mixes

1 Unless suitable data is available, trial mixes are required for each source of material to be used. Cements from different sources used with the same mix may have varying effects on the strength and workability of the concrete.

2 The trial mix in the laboratory should be assessed, not only for strength but also for workability and the effects of vibration. It should be used to assess the rate of gain of strength between 7 and 28 days. It is important to know what the ratio will be during the trial length as 28 day results may not be available before normal working is likely to commence.

3 Trial mixes should be used to obtain the rate of gain of strength of normal and high strength concretes to assess the time when the pavement layer may be used by traffic.

The tests should be completed in advance of the start of urgent work such as reconstruction or widening existing roads.

NG 1007 Separation and Waterproof Membranes

1 A separation membrane is required to prevent loss of water from the fresh concrete. For jointed pavements a degree of slip is desirable, so polythene sheet is normally used. For continuously reinforced concrete (CRC), a waterproof bituminous spray should be used on the sub-base because a degree of restraint is required. Geo-textiles are laid between concrete slabs and cement bound materials as sub base.

NG 1008 Steel Reinforcement

1 Supports for reinforcement should be sufficiently numerous and rigid so that the reinforcement will withstand a man's weight with no greater vertical distortion at any point than half the allowable vertical tolerance for the position of the reinforcement.

2 When fixed height supports are used, eg. rings of standard mesh reinforcement, it is necessary to ensure a good surface regularity to the sub-base or base course on which the reinforcement is laid.

3 When prefabricated sheets are laid in two layer construction it is permissible to lay alternate sheets along the pavement with transverse steel uppermost. This allows the transverse lap to be made by placing one transverse bar of one sheet within the first mesh of the next sheet. This requirement will not apply if flying ends are provided in

the prefabricated sheets at the position of the laps.

4. The final slab will be stabilized to sliding by:

- an anchor or
- an increase of the slab thickness to the thickness of the base course. In case of unbound base courses the thickness should be 40cm.

The concrete anchor has a width of 60cm and a depth of 80cm below the pavement. Reinforcement will be carried out by a reinforcing cage consisting of steel bars diameter 16mm at a distance of 20cm. There is an expanded polystyrene board of 40mm thickness below the anchor.

NG 1009 Transverse Joints

1 Transverse joints are normally contraction joints. Expansions are only provided in special cases like internal fittings. Warping joints are retained in Clause 1009 for special cases, eg. for extra joints at manhole positions or when unreinforced slabs are alongside reinforced slabs, or in long narrow or tapered URC slabs between normal joint positions, to reduce the length/width ratio of the slabs to 2 or less, and in other similar situations. Alternatively, instead of extra joints, slabs with an aspect ratio greater than 2 may be reinforced. The spacing of transverse joints should be described in Appendix 7/1.

2 Structures within the pavement depth should be isolated by at least 5 m of hot rolled asphalt or dense bitumen macadam road base.

3 At buried structures the base course and sub-base should be continued over the

structure. The sub-base should be isolated from the structure by not less than 150 mm of granular fill. Composite base courses should not be permitted to abut the structure.

4 At the ends of CRCP, jointed reinforced slabs with expansion joints should be constructed between the anchorages and any other form of pavement. At the ends of CRCP, a jointed unreinforced slab with an expansion joint should be constructed between the anchorages and any other form of pavement. Between anchorages the only joints will be construction joints.

5 Where an unreinforced carriageway is constructed in more than one width and transverse cracking occurs before concreting the adjacent width, repair of the cracks should be carried out before the laying of adjoining slabs to reduce the risk of sympathetic cracking. If extra joints are put in as part of the repair, they should be matched in adjacent subsequently laid slabs.

NG 1010 Longitudinal Joints

1 Longitudinal joints are required at such a spacing as will reduce the combination of thermal warping stresses and loading stresses to a minimum and reduce the risk of longitudinal random cracking. The maximum bay width is therefore set at 4.2m, except when reinforced pavements are constructed in widths up to 6.0m (or 5.0m and 7.6m respectively with limestone aggregate).

2 Joints may be situated at or near lane lines or in the centre of a lane, whichever is the most economical for the Contractor's method of construction, but they should not be near the wheel track especially in heavily trafficked lanes.

NG 1011, NG 1012, NG 1019 Placing and Inspection of Dowel Bars and Tie Bars

1 When dowel and tie bars are to be inserted vertically into fresh concrete the concrete should be fully compacted over them. Tie bars may be inserted into the side of a slab provided the method ensures a good bond to the concrete.

2 The fixings for dowel bar assemblies should be tested for strength in the trial lengths. Once the type of assembly has been approved, sample testing should be carried out in the main construction in the Permanent Works to ensure that standards are maintained.

3 To check the alignment of dowel bars it is necessary to remove the fresh concrete carefully to expose the top half of each end of each bar across the whole width of the slab under construction. The position of the ends of the bars can be measured relative to the side forms or wires by means of steel tapes stretched between the forms or wires, using a vertical spirit level placed alongside the bars. The alignment for level can be measured from nylon lines pulled taut across the forms or measured using a gauge incorporating a spirit level with legs 300 mm apart with forks at the ends for placing over the bars. The legs can include rules to measure the position of the bar ends below the steel tapes.

4 As the measurement of all the bars in any one joint is time consuming it will not be possible to complete the measurement, recompact and finish the concrete within the normal time allowed in Table 10/6. It will be necessary to reinstate with a 1m long reinforced slab as a full depth repair. Alternatively the penultimate joint in a day's

work could be selected for the dowel alignment check. The remaining concrete in the last slab is then discarded before work starts again.

5 Dowel bars, tie bars and transverse reinforcement across a longitudinal joint need to be protected from corrosion. Thin flexible plastic sleeves have been found to be effective for dowel bars. Suitable bituminous protective paint is allowed for reinforcement. Tie bars and dowel bars should be protected by bonded polymeric corrosion resistant coatings.

NG 1013 Joint Grooves

1 Sawn grooves are preferred for transverse contraction and warping joints in summer work as they avoid disturbance to the surface of the plastic concrete. Because of the risk of cracking starting from the bottom at lower temperatures and the fact that bottom crack inducers are not used with sawn joints, joint grooves may be formed at lower temperatures (21 November to 21 February). The timing of sawing the hardened concrete is critical. If sawn too soon the aggregate will be plucked out, if too late, the concrete will have cracked already. If a crack forms before or during sawing, it should be left without sawing alongside it until the time comes to seal it. If the crack cannot be encompassed within a 40 mm wide joint, the slab should be repaired. In slabs constructed in more than one pass of the paver (one rip) cracks may occur earlier in the second pass under the influence of joint movement of the first pass unless sawing is carried out as soon as possible.

2 Narrow crack-inducing grooves should be sawn first and widened for sealing later. In order to meet the requirements for high

paving speeds with an economical number of saws and still reduce the risk of random cracking, it is common practice for approximately every third joint to be sawn as early as possible; the intermediate joints being sawn within the next few hours.

3 Wet-formed joint grooves with bottom crack inducers will be allowed at lower temperatures to ensure cracks appear at joint positions. In such cases it is important that the concrete is fully re-compacted around the former or cork seal. As the joint groove former is placed just below the surface of the concrete, it is important to ensure that the surface of the concrete is a straight plane between the forms at wet-formed joints. Otherwise if the surface level is bowed by excess concrete, the former will be tilted by the diagonal finisher when planing off the excess concrete. The depth of the top layers should be considerably greater than the depth of the joint former so that the positions of the formers are not influenced by the stiffness of the bottom layer.

4 It is not good practice to set the formers low and pull them up again after the diagonal finisher. It is likely to cause lack of compaction of the concrete adjacent to the former and may lead to separation of the removable part of the former and bridging by mortar under it, which may cause horizontal cracking. However, it may be necessary on occasions to adjust the depth of former in which case the whole former must be raised in a vertical plane only using suitable tools. If excess concrete is not cleaned off above the former, concrete or mortar will bridge over the joint and will cause spalling of the arrises before sealing.

5 The joint groove must form a complete discontinuity across the slab, so that the concrete will crack along the joint position.

It is necessary to ensure that the groove is continued across the longitudinal joint and to the edge of the slab by sawing when forms have been removed.

6 In normal summer work in URC only about one joint in four will crack initially. These joints tend to have greater movement at first until the other joints crack later with seasonal temperature changes or under traffic. In pavements constructed in two or more slabs the movement of joints in one slab will influence the cracking of uncracked joints in the adjacent slab from the longitudinal construction joint to the outer edge. A lack of discontinuity along the joint or dowel restraint may result in a crack appearing off line. This can be avoided by cleaning the top of the joint formers, using bottom crack inducers, and ensuring dowel alignment is satisfactory.

NG 1014 Not Used

NG 1015 Joint Filler Board

1 Expansion joint filler board should have pointed ridge as shown in the RCD, drawing number C2. The top of the ridge should be below the surface of the concrete but just within the depth of the sealing groove. It acts as a crack inducer initially and the sealing groove is sawn out later. Any other method of forming the sealing groove should be demonstrated in a trial.

NG 1016, NG 1017 Preparation and Sealing of Joint Grooves

1 One of the main causes of compression failures and damage to joints is the ingress and build up of solids or water-borne silt in the joint over a long period preventing or limiting proper movement at the joint. The requirements of a pavement joint sealant are:

- (i) It should prevent the ingress of any solid matter into the joint.
- (ii) It should form a waterproof seal and prevent most of the surface water from entering the joint crack.
- (iii) It should be robust, have high extensibility, be resilient, be resistant to tearing, have a good bond to concrete and be unaffected by ageing and weathering.

2 Preparation of the sealing groove is most important. In order to remove any laitance from the groove sides and to provide a good key for applied seals, the joint sides must be grit blasted. Grinding may be permitted to clean small lengths of groove where grit blasting is impracticable. Wire brushes may be used to remove filler board prior to grit blasting, and for preparing grooves for compression seals.

3 Cracks will appear at transverse joints sporadically in new unreinforced concrete construction. Those that crack the earliest tend to have greater movement than would be expected if all the joints cracked evenly. This means that the groove width at lower temperatures may be wider than originally constructed, and allowance for future compression of the sealant should be made when sealing in cooler periods and the joint grooves should not be overfilled. Because of the extra movement in new URC pavement joints, cork and compression seal widths need to be greater to maintain them in compression.

4 For compression seals the width of the seal required is governed by the calculated movement to ensure that the seal remains always in compression.

5 With all sealants it is important to keep the top of the sealant below the surface at transverse joints to prevent damage by traffic when the joints are compressed in summer. When sealing in colder periods the level of the seal should be lower than in summer to allow for the compression of the seal upwards in warm periods. When longitudinal joints are sealed, the seal should be just below the surface.

6 There are two grades of two part cold-applied sealing compounds to BS 4254, used in structures and kerbs, etc; one for horizontal joints and the other for vertical joints. The grade offered by the Contractor should be suitable for the particular joint.

7 Although the British Standards refer to two part sealants some types have three parts. These sealants may also be permitted as it is often advantageous to vary the quantity of retarder (within limits set by the manufacturer) according to the temperature conditions at the time of sealing, rather than include it in the hardener. In cooler weather cold applied sealants take longer to cure.

8 In circumstances where longitudinal joints may not be on line with road markings, consideration should be given to the avoidance of contrasting colours of joint sealant and pavement. The requirements for joint sealant colour should be included in Appendix 7/2.

NG 1018 Joints at Manhole and Gully Slabs

1 Wherever possible, manholes and gullies should be sited outside the pavement, but if they occur in the pavement they should either straddle or be adjacent to a transverse joint in jointed concrete pavement. If the

joint spacings are such that a manhole or gully position is in the middle of the slab, an extra joint is necessary which should be a tied warping joint.

2 Details of the reinforcement required in the main slab and in CRC slabs around manhole or gully slabs are given in the RCD.

3 Gully and manhole slabs should have square corners as in the RCD, on the sides that are not adjacent to a joint to avoid a proliferation of cracks induced from oblique corners.

NG 1020 Side Forms, Rails and Guide Wires

1 In order to avoid adverse effects on the riding quality it is most important to check that all the sensors on any wire-guided machine are functioning within the correct tolerances during all paving, especially if the machine has been standing overnight in wet conditions.

2 The sub-base or any bedding for forms should be of sufficient strength to carry the train or paver without vertical movement and where necessary to carry any construction traffic. Cement bound bedding should have sufficient time to reach the necessary strength before paving begins. Precautions should be taken to prevent any construction traffic from damaging the sub-grade next to the rails or paver tracks and so altering the levels after they have been set. Bedding other than the sub-base itself should be broken out after any section of pavement has been constructed and before any adjacent concrete is laid alongside, so that drainage of the subbase and pavement is not impaired.

NG 1021 Delivery, Storage and Batching of Concreting Materials

1 The requirement for 8 hours storage of materials containing sands is to ensure that moisture contents are stabilised so reducing batch variability in the mixed concrete.

2 Checks should be made on the method of delivery and forming stockpiles to prevent segregation and accumulation of moisture. Aggregates can be contaminated during stockpiling, by ‘dozing’ or digging into the soil at the base of the stockpile.

3 For storing Portland cement, ggbs and pfa, a silo having a dividing partition down the middle may be regarded as two separate silos, provided the materials either side of the partition are kept separate from each other at all points in the silo and provided individual filters are fitted for each compartment. The operation of the two compartments must be independent of each other.

NG 1022, NG 1023 Mixing, Transport and Delivery of Concrete

1 A constant supply of concrete with consistent workability is essential to maintain steady progress in paving. Disruption to this steady progress inevitably results in loss of workability making finishing difficult and leading to bad riding quality. To maintain an adequate supply to the paver, pavement quality concrete should preferably be mixed on or adjacent to the site in a batch type mixer with an output greater than the capacity of the paver when proceeding at the average planned speed.

2 Supplies from off-site mixing can be very dependent on local traffic conditions outside

the Contractor’s control, but they may be permitted for smaller or ancillary works. The variability of concrete mixed in truck mixers may be greater than that mixed in batch mixers so they are unlikely to be suitable for large quantities of pavement quality concrete. Truck mixers may be permitted to mix pavement quality concrete for small individual slabs and may be used as agitators, the concrete having been mixed at the central batching and mixing plant. To maintain constant workability and consistent concrete its temperature should be kept as constant as possible during the day. In high ambient temperatures there is a considerable advantage in cooling the mixing water. Similarly in cold weather heated water is often necessary, but in both cases the temperature of the mixing water should not be excessive.

NG 1024 Construction by Machine

1 Descriptions of two main types of pavers (fixed form and slip-form) are given in the Guide to Concrete Road Construction (SO 1978). With either type of machine the slab may be laid in one or two layers. However, there are more restrictions on single course paving.

2 With fixed form paving, the control of surface levels is mainly governed by the spreader being able to spread the concrete evenly to the correct surcharge. It is bad practice to rely on subsequent regulating beams and the diagonal finisher to achieve the correct levels by a major planing operation. If the first regulating beam in the compactor/finisher has too big a roll of concrete anywhere along the beam the setting of the spreader should be changed. The roll in front of the regulating beam or diagonal finisher should be between 100 mm

and 150 mm evenly distributed along the beam. If the roll is too great then adjustment should be made at the spreader. If segregation occurs in the roll, adjustments to the workability of the mix may be necessary.

3 With slip-form pavers there is a tendency for edge slump in the concrete immediately after leaving the paver. If the slump is out of tolerance for level, fixed side forms are required where concrete being placed has to be matched to another section of pavement, eg. At slip road tapers or when construction is in two or more strips. In other work it is advisable for transverse finishing operations to be made against the crossfall to reduce the effect of flow towards the low side. Similarly on steep longitudinal gradients construction should preferably be up the gradient.

4 Joint groove formers should be cleaned prior to and after texturing to prevent concrete or mortar bridging over them, which would later cause spalling of the joint arrises.

NG 1025 Construction by Small Paving Machines or Hand Guided Methods

1 If sufficient internal vibration is provided and truss type finishing screeds with multi-vibration points are used together with scraping straight edge and bull floats where necessary, a well compacted slab with a satisfactory level and finish can be achieved. There is no technical restriction on the lengths of pavement which can be constructed in this manner, which is suitable for short bypasses, urban areas, widening or slip roads. More even distribution of the concrete is obtained if auger spreaders are fitted to the screeds.

