

IMPLEMENTATION SPECIFICATION FOR ROAD **WORKS**

SERIES IM/2400 (IMPLEMENTATION)

BRICKWORK, RUBBLE WALL AND RURAL STRUCTURES



*This Specification Series implements the requirements in
Subsidiary Legislation 499.57, Part II (New Roads and Road
Works Regulations) in accordance with the Agency for
Infrastructure Malta ACT XXVIII, CAP. 588, Part I*

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2400 BRICKWORK, BLOCKWORK AND STONEMWORK

2401 Cement

- 1 Cement shall be one of the following:
 - a) Portland cement conforming to MSA EN 197-1;
 - b) Masonry cement conforming to MSA EN 413-1;
 - c) Sulfate-resisting Portland cement conforming to BS 4027 where described in IM IM Appendix 24/1.

2402 Aggregates

- 1 Fine aggregate shall conform to MSA EN 13139.

2403 Water

- 1 If water for the Works is not available from a water company's supply, the Contractor shall ensure that the water complies with the guidance given in MSA EN 1008. The sulfate content of the water shall be tested in accordance with Test No. 1 in TRL Report.
- 2 The water shall not be used if the sulfate content exceeds 1.4 g of sulfate (as SO₄) per litre. Water from the sea or tidal rivers shall not be used.

2404 Mortar

Mortar Work Other Than Unreinforced Masonry Arch Bridges

- 1 Cement mortar for brickwork, blockwork and stonework shall be mixed in the proportions given in Table 2400-1 according to the mortar designation described in IM IM Appendix 24/1.
- 2 The chloride ion content of the mortar determined in accordance with MSA EN 1744-1 shall not exceed 0.3% of the mass of cement for mortar made with Portland cement and 0.2% for mortar made with sulfate-resisting Portland cement. Calcium chloride or admixtures containing calcium chloride shall not be used.
- 3 For work in which cement mortars of designation (ii) or (iii) as defined in MSA EN 1996-2 are required, the Contractor shall select the appropriate mortar from one of the mixes for the designation given in Table 2400-1. If the work is to be carried out in frosty weather and the bricks are wet when laid, then a cement sand mortar with an air entraining plasticiser shall be used. Admixtures shall conform to MSA EN 934-3:2009+A1:2012 and any additional performance requirements stated in IM IM Appendix 24/1 and shall not contain calcium chloride.

Table 2400-1: Mortar Proportions by Volume

Mortar designation	Cement: lime: sand	Masonry cement: sand	Cement: sand with plasticiser
(i)	1:0 to 1/4:3	-	-
(ii)	1:½:4 to 4½	1:2½ to 3½	1:3 to 4
(iii)	1:1:5 to 6	1:4½	1:5 to 6

- 4 The inclusion of lime in mortar designation. (i) is optional. The proportions of lime given in Table 2400-1 are for lime putty conforming to MSA EN 459-1. If the lime is measured as the dry hydrate, the amount may be increased up to 1.5 volumes for each volume of lime putty. Where a range of sand contents is given in Table 2400-1, the higher shall be used for sand that is well graded and the lower for coarse or uniformly fine sand.
- 5 Mortar shall be mixed thoroughly either by hand or mechanically until its colour and consistency are uniform. The constituent materials shall be accurately gauged, allowance being made for bulking of sand. Mortar shall be made in small quantities only as and when required. Mortar which has begun to set or which has been mixed for a period of more than one hour in the case of a mortar designation (i) or more than two hours in the case of other designations shall be discarded.
- 6 A set of mortar prisms shall be made for each type of mortar designated to be used and shall be tested in accordance with sub-Clause 2413.5.

2405 Lime Mortar

- 1 Lime mortar shall consist of one part by volume of hydrated lime conforming to MSA EN 459-1 to 2.5 parts by volume of sand.
- 2 Where natural hydraulic lime is instructed by the Client, this shall be NHL grade for internal works and NHL grade 3.5 for external bedding and pointing.

