

ROAD PAVEMENTS - GENERAL

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Road Pavements - General

NG 701 Pavement Construction

- 1 The permitted options should be agreed with the NRA or Department of the Environment as appropriate.
- 2 A separate Appendix 7/1 Sheet 1 or Sheet 2 as appropriate is to be included in the contract for each permitted pavement option.

Sheets 1 and 2 of Appendix 7/1 should cover all permitted alternatives for each length of carriageway and paved area.
- 3 A summary may be included as sheet 3 of Appendix 7/1.

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 7/2 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 10 m longitudinally and 2 m transversely. 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.
- 3 The tolerances on surface levels of wearing course 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 carriageway 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 7/2 and for each different section of road the category must be stated in Appendix 7/1. The Engineer should decide the category on the quality and quantity of traffic, on the road layout and potential speeds of traffic. Category B generally will apply to minor roads.
 - 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. The rolling straight-edge should be used at about 2 km/hour. Some coarse textures can lead to incorrect readings if the surface is traversed too quickly. Areas shown not to comply with the Specification should be rectified as soon as possible and checked by a 3 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 over-cutting. 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 over the full area of unreinforced slabs, and a minimum length of 5 metres of reinforced slabs.

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 sub-base 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 are moisture susceptible and are unsuitable for construction traffic in wet periods, the Contractor's programme and methods of laying the roadbase and subsequent layers should take cognisance of this. Traffic running on the sub-base may cause irreparable damage to the subgrade or capping. Protection of the sub-base against weather can best be achieved by laying the subsequent layers as soon as possible. Work should preferably be programmed so that the roadbase is applied before the sub-base is 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 roadbase 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 705 General Requirements for Sub-bases and Roadbases

- 1 Clause 705 applies to all sub-base and roadbase materials whether unbound (800 Series), bituminous bound (900 Series) or cement bound (1000 Series).

Frost Heave

- 2 The frost heave test described in BS 812 : Part 124 : 1989 is costly and time consuming and is not suitable for routine control checks on Site. The test has been developed from earlier test methods to overcome problems of repeatability and reproducibility. The test is primarily intended as a method to establish whether or not an aggregate from a particular source is likely to be frost-susceptible when used in an unbound condition within that part of the road pavement subject to frost penetration. Material for the frost heave test must be representative of the source and comply with all other requirements of the Specification otherwise the test is superfluous. Once a material has been established as non-frost-susceptible the test need only be repeated if the Engineer considers that the material varies from the original sample, or where the source is changed.

- 3 Clause 6 of BS 812 : Part 124 : 1989 sets down the procedure for adjusting the water level in the self-refrigerated unit (SRU). A possible problem has been identified that with the tolerances given to the dimensions for the cradle and specimen carriers it is possible for the porous discs in the specimen carriers to be located incorrectly in relation to the water level. In order to guard against this it is recommended that before testing commences the cradle and specimen carriers be put into the SRU without samples. A check is then made to ensure that discs are set at the level specified in the above-mentioned standard.

- 4 The requirement for material to be non-frost-susceptible within 450 mm of the surface of a

road or paved central reserve may be reduced to 350 mm if the Mean Annual Frost Index (MAFI) of the site is less than 50. The Frost Index is a measure of the severity of a period of cold weather and provides a means of assessing likely penetration of frost into a road. Frost index is measured in 'degree days Celsius below zero' and is calculated by taking the mean air temperature for each twenty four hour period and adding those values together. Frost penetration into a modern road in the British Isles may be estimated using the formula $x = 40 \sqrt{I}$ where x is the approximate penetration in mm and I is the frost index for the freezing spell. The Annual Frost Index is the frost index accumulated over a year commencing September 1st. Mean Annual Frost Index (MAFI) is the average of all the frost index values computed for each year since September 1959. The MAFI for a site is determined using records from one or more meteorological stations close to the site, taking account of local geographical variation, such as high ground or frost hollows. The Engineer may consider different requirements for different parts of a contract length. Further information on the MAFI can be found in UK Department of Transport Standard HD 25. Advice on the frost index may be obtained from the Meteorological Service, Glasnevin Hill, Dublin 9.

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 As much information as possible should be provided in Appendix 7/2 and on the Drawings for 1(iii) and (iv) 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 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.