2 Slip road tapers adjacent to a concrete pavement should always be of a similar construction for the full length of the taper, which is adjoining the concrete slab, in order to keep the same depth of construction across the whole pavement width. If the remainder of the junction or roundabout is of flexible construction, a standard transverse transition slab should be included at the end of the taper after the slip road has diverged and is separate from the carriageway. The slip road taper slab should not be tied longitudinally to the main carriageway after the point where the traffic lanes of the slip road leave the main carriageway, as this is the point at which changes in level and direction of movement of the slabs can occur. Joints in that part of the slip road taper which is tied to the carriageway and constructed at the same time can be normal to the axis of the main carriageway and in the same line of the main carriageway joint.

NG 1026 Finished Surface Requirements

1 It is important that a uniform texture is achieved both along and across the slab. It is therefore necessary to take full account of the workability of the concrete at the time of brushing and the operator must have the ability to gauge the optimum time for brushing after compaction and finishing of the concrete. Care should be taken to minimise variations which may occur with differences in ambient conditions and the workability of the concrete.

Brushed Concrete Surface Finish

2 From experience a suitable texture can be obtained by using a wire brush made of 32 gauge tape wires grouped together in tufts and initially 100 mm long. The brush should

have two rows of tufts. The rows should be 20 mm apart and the tufts in one row should be opposite the centre of the gap between tufts in the other row. The brush should be replaced when the shortest tuft wears down to 90 mm long.

3 If the texture depth is over 1.25 mm it will produce unacceptable tyre noise. Trial lengths should be closely monitored and if the texture depth is outside the limits, adjustments should be made to the workability of the concrete mix, or to the pressure on the brush, or to the time when brushing is carried out after compaction, or the type of brush changed. Thereafter spot checks should be made on the concrete surface as necessary.

4 Where the surface texture from the average of ten results has been found to be deficient or excessive the areas to be rectified can be assessed from the individual measurements. If necessary, additional measurements can be made in a particular lane to decide the limit of treatment. If four or more successive individual measurements are deficient or excessive, the area relating to those measurements should be treated across the full lane (or lanes) width.

5 Isolated areas less than 6 m in length need not be treated unless the texture has been omitted altogether or riding quality is impaired. If such areas are close or occur in a regular pattern or chain, they should not be left untreated.

6 Measurements should be carried out in sufficient time before opening to general traffic to allow the Contractor to complete remedial works, taking into account the effect of wear of heavy construction traffic.

7 The depth of grooved texture (hardened concrete) should be measured by means of a tyre tread gauge.

NG 1027 Curing

1 Curing is essential to provide adequate protection from evaporation and against heat loss or gain by radiation and so permit the concrete to achieve its designed strength. The retention of moisture is particularly important with cement or cement blends which have a slow rate of increase in strength. Without moisture the hydration process cannot be completed. Without adequate curing the concrete strength could be half the strength of the corresponding cubes cured in water in the laboratory.

2 The best form of curing is to keep the concrete constantly damp. This can be achieved by covering the concrete with plastic sheeting, or by a sprayed plastic material which hardens into a plastic sheet, which can be removed by traffic, or by an aluminised curing compound. For small bays or patches, wet hessian covered by plastic sheeting is satisfactory. For roadbases a waterproof bituminous spray is normally sufficient.

3 Plastic sheeting or sprayed plastic film will avoid the risk of damage by rainfall and the consequent cost of rectification by surface grinding, retexturing or relaying. The use of tentage will also reduce the risk of rain damage but unless closed at sides and ends it could cause a wind-tunnel effect which would reduce the curing. Where tentage is used measures should be taken to prevent drips falling on to unhardened concrete. Tentage covers should overlap by a minimum of 500 mm. Remedial works leave a generally patchy, aesthetically unpleasant

surface. The rate of progress of fixed form paving plant makes the provision of tentage feasible, but with the higher output of slip form pavers tentage is generally uneconomical, and without rails there could be damage to the sides of the pavement. Sprayed plastic film allows paving to continue in wet weather, except in heavy storms.

4 Thermal insulation blankets provide accelerated curing and an increased rate of strength development.

NG 1028 Trial Lengths

1 The Engineer may only approve machinery and plant which is known or proved to be capable of constructing a pavement to meet the specification. Trials to prove new or modified machinery should be carried out off Site or below pavement level. The Contractor is permitted to choose whether he lays the trial as part of the pavement or elsewhere, but if the former, he is not allowed to proceed with other trials or further paving at pavement surface level until any defective trial lengths have been removed, or rectified to comply with the

NG 1029 Texturing of Hardened Concrete

1 Experience has shown that grooving, with the grooves at an irregular spacing and of average size 3 mm wide by 4 mm deep as required, produces less tyre noise than surface dressing. It is the only acceptable method of retexturing the surface of concrete pavements as it will provide a long life texture. Grooving across joints should be avoided as this could lead to minor spalling and damage to the seal. In order to obtain the minimum depth of 3 mm the setting of the

machine should take into account the transverse irregularity of the surface. Isolated areas of substandard texture less than 1m in length along the carriageway would be unlikely to require treatment except in special circumstances.

NG 1030 Not Used

NG 1031 Not Used

NG 1032 Not Used

NG 1033 Not Used

NG 1034 Not Used

NG 1035 General Requirements for Cement Bound Materials General

1 Cement Bound Material CBM2 will be applied below asphalt layers and cement bound material CBM4 will be applied below concrete pavements.

Mix Design for Cement Bound Materials

2 Cement bound materials are mixtures of raw material and cement that have a moisture content compatible with compaction by rolling. If the requirement for surface level, regularity and surface finish are to be achieved, compaction will need to be carried out at or close to optimum moisture content (omc). The compaction tests described in BS 1377: Part 4 can be used to determine omc or alternatively Clause 2.1.5 of BS 1924: Part 2: 1990. Difficulty in determining the exact omc for

clean gravel mixtures is sometimes experienced due to the lack of fines present which allows the cement/water paste to be pumped out under vibration. However, a sufficiently accurate estimate of omc can usually be made from the results obtained.

3 Using the value of omc, the cement content needed to achieve the required strength can be determined by establishing the compressive strength of the CBM over a range of cement contents.

4 With some aggregates the strength requirements of CBM4 can be met with very low quantities of cement. Ratios of aggregate to cement greater than 24:1 are unlikely to result in an acceptable homogeneous mix and if permitted should be closely monitored throughout the works.

5 Pfa and ggbs may be used in combination with PC as cementitious binder for CBM. The strength gain for such mixes after 7 days is likely to be higher than for mixes using PC alone. The Contractor may wish to take account of this when using pfa or ggbs blends, and this may be achieved by testing at 28 days rather than 7 days. It will be necessary for the Contractor to show from trial mixes that the 28 day strength of the blended cement mix compares with that of the PC mix which meets the specification requirements at 28 days. The curing period before use by traffic and overlaying should be extended to ensure that the specified 28-day strength is reached. The pozzolanic reaction of pfa requires the products of hydration of PC before it can take effect. Care will be necessary in mixes where the amount of PC is very low, due to the difficulty of dispersion of the PC during mixing. This can lead to local variations in strength with the risk of very weak patches.

Delivery and Storage of Materials

6 It is important to prevent contamination and degradation of materials. The deposition of stockpiles of materials and subsequent extraction from them should be carried out in such a way that segregation is minimised.

Mix-in-plant Method of Construction

7 In this method the material, cement and water are mixed in a central plant with the resulting mixture being transported to the point of laying and spreading.

8 To ensure completed distribution of the relatively small quantities of cement, mixing should preferably be carried out in a forced action mixer of either the batch or continuous type, carefully selected such that the plant can process the material and produce a uniform CBM to the requirements of Table 10/9. If the Contractor proposes a mixer other than a forced action mixer he should ensure during the trials that a satisfactory mixing is achieved. The mixer should have an output to satisfactorily meet the demands of the spreading and compacting operations.

9 Vehicles transporting mixed CBM should be of sufficient number and capacity to meet both the output of the mixer and spreading and compacting operations.

Laying

10 The formation of satisfactory joints between adjacent areas of CBM or other material and of longitudinal joints is vital to the performance of the layer. When laying against compacted cement-bound or other material, cut back vertical joints prevent wedges of CBM which may crack or allow the riding up of one area on another.

Compaction

11 When CBM has begun to harden it is important that the matrix is not disturbed, hence the requirement that compaction must be completed within two hours of the addition of the cement. However, some cement-bound materials are more critical than others in this respect. Equally the weather conditions at the time of construction affect this particular aspect. In all circumstances the two-hour requirement should be adhered to unless site trials indicate a tightening or relaxation of this limit. Great care must be exercised when compacting CBM at joints to ensure that compaction plant does not bear on previously compacted CBM after the two-hour period.

Use by Traffic

12 CBM is susceptible to overstressing if traffic is permitted to run on it before it has obtained its specified strength. Use by traffic earlier than the specified times may be permitted once the specified strength has been achieved, which may be obtained by high cement contents or special mixes. Alternatively, if high density CBM's using pfa or ggbs as a filler to reach densities above 97% of theoretical density are used, early use by traffic to lay subsequent layers may be permitted. Further information is to be found in Clause 1048.

Preliminary Trial

13 The size of the preliminary trial relates to larger areas of CBM. Where small areas are to be laid the Contractor may propose trial areas of less than 400m². Trial areas might be necessary if there is insufficient experience with Cement Bound Materials.

NG 1036 Not Used

NG 1037, NG 1038, NG 1039 Cement Bound Materials

1 The aim is to achieve a uniform layer meeting the strength and density requirements of the Specification. This is particularly important with CBM where the cement content is relatively low, and mixing and quality control need to be adequate so as to produce a homogeneous mix. The correct application of the trial and test regime clauses is most important to ensure that this is being achieved in the field. The rate of testing, in cases of non-uniformity, should be increased.

2 Immersion tests according to Clause 4.3 of BS 1924: Part 2: 1990 may be carried out for CBM2 to assess the effect of immersing the CBM in water and to detect the presence of sulfates, expansive clays and deleterious constituents present in the material to be stabilised. The test should be repeated during construction, particularly if the material being stabilised varies.

The average compressive strength after immersion shall not be less than 80% of the average compressive strength of fire control specimen. After the 7 days immersion period the specimen shall not show any signs of cracking or swelling. The aggregate used in Malta is normally not contaminated by these constituents.

3 In order to preclude the use of weak materials for CBM2, a ten per cent fines test is included.

4 Crushed concrete including crushed lean concrete can provide suitable aggregate for producing CBM. However, the quality of

crushed concrete can vary widely and therefore before using such a source the Contractor should demonstrate that the crushed concrete is of an equivalent standard to aggregate conforming to BS 882 where it is to be used for CBM4.

NG 1040 Testing of Cement Bound Materials

1 Cubes for strength testing for all cement-bound materials are effectively compacted to refusal when made in the specified manner. The cube strengths are consequently higher than would be expected from cubes compacted at field density. Field density requirements are met by comparing in situ measurements with those of the strength cubes.

2 Care is necessary to ensure each cube has been made and cured correctly and is a valid specimen.

3 Nuclear density gauges can be operated in either direct transmission or backscatter mode. As the backscatter mode only measures the density of the top 50 mm - 60 mm of the layer, the direct transmission mode is used for CBM.

NG 1041 Use of Nuclear Density Gauges With Cement Bound Materials

1 Nuclear density gauges utilise radioactive substances and unless used in accordance with the manufacturer's instructions may be hazardous to the health of users. Regulations cover the use, transportation and storage of gauges. Gauge suppliers and manufacturers will usually advise on these regulations. Supervisory staff need to be familiar with the appropriate regulations and the

manufacturer's operating instructions. In exceptional circumstances, where nuclear gauges cannot be used for the measurement of in situ wet density, the sand replacement method given in BS 1924 may be used as an alternative. The tests should be made between 4 hours and 24 hours of completion of compaction of the layer.

2 A preliminary check is included because Transport and Road Research Laboratory Report No. LR 1109 indicates that certain materials can give biased results when tested with nuclear density gauges. This is due to the radiation absorption characteristics of the material and is allowed for by re-calibration of the gauge or adjustment of the displayed result. It may be necessary to repeat the preliminary check from time to time where the materials used for CBM are variable. The mass of each block may be determined by weighing the concrete in batches before it is placed into the mould, providing accuracy is maintained.

NG 1042 Not Used

NG 1043 Not Used

NG 1044 Pavements with an Exposed Aggregate Concrete Surface

1 Guidance to the requirements specified in Clause 1044 is contained in Chapter 3 of HD 38.

2 Methods and construction requirements for this type of surface should be based on the general requirements of Series 1000.

3 The PSV and AAV requirements of the coarse aggregate in the surface layer

concrete are dependent on the traffic category and should be specified in Appendix 7/1. Guidance on the PSV and AAV requirements is given in Chapter 2 of HD 36.

4 Attention is drawn to the flakiness index requirement in Clause 1044 for the coarse aggregate in the top layer concrete. This is 20%, rather than the more common 25% or 35%.

5 Sub-Clause 1044.5.(iv) specifies that at least 60% of the concrete (total mass of the constituents excluding water) should consist of the coarse aggregate specified in Appendix 7/1. This is to ensure that sufficient coarse aggregate is presented at the surface after brushing the laitance to expose the aggregate.

6 Hardness and durability of the coarse aggregate should be as described in sub-Clause 901.2.

7 The compiler should specify in Appendix 7/1, coarse aggregate size and appropriate texture depth requirements using Table NG 10/3. A high-speed road has an 85 percentile speed of traffic exceeding 90 km/h (55 miles/hour). The compiler should assess if the in-use traffic speed of the road is anticipated to be above this level.

8 The Contractor should be required to submit at the time of tender a completed Appendix 10/1, containing details of his proposed plant and equipment to achieve the required surface.

9 The Contractor is required to submit to the Overseeing Organisation for their consent a detailed method statement one month prior to the commencement of site trials. In the UK trials have been successfully concluded using conventional rail mounted paving equipment, but in the rest of Europe and elsewhere contractors have normally chosen to use slipform paving equipment.

TABLE NG 10/3 Grading and Texture Depth Requirements

CATEGORY OF ROAD	COARSE AGGREGATE SIZE	TEXTURE DEPTH REQUIREMENTS		
		AVERAGE	MAXIMUM	MINIMUM
High Speed Roads (> 90 km/h)	10-6 mm	1.5 mm ± 0.25 mm	1.80 mm	1.20 mm
Low Speed Roads (< 90 km/h)	8-4 mm	1.0 mm ± 0.20 mm	1.30 mm	0.75 mm

NG 1045 Weather Conditions for Laying of Cementitious Materials

1 Thermal insulation blankets laid on the finished concrete can enhance the rapidity of curing by the retention of heat. This is of benefit not only in cold weather, but also at other periods to accelerate the curing of the concrete slab.

NG 1046 Cold Recycled Cement Bound Material

1 General advice for the design and construction of cold recycled materials is published in Volume 7 of The Design Manual for Roads and Bridges (DMRB).

2 These Notes relate to the associated Specification for Cold Recycled Materials and offer the Design Consultant, Overseeing Organisation and Contractor the latest best practice advice on the design, supervision and execution of cold in-situ recycling works, used for structural maintenance of highway pavements.

3 Dependent on the type of pavement and specific site conditions, the cold recycling process may be used to form the structural course for a reconstructed pavement or the structural course and foundation platform as a combined layer. Alternatively, it may be used to provide a foundation course for a new overlying pavement construction.

Site Evaluation

Identification of Sites for Structural Maintenance by Cold Recycling.

4 Structural maintenance of a road pavement may be required for a variety of reasons, when the running surface of the pavement becomes unserviceable and the cost of local repairs too expensive to sustain, due to the underlying pavement structure being incapable of offering the support required.

5 In the event of the deterioration being identified as a failure of the road haunch, any remedial measures should be investigated and implemented in accordance with TRL Report 216, Road Haunches: A Guide to Re-usable Materials (Potter, 1996).

6 If the deterioration is identified as being a general structural failure of the running lanes then any remedial measures should be investigated and implemented in accordance with TRL Report 386, Design Guide and Specification for Structural Maintenance of

Highway Pavements by Cold In-situ Recycling (Milton and Earland, 1999).

7 In keeping with the objectives of sustainable development, each site should be investigated with the prime aim of determining the suitability of the existing materials for re-use. Irrespective of the remedial strategy ultimately implemented, the limits and condition of the site should be identified, including the following details for completion of Appendix 7/19.

- (a) location, length and width of the site;
- (b) construction of existing pavement;
- (c) type and severity of deterioration;
- (d) subgrade bearing capacity and condition;
- (e) location and condition of drainage;
- (f) location and condition of services;
- (g) edge detail and verge condition, and
- (h) future traffic loading.

8 To achieve the economies of scale and energy savings offered by the recycling process, a minimum programme of works of the order of 3,000m² is suggested as a general guide, which could be a combination of a number of smaller schemes in close proximity. However, in particular circumstances, where conventional methods of reconstruction are onerous or precluded, smaller scale recycling works may still offer a cost effective solution.