2406 Blocks

- 1 Concrete blocks shall comply with MSA EN 771-3 and MSA EN 772-2 and with the particular requirements as described in IM IM Appendix 24/1.
- 2 Solid concrete blocks beneath frames for chambers and gullies, and for the construction of chambers, shall, unless otherwise described in IM IM Appendix 24/1, be concrete blocks conforming to MSA EN 771-3 and MSA EN 772-2 having an average crushing strength value of not less than 20 N/mm² when used for surface water drainage, or special purpose concrete blocks having a minimum cement content of 350 kg/m³ when used for foul drainage.
- 3 Hollow concrete blocks for the construction of chambers, shall, unless otherwise described in IM IM Appendix 24/1, be 220mm (9", Single) units with a percentage of formed holes

ranging from 25% to 60% and conforming to MSA EN 771-3 and MSA EN 772-2 having an average crushing strength value of not less than 6 N/mm².

2407 Franka Building Stone (Globigerina)

Source and Quality

- 1 The Contractor shall submit the name, location and licence number of the stone supply quarry from where the stone blocks will be cut. The supply quarry cannot be changed without the approval of the Overseeing Organisation.
- 2 Building stone (Globigerina limestone blocks - "Franka") shall be totally free of "soil" traces and blue markings ("swaba kohol").
- 3 Stone that will remain exposed and "unrendered" shall have a uniform and consistent appearance. The stone has to be fine-grained and free from spits and clayey material. It shall not contain excessive quantities of red stains or hard shell fragments.
- 4 Stone from the lower levels of the quarry exhibiting a deep yellow hue may be utilised in the Works except for "unrendered" facades.
- 5 Blocks with excessively chipped edges and corners shall be rejected.

Compressive Strength

- 6 The Contractor shall furnish test certification stating the compressive strength of equivalent 150mm x 150mm stone samples the material.

Stone Sizes

- 7 All stone blocks shall be cut as smooth as possible before delivery to the site of the Works. All arrises shall be true, and all surfaces plane and truly perpendicular to each other and to a finished uniform height.
- 8 The stone blocks shall be delivered to the site on pallets.
- 9 All stone blocks shall be unloaded using lifters to prevent damage and wastage. Tipping shall not be permitted.
- 10 The finished size of stone blocks shall be in accordance with the Subsidiary Legislation 10.31 - Building Stone Order.

Limestone Dust (Xahx)

- 11 Limestone dust for mortar shall be delivered separately and adequately packaged.

Workmanship

- 12 Stone blocks shall be laid in a regular stretcher bond course pattern approved by the Overseeing Organisation.

- 13 All stone blocks shall be dressed to accurate planes and shall be neatly fine-tooled on the face.
- 14 The “spika” and any arrises shall be dressed square.
- 15 Stone blocks above DPC level shall be rendered smooth either manually or mechanically.
- 16 Mechanical planers, band and rotary saws are permitted but dust control measures are required.
- 17 The bedding plane and the stone must be wet before the mortar is applied.
- 18 Mortar shall normally comprise of a prescribed mix of OPC cement, limestone dust (xañx) and clean water mixed to achieve a good workability. It shall generally correspond to a strength Class M2 mortar as denoted in EN 998-2.
- 19 Where required proprietary bedding plane reinforcement mesh (or similar) for additional bonding shall be subject to the approval of the Overseeing Organisation.
- 20 “Fuq il-fil” courses shall be placed to form a consistent pattern with perpends in strict alternate distributive vertical alignment including joints, curved and flat arches, jambs and ornaments.
- 21 Jointing of stone blocks in horizontal courses shall be by the “inkulmar” method. Jointing shall only proceed at the end of full course placement. Vertical joints are to be broken at not less than 150mm.
- 22 Courses shall be laid true to the lines and levels and with corners straight and plumb. Jambs shall be square and plumb. In double wall construction they shall extend the whole width in an alternate manner.
- 23 Double walls shall have adequate bond stones, properly damp proofed at the external face end. Proprietary bond fixtures may be used subject to the approval of the Overseeing Organisation.
- 24 Quoins of all openings shall be protected during construction.
- 25 Stone Block lintels shall not be centrally loaded.
- 26 Voussoirs shall be to the exact curvature as detailed in the drawings having all blocks of the same curved length including the key block.
- 27 Alternate corner lock blocks shall be interlocked the full width using a suitable tothing technique.
- 28 Any dressing, moulding and carving templates (mollijiet) shall be approved by the Overseeing Organisation.
- 29 Flat arches shall be as detailed in the drawings having all blocks of the same width including the key block. Flat arches shall be jointed with a mix of 1:1 cement/water grout placed in vertical insets cut along the vertical jointing plane.
- 30 Drip channels shall be provided or formed at exposed sills, projecting mouldings and edges.