- 3 Approval to excavate paved areas already constructed as part of the Permanent Works should only be given when it is necessary to carry out the Permanent Works or where no other practical means of completing the Permanent Works can be devised.
- 4 Advice and methods of reinstating concrete pavements are given in the "Manual for Maintenance and Repair of Concrete Roads" produced jointly by the UK Department of Transport and the Cement and Concrete Association (now the British Cement Association).

NG 708 Weather Conditions for Laying of Hot Rolled Asphalt Wearing Course and Other Bituminous Pavement Layers

- 1 This clause sets requirements for laying hot rolled asphalt wearing course. It takes into account the cooling effect of wind, in addition to air temperature, on hot rolled asphalt wearing course.
- 2 The thickness of hot rolled asphalt wearing course incorporating 30 per cent coarse aggregate should be 45 mm, unless otherwise stated in Appendix 7/1.
- 3 When site conditions are such that the time available for compaction is excessively long, such as when air temperatures are high, wind speeds are low or solar radiation is high, the delivery temperature may be reduced subject to the agreement of the Engineer. However, the delivery temperature for hot rolled asphalt wearing course materials should not be less than 150°C for a layer thickness of 45 mm.
- 4 The term 'Tight precipitation' is considered as rainfall less than 0.5 mm per hour.
- 5 The requirements of Clause 708.3 are based on a minimum available compaction time of ten minutes from the time the material emerges from the paver. The requirements of Clause 901 still apply, unless specifically amended by this Clause.

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].

Location \e.g. Chainage, Road Name, Carriageway Reference]

Grid for checking surface levels of pavement courses, if different from the requirements of sub-Clause 702.4:

Longitudinal dimension:
Transverse dimension:

Surface regularity [702.7/:

Category of road: [A or B]

Requirements for determination of compaction level if different from the requirements of sub-Clause 901.19 and 927.1.

Coated chippings. if different from the requirements of sub-Clause 910.5 and 911.8 and Clause 915:

Nominal Size:
Minimum PSV:
Maximum AAV:
Maximum Flakiness Index:

Requirements for hardness, durability and cleanness of aggregates if different from the requirements of sub-Clause 901.2.

Requirements for regulating course [907].

	<i>Clause</i>	<i>Material</i>	<i>Grade of Binder</i>	<i>Thickness (mm)</i>	<i>Special Requirements</i>
Surfacing			[see Note 2]	[see Note 3]	BS 594 : Part 1 Table Nos: Column Nos: Marshall Stability range: Marshall Flow: [Clause 911] BS 4987 : Part 1 Clause Nos: Nominal Size: Minimum PSV: 19121(9161:
Wearing Course					
Base-Course					
Roadbase					
Upper Roadbase					
Lower Roadbase					
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 the wearing course is to comply with Clause 912, i.e. 100 pen or 200 pen only.
- 3 Refer to NG 708.2 concerning the thickness of hot rolled asphalt wearing course.]

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: [A or 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 may be increased by 20% if limestone coarse aggregate is used throughout the depth of the slab.
Jointed reinforced concrete surface slabs (JRC)				mmVm width	1. The range of reinfmt. and max transverse joint spacings corres. to slab thicknesses given and intermediate values may be interpolated. 2. Max transverse joint spacings may be increased by 209c if limestone coarse aggregate is used throughout the depth of the slab. 3. Transverse reinforcement [<i>if required for differential settlement!</i>]
	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 Sheets 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 cross-refer to the Drawing Number.]*

NG SAMPLE APPENDIX 7/2: EXCAVATION AND REINSTATEMENT OF EXISTING SURFACES

/Note to compiler: Include here:]

- 1 Locations of any trenches, pits, etc, which require to be excavated in existing paved surfaces in order to carry out the 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 match levels where new and existing pavements abut. Reference to any drawings giving further details. [706.7]
- 3 Cross-section diagram of typical trench reinstatement in bituminous and concrete pavements giving details of materials.
- 4 References to drawings which show construction at junctions between concrete pavements and between concrete and bituminous pavements /706.13].

NG SAMPLE APPENDIX 7/3: SURFACE DRESSING

/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 AAV:

Maximum ACV:

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 [920.5]:

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.]