9 The use of the cold recycling process may also depend on whether there is sufficient thickness of existing pavement available for

recycling. Although, in certain circumstances, it may be possible to include subgrade material into the recycled structural course, provided that a non-plastic pulverised aggregate is produced naturally or by modification using lime or cement. Alternatively, it might be possible to import additional material suitable for recycling.

Investigation Framework

10 Any pre-contract site evaluation, forming the first stage of the design process, should be planned and implemented to ensure that sufficient information is obtained to demonstrate to the Overseeing Organisation whether or not, the recycling option is feasible. In addition, this evaluation should offer any prospective contractor all information necessary to plan their working practices and to tender on an equitable basis to achieve the targets set by an end-product performance specification.

11 The sampling and testing proposals for cold recycling projects on medium to heavily trafficked sites are summarised in Table 4 of TRL Report 386. However, the actual scope of the investigation carried out should reflect the nature and variation of the existing pavement materials.

12 Sites known to contain a variety of materials of uncertain origin should be evaluated more fully than those that are known to contain consistent layers of standard materials. The limits of each section of works should be identified and listed separately in Appendix 7/19. Also, sufficient representative information should be collected to enable the design process to be carried out for each of these sections.

Alternative Recycling Strategies

13 The situation may arise where it is impractical to divide the site into sections that contain consistent materials, capable of being designed as cold in-situ recycle material. However, as a mixed stockpile of materials from various parts of the site, it provides suitable feedstock for a processed recycled aggregate. In such cases, despite contributing less to sustainable development, in terms of transport movements and energy used, compared to the in-situ process, alternative recycling strategies could be considered using central or mobile crushing, screening and mixing plants.

14 To encourage and advance the cause of sustainable development, attention should be paid to the removal from site of surplus pulverised aggregate, which could be used to strengthen other roads in the area. Local cooperation between different highway authorities should be sought and programmes of maintenance works on different parts of the local road network coordinated. Locations for stockpiles of surplus materials should be included in Appendix 7/19.

Representative Test Specimens

15 For any assessment related to the design of recycling works, it is important that any sample of aggregate obtained for testing is typical of the pavement to be recycled, either as a mixed sample in representative proportions or as separate components for recombining later.

16 Ideally, the test specimens should also represent the grading and particle shape of the pulverised aggregate. Development and use of mini-planers designed for trenching works, used to excavate trial pits, may offer

a means of obtaining such samples. However, to date, pulverised aggregate is not generally available during the pre-contract investigation and the design process relies on test specimens derived from samples crushed in the laboratory. A variety of laboratory crushing methods and devices are currently employed but none is specifically designed to produce the pulverized aggregate produced by a recycling machine.

17 Where it is recognised that the laboratory crushing process is not achieving sufficient fine material, which is often the case where the feedstock material contains a significant proportion of hot rolled asphalt, the finer grading should not be obtained by further excessive crushing because this would not reflect the pulverisation in the field, which tends not to break the existing aggregate component. Although not ideal, the grading of the test specimen should be modified to satisfy the specified grading envelope by the transfer of fine material from other sub-samples of the laboratory-crushed material.

18 Alternatively, the grading of the test specimens could be made to meet the specified grading envelope by the addition of crushed rock fines or pit sand, particularly if their addition is considered beneficial to the performance of the recycled material in the field. Therefore, if the design using these test specimens is accepted, the proportion of fine material added to the material pulverised in the field should, ideally, be the same as the proportion of the same fine material used in the design process.

Underground Services, Ducts and Culverts

19 Because of their potential for disrupting the recycling works, all known services,

ducts and culverts within 150 mm of the underside of the recycled layer should be accurately located and included with the site details given in Appendix 7/19.

Risk Assessment

20 Before drawing up a Contract involving the use of cold recycled materials, which are inherently more variable than plant produced new materials, the additional risks should be identified, apportioned and their management pre-planned to the satisfaction of all parties concerned. For this reason, the Overseeing Organisation and Contractor should be satisfied and agree that the existing pavement materials in all sections of the works, as defined in Appendix 7/19, are capable of being recycled by pulverisation, to form the primary aggregate component of a new cold recycled mixture. Also, that the mixture designed in accordance with sub-Clauses 1046.43 to 1046.49 for cement bound material is capable of being produced to meet the end product performance requirements.

Component Materials

Pulverised Aggregate

21 The nature and grading of the aggregate produced by pulverisation will depend largely on the nature, thickness and proportions of the existing road materials. In situations where the depth of the existing pavement is insufficient to accommodate the new pavement design, it may be necessary to include subgrade material into the recycled structural layer or treat the subgrade as the foundation, compensated by an equivalent increase in thickness of the recycled layer provided that site level changes are acceptable.

22 Normally the cement bound recycling option is reasonably insensitive to the aggregate grading, nevertheless, an upper limit of 35 per cent by mass passing the 75 micron BS sieve is specified.

Moisture

23 The moisture content of the pulverised aggregate during stabilisation and compaction is as important as the grading because it is a prime feature controlling the workability and, therefore, the degree of compaction that is achievable.

24 For compaction of granular material used in construction, the moisture content is usually targeted on the optimum moisture content determined in accordance with BS 5835. However, for recycled mixtures, the specified moisture content is dependent on the binder content, targeted slightly on the wet side of the optimum moisture content, determined in accordance with BS 1924: Part 2. Furthermore, the constituents of the mixture to determine the optimum moisture content are dependent on the proportion of filler added in the field.

25 For cement bound mixtures, experience has shown that the best compaction results are achieved using a specified moisture content range of optimum moisture content to +4% of the optimum moisture content. In those cases where a small amount of filler is added in the field, the optimum moisture content of the unmodified pulverised aggregate will normally suffice for control purposes because the moisture absorbed by the filler is mostly balanced by the suppression of the optimum value. However, where the addition of filler in the field accounts for more than 4 per cent by mass, the moisture content control should be based

on the optimum moisture content determined for the modified aggregate.

Binder Agents

Primary Binder Agents

26 The selection of the primary binder agent for a particular recycling contract will depend to a great extent on the site conditions, cost factors and the design requirements in terms of either a flexible or flexible composite pavement. For UK conditions the current recommended choice is restricted to cement, as described in sub-Clause 1046.6 or foamed bitumen, as described in Clause 948. For Maltese conditions the use of cement and bitumen emulsion can be recommended

27 Cement is readily available and, apart from the potential for thermal cracking of stronger mixes, it has the advantage of being adaptable to a wide range of site conditions.

Supplementary Binder Agents

28 Lime may be added as filler or as the modifier for plastic fines within the pulverised aggregate. Despite the practical advantages of using quicklime, related to water absorption and control of spreading, the stringent safety measures required lead to hydrated lime as the preferred option for inclusion in Appendix 7/19.

Pulverisation and Stabilisation

29 Road pulverisation and stabilisation involves the use of specialised stabiliser plant that operates to the specified depth plus construction tolerances. To ensure adequate pulverisation and mixing of materials to full

depth, it is recommended that the drive performance of the recycling machine is at least 260kW.

30 Stabilisers are manufactured with a height adjustable mixing box situated close to road level, incorporating a special toothed rotor designed to pulverise and mix the material within the mixing hood. The use of smaller agricultural equipment is no substitute because they are usually designed to work on cohesive soils and, therefore, are not designed to produce pulverised granular aggregate of the required grading and shape for construction purposes.

31 However, the powerful stabiliser plant can damage services, so the Overseeing Organisation should identify any services or obstructions present and include their details in Appendix 7/19. The time required to lower any services should also be taken into account within the Works programme.

32 A specialist manufactured stabiliser plant will incorporate all the features and facilities necessary to complete the works in accordance with the current recycling specification. Some will be larger and more powerful than others, whereas others may incorporate more refined control systems.

33 The systems normally employed to control the depth of pulverisation relate the position of the rotor relative to the vertical position of the wheels. Therefore, to ensure that the appropriate depth of pulverisation or stabilisation is carried out consistently, it is particularly important that a working platform of known level profile is prepared prior to the operation of the stabiliser.

Process Control

34 This section provides guidance for the Overseeing Organisation to help supervise the Works but, in addition, describes the best practice for the Contractor to follow to control the pulverisation and stabilization processes.

Cement-bound Material

35 Because of the similar nature of the cement bound recycled material to that of plant mixed CBM, significant sections of the Clauses for CBM apply equally well for the recycled option. The Specification refers directly to the option of using a mix-in-place method of construction for CBM1, CBM2 and CBM3 mixtures. In consequence, most of the Clauses given in the Notes for Guidance are also applicable to recycling.

36 One exception to the above guidance relates to the curing period and use by traffic. In a structural maintenance situation there is usually a requirement to maintain access through and within the site for residents and services traffic. However, for most recycling contracts, any access restriction will inevitably delay the works programme. Therefore, early life or same day trafficking is sometimes unavoidable.

37 However, any damage to the recycled layer by early trafficking may be minimised by the use of higher cement content for early strength gain or by ensuring that adequate compactive effort has been applied and high density achieved. Provided that the as-installed elastic modulus, measured by dynamic plate loading or penetrometer techniques or test results achieved by Static Plate Bearing Tests and Benkelman Beam measurements meets the targets set by the Specification or experience data, there

should be no problem in proceeding with construction of the overlying pavement.

38 Conversely, without additional cement to enhance strength development, it is possible to argue that early life trafficking could be beneficial to the longer-term performance of the pavement by establishing a closer spaced pattern of crack in the structural course, thus making the surfacing less prone to reflection cracking.

Added Water and Moisture Control

39 Although the control of moisture content is of prime importance for optimum compaction, there is currently no automated process available that can ensure the provision of moisture at a uniform and optimum level during the recycling process. It is vital, therefore, that the process is controlled by an experienced operator who has access to controls for adding water, particularly when the water is sprayed directly in the mixing box at the time of stabilisation.

40 The stabiliser should, ideally, be fitted with a separate pump and spray bar system for metering the added water, which is regulated to the ground speed of the machine. An experienced operator will normally assess the moisture content of the mix relative to the target optimum by squeezing samples of the material regularly by hand and be guided by test results at the commencement and during any job so as to “calibrate” personal judgement. The operator must assess the moisture content immediately behind the stabiliser and be prepared to make quick adjustments as the machine may be progressing forward at a rate of 4-6 metres per minute.

Application of Cement or Hydrated Lime

41 Cement may be required either as the primary binder or as a supplementary binder to act as an adhesion agent or to help improve the short-term properties of the compacted material. In comparison, hydrated lime is generally used as a plasticity modifier for cohesive fines within the pulverised aggregate.

42 Specialist spreaders are necessary for the application of these materials, which should incorporate control systems to ensure that the rate of spread is achievable to a target accuracy of ± 0.5 per cent of the specified spread rate. The particle size of cement and lime as supplied may vary and such behaviour should be noted as it may affect the accuracy of application. The use of consistent sources and standard routines for storage and loading of the spreader is recommended to minimise any variation.

Compaction

43 Compaction is a critical part of the stabilization process and demands particular care. This is especially the case for thicker layers of construction, where there is the possibility of a density profile developing during compaction, such that the lower part of the layer does not achieve the same density as the upper part.

44 This effect may be minimised when applying compaction at the earliest possible time using either heavy vibratory compaction or by a compactor capable of “kneading” the material at depth, as is the case with a tamping roller. To date in the UK, heavy compaction for cold recycling works has been carried out mostly using the heavy vibratory roller option although, more recently, a heavy combined pneumatic tyre

roller (PTR) and vibratory drum roller has been trialed but their field performance has yet to be verified. In Malta the experience from the Salina Experimental Road can be used where Cold Recycling has been carried out.

45 From monitored works, it is evident that vibratory compaction did not always achieve full depth compaction of thicker layers. Therefore, where the stabilized material is assessed as having poor workability, it is recommended that consideration be given to the use of heavy tamping rollers for the initial deep-seated compaction, particularly for layers having a compacted thickness in excess of 225 mm. This should be followed by grading of the surface and final compaction using the conventional heavy vibratory compaction. This is similar to the compaction methodology commonly used in Australia for thick-lift construction.

46 When using heavy vibratory compactors, caution should be exercised where there is any danger of damage to shallow culverts, underground services or adjacent buildings.

47 The use of a pneumatic tyre roller (PTR) as a finishing roller is often advocated, particularly for the cement bound material. However, whereas the PTR may tend to assist in the compaction of the lower level material, care is required to ensure that the near surface material does not dry out or stiffen too quickly, which may result in disruption and shear displacement of the near surface material caused by the load applied under the individual tyres, which results in an unstable surface finish and the necessity for removing loosened unacceptable material.

Surface Sealant

48 The type and rate of spread of the bitumen sealant, as stated in Appendix 7/19 should comply with the recommendations given in BS 434.

End-Product Performance Specification

49 The process of cold recycling for the structural maintenance of highway pavements has been developed and used in a variety of countries, each with their own local requirements, often related to climate and geology. Consequently, the types of road available for recycling have been wide ranging. As a result, previous recycling specifications have been derived from a variety of component material designs and construction methods that were generally aimed at producing materials of conventional form with anticipated performance similar to the plant mixed option.

50 Whilst the recipe and methods specification has served the industry well for the lower trafficked roads, end-product performance specification is seen as a means of specifying recycled materials in their own right, using performance properties, allowing the recycled material to be considered for more heavily trafficked sites on an equitable basis to standard plant produced materials.

51 The end-product performance assessment is designed to follow a three-stage procedure, to allow the construction to proceed at the same time as giving the Overseeing Organisation the opportunity to verify the acceptability of the product at the earliest possible time.

As-Installed Stiffness Using a Dynamic Plate Penetrometer Tests Static Plate Bearing, requirement or the Benkelman Beam

52 The as-installed performance of the stabilised layer, within 24 hours of completion of compaction, is evaluated using a dynamic plate loading or penetrometer techniques to determine the elastic modulus at points on a closely spaced grid pattern. Furthermore, before proceeding with the surfacing, repeated values are expected to demonstrate that the elastic modulus values have increased, as an indication that the curing / strengthening process has started. The first repeat measurements should normally be made after 24 hours and thereafter at intervals, dependent on the measured rate of increase of elastic modulus. In the trial and first section of main paving, tests should be carried out in a 2 m grid pattern. During main paving, should consistent elastic moduli be achieved, the longitudinal grid spacing can be relaxed to 5 m and 10 m should the latter spacing also produce consistent results. The single point and mean value of elastic modulus for the assessment areas, and their respective percentage increase, must comply with the minimum standards stated in Appendix 7/19.

Analogously the results from Plate Bearing test and Benkelman Beam measurements are obtained and evaluated.

53 Experience to date; using a dynamic (light) plate loading technique has determined that fresh, well-compacted cold recycled material typically achieves a single point elastic modulus value (Evd) in the range 40 to 70 MPa. Therefore, the as-installed performance of an acceptable constructed layer, based on at least 100 point

evaluations, is expected to display an initial minimum mean value of elastic modulus in excess of 50 MPa, with no single point value less than 30 MPa. Prior to surfacing, an increase of 20 per cent for single point values and 30 per cent for the mean value, would be indicative that the curing process is underway. These values should be applied to the as-installed condition and initial stage of curing. For other plate loading or penetrometer test methods, an equivalent correlation should be provided to the satisfaction of the Overseeing Organisation.

Pavement Stiffness from Falling Weight Deflectometer (FWD) Survey

54 The current status of the FWD and associated elastic stiffness evaluation does not allow the procedure to be used as a rejection method. However, if acceptably high stiffness modulus values are determined consistently, as described in 7/19 the method should provide the Overseeing Organisation with sufficient confidence and a means of acceptance for the cement bound material.

55 Experience to date using the FWD, as described in the Specification, suggests that a pavement stiffness value for the combined bound layers of the pavement (i.e. recycled layer plus surfacing) of the order of 5000 MPa for the cement bound option below which not more than 15 per cent of the derived values should fall, offers an acceptable performance standard.

Compressive Strength / Stiffness Measurements of Core Specimens

56 The development of the end-product performance specification for the cold recycled materials has passed through various stages, in which the initial intention was to determine the performance of cored

specimens in terms of the compressive strength of cement bound material.

57 The above option was set aside, however, when it was decided that coring should only be performed as a last resort. This decision was reinforced by the experience gained on some monitored sites, where the core extraction itself was difficult, such that a suitable number of test specimens could not be obtained.

58 The rate of success for extraction of cores from cold recycled material is generally enhanced by using air flush coring in place of the more usual water flush method. Also, removal of the cored asphalt surfacing layers, before proceeding with the coring into the recycled material, was found to improve the success rate of core extraction.

