

BRICKWORK, BLOCKWORK AND STONEWORK

Contents

<i>Clause</i>	<i>Title</i>	<i>Page</i>
NG 2401	Cement	2
NG 2404	Mortar	2
NG 2405	Lime Mortar	2
NG 2406	Masonry Units (Bricks)	2
NG 2407	Masonry Units (Blocks)	2
NG 2408	Manufactured Stone	3
NG 2409	Natural Stone	3
NG 2412	Brickwork and Blockwork	3
NG 2413	Stonework	3
NG 2414	Cold Weather Working	3
NG 2415	Protection of New Work	4
NG 2416	Brick, Block and Stone Facework Fixed to Concrete	4
NG	Sample Appendices	5

Brickwork, Blockwork and Stonework

NG 2401 Cement

- 1 The cement to be used in different locations should be shown in Appendix 24/1 with reference to the NRA Road Construction Details, as appropriate.
- 2 Sulphate-resisting Portland cement should be specified where there is a risk of sulphate attack; guidance is given in Table F1 of Annex F to IS EN 206-1.

NG 2404 Mortar

- 1 Table 24/1 in the Specification is confined to the more durable mortars which can withstand exposure to severe weather. Guidance on design and construction to achieve adequate durability of mortar joints is given in section 8 of EN 1996-1-1 and EN 1996-2.
- 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. Refer to Table NG 24/1.
- 3 Generally for brickwork, blockwork or stonework in bridgework, mortar designation (i) or (ii) will be appropriate except for manufactured 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 IS EN 1996-1-1, 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 are shown in Table NG 24/1.
- 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 Masonry Units (Bricks)

- 1 Consideration should be given to the quality of brick and mortar to enable water/sand blasting to be used to remove graffiti.
- 2 Full details of the units required for use in the Works should be shown in Appendix 24/1. The following terms of IS EN 771-1 should be used for the description of the units:
 - (i) HD or LD units;
 - (ii) Dimensions (length, width, height) and tolerance category;
 - (iii) Compressive Strength;
 - (iv) Net dry density;
 - (v) Water absorption;
 - (vi) Freeze/thaw resistance category;
 - (vii) Active Soluble salts content category.
- 3 Masonry units with freeze/thaw resistance category F2 and active soluble salts content category S2 should be specified for facework. Bricks with a minimum strength of 7 N/mm², will normally be sufficient for non-structural facework fixed to concrete as described in Clause 2416. If a higher strength is required, e.g. where the facework is load bearing, this should be shown in Appendix 24/1.

NG 2407 Masonry Units (Blocks)

- 1 Full details of the units blocks required for use in the Works should be shown in Appendix 24/1. The following terms of IS EN 771-3 with regard to type and designation should be used for the description of the units:
 - (i) HD or LD units;
 - (ii) Dimensions (length, width, height) and tolerance category;
 - (iii) Compressive Strength;
 - (iv) Gross dry density;
 - (v) Water absorption;
 - (vi) Freeze/thaw resistance category;

(vii) Block colour and texture (RCD/2400/3).

NG 2408 Manufactured Stone

- 1 Manufactured 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.

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 in the Contract.
- 2 The bond and type of mortar required for jointing, and pointing where necessary, should be identified in Appendix 24/1 and for all visible work the coursing should be described, e.g. brickwork, 4 courses to 300 mm.
- 3 The drawings in the Contract should also include information regarding the use of purpose-made bricks or blocks, e.g. 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 in the Contract. 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 IS EN 1996-2.

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 Reference should be made to BS 5390 for guidance on walling type, finishes and other relevant details.
- 5 When special stones are required for quoins, copings or other similar purposes, they should be detailed separately on the drawings in the Contract. 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 and be able to withstand frost.
- 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

- 1 The precautions to be adopted if bricks, blocks or stonework are to be laid in cold weather may include:
 - (i) storing materials in a heated shed or covering them with waterproof sheets;
 - (ii) warming fine aggregate and water but not the cement or lime;
 - (iii) not wetting the bricks, blocks or stonework, but if necessary using a little more water for mixing the mortar;
 - (iv) protecting the working areas and the site where mortar is mixed from frost, snow and rain;
 - (v) ensuring compliance with Clause 2414 if special precautions are not taken.

NG 2415 Protection of New Work

- 1 Efflorescence in facework may be reduced by -
- (a) use of bricks with low soluble salt content (S₂ to IS EN 771-1);
 - (b) use of cements with low free-alkali content (less than 0.1%);
 - (c) use of well washed fine aggregate in mortars;
 - (d) avoidance of excessive amounts of plasticisers, used in accordance with the manufacturers recommendations;
 - (e) protection of new work from rain.

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 in the Contract. 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 and subsequently freezing. The gap to be filled should be a minimum of 30mm.

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

- 4 The acceptable variation in depth from front to back of stones for masonry facework should be shown in Appendix 24/1.

Table NG 24/1: Mortar Compressive Strengths

	Mortar designation	Compressive strength class	Cement: lime: sand	Masonry cement: sand	Cement: sand with plasticiser	Compressive strength at 28 days
Increasing ability to accommodate movement, e.g. due to settlement, temperature and moisture changes 	(i)	M12	1:0 to ¼:3	-	-	12
	(ii)	M6	1: ½:4 to 4½	1:2½ to 3½	1:3 to 4	6
	(iii)	M4	1:1:5 to 6	1:4½	1:5 to 6	4
	(iv)	M2	1:2:8 to 9	1:5½ to 6½	1:7 to 8	2

NG Sample Appendices

NG SAMPLE APPENDIX 24/1: BRICKWORK, BLOCKWORK AND STONWORK

[Note to compiler: This should include:]

- 1 Locations where sulphate-resisting Portland cement is to be used [2401.1].
- 2 Mortar designations and colour for brickwork, blockwork and stonework [2404.1, 2404.3, 2412.5, RCD/2400/2].
- 3 Additional performance requirements for admixtures [2404.3].
- 4 Particular requirements for clay masonry units (bricks) to IS EN 771-1 [2406.1].
- 5 Particular requirements for aggregate concrete masonry units (blocks) to IS EN 771-3 [2407.1, RCD/2400/2].
- 6 Particular requirements such as colour, special mixes, texture and casting-in stainless steel ties for manufactured stone [2408.1].
- 7 Details of the type and quality of natural building stone [2409.1, RCD/2400/3 and RCD/2400/4].
- 8 Type of bonding for brickwork and blockwork [2412.1].
- 9 Locations where overhand work is permitted [2412.3].
- 10 Locations where pointing is required and the type of pointing [2412.5, RCD/2400/3, RCD/2400/3 and RCD/2400/4].
- 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].
- 17 Whether stonework is coursed or uncoursed, and course heights [RCD/2400/3, RCD/2400/4].
- 18 Type of coping to stonework walls [RCD/2400/3, RCD/2400/4].
- 19 Type of rendered finish to blockwork walls [RCD/2400/1].

NG SAMPLE APPENDIX 24/2: BRICKWORK, BLOCKWORK AND STONWORK : NRA ROAD CONSTRUCTION DETAILS

[Note to compiler: List the relevant Series 2400 RCDs (2412.1 & 2413.1)]

Clause No.	Road Construction Detail Drg No.
2412.1	RCD/2400/1, 2, 3, 4, 5, 6
2413.1	RCD/2400/3, 4, 5