59 In the event that acceptance is not achieved using the FWD survey and analysis, the current specification uses the core testing option as the last resort performance assessment. If carried out after the FWD survey, as late as possible within the Contract maintenance period, it should maximise the success rate for the extraction of cores and offers the best opportunity of obtaining specimens that are suitable for testing.

Mixture Design and Characterisation

60 The design procedures adopted to date, have been developed by various organisations for their local needs although, in general, most mixture design procedures for cold recycled materials are based on the determination of compressive strength for cement bound material related to a recycled layer of specified thickness, to carry a required traffic loading over a stated period of time.

61 In practice, the feedstock material to be stabilized does not usually exist until after pulverisation, so the initial mix appraisal or design process is often a matter of experience by the specialist contractors using their particular recycling plant, in order to obtain the optimum component design.

62 Also, the results of stiffness and other tests performed on laboratory prepared specimens are dependent on the curing regime of the specimens, which is unlikely to be representative of the site conditions, so these tests are only valid for comparison and assessment of the optimum mixture condition. Therefore, the values obtained do not necessarily relate to the in-situ condition of the material.

Guidance for Mix Design can also be found in the German Specification ‘Cold Recycling In-Situ’

63 The detail of the procedure given in sub-Clauses 1046.43 to 1046.49 is based on the current industry practices, which will be developed when more representative specimens and test results can be verified.

Cement-bound Mixtures

64 For lower traffic situations, cold in-situ cement bound recycling is often used to provide a new foundation and/or structural course, designed to have an average 7-day cube compressive strength of 4.5 N/mm² or 7 N/mm².

65 For higher traffic loading, the recycled layer is used as the main structural course, designed to have an average 7-day cube compressive strength of 10 N/mm². In ideal circumstances, this material might be

considered structurally equivalent to plant mixed CBM of equal compressive strength. In practice, inherent variability of the feedstock materials, short mixing period and practical difficulties associated with thick-lift construction, will require a factor of safety to be applied to the design thickness. Further, guidance is given in TRL Report 386.

66 For the stronger recycled mixtures, the potential for thermal cracking and reflection cracking of the bituminous surfacing is similar to that for conventional plant mixed CBM. Therefore, the thickness of surfacing layers should normally be the same as that specified for a conventional flexible composite pavement carrying the same traffic loading. The cement contents used in the design process for recycled mixtures are similar to those required for the plant mixed equivalent, except that an absolute minimum cement content of 3 per cent by weight is recommended to ensure there is adequate cement available for distribution throughout the mixture during the short period of in-situ mixing.

NG 1047 Induced Cracking of Cement and Hydraulically Bound Material

General

1 This Clause describes the method of inducing cracks in cement and hydraulically bound materials. The insertion of a crack inducing material transversely across the pavement places a weakness in the material that allows shrinkage cracks to occur much more regularly than without inducement during curing. Further cracks may occur at the inducement locations during loading. The numerous small cracks reduce the forces in the surfacing that lead to reflection

cracking. A crack ‘pattern’ is not formed when inducing cracks in CBM materials.

2 A groove will be formed within the material following laying, usually by a blade being run through the material prior to rolling. Specialist plant may be used to conduct this operation and insert the crack inducing material in a single operation. Alternatively, the use of a vibrating compaction plate with a metal blade welded perpendicular to the plate may be used to traverse the material and leave a groove.

3 Where it is found that a groove collapses before it is possible to insert the crack inducing material, the material mixture should be adjusted to give a more stable mixture or stability can be gained by extra compaction applied by the paver or a light-finishing roller. If rolled prior to grooving, care must be taken to ensure full closing and compaction of the grooves following insertion of the crack inducing material.

4 Where bituminous emulsion is used as the crack inducing material, care will need to be taken to ensure complete coverage of the walls of the groove in the layer, without excessive pooling of emulsion at the bottom of the groove.

5 Where bitumen emulsion is used and this causes material to stick to the roller, additional layer material may be applied to cover the grooves prior to compaction.

6 The general practice in Malta for induced cracking is the cutting of notches by a cutting device.

Trial lengths

7 The trial is to prove the plant, equipment and methods proposed are suitable for use

with the material being used. If the trial forms part of the finished pavement, any defective areas must be removed and replaced in accordance with the Specification, before any further paving is undertaken. The contractor should be aware that the whip hammer method of inducing cracks does not comply with this sub-Clause.

NG 1048 Use of surfaces by Traffic and Construction Plant

1 Where there is a need to open a section of concrete pavement or basecourse or sub-base to traffic early after placing the concrete, high strength mixes may be used. To estimate the time when the required strength may be achieved trial mixes should be tested at various early periods to establish a rate of strength development. These times can be confirmed by testing cubes, which were placed alongside the pavement in moulds insulated around the sides. However, such results can only be used as an expedient for the purpose and not for compliance with the Specification.

NG SAMPLE APPENDIX 10/1: PLANT AND EQUIPMENT FOR THE CONSTRUCTION OF EXPOSED AGGREGATE CONCRETE SURFACE

The Contractor shall insert details below of the methods, plant and equipment he intends to use in the Works to construct an exposed aggregate concrete road surface to Clause 1044 and **shall submit this Appendix with his Tender.**

No of Layers [1044.3]	a) One b) Two	
Paving Equipment [1044.6]	a) Fixed Form b) Slip Form	i) Two Separate Pavers ii) Two layer paver i) Two separate pavers ii) Two layer paver
Retarder Type [1044.12]	a) Manufacturer b) Type reference	
Brushing Details [1044.8]	a) Wet b) Dry	
Brushing Equipment [1044.23]	a) On Slab b) Spanning Slab	

Retarder Protection Method [1044.16]

KERBS, FOOTWAYS AND PAVED AREAS

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KERBS, FOOTWAYS AND PAVED AREAS

NG 1101 General

1 Precast concrete kerbs, channels, edgings and quadrants are preferred. If the Contractor intends to produce machine laid in situ sections it has to be demonstrated that the same quality like precast sections will be achieved.

2 Care should be taken in preparing detailed drawings to ensure good drainage from the carriageway construction either through or under the kerb foundation.

3 The construction adopted for footways will depend upon the availability of local materials and local conditions. The cheapest alternative from chart 5 of the “Directives for the Standardization of Pavements for Traffic Areas” should normally be used unless there is good reason to do otherwise.

4 For footways which are known to be subjected to vehicle overrun the use of smaller and thicker paving flags laid on a thin layer of sand may be considered. Other alternatives would be concrete block paving, in situ concrete, or for flexible footways increased construction thickness and the use of denser surfacing materials. Thicknesses may be chosen by using the lowest construction classes of Chart 1 and Chart 2 of the Directives.

5 Concrete block paving may be considered in certain low speed traffic situations, eg. service areas, and lay-bys, because of their resistance to oil spillage and to deformation due to wheel loads. The block layout and other details

should be described in Appendix 11/1 wherever possible and incorporate whole units immediately adjacent to the edge of a carriageway or hard strip and avoid trimming of units to less than one third of their surface area.

6 The construction adopted for cycle tracks should be one of those given for footways and paved areas.

NG 1102 Not Used

NG 1103 Freestanding In Situ Concrete Kerbs, Channels and Edge Details

1 Experience suggests that for the in situ construction of relatively high drainage channels by slip-forming or extrusion techniques, the use of crushed or partially crushed aggregate will ensure a more consistent and stable profile. Uncrushed aggregate may be used for surface water channels of 400 mm or less in height where past experience in the use of a particular aggregate, or the result of trials, demonstrate that a satisfactory profile can be achieved. Only crushed aggregate is normally used in Malta.

2 The precise level of concrete workability will depend on the type of construction plant used, for example:

extrusion auger (small kerbs)

ram compaction (small kerbs,
kerbs, channels)

slip-form (kerbs, channels).

NG SAMPLE APPENDIX 11/1: KERBS FOOTWAYS AND PAVED AREAS

[Note to compiler: This should include:]

- 1** Dimensions and type designations of precast concrete kerbs, channels, edgings and quadrants *[1101.1]*.
- 2** Dimensions of precast concrete kerbs to be bonded to the pavement surface *[1101.2]*.
- 3** Details of kerb joints at bridge expansion joints designed by the Overseeing Organisation *[1101.3]*.
- 4** Dimensions of in situ asphalt kerbing or in situ concrete kerbing *[1102.2, 1103.1]*.
- 5** Concrete curing requirements if different from Clause 1027 *[1103.3]*.
- 6** Type designation and thickness of precast concrete flags or natural stone flags *[1104.1]*.
- 7** Details of required bond for flags or natural stone flags *[1104.2]*.
- 8** Whether alternative bed for flags or natural stone flags, less than 450 mm x 450 mm, is permitted *[1104.2]*.
- 9** Details of flexible surfacing materials to be used *[1105.1]*.
- 10** Required thickness of surfacing and sub-base *[1104, 1105, 1106]*.
- 11** Requirements for laying and curing in situ concrete *[1106.1]*.
- 12** Required finish and grade of in situ concrete *[1106.1]*.
- 13** Requirements for shapes, dimensions and colours of precast concrete paving blocks *[1107.1]*.
- 14** Block or paver layout details *[1107.3]*.

Series NG 1200

TRAFFIC SIGNS

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TRAFFIC SIGNS

NG 1200 General

1 The Series 1200 covers all traffic signs including permanent, prescribed temporary and temporary. It draws on BS 873 for the majority of its requirements but also other sources including The Traffic Signs Regulations and General Directions (Statutory Instrument No. 1519, 1994). For illuminated signs and traffic signals it utilises the 'electrical work' aspects of Series 1400.

2 Advice on the above and other matters is available from the Design Manual for Roads and Bridges (DMRB).

NG 1201 Regulations, Sign Classification and Standards

1 The Contractor's proposals for temporary traffic signs (including haul route signals) should be discussed with the police and the appropriate highway authority. The agreed proposals should be forwarded to the Overseeing Organisation for statutory authorisation and approval.

2 The Contractor's proposals for traffic signal and control equipment, variable message signs and retroreflecting road studs will include details of any statutory type approval previously obtained by the manufacturer. Confirmation should be obtained from the Overseeing Organisation that such approval covers the intended use. Where this is not the case, the Contractor will need to apply to the Overseeing Organisation for statutory type approval.

3 The information to be given in Appendix 12/1 for prescribed temporary signs should be the same as that for permanent signs. Where a sign is to be erected for less than 6 months, it may be considered to be a fixed short life sign as described in sub-Clause 1216.3. Appendix 12/1 should state those signs which are to be fixed short life signs.

4 Checks should be made that current legal requirements in respect of the following as appropriate, have been met before a traffic sign is installed:

- i) Statutory authorisation.
- ii) Statutory approval of location.
- iii) Statutory type approval. Advice on current legal requirements can be obtained from the Overseeing Organisation.

NG 1202 General Requirements for Permanent Traffic Signs

1 Appendix 12/1 should include a Schedule of Traffic Signs containing the details listed in sample Appendix 12/1 and should also contain all the other information required to supplement the Specification Clauses which state 'as described in Appendix 12/...'. This other information may be shown on fully detailed drawings cross-referenced from the relevant Appendix.

2 The legend layout should be determined in accordance with the Traffic Signs Manual, Chapter 7: Design

of Traffic Signs and therefrom the sizes of sign faces, adding on extra area for light-spill screens, where required. From this information the actual sizes of sign posts and foundations are to be determined.

3 Unless there are scheme specific requirements the Contractor should have freedom to adopt the type of sign plate (eg. sheet aluminium, or extruded aluminium or fabricated planks) and should determine the stiffening and framing, if any, for the plate he adopts, so as to meet the ‘mechanical properties and construction’ requirements of Parts 5 and 6 of BS 873 as if it were to be tested in accordance with Part 1.

4 Impact Category 1 of BS 873 : Part 5 should normally be specified unless the sign panels are so located that the likelihood of damage by vandals is remote.

5 Category 2 luminances to comply with BS 873 : Part 5 are suitable for locations with a high background luminance such as those described in BS 873 : Part 5, and are achieved by internally illuminated signs.

6 It is not intended that the tests in BS 873 shall be carried out on each sign as BS 873 implies, but that each sign shall be capable of passing the tests therein.

7 Assessment of the Contractor’s fabrication drawings for approval should ensure that where dissimilar metals are used they are separated by electrical insulators.

NG 1203 Foundations for Permanent Traffic Signs and Signals

1 It has been assumed that all traffic signs and signals will have a concrete foundation. However where it is considered that a sign can be founded purely in the soil, this should be specified in Appendix 12/1.

2 The design of concrete foundations should be prepared adopting the advice given in NG 2602 utilising the wind loading described in BS 873 : Part 1.

3 The foundations for free-standing luminaries should be designed to the same standards as those for sign posts, allowing for the size of luminaires likely to be adopted.

NG 1204 Posts for Permanent Traffic Signs

1 The number, type, size, protective finish and material of posts should be determined to satisfy the structural requirements of BS 873 : Parts 6 and 7.

2 Information is available from the Overseeing Organisation covering the design of posts using steel circular and rectangular hollow sections and reinforced or prestressed concrete.

3 The requirements for ‘large’ or ‘small integral’ base housings or a separately attached ‘root box’, or a ‘switch box’ to accommodate electrical equipment should be described in Appendix 12/1.

NG 1205 Not Used

NG 1206 Faces for Permanent Traffic Signs

1 Full details of the legend layout for faces of Contract-specific traffic signs (eg. Directional informatory and informatory) should be shown on fully detailed drawings listed in Appendix 12/1.

2 Legend layout of faces of non-prescribed traffic signs that have been authorised by ADT should also be fully detailed on drawings listed in Appendix 12/1.

3 Other traffic signs which have standard symbols and markings (with permitted variants) need not be drawn in detail. These signs are shown in the Traffic Signs Regulations and General Directions or in Working Drawings for Traffic Sign Design and Manufacture (3 volumes, The Stationery Office). The diagram number and where necessary the required permitted variant and the overall size of the sign or where no size is given, the x height of lettering required should be included in Appendix 12/1.

4 The standard of reflectivity and whether the sign is to be internally or externally lit, retroreflective or non-retroreflective should be specified in Appendix 12/1 for each permanent traffic sign.

5 Guidance on the use of variable message signs on all-purpose and motorway trunk roads is given in Advice Note TA 60 and Standard TD 33.

6 When using overlay material (ECOF-Electro Cutable Overlay Film) to manufacture the sign, face overlaps are not used. Manufacturers' recommendations should be followed for all face materials.

NG 1207 Construction and Assembly of Permanent Traffic Signs

1 When it is proposed to fit signs to new lighting columns the technical approval procedures should prove relatively simple. If many signs are to be added to existing columns it is likely that several different combinations of column and luminaire will be involved. Where the effects on the column are small, an overall technical approval procedure may be considered. In all cases where the columns are over 5 years old the possibility of reduced strength due to corrosion should be considered. A site inspection of the condition, particularly at ground level, should be carried out and allowance made for any loss of material. When considering the possibility of drilling holes in lighting columns the effect of the holes both on the strength and fatigue resistance of the column should be considered.

2 Puncturing of the sign face material for the purpose of affixing stiffening is not permitted.

3 Puncturing of the sign face material is permitted in accordance with sub-Clause 1207.12 for purposes other than affixing stiffeners. This includes the provision of holes for affixing temporary and permanent cover plates.

NG 1208 Not Used	heavy traffic wear or are required as temporary markings, or for the maintenance of existing edge lines.
NG 1209 Not Used	
NG 1210 Not Used	5 The following additional information should be stated in Appendix 12/3:
NG 1211 Not Used	(i) Whether a tack coat is to be used. Generally a tack coat is only required on concrete or on some old, polished surfaces.
NG 1212 Road Markings	(ii) Whether white or yellow colour required. The acceptable alternative shades from BS 381C are Primrose and Deep Cream which are equivalent to Class Y1 in BS EN 1436, and Canary Yellow and Lemon which are equivalent to Class Y2.
Permanent Road Markings	(iii) Whether the material should be reflectorised, i.e. contain and be surface dressed with spherical glass beads. All road markings on arterial and distributory roads are to be reflectorised. The need for reflectorisation of road markings on other trunk roads and on side roads forming part of the Works should be determined in accordance with Regulation 28 of The Traffic Signs Regulations and General Directions 1994, or the Traffic Signs Regulations (Northern Ireland) 1997 as appropriate, and where appropriate the Traffic Signs Manual, Chapter 5. Appendix 12/3 should state that all temporary road markings shall be reflectorised.
1 Advice on the type and dimension and the location and layout of road markings within the highway cross section can be found in the Design Manual for Roads and Bridges, the Traffic Signs Regulations and the Traffic Signs Manual.	
2 It should be stated in Appendix 12/3 (crossreferring to the appropriate Drawing) where and whether thermoplastic, paint or preformed road markings or other special materials are required and, if thermoplastic, whether it should be screed, extruded, profiled, preformed or spray applied. If a special material is required, full specification requirements should be included in Appendix 12/3.	
3 Thermoplastic material, whether screed, extruded, profiled, preformed, or spray applied is recommended for use on all types of roads particularly those that carry a heavy flow of vehicles and at locations which are subject to turning movements.	
4 Road marking paints are best used in situations where they are not subject to	(iv) Whether raised rib edge lines are required. These should be provided on arterial and

distributory roads with full hard shoulders. (Approval for the use of these on all-purpose roads must be obtained from the Overseeing Organisation who will provide the appropriate advice.) Further advice on appropriate horizontal geometry is given in Traffic Advisory leaflet 2/95.

- (v) Where drainage gaps are required in raised rib road markings. These are usually 25 mm to 50 mm at irregular intervals where ponding is expected, to promote free surface water drainage.
- (vi) Whether there is a requirement for improved visibility for wet night conditions.
- (vii) The spacing of the transverse raised ribs where Regulation 29 permits alternatives.

6 Class S3 Skid resistance to Table 7 of MSA EN 1436 should be specified for road markings at potentially hazardous locations, eg. where braking or turning is likely to occur on large areas of road surface covered by the road marking materials.

7 Functional life of a road marking is defined in MSA EN 1436 as “Period during which the road marking fulfils all the requirements initially specified by the responsible road authority”. Among other factors it is also dependent upon traffic volumes and location of road markings.

This is particularly critical in respect to retroreflectivity. As surface applied glass beads are worn away the insitu readings

may likely to be below that specified until the in-mix glass beads become exposed by gradual traffic wheel-overs.

Though the road trial procedures are specified to P5 Roll-over class in MSA EN 1824, the manufacturers should be able to demonstrate that their material formulae will comply with the specification requirements prior to works commencing.

8 For the relevant luminance factors of white and yellow road markings see Table 5 of MSA EN 1436 and for corner points of chromaticity for white and yellow road markings see Table 6 of MSA EN 1436 and Table 1 of BS 381C.

Temporary Road Markings

9 Permanent road marking material should not normally be permitted for temporary road markings on carriageways which form part of the Permanent Works. Instead, one of the removable materials now available should be adopted but the limitations referred to in 11 below, as to their use, should be considered. Appendix 12/3 should state that all temporary road markings shall be reflectorised.

10 Where there is a requirement to remove or cover existing road markings at road works, Appendix 12/3 should specify, according to site conditions, either permanent removal or the use of a black masking material. Only black masking materials which either comply with BS 7962 or which have received written type approval from the Overseeing Organisation should be incorporated into the Works.

11 Appendix 12/3 should include the limitations as to where only certain of the removable materials will be acceptable. For example materials which are only available in 100 mm and 150 mm wide strips should not be used to form warning arrows, etc. Others should not be used on particularly rigorous surfaces such as a surfaced dressed finish or a worn open textured finish. Further information may be obtained from the Overseeing Organisation and from MSA EN 1790.

NG 1213 Road Studs Retroreflecting Road Studs

1 The RCD show typical positions of permanent retroreflecting road studs on motorways. Regulation 28 of The Traffic Signs Regulations and General Directions 1994, or The Traffic Signs Regulations (Northern Ireland) 1997 as appropriate, together with, where appropriate, the Traffic Signs Manual Chapter 5 should be consulted for the application and spacing on all other roads.

2 Appendix 12/3 should list those locations where retroreflecting and non-retroreflecting road studs are to be used, together with any other requirements.

3 Retroreflecting road studs and components should not be installed by any method other than that recommended by the manufacturer and approved by the Overseeing Organisation. Full compliance with these installation instructions is essential.

4 Temporary retroreflecting road studs are special studs designed to be effective for a minimum of 3 months. After this

period their colour may deteriorate and compliance with the photometric and colorimetric values may be outside the set limits. If the period of installation is expected to be much in excess of 3 months the temporary studs should be examined and renewed as necessary or permanent retroreflecting road studs may be used with the Overseeing Organisation's approval, depending on the total expected duration and Site conditions of the Works. Further information on permanent and temporary reflecting road studs may be obtained from the Overseeing Organisation.

NG 1214 Traffic Cones, Traffic Cylinders, Flat Traffic Delineators and Other Traffic Delineators

1 For permanent cones, cylinders, FTDs and other delineators, Appendix 12/4 should state whether testing of samples selected from the batch to be supplied under the Contract is required.

2 Where testing of permanent cones, cylinders, FTDs and other delineators is to be carried out it is recommended that not less than 1 item in 500 should be selected at random for testing. However, the minimum number to be tested should be determined by the numbers required for a single test; for example, for a single test to BS 873 : Part 1, two samples of cones and four samples of cylinders are required. For FTDs it may only be necessary to have extra samples of the blades. The requirements should be listed in Appendix 12/4 and cross-referenced in Appendix 1/5.

NG 1215 Not Used

NG 1216 Temporary Traffic Signs

1 The term temporary in the context of the Contract includes signs known as portable in BS 873 : Part 2 and fixed short life signs of Chapter 8 of the Traffic Signs Manual.

NG 1217 Traffic Signals

General

1 Information on the installation and maintenance of permanent traffic signals together with technical advice, is available from the Overseeing Organisation

2 The installation and commissioning of traffic signal controllers is a task calling for specialist skills and experience in this type of work. It should be established that any sub-contractor proposed has the necessary skills and experience.

Provision of Controllers

3 A minimum of four spare cores should be specified in cabling between each post and the controller. All cables should be marked or tagged at each end and at each intermediate joint or connection so as to identify the function of each cable clearly in the phasing sequence. The method of marking should be specified in Appendix 12/5.

4 All cables within the controller/signal installation should be specified to be of

adequate size and rating to meet the electrical current requirements and electrical protection system, increased if necessary to ensure there is no voltage drop on longer cable lengths, eg. extensions to mast arm or bracket assemblies.

5 Low voltage and extra low voltage cables should be designed to be kept separate and not used in the same multi-core cable.

6 The minimum requirements for the location of all traffic signal equipment should be included in Appendix 12/5. The position of the controller cabinet, all posts, signal heads and push button equipment, interconnecting ducts and cable requirements, loop detector locations and the mode of operation for the signal control cycle should be included on a Drawing to a scale of 1:500 identified in Appendix 12/5.

7 The cable core to function allocation for all cables should be specified in Appendix 12/5.

Permanent

8 The requirements for permanent traffic signals, including installation of loop detector cables, should be given in Appendix 12/5. This should be written for the particular installation ensuring compatibility with Series 1200 and 1400.

9 Any special requirements for servicing of the equipment once in use should be included in Appendix 12/5.

Temporary

10 If temporary haul crossings and other site accesses joining the public highway

are likely to be required, the requirements for traffic signals for these or any other purposes (in addition to any requirements required under Clause 117) should be included in Appendix 12/5. The requirements for standards of operation and for maintenance of all temporary traffic signals (including portable traffic signals used to control alternate one way working) based on advice from the Overseeing Organisation should be included in Appendix 12/5.

NG 1218 Detector Loops

1 The Contractor's loop installation record drawings should be complete before being submitted to the Overseeing Organisation. The requirements of Paragraph 6.4 of Specification MCH1540 may be waived if the information is contained in other installation drawings or on the Drawings. The Overseeing Organisation is to be provided with a copy of the loop circuit test results for its maintenance records.

2 If during slot cutting the saw breaks through into a hardcore bed or any other roadbase or into any reinforcing material, the work should be stopped, the Overseeing Organisation informed that the loops cannot be installed to the Specification and its alternative requirement sought.

3 For guidance on all matters relating to electrical work and safety, refer to Series NG 1400.

4 The following formula can be used to calculate the approximate inductance of a square or rectangular loop:

$$L = 0.82.P.N(N+1)$$

where L = Inductance of loop in microHenries

P = Perimeter of loop in metres

N = Number of turns in a loop

When connecting more than one loop to a detector channel in series the total loop inductance will be the sum of the inductances of the separate loops.

5 Vehicles can also be reliably detected when up to 300 m of feeder cable is connected to a loop system, therefore a length longer than 200 m may be installed provided approval has been granted by the Overseeing Organisation. Advice should be sought from the Overseeing Organisation as to whether the detectors to be used are effective for their specified use with feeders in excess of 200 m.

6 For guidance on all matters relating to type 600 Cabinets, refer to Series 1500.

NG 1219 Controlled and Uncontrolled Crossings

1 The requirements for controlled and uncontrolled crossings should be described in Appendix 12/5. The Overseeing Organisation will advise on particular equipment specifications.

2 The required type, eg. thermoplastic (screed or spray applied) or paint, for road markings related to pedestrian crossings other than on the crossing area should be stated in Appendix 12/5.

3 For the crossing area, the required material, eg. screed applied thermoplastic or preformed plastic tiles, should also be stated in Appendix 12/5. The choice of material should be based upon traffic flows or other requirements specific to the Site.

4 Details of pedestrian guard railing associated with pedestrian crossings should be detailed in Appendix 4/2 to comply with Clause 412.

NG 1220 Traffic Signs on Gantries

1 The requirements for traffic signs on gantries including variable message signs and matrix signals should be included, in the same way as other traffic signs in Appendix 12/1.

2 Any illumination and electrical work on or to the gantry should also be specified utilising Series 1400 supplemented with any special requirements in Appendix 14/5, cross-referring to gantry detail drawings as

appropriate. Standard drawings for fabricated steel gantries, which include sign supports and electrical apparatus eg. cable trays etc. are available from the Overseeing Organisation. These drawings should be adopted wherever possible. Requirements should be given in Appendix 12/6.

NG 1221 Preparation and Finish of Metal and Other Surfaces

1 Where paint finish is required to steel traffic sign components the minimum requirements of Series 1900 should be adopted. The items to receive such treatment should be listed in Appendix 19/2 together with the paint system (chosen from the typical ones in NG 1900) and a HA/P1 sheet incorporated in Appendix 19/2 for each differently painted item. Where the Contractor offers a painted sign in compliance with BS 873 the preparation and paint system should be equivalent to the minimum requirements of Series 1900.

Sample Appendices

[Note to compiler: Include in Appendices 12/1 to 12/6 the information listed below, referring to any drawing numbers where this information is otherwise located.]

NG SAMPLE APPENDIX 12/1: TRAFFIC SIGNS: GENERAL

1 Schedule of Traffic Signs

- (i) Location of traffic signs included in Clause #1201 other than those in Appendices 12/2 to 12/6 inclusive.
- (ii) Drawing number or diagram number in Schedules 1, 2, 3, 4, 5 or 7 of the Traffic Signs Regulations and General Directions and drawing numbers giving Contract-specific details.
- (iii) Overall sizes of sign plates and details of any light-spill screens.
- (iv) Requirements for type of material, preparation and finish, for sign plates, posts, etc. *[For painting, cross-reference should be made to Appendix 19/2.]*
- (v) Details of foundations including cable ducting, reinstatement and any requirements for anchorages and attachment systems including their loadings and torque settings.
- (vi) The number, type and size of posts including details of any baseplates or flange plates.
- (vii) Details of any electrical equipment compartments.
- (viii) The type of sign face material including the Class of any retroreflective material.
- (ix) The type of any direct illumination; whether internal or external, overhead mounted or upward pointing luminaires and whether free standing on separate foundations. Also the luminance and impact categories of the signs and luminaires.
- (x) The method of switching the illumination *[eg. photo-electric control, time switch]*.
- (xi) Whether any bollards are to be internally illuminated or reflective only.

2 Additional Information

- (i) Any particular requirement for the covering of signs *[1209.1]*.
- (ii) Where sign fabrication drawings are not required, and the details to be provided for warning and regulatory signs *[1202.5]*.
- (iii) The number of keys required for locks to traffic sign housings *[1202.6]*.
- (iv) Details of location identifying marks *[1202.7]*.

-
- (v) Requirements for filling pockets in concrete foundations if different from the requirements of sub-Clause 1208.4.

NG SAMPLE APPENDIX 12/2: TRAFFIC SIGNS: MARKER POSTS

- (i) Dimensions, and locations of distance and hazard marker posts. *[Cross-reference should be made to the RCD Series E Drawings.]*
- (ii) Construction/material.

NG SAMPLE APPENDIX 12/3: TRAFFIC SIGNS: ROAD MARKINGS AND STUDS

- (i) Colour, location and material type for permanent road markings. *[Any requirements for reflectorisation and for a tack coat should also be stated as should those for raised rib edge lines.]*
- (ii) Locations where gaps are required in raised rib road markings.
- (iii) Locations where a skid resistance Class S3 to MSA EN 1436 is required for permanent road markings.
- (iv) Limitations on the use of preformed temporary road marking materials.
- (v) Locations and any other requirements for reflecting and non retroreflecting road studs.
- (vi) Requirements for the temporary covering of road studs and road markings.
- (vii) Locations where enhanced improved night visibility retroreflective road markings are required to Class R2 to Table 2 of MSA EN 1436.
- (viii) Spacing of transverse raised ribs.

NG SAMPLE APPENDIX 12/4: TRAFFIC SIGNS: CONES, CYLINDERS, FTDS AND OTHER TRAFFIC

DELINEATORS

- (i) Types of traffic delineators other than cones and cylinders and FTDs.
- (ii) The requirements, sampling rate and method of testing cones, cylinders, FTDs and other delineators [*cross-referenced in Appendix 1/5*].
- (iii) The height of FTDs [*12/4.4*].

NG SAMPLE APPENDIX 12/5: TRAFFIC SIGNS: TRAFFIC SIGNALS

1 Permanent Traffic Signals

- (i) Locations for:
 - (a) Signal heads.
 - (b) Controller.
 - (c) Ducting of carriageway and cable crossings.
 - (d) Electricity supply.
 - (e) Detection (including control units).
 - (f) Posts and gantries.
 - (g) Cables and routes.
 - (h) Telecommunications carrier interface.
 - (i) Inspection chambers.
 - (j) Road markings.
- (ii) Equipment:
 - (a) Vehicular signal heads.
 - (b) Pedestrian signal heads.
 - (c) Signal heads for cyclists.
 - (d) Light Rapid Transit (LRT) signal heads.
 - (e) Push buttons for pedestrians (including audible and tactile equipment).
 - (f) Additional signs.
 - (g) Green arrow aspects.
 - (h) Twin head or more with or without combinations of the above.
- (iii) Operation:
 - (a) Phasing/staging.
 - (b) Timings.
 - (c) Special functions.
 - (d) Linking.
- (iv) Detection:

-
- (a) Type (Loop and above ground detection).
 - (b) Loop: location, configuration, size, shape, facilities.
 - (c) Power supply and cabling.
 - (d) System of cable identification.
- (v) Testing:
- (a) Factory.
 - (b) Site.
- (vi) Special road surfacing.
- (vii) Locations of other services (gas, water, electricity, etc.).
- (viii) Maintenance and servicing requirements.

2 Temporary Traffic Signals

Generally as for 1 above with the exclusion of:

- (i) as this is liable to alteration during the progress of Works, it should state at what stages during the Works temporary traffic signals are required
- (iii) (b) to (d) inclusive.
- (v) (a).
- (vi) , and
- (vii)
- (viii).

Add with regard to:

- (i) “a power supply may be a portable generator”.
- (ii) cable crossing protection.

Traffic Signs

3 Controlled Crossings

[Generally as for 1 above.]

4 Zebra Crossings

- (i) Location:
 - (a) Road markings.

-
- (b) Beacons.
 - (c) Electricity supply.
- (ii) Materials:
- (a) Road surfacing.
 - (b) Road markings.

NG SAMPLE APPENDIX 12/6: TRAFFIC SIGNS: SPECIAL SIGN REQUIREMENTS ON GANTRIES

- (i) Material and constructional requirements for gantries.
- (ii) Mounting details for traffic signs and sign lighting requirements.
[Electrical equipment should be described in Appendix 14/5. Traffic signs including variable message signs and matrix signals should be described in Appendix 12/1.]

Sample Appendices

[Note to compiler: Include in Appendices 12/1 to 12/6 the information listed below, referring to any drawing numbers where this information is otherwise located.]

NG SAMPLE APPENDIX 12/1NAW: TRAFFIC SIGNS: GENERAL

1 Schedule of Traffic Signs

- (i) Location of traffic signs included in Clause 1201NAW other than those in Appendices 12/2 to 12/6 inclusive.
- (ii) Drawing number or diagram number in Schedules 1, 2, 3, 4, 5 or 7 of the Traffic Signs Regulations and General Directions and drawing numbers giving Contract-specific details.
- (iii) Overall sizes of sign plates and details of any light-spill screens.
- (iv) Requirements for type of material, preparation and finish, for sign plates, posts, etc. *[For painting, cross-reference should be made to Appendix 19/2.]*
- (v) Details of foundations including cable ducting, reinstatement and any requirements for anchorages and attachment systems including their loadings and torque settings.
- (vi) The number, type and size of posts including details of any baseplates or flange plates.

-
- (vii) Details of any electrical equipment compartments.
 - (viii) The type of sign face material including the Class of any retroreflective material.
 - (ix) The type of any direct illumination; whether internal or external, overhead mounted or upward pointing luminaires and whether free standing on separate foundations. Also the luminance and impact categories of the signs and luminaires.
 - (x) The method of switching the illumination [*eg. photo-electric control, time switch*].
 - (xi) Whether any bollards are to be internally illuminated or reflective only.

2 Additional Information

- (i) Any particular requirement for the covering of signs [*1209.1*].
- (ii) Where sign fabrication drawings are not required, and the details to be provided for warning and regulatory signs [*1202.5*].
- (iii) The number of keys required for locks to traffic sign housings [*1202.6*].
- (iv) Details of location identifying marks [*1202.7*].
- (v) Requirements for filling pockets in concrete foundations if different from the requirements of sub-Clause 1208.4.

3 Details of bilingual sign layouts [*1201.1NAW*].

NG SAMPLE APPENDIX 12/1NI: TRAFFIC SIGNS: GENERAL

1 Schedule of Traffic Signs

- (i) Location of traffic signs included in Clause 1201NI other than those in Appendices 12/2 to 12/6 inclusive.
- (ii) Drawing number or diagram number in Schedules 1, 2, 3, 4, 5 or 7 of the Traffic Signs Regulations (Northern Ireland) 1997 and drawing numbers giving Contract-specific details.
- (iii) Overall sizes of sign plates and details of any light-spill screens.
- (iv) Requirements for type of material, preparation and finish, for sign plates, posts, etc. [*For painting, cross-reference should be made to Appendix 19/2.*]
- (v) Details of foundations including cable ducting, reinstatement and any requirements for anchorages and attachment systems including their loadings and torque settings.

-
- (vi) The number, type and size of posts including details of any base plates or flange plates.
 - (vii) Details of any electrical equipment compartments.
 - (viii) The type of sign face material including the Class of any retroreflective material.
 - (ix) The type of any direct illumination; whether internal or external, overhead mounted or upward pointing luminaires and whether free standing on separate foundations. Also the luminance and impact categories of the signs and luminaires.
 - (x) The method of switching the illumination [*eg. photo-electric control, time switch*].
 - (xi) Whether any bollards are to be internally illuminated or reflective only.

2 Additional Information (05/01)

- (i) Any particular requirement for the covering of signs [*1209.1*].
- (ii) Where sign fabrication drawings are not required, and the details to be provided for warning and regulatory signs [*1202.5*].
- (iii) The number of keys required for locks to traffic sign housings [*1202.6*].
- (iv) Details of location identifying marks [*1202.7*].
- (v) Requirements for filling pockets in concrete foundations if different from the requirements of sub- Clause 1208.4.

SERIES NG 1300 ROAD LIGHTING COLUMNS AND BRACKETS AND CCTV MASTS

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ROAD LIGHTING COLUMNS AND BRACKETS AND CCTV MASTS

NG 1301 General

1 Standards BD 26 and BD 83 are complementary to the Specification and include details of the acceptable materials and dimensional limitations.

The Specification includes design requirements since the Contractor is required to propose columns and brackets, and CCTV masts which have been designed by the manufacturer; to design foundations for planted lighting columns to meet the Overseeing Organisation's stated requirements, and to submit designs to the Overseeing Organisation for acceptance. This responsibility includes for the design of planted lighting column foundations for each of the types of soil listed in Appendix 13/1 and where required, the design of foundations for columns and masts with flange plates.

2 Electrical engineering requirements for lighting columns are given in Series 1400. Electrical engineering requirements for CCTV masts should be as described in Appendix 15/1.

3 Wall mounting bracket positions should be detailed on the Drawings. Details of the provision to be made for electrical services eg. ducting, conduits, junction boxes, etc. should be shown on the Drawings.

4 Where wall mounted brackets and fixtures are required, wayleaves, i.e. permission to fix, may be necessary.

5 The Contractor should ensure that the appropriate electricity suppliers have confirmed their approval to the clearances provided to overhead lines and provide evidence to the Overseeing Organisation that agreement has been reached in advance of installation.

6 The information to be provided by the Overseeing Organisation at the time of inviting tenders should be given in Appendix 13/1 and Appendix 13/4.

7 Further advice is published in The Design Manual for Roads and Bridges, Volumes 8 and 10.

NG 1302 Design of Lighting Columns, Brackets, CCTV Masts, Foundations, Anchorages and Attachment Systems

1 The Contractor is required to submit to the Overseeing Organisation the design and check certificates as required by the technical approval scheme adopted by the Overseeing Organisation for the design of each lighting column, bracket, CCTV mast, planted foundation, foundations for columns and masts with flange plates and their associated anchorages and attachment systems.

2 The Contractor should normally be made responsible for the design of wall mounted brackets and fixings. The wall on which mounted brackets are to be fixed should be checked to ensure that it is capable of carrying the additional

loads and other forces that may be transmitted by the bracket.

Aesthetic Requirements

3 The Contractor's designs of columns, masts and luminaires, including bracket arms, are to be submitted to the Landscape Architect of the Overseeing Organisation.

NG 1303 Data Sheets

1 The information required on the completed Data Sheets is that which is necessary to ensure that the equipment being offered satisfies the requirements of both the Specification and Standards BD 26 and BD 83. Typical Standard Data Sheets are included in these Notes for Guidance. The information provided by the Overseeing Organisation, including that in Appendix 13/1 and Appendix 13/4 should be all that is necessary to enable the Contractor to complete the Data Sheets in accordance with the "Instructions for Completion of Data Sheets" shown in Appendix 13/3 and Appendix 13/6.

In completing and submitting the Data Sheets the Contractor confirms compatibility of the columns, masts, cameras, housings, mountings and luminaries being offered.

Appendix 13/1 and Appendix 13/4 should specify the date by which completed Data Sheets are to be submitted. Where these are required at the time of tender this should be stated in Appendix 13/1 and Appendix 13/4, and the information provided by tenderers should be sufficient to evaluate the

tenders and suitability of equipment being offered.

Appendix 1/4 should list the Contractor's detail drawings which are to be submitted. Such drawings are normally submitted after the Contract is awarded unless there is good reason to specify otherwise. Drawings are usually required to give details unique to the scheme which can be of assistance to the Malta Transport Authority, eg sizes and centres of foundation holding down bolts, etc. Drawings which show only general construction details are not usually required.

NG 1304 Identification and Location Markings

1 The location marking required for each column and mast will vary throughout the country and instructions in the Contract should generally be agreed with the road authorities concerned. The following should be specified:

- (i) The direction in which the numbers should face.
- (ii) The colour and background of the numbers.
- (iii) The size of the numbers and distance above ground.
- (iv) Method of marking eg. in paint or plastic, etc.
- (v) Number of marks on each column and mast shafts (generally two for columns and masts on central reserve).
- (vi) The mark which will enable a particular column/mast to be located.

- (vii) Any distinctive system in order to highlight the location number at night.

NG 1305 Installation of Foundations, Anchorages and Attachment Systems

1 The method of installation of planted root columns can influence their performance. Planted columns are backfilled over the full planting depth with either concrete in accordance with sub-Clause 1305.4 or earth backfill in accordance with sub-Clause 1305.5. A combination of concrete and earth backfill is not permitted as this may alter the stress distribution on the column.

2 Examples of the evidence required by sub-Clause 1305.10(i) include:

- (a) the results of testing to BS 5080 by a testing laboratory accredited for such test; or
- (b) a Certificate from any UA Etc member together with the results of testing to the European Union of Agrément Directive for Assessment of Anchor Bolts MOAT No. 42 (adapted to include only anchorage types permitted by the Specification).

An example of the evidence required by sub-Clause 1305.10(ii) is the result of testing to Clause 5.4.2.5 of MOAT No 42 (adapted to include only anchorage types permitted by the Specification).

If the four week time period required by sub-Clause 1305.10 is unrealistic then the appropriate time period should be

stated in Appendix 13/1 and Appendix 13/4.

3 Failures of anchorages in drilled holes are known to occur due to either the lack of cleanliness of the hole or the excessive tolerances of the size of the hole. The manufacturer of the anchorage should give the maximum tolerance permitted and the evidence submitted in accordance with sub-Clause 1305.10 should show that the anchorages are satisfactory when installed in holes having these maximum tolerances.

4 Where lighting columns and CCTV masts are to be installed on bridge decks, columns and masts with flange plates should be used. Care should be taken to avoid damaging bridge deck waterproofing. Normally an anchorage and attachment system which avoids this problem should be used. In exceptional circumstances, where damage to the waterproofing is unavoidable, a compatible sealing system to prevent ingress of water and avoid corrosion should be used.

5 Where attachment systems are used, the bolts or nuts are to be tightened adequately in accordance with the manufacturer's instructions, to ensure that the attachment system does not work loose when subject to wind loading. In addition, it is important to ensure an adequate length of thread engagement.

6 Sealing of voids in anchorages, attachment systems and flange plates with a non-setting passive filler is important to prevent ingress of water and to avoid corrosion.

NG 1306 Site Tests on Anchorages in Drilled Holes

1 The Contractor is responsible for carrying out Site tests and, where required, for designing the anchorages. Anchorages should be selected on behalf of the Overseeing Organisation to be tested within the frequency given in Appendix 1/5.

2 Where anchorages in drilled holes are designed by the Contractor, it should be established to the satisfaction of the Overseeing Organisation that the Contractor's calculations for the nominal tensile load have been correctly carried out and have been checked, before selecting the anchorages for testing.

3 The Contractor's test record documents should be included in the as-built records.

NG 1307 Materials and Surface Finishes

1 The system of protection for steel columns and masts is dependent upon the and environment utilizing the information given in Series NG 1900 and the requirements stated in Appendix 19/1.

2 A suitable quality of the surface protection for temporary lighting columns and brackets and CCTV masts should be specified in Appendix 19/1. The full requirements of Series 1900 for such lighting and CCTV cameras may not be necessary.

3 Metal fixings to concrete columns should also comply with the requirements of Series 1300. No protection to the concrete is normally required.

NG 1308 Not Used

NG 1309 Amendments and Additions to BS 5649 : Part 2 : 1978 for Lighting Columns

1 The amendments to Page 5 Clause 4 introduce the width of cable entry slot dimension 'X' which should be 75 mm for all columns of nominal height of 8 m or more and may be 50 mm for columns of lesser height. The value of 'X' should be stated in Appendix 13/1.

2 The additional sub-clause 8.7.1.3 in Specification Clause 1309 specifies the material thickness tolerance. in the event of the thickness of the material supplied being outside the -5% tolerances but still being within the tolerances specified for steel in appropriate Euro norms as listed in MSA EN 10 025, the material may be used providing its actual certified yield strength is not less than the product of the ratio of nominal thickness to actual thickness and the specified nominal yield strength, ie:

$$\sigma_y \geq \frac{\sigma_{y_a} t_n}{t_a}$$

where

σ_{y_a} = actual certified yield strength

σ_{yn} = nominal specified minimum yield strength in BS EN 10 025

t_n = nominal specified thickness

t_a = actual thickness

Note: A similar approach may be adopted in the case of aluminium.

NG 1310 Amendments and Additions to BS 5649: Part 3: 1982 for Lighting Columns and Brackets and CCTV Masts Welding

1 Prior to the anticipated start of manufacture of columns and masts, copies of the most recent certified destructive test reports covering those component types to be supplied under the Contract should be available for inspection.

2 Sample column/mast components and/or joints for destructive testing should be selected by a certified Welding Inspector. Selection should be made taking into account the manufacturer's inspection reports, previous destructive test reports and observations of current production practice on similar column types. Samples should be selected on the basis that they represent the lower end of quality in the production batch. Particular attention should be given to any features which could adversely affect the true throat size or the mechanical properties of the materials or introduce stress raisers transverse to the member axis.

3 For the purposes of defining lighting column and CCTV masts types in 7.1.5,

differences in either member cross-sectional shape, joint configuration or weld type, constitute a change in lighting column and CCTV mast types. Variations in parent metal thickness or weld throat dimension from the specified sizes on the sample selected for destructive test may be included within the same lighting column and CCTV mast types up to a limit of $\pm 40\%$.

4 Sample components and/or joints selected for destructive testing should be indelibly marked and dispatched to a testing laboratory appropriately accredited for weld testing.

5 The following points should be considered when ascertaining the acceptability of components subject to destructive testing:

- (a) Each length of weld between weld ends or changes of direction should be sectioned at intervals not exceeding 100 mm. Circumferential welds should be sectioned on at least 2 diameters. Post seam welds should be sectioned at a minimum of 4 locations along their length. One side of each section should be ground, filed, finished or machined to a finish at least as smooth as that produced by a 120 grit paper to BS 871, so that the actual throat and leg dimensions can be measured and any discontinuities exposed. One nick break test in accordance with BS 709 on a length of weld of not less than 25 mm should be made for each joint type on each component. Additional sections and nick break tests may be

required in cases of borderline acceptance. Non-conformances with the imperfection acceptance levels of MSA EN 288 : Part 3 or Part 4, as appropriate should be recorded. Non-conformances with the requirements of 7.1.4 should be cause for rejection, except that in 7.1.4.2 the throat and leg dimensions should be the true rather than the apparent dimensions.

- (b) One representative section from each joint type for each type of column should be prepared for macro-examination. A hardness survey should be done where any of the parent material thickness exceeds 20 mm. An additional macro-examination should be made of each non-conforming weld.

6 The results of the destructive tests including macrographs should be reported and a certified copy sent to the manufacturer. In the event of nonconformances being found the Contractor and manufacturer should be notified as soon as possible. The test

specimens, uniquely identified by hard stamped marks should be returned to the manufacturer's works.

NG 1311 Not Used

NG 1312 Not Used

NG 1313 Laminated Glass Fibre Reinforced Plastic (GFRP) Lighting Columns

Manufacture of GFRP Laminates

1 The internal surface of the column should not contain any dry patches but may show the presence of cracking in resin-rich layers or occasional bubbles. These do not affect the strength of the column and may be ignored.

2 The thickness of the column may vary step-wise along its length. Around the door area, additional reinforcement layers should generally be provided dependent on design requirements.

NG SAMPLE APPENDIX 13/1: INFORMATION TO BE PROVIDED WHEN SPECIFYING LIGHTING COLUMNS AND BRACKETS

[Notes to compiler:]

1 *Appendix 13/1 should be specific and provide all the information which a tenderer will need in addition to information provided elsewhere in the documents; in order to submit a tender. Reference should be made in Appendix 13/1 to other relevant documents, eg drawings.*

2 *The requirements for each type of lighting column should include the following information as applicable:]*

- (i) number of columns;
- (ii) nominal height of column;
- (iii) bracket projection, single or double: or whether post-top fitting;
- (iv) luminaire weight and windage area and centres of application of the forces from the centroid of the column shaft;
- (v) size, length and angle of luminaire fixing;
- (vi) location of column, ie location factor k, and exposure class;
- (vii) height of installation above ground level, ie for lighting columns mounted on a structure or embankment the height of installation should include the nominal height of the column plus the height of the datum above the adjacent ground level;
- (viii) type of column base, ie planted with or without base plate or column with flange plate;
- (ix) list of columns with flange plates where the Contractor is to design the foundations, anchorages and attachment systems;
- (x) information on soil types for design in accordance with BS 5649 : Part 2 : 1978 Appendix B for individual or groups of columns;
- (xi) requirements for backfilling if not to be Class 8 as described in sub-Clause 1305.5;

- (xii) size and number of door openings, number of doors to be fitted with hinges or metal chains and direction doors are to face;
- (xiii) size requirements for base compartments;
- (xiv) acceptable column materials and types in very exposed sites as defined in BD 26;
- (xv) provide information as required in Appendix 19/1;
- (xvi) any specific requirements for aesthetic approval of lighting column and bracket combinations *[as agreed with the Regional Landscape Architect]*;
- (xvii) number of door keys if different from Clause 1311;
- (xviii) identification and location markings;
- (xix) requirements for wall mountings including fixings;
- (xx) requirements for earthing *[see NG 1420]*;
- (xxi) columns to be mounted on structures or in situations where there is a risk that a detached door could cause an accident if it fell onto the area below;
- (xxii) any other special requirements, eg dimension 'X' for cable entry slot width, signs and attachments in excess of BD 26 requirements;
- (xxiii) requirements of electricity supplier including warning notices regarding proximity to overhead power lines

3 Latest date by which completed Data Sheets shall be provided. *[This date should generally be not earlier than 2 weeks after the date of award of Contract; however, there may be special reasons to advance this date, such as when there is a requirement for lighting columns of high aesthetic standard. This date may sometimes be better determined after the award of Contract based on the Contractor's programme and his reasonable lead-times for approval and procurement. 1303.1]*

APPENDIX 13/2

(SPECIFICATION FOR ROAD WORKS)

TYPICAL LIGHTING COLUMN AND BRACKET DATA – SHEET 1

Name of Manufacturer:	Column Reference No.	
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NAME OF CONTRACT

Revision No.	
Date	

Part A General

Column nominal height (m)

Column material

Material design strength (N/mm²)

No. of door openings

Door opening size - Height (mm)

- Width (mm)

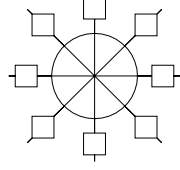
Cross-section of base compartment	Height (mm)	Width (mm)	Depth (mm)
	<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>

Corrosion protection (steel columns only) - system (NG 1901)

Details of signs and attachments allowed for in the design Area (mm²), Eccentricity (mm), Height

- additional sacrificial steel thickness, above that needed in the design, from the bottom of the column to at least 250mm above the anticipated ground level

Acceptable position of bracket
Arms relative to door position

<p>Door Opening</p> 	Any <input style="width: 30px;" type="text"/>
Manufacturer's drawing ref. No.	<input style="width: 100px;" type="text"/>

 (mm)

Part B Foundation Data

Planted base

Planting depth

 (m)

Diameter of concrete surround (if any)

Standard Soil Type Factor G		
630	390	230
<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>

Flange base

Bolt hole centres	Hole diameter	Design load/bolt
(mm)	(mm)	(mm)
<input style="width: 100px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input style="width: 100px;" type="text"/>

Relevant forces and moments at ground level
Line of action of max. moment relating to door opening

NOTE: For flange plates with slotted holes a diagram shall be included with this Data Sheet

APPENDIX 13/2

(SPECIFICATION FOR ROAD WORKS)

TYPICAL LIGHTING COLUMN AND BRACKET DATA – SHEET 2

Part C Acceptable Luminaires

Luminaire: Maximum Characteristics

		Standard k Factors (see BS 5649)				
		1.50	1.80	2.20	2.50	3.00
Luminaire Max Wt (kg)	Luminaire connection	Maximum Windage Area (m ²) for standard k factors				
Diameter	Length					

Single Arm
Bracket
Column:

Luminaire Lever Arm (mm)	
Due to wt. of luminaire	Due to windage on luminaire

Bracket Projection (m)	Ref No.	Drawing No.	Material		Luminaire Fixing Angle	Luminaire Connection		Luminaire Maximum Wt (Kg)	Maximum Windage Area (m ²) for standard k factors				
			Grade	Design Strength (N/mm ²)		Diameter (mm)	Length (mm)						

Double Arm
Bracket
Column:

Luminaire Lever Arm (mm)	
Due to wt. of luminaire	Due to windage on luminaire

Bracket Projection (m)	Ref No.	Drawing No.	Material		Luminaire Fixing Angle	Luminaire Connection		Luminaire Maximum Wt (Kg)	Maximum Windage Area (m ²) for standard k factors				
			Grade	Design Strength (N/mm ²)		Diameter (mm)	Length (mm)						

Part D Certification

It is certified that the information given in this Data Sheet has been obtained in accordance with the requirements of
MSA-EN 40: Part 1 and BS 5649 as implemented by Standard BD 26 and the Specifications.

Signed on behalf of the
Contractor _____

Date _____

APPENDIX 13/3 INSTRUCTIONS FOR COMPLETION OF LIGHTING COLUMN AND BRACKET DATA SHEETS

General

- 1 When information is not required a dash shall be inserted in the appropriate boxes.
- 2 Where a Data Sheet is amended it shall be given a new revision number with a date.
- 3 The revision numbers shall be consecutive letters of the alphabet, commencing with "A".
- 4 The date of the revision shall agree with the date of the Contractor's signature.
- 5 The column, or bracket material shall be steel, aluminium, reinforced or prestressed concrete, glass fibre reinforced plastic or any other suitable material.
- 6 The material design strength shall be the minimum specified in the design. Where more than one material is used values for all materials shall be given.
- 7 All relevant entries shall be made on the Data Sheet before the document is certified by the Contractor.

Column Data

- 8 The column nominal height shall be selected from clause 2 or 3 of BS 5649 : Part 2 : 1978 as appropriate.
- 9 The number of door openings shall agree with the manufacturer's drawing.
- 10 The cross-section of the base compartment shall be indicated by a dimensioned diagram/sketch.
- 11 The acceptable positions of bracket arms relative to the door position shall be indicated on the diagram. Where all positions are acceptable the box noted "ANY" shall be ticked.
- 12 Where concrete is necessary around the planted base in accordance with sub-Clauses 1305.3 and 1305.4 the minimum diameter shall be entered.
- 13 For flange bases all forces and moments used in the design of the foundations, anchorages and attachment systems shall be given.
- 14 The corrosion protection system used on the column when new shall be recorded. Where additional steel is provided for sacrificial purposes the amount shall be recorded.

15 The signs and attachments surface area, eccentricity from the centre line of the column to the centre of area of the sign and height above ground level to the centre of area of the sign shall be stated.

Bracket Data

16 The luminaire lever arms, weight and maximum windage area quoted shall be based on the most adverse loading on the bracket when it is attached to any of the columns quoted in the compatible column sections.

(Note: The luminaire lever arms are the horizontal distances from the centre of gravity of the luminaire and, if applicable, the centroid of the windage surface area to the end of the bracket joint).

NG SAMPLE APPENDIX 13/4: INFORMATION TO BE PROVIDED WHEN SPECIFYING CCTV MASTS

[Notes to compiler:]

1 Appendix 13/4 should be specific and provide all the information which a tenderer will need in addition to information provided elsewhere in the documents, in order to submit a tender. Reference should be made in Appendix 13/4 to other relevant documents, e.g. drawings.

2 *The requirements for each type of CCTV mast should include the following information as applicable:]*

- (i) number of masts;
- (ii) nominal height of masts;
- (iii) type of camera mounting;
- (iv) camera and housing weight and windage area and centres of application of the forces from the centroid of the column shaft;
- (v) location of mast, ie National Grid Reference;
- (vi) site wind speed, V_s (m/s) as defined in Institution of Lighting Engineers Technical Report 7, 2000 Edition;
- (vii) height of installation above ground level, i.e. for CCTV masts mounted on a structure or embankment the height of installation should include the nominal height of the mast plus the height of the datum above the adjacent ground level;
- (viii) list of masts with flange plates where the Contractor is to design the foundations, anchorages and attachment systems;
- (ix) size and number of door openings, number of doors to be fitted with hinges or metal chains and direction doors are to face;
- (x) size requirements for base compartments;
- (xi) acceptable mast materials;
- (xii) acceptable corrosion protection treatments;
- (xiii) any specific requirements for aesthetic approval of CCTV masts *[as agreed with the Overseeing Organisation]*;
- (xiv) number of door keys if different from Clause 1311;
- (xv) identification and location markings;

- (xvi) requirements for earthing [*see NG 1420*];
- (xvii) masts to be mounted on structures or in situations where there is a risk that a detached door could cause an accident if it fell onto the area below;
- (xviii) any other special requirements, eg details of special attachments to the CCTV masts;
- (xix) requirements of electricity supplier including warning notices regarding proximity to overhead power lines.

3 Latest time by which complete Data Sheets shall be provided.

APPENDIX 13/6: INSTRUCTIONS FOR COMPLETION OF CCTV MAST DATA SHEETS

General

- 1 When information is not required a dash shall be inserted in the appropriate boxes.
- 2 Where a Data Sheet is amended it shall be given a new revision number with a date.
- 3 The revision numbers shall be consecutive letters of the alphabet, commencing with "A".
- 4 The date of the revision shall agree with the date of the Contractor's signature.
- 5 The mast shall be steel.
- 6 The material design strength shall be the minimum specified in the design. Where more than one material is used values for all materials shall be given.
- 7 All relevant entries shall be made on the Data Sheet before the document is certified by the Contractor.

Mast Data

- 8 The mast nominal height shall be as defined in BD 83, clause as appropriate.
- 9 The number of door openings shall agree with the manufacturer's drawing.
- 10 The cross-section of the base compartment shall be indicated by a dimensioned diagram/sketch.
- 11 The acceptable positions of the mounting relative to the door position shall be indicated on the diagram. Where all positions are acceptable the box noted "ANY" shall be ticked.
- 12 For flange bases all forces and moments used in the design of the foundations, anchorages and attachment systems shall be given.
- 13 The corrosion protection system used on the column when new shall be recorded. Where additional steel is provided for sacrificial purposes the amount shall be recorded.
- 14 The signs and attachments surface area, eccentricity from the centre line of the mast to the centre of area of the sign and height above ground level to the centre of area of the sign shall be stated.

Bracket Data

- 15 The lever arms, weight and maximum windage area quoted for the CCTV camera with to any of the masts quoted in the compatible mast sections.

(Note: The lever arms are the horizontal distances from the centre of gravity of the CCTV camera with associated mounting and housing and, if applicable, the centroid of the windage surface area to the centreline of the mast.)

ELECTRICAL WORK FOR ROAD LIGHTING AND TRAFFIC SIGNS

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MOTORWAY COMMUNICATIONS

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PILING AND DIAPHRAGM WALLING

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STRUCTURAL CONCRETE

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SERIES 2000

WATERPROOFING FOR CONCRETE STRUCTURES

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WATERPROOFING FOR CONCRETE STRUCTURES

2001 General

1 Immediately before the application of the primer or laying of the waterproofing system or protective layer, the concrete surface or primed surface shall be clean, dry and free from laitance, loose aggregate dust and where the adhesion to the concrete would be impaired, free form curing liquids, compound and membranes.

2 The waterproofing membrane, primer and bonding agents including tack coat, shall be compatible with each other.

3 The use of ventilation layers, partial bonding or bond breakers with the waterproofing system is not permitted.

4 The surface finish for new bridge decks between parapet up stands and to top of buried structures to be waterproofed shall be Class U4 finish in accordance with sub-Clause 1708.4.

5 Existing waterproofing systems to bridge decks between parapet up stands are to be repaired or replaced in accordance with Clause 2008.

6 An additional protective layer shall be applied immediately above bridge deck waterproofing only to those areas shown on the Drawings and shall comply with this Series

2002 Protection of Bridge Deck Waterproofing During Construction

1 On any structure, providing no damage results, plant and equipment all fitted only with rubber tyres may stand or travel on waterproofing systems solely for the purposes of laying an additional protective layer or surfacing course on that structure.

Rollers shall not be permitted to stand or travel directly on the waterproofing system.

Where it is necessary for plant, equipment or traffic to stand or travel on a bridge deck that has been waterproofed (mastic asphalt waterproofing or proprietary waterproofing systems) with a permitted system before the laying of an additional protective layer, suitable temporary protection shall be provided. All such plant and equipment shall have its tyre treads regularly inspected and any embedded hard objects removed.

2 Temporary protection shall be provided where damage to the waterproofing, protective layer or additional protective layer could result from particular site traffic.

3 The protective layer of a two layer waterproofing system, or any protective layer additional to that included as part of a waterproofing system, shall be laid immediately after the waterproofing layer's bonding agent has set or cured. Where a waterproofing membrane also serves as an adhesive for the protective layer, any additional protective layer shall not be laid until the liquid

waterproofing membrane/adhesive has set or cured.

2003 Materials for Waterproofing Concrete Bridge Decks

Primer for Mastic Asphalt

1 Primer for sealing concrete surfaces prior to waterproofing shall be spirit based and compatible with mastic asphalt. The viscosity of the primer shall be such that it penetrates the concrete without forming a skin.

Mastic Asphalt

2 Unless otherwise described in Appendix 20/2, mastic asphalt for waterproofing complying with NBS 6925, type R988. Where mastic asphalt for waterproofing complying with BS 6925, type T1097 is required, the hardness number at the time of laying shall not exceed 90 at 25 °C.

Proprietary Waterproofing Systems

3 Proprietary Waterproofing systems incorporated in the Permanent Works shall have a current International Agreement Board Roads and Bridges Certificate. Each System shall also have a current PWS (Proprietary Waterproofing System) Data sheet cleared through IAB in their certification procedure.

The contractor shall furnish the Engineer with 3 copies of the PWS Data Sheet and Annex 'A' a blank copy of which is shown in Appendix 20/1. The system shall not be adopted for the works until the Engineer has provided his written acceptance of the complete system, its

component materials, their characteristic properties and the preparation and installation instructions all as stated on the PWS Data Sheet and its Annex 'A'. When furnishing the Engineer with the PWS Data sheet the contractor shall include for acceptance any additional information or limitation necessary to cater for the conditions at site including climatic and environmental limitations, compatibility of materials and details at the interface of the waterproofing with the bridge deck movement joints. No departures from the specified constituent materials as stated on the International Agreement Board Roads and Bridges Certificate and the PWS Data Sheet shall be permitted.

Additional Bituminous Protection

4 Bituminous protection where shown on the drawings as an additional protective layer, shall comply with BS 594 : Part 1 recipe Type F wearing course mixture Designation 0/3 except that 5% ± 0.5% of the total mix shall be inorganic red oxide and regarded as part of the filler content, where the additional protective layer is required to be tinted.

2004 Materials for Waterproofing Below Ground Concrete Surfaces

Primer for Tar and Bitumen

1 Primer for sealing concrete surfaces prior to waterproofing shall be compatible with the selected tar or bitumen waterproofing material. The viscosity of the primer shall be such that it penetrates the concrete without forming a skin.

Tar

2 Tar shall comply with BS 76 of viscosity grade within the range 30-38°C equi-viscous temperature.

Cut Back Bitumen

3 Cut back bitumen shall comply with BS 3690 : Part 1 of viscosity grade 50 seconds.

Proprietary Materials

4 Subject to any restrictions specified in Appendix 20/2, proprietary materials may be used.

2005 Workmanship for Waterproofing Concrete Bridge Decks

Mastic Asphalt

1 Unless otherwise agreed by the Engineer, the concrete surface shall be thoroughly sealed with evenly applied primer. The primer shall be well brushed in to avoid ponding in any depression in the deck.

2 Mastic asphalt shall be laid directly onto the primer surface:

- (i) on horizontal surface and sloping surfaces up to 30 °C to the horizontal in two coats or equal thickness to a total thickness of not less than 20 mm;
- (ii) on vertical surface and sloping surfaces of over 30 °C to the horizontal in two or three coats of equal thickness to a total thickness of not less than 20 mm.

3 The method of laying and workmanship shall comply with the recommendations of British Standard Code of Practice CP 144: Part 4: 1970, Section 4 except that:

- (i) in addition to sub-clause 4.6.1., visible blow holes and other defects shall be made good before laying a subsequent coat.
- (ii) Sub-Clause 4.6.2. and 3 and 4.7.1, 2, 8 and 9 shall not apply; and
- (iii) details described in the contract shall prevail over any conflicting requirements in the Code of Practice.

4 Joints shall be staggered a distance of at least 150mm between courses and their position and the sequence of working shall be agreed by the Engineer before commencement of the work. The mating edges of all the joints shall be intimately bonded. The surfaces of gullies or other metal features with which the waterproofing will be in contact shall be clean, dry and painted with at least 2 coats of cut back bitumen.

5 Proprietary waterproofing systems shall be only installed by applicators approved by the manufacturers and in accordance with the PWS Data Sheet and its Annex 'A'. The formation of defects affecting the integrity of the membrane including pin/blow holes (continuous or non-continuous) and blisters in the waterproofing shall:

- (i) be made good by repair in accordance with the International Roads and Bridges Agreement

Certificate before any subsequent layers are applied; or

- (ii) require the system to be replaced where directed by the Engineer.

For sheet membranes bonded with oxidized bitumen the heating and temperature of the bitumen shall comply with the manufacturer's requirements within the limits stated in BS 8000 : Part 4.

A means of checking the bitumen temperature shall be provided.

Sheet membranes shall wherever possible be laid in the direction that the additional protective layer or surfacing will be laid and compacted by roller.

6 Unless otherwise specified in the International Roads and Bridges Agrément Certificate, joints between sheets shall be lapped with end laps of at least 150 mm and side laps of at least 100 mm. The joints shall be arranged so that:

- (i) at no point are there more than three thicknesses of sheeting and,
- (ii) water will drain away from the exposed edge.

7 Proprietary waterproofing systems shall be laid to follow the contours of the concrete surface. Laps, ridges and ripples in waterproofing sheeting, and peaks and steps at butt joints in waterproofing boards, shall not be greater than 10 mm in height.

Additional Bituminous Protection

8 Bituminous protection complying with sub-Clause 2003.4 shall be laid on the clean and dry substrate, and compacted in accordance with Clause 901 to the areas and thickness shown on the Drawings.

Bond Between Additional Protective Layer or Surfacing and the Waterproofing System

9 The additional protective layer or surfacing laid on the waterproofing system shall be firmly bonded to the system for the life of the system. Where a tack coat for the additional protective layer or surfacing is not provided as part of the waterproofing system, a satisfactory bond to the membrane shall be obtained from

- (i) a separate compatible tack coat or
- (ii) the binder within the directly applied additional protective layer or surfacing.

Where the tack coat is of the type activated by the heat of the succeeding bituminous layer the rolling temperature of this layer shall be sufficient to ensure adhesion.

2006 Workmanship for Waterproofing Below Ground Concrete Surfaces

Priming for Tar and Bitumen

1 Unless otherwise described in Appendix 20/2 and prior to the application of the selected tar or bitumen waterproofing, concrete surfaces shall be

thoroughly sealed with an evenly applied primer. The primer shall be well brushed in and not allowed to pond in any depressions.

Tar

2 For tar waterproofing, two coats of tar shall be hot applied at a rate of spread per coat of 1 litre/m². The first coat shall be allowed to dry before the second coat is applied.

Cut Back Bitumen

3 For bitumen waterproofing two coats of cut back bitumen shall be hot applied at a rate of spread per coat of 0.6 litre/m². The first coat shall be allowed to dry before the second coat is applied.

Proprietary Materials

4 For proprietary materials the method of application, rate of spread, number of coats and other requirements for each system shall be as described in the manufacturer's method statement and application requirements and shall satisfy the requirements of Appendix 20/2.

2007 Integrity Testing of Concrete Bridge Deck Waterproofing

1 Waterproofing systems to concrete bridge decks shall be tested where required in Appendix 20/2 in accordance with the requirements therein to verify the integrity of the waterproofing.

2008 Repair and Replacement of Bridge Deck Waterproofing

1 The repair and replacement of existing bridge deck waterproofing systems shall comply with the requirements of Clauses 2002, 2003, 2005 and 2007 and any additional requirements described in Appendix 20/1.

BRIDGE BEARINGS

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BRIDGE EXPANSION JOINTS AND SEALING OF GAPS

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SERIES NG 2400

BRICKWORK, BLOCKWORK AND STONework

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BRICKWORK, BLOCKWORK AND STONWORK

NG 2401 Cement

1 Sulfate-resisting Portland cement should be specified where there is a risk of sulfate attack; guidance is given in BS 5628: Part 3. The cement to be used in different locations should be shown in Appendix 24/1.

NG 2402 Not Used

NG 2403 Not Used

NG 2404 Mortar

1 Table 24/1 in the Specification is confined to the more durable mortars which can withstand exposure to severe weather. Further guidance is given in BS 5628 : Parts 1 and 3.

2 An important consideration besides durability when selecting a mortar for a particular use is that increasing strength is accompanied by decreasing ability to accommodate movements such as drying shrinkage, expansion or settlement.

3 Generally for brickwork, blockwork or stonework in bridgework, mortar designation (i) or (ii) will be appropriate except for reconstructed stone, concrete and calcium silicate bricks and blocks, when mortar designation (iii) should be specified to allow for their relatively high shrinkage. Details of the mortar required for use in the Works should be shown in Appendix 24/1.

4 Extensive use of loadbearing brickwork, blockwork and masonry is not envisaged in new bridge construction but when these are required, reference should be made to BS 5628 : Part 1, and the Specification should contain an Additional Clause which should include 28-day mean compressive strengths.

5 The approximate 28-day mean compressive strengths of the mixes in Table 24/1 based on six 75 mm cubes, 100 mm cubes or 100 mm x 25 mm x 25 mm prisms are shown in Table NG 24/1.

TABLE NG 24/1: Mortar Compressive Strengths

Mortar Designation	28-day mean compressive strength	
	Laboratory tests N/mm ²	Work Tests N/mm ²
(i)	16.0	11.0
(ii)	6.5	4.5
(iii)	3.6	2.5

6 Where a plasticiser is to be used the recommendations of the admixture manufacturer should be followed. Where previous evidence of the suitability of the mixer and time of mixing is not available trials should be conducted.

NG 2405 Lime Mortar

1 Lime mortars have good working qualities but develop strength very slowly. For this reason such mortars are rarely suited to present day needs and should only be used for renovating existing lime mortar joints.

NG 2406 Bricks

1 Full details of the bricks required for use in the Works should be shown in Appendix 24/1. The terms of BS 3921 should be used for the description of the bricks.

2 Bricks manufactured to the requirements of BS 3921 should have a minimum strength of 5 N/mm², which will normally be sufficient for non-structural facework fixed to concrete as described in Clause 2416. If a higher strength is required, eg. where the facework is loadbearing, this should be shown in Appendix 24/1.

3 Consideration should be given to the quality of brick and mortar to enable water/sand blasting to be used to remove graffiti.

NG 2407 Blocks

1 Full details of the blocks required for use in the Works should be shown in Appendix 24/1. The terms of BS 6073 with regard to type and designation should be used for the description of the blocks.

NG 2408 Reconstructed Stone

1 Reconstructed stone is alternatively referred to as cast stone, or reconstituted stone.

2 Special requirements such as colour, special mixes, texture, and casting in stainless steel ties should be shown in Appendix 24/1.

NG 2409 Natural Stone

1 In some quarries the durability of stone is well known while in others the variations are such that each individual block has to be considered separately. The performance of the stone used in the area should be studied to gauge the effects of exposure. Samples of selected stones should be taken and these should represent the range of variations that are acceptable. Further guidance on choice of stone is given in BS 5390.

NG 2410 Not Used

NG 2411 Not Used

NG 2412 Brickwork and Blockwork

1 Different bricks and blocks including reconstructed stone possess different suction properties and any requirements regarding wetting before laying should be given on the Drawings.

2 The bond and type of mortar required for jointing, and pointing where necessary, should be shown in Appendix 24/1 and for all visible work the coursing should be described, eg. brickwork 4 courses to 300 mm.

3 The Drawings should also include information regarding the use of purpose-made bricks or blocks, eg. in quoins, copings or string courses, and of any sample panels of brickwork or blockwork which will be required to be built.

4 Reinforcement laps and cover should be detailed on the Drawings. This is

particularly important if the joints are raked out and left open.

5 The type of pointing required in exposed joints should be described in Appendix 24/1. Reference should be made to BS 5628 : Part 3 for the correct definitions.

NG 2413 Stonework

1 The selection of stone to be used for masonry will involve aesthetic as well as technical consideration.

2 Where required, directions should be shown in Appendix 24/1 regarding:

- (i) the amount and type of dressing the stones require on the face and sides;
- (ii) the minimum and maximum size of the stones;
- (iii) the treatment of the pointing;
- (iv) in the case of coursed work, the depth of the course;
- (v) stonework fixings including dowels, cramps, joggles, etc;
- (vi) stones which must be laid damp;
- (vii) the limit of projection of any part of the exposed face of stones;
- (viii) the minimum and maximum thickness of joints.

3 Except in the case of the finest ashlar, joints should not normally be less than 6 mm thick in any part of the bed.

4 For guidance on walling type, finishes and other relevant details reference should be made to BS 5390.

5 When special stones are required for quoins, copings or other similar purposes, they should be detailed separately on the Drawings. Special care should be taken in the choice of stone for parapets, cornices, string courses and places where more than one face of the stone is exposed. Such stones should have good weathering characteristics.

6 The use of block-in-course stonework is limited to heavy engineering works and requires the use of power-driven plant to lift the heavy stones.

NG 2414 Cold Weather Working

It can be assumed that temperatures below 3°C will never have to be considered for bricks, blocks or stonework.

NG 2415 Protection of New Work

1 For advice on the avoidance of efflorescence and lime-staining reference should be made to BS 5628: Part 3.

NG 2416 Brick, Block and Stone Facework Fixed to Concrete

1 Brick, block and stone facework should normally be built after the concrete has hardened. Brickwork built by this method is less liable to discoloration from efflorescence than that used as formwork.

2 Full details of the method of construction and spacing of ties should be shown on the Drawings. An adequate support should be provided so that the sole function of the ties is to hold the facework back to the concrete and not to carry its weight.

3 It is essential that there should be no voids between the facework and the backing so that damage will not be caused by water collecting behind the facework. The gap to be filled should be a minimum of 30 mm.

4 The acceptable variation in depth from front to back of stones for masonry facework should be shown in Appendix 24/1.

NG SAMPLE APPENDIX 24/1: BRICKWORK, BLOCKWORK AND STONework

[Note to compiler: This should include:]

1. Locations where sulfate-resisting Portland cement is to be used [2401.1].
2. Mortar designations for brickwork, blockwork and stonework [2404.1, 2412.5].
3. Particular requirements for clay bricks to BS 3921 [2406.1].
4. Requirements for bricks for chambers if different from the requirements of sub-Clause 2406.4.
5. Particular requirements for concrete blocks to BS 6073 [2407.1].
6. Details of the type and quality of natural building stone [2409.1].
7. Particular requirements such as colour, special mixes, texture and casting-in stainless steel ties for reconstructed stone [2408].
8. Type of bonding for brickwork and blockwork [2412.1].
9. Whether overhand work is permitted [2412.3].
10. Locations where pointing is required and the type of pointing [2412.5].
11. Locations where jointing is required and the type of finish to be used [2412.6].
12. Requirements for dimensions of stones if different from the requirements of sub-Clause 2413.1.
13. Requirements for tooling stonework [2413.6, 2413.7].
14. Requirements for dimensions of bond stones if different from the requirements of sub-Clause 2413.9.
15. Details of the requirements for levelling squared random rubble coursed and uncoursed stonework [2413.9].
16. The variation in depth, front to back for masonry facework [2416.4].

SPECIAL STRUCTURES

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MISCELLANEOUS

NG 2601 Bedding Mortar

General

1 Great importance is attached to the material having flow characteristics sufficient for it to occupy all the spaces between base plates and the surrounding substrata completely including around all holding down bolts. The Specification for Road Works does not cover non-flowing mortars or dry pack mortars.

Where the Engineer requires a higher strength, this should be specified in Appendix 26/2. Materials with higher strengths may be more temperature sensitive and variable.

Mortar test cubes required in connection with early loading should be cured under conditions which simulate as far as possible those of the mortar in the Works.

Materials

- 2 (i) The minimum thickness of bedding mortar should be 10 mm and the maximum thickness without reinforcement should be 30 mm. This will allow sufficient space to enable filling yet reduce creep and shrinkage effects. The nominal thickness, with tolerances, should be shown on the Drawings.
- (ii) A purpose-made portable insulated store, equipped with thermostatically controlled heaters would be suitable for complying with sub-Clause 2601.2(ii)(a). It may be convenient to include provision for storage of the mixing water at 20°C.

Site Mixing, Placing and Curing

- 3 (i) It is common practice to add the dry material to the water in the mixer. If the material does not flow correctly the addition of extra water or dry mortar to the sample is not permissible. In order to control the amount of water accurately it is good practice to use a proprietary graduated container. A bucket with a mark is not suitable.
- (ii) Where permanent shims are used underneath base plates to align or support parapet posts etc. they should take the form of either central packers or slotted washers placed around the shanks of the holding down bolts. Packers and washers should be made of materials which will not corrode. Adequate bedding cover should also be provided to the packers and washers to ensure that they are fully protected from the weather and any road and traffic contaminants. Packers and washers should be compatible with the materials used in the base plates or bolts.
- (iii) Addition of mortar may be required to form a finished plinth. Voids may occur under the base plate if this operation is carried out incorrectly.
- (iv) The quantity of mortar in the plinth extending beyond the base plate should be kept to a minimum to reduce cracking. Forming of large plinths to support two or more base plates is not recommended.

Approval Tests

- 4 (i) It is important that the various temperatures required in the flow tests are accurately maintained within the tolerances specified. The testing laboratory appointed should be able to demonstrate that it has the facilities for accurate cold testing.
- (ii) Where different methods of placing the mortar are proposed, eg. pumping, or where the geometry of the base plate is significantly different from that shown on the UK Department of Transport Highway Construction Detail (HCD) Drawing No. K2, then the glass plate test, specified in sub-Clause 2601.4(iii), should be modified to take account of the differences.

Batch Acceptance Tests

5 The tests on Site should be conducted by a competent person. Proof of ability to carry out the flow cone test method consistently may be checked by trials using water.

NG 2602 Concrete for Ancillary Purposes

1 Concrete mixes complying with Clause 2602 will normally be suitable for the purposes described in Table 26/1 and need not be shown on the Drawings for these purposes. Standard mixes from BS 5328 may also be suitable for other purposes and should be called up on Drawings where necessary. Sub-Clause 1 of Clause 2602 makes it unnecessary to do more than show “ST4 concrete” (for example) on the Drawings. The relationship between concrete mix and strength of the concrete is given in BS 5328 : Part 2.

2 Where additional requirements are necessary, for example the use of sulfate-resisting cement in ground containing sulfates (see 1704.2), or

resistance to alkali-silica reaction, these requirements should be specified in Appendix 26/1. Air entrainment will not normally be necessary but if it is required, this should also be specified in Appendix 26/1. Alkali-silica reaction will not normally be a risk because cement contents are comparatively low but in some areas where aggregates are known to be highly reactive, it may be necessary to state in Appendix 26/1 that ancillary concrete is to comply with sub-Clause 1704.5 for ST4 and ST5 mixes.

3 Foundations for traffic sign supports, lighting columns and safety fence anchors including foundations requiring technical approval, should where necessary be structural concrete complying with the 1700 Series and be shown on the Drawings accordingly.

NG 2603 Not Used

NG 2604 Not Used

NG 2605 Not Used

NG 2606 Cored Thermoplastic Node Markers

Node Markers

1 Node markers shall be installed at all CHART nodes, link and section ends. The position of the CHART nodes shall be in accordance with Trunk Road Maintenance Manual Volume 1. Where node markers have previously been installed the re-established markers shall be installed in accordance with the existing site record and this should be provided in Appendix 26/3. On new roads or altered roads where the CHART referencing is to change the CHART network and the location of new CHART nodes, link and section ends must be agreed

between the designer, the Overseeing Organisation and its Network Maintainers and the Overseeing Organisation's Maintenance Agent. The location of the node markers should then be indicated in Appendix 26/3. The location must be given both longitudinally and transversely.

Site Records

2 On completion of the installation of a node marker a record form shall be prepared in accordance with Trunk Road Maintenance

Manual Volume 1. This form must contain Sufficient information to enable the node markers to be restored after resurfacing to the tolerances in sub-Clause 2606.2 (i).

3 The site records for the completed node markers should only use references to permanent features. Where features to which existing node markers are referenced are to be removed during the Contract other suitable references for the re-establishment of the node markers must be provided in Appendix 26/3.

NG SAMPLE APPENDIX 26/1: ANCILLARY CONCRETE

[Note to compiler: Special requirements for Ancillary Concrete, eg. sulfate-resisting cement, etc. should be listed here. Also to distinguish different mix designs, mix references should be listed here but differentiated from those for structural concrete in Appendix 17/1]

NG SAMPLE APPENDIX 26/2: BEDDING MORTAR

[Note to compiler: Include here:]

1. Compressive strength requirements. *[Where different from 2601.1(i)]*
2. Locations at which permanent metal shims are acceptable *[2601.3(v)]*.
3. Early loading requirements *[For bridge bearings, cross-reference should be made to Appendix 21/1]*.

NG SAMPLE APPENDIX 26/3: CORED THERMOPLASTIC NODE MARKERS

[Note to compiler: Include here:]

1. Locations of node markers *[2606.1]*
2. Copies of existing site records
3. References for the re-establishment of existing node markers

LANDSCAPE AND ECOLOGY

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