2408 Reinforcement

- 1 Wire or fabric laid between brickwork or blockwork shall be stainless steel to MSA EN 10088-1, designation 1.4301, 1.4401 or 1.4436, softened condition, excluding free machining specifications.
- 2 Steel bars laid between brickwork or blockwork shall be stainless steel to BS 6744, designation 1,4301 or 1,4436, softened condition, excluding free machining specifications.

2409 Anchorages, Dowels, Fixings and Ties

- 1 Anchorages, dowels, fixings and ties shall be stainless steel designation 1.4301, 1.4401 or 1.4436, softened condition, excluding free machining specifications, complying with the requirements listed in Table 2400-2.

Table 2400-2: Austenitic Stainless Steel

Form	Standard to be complied with
Strip	MSA EN 10029, MSA EN 10048, MSA EN 10051, MSA EN 10258, MSA EN 10259
Rod	MSA EN 10088-1
Bar	MSA 6744
Tube	MSA EN 10296-2
Wire	MSA EN 10088-3

2410 Blockwork

- 1 Blockwork shall be laid on a full bed of mortar and bonded as described in IM IM Appendix 24/1. Perpend between blocks shall be filled with mortar before the next mortar bed is laid. Whole blocks shall be used except where it is necessary to cut closers.
- 2 Blockwork shall be built uniformly. Corners and other advanced work shall be stepped back and not raised above the general level more than 900 mm. Courses shall be kept horizontal and matching perpend shall be in vertical alignment.
- 3 Bed-joint reinforcement shall have a 15 mm minimum of mortar cover to each masonry face. It shall not be laid dry on a bed face but shall be embedded within the mortar bed thickness.
- 4 Where pointing is required in IM IM Appendix 24/1 the joint shall be raked out to a depth of 12 mm and after the completion of the entire facework, pointed in mortar as described in IM IM Appendix 24/1.
- 5 Where jointing is required in IM IM Appendix 24/1 it shall be done as the work proceeds to the finish described in IM IM Appendix 24/1.

2411 Stonework

General

- 1 Except where otherwise described in IM IM Appendix 24/1, the length of any stone shall not exceed three times its height. The breadth on the bed shall be not less than 150 mm, nor greater than three-quarters of the thickness of the wall.
- 2 Except for dry rubble walling, all joints shall be sufficiently thick to prevent stone-to-stone contact and shall be completely filled with mortar.

Ashlar for Rural Structures

- 3 All stones shall be dressed to accurate planes on the beds and joints, and they shall be fair and neatly or fine tooled on the face as described in IM IM Appendix 24/1.

Hitan tas-Sejjieħ

- 4 These shall be as defined in Subsidiary Legislation (S.L) 552.01 and constructed without the use of cement or mortar. The construction shall be in accordance with the methodology described in “Il-Hitan tas-Sejjieħ”, Elizabeth Ellul, 2005.
- 5 The Contractor shall provide a sample panel of 10m in length for approval of the look and method of works by the Overseeing Organisation prior to the commencement of the Works.

Dry Rubble Walls

- 6 The Contractor shall provide a detailed method statement for the construction methodology for the approval of the Overseeing Organisation.
- 7 The Contractor shall also construct a sample panel of 10m or an actual constructed length for the approval of the Overseeing Organisation prior to commencement of the Works. A typical illustrative example is shown below.



Figure 2400- 1: Dry Rubble Wall (Illustrative)

2412 Stone and Concrete

Stone Facing over Concrete

- 1 Any loose material shall be removed from the concrete, and its surface washed with clean water before any masonry is laid.
- 2 The portion of the steel fixing projecting from the concrete shall be completely embedded in the mortar of the facework and shall be kept back a minimum of 40 mm from the face of the masonry.
- 3 The cavity between facework and the concrete shall be completely filled as the work proceeds with mortar of the same mix as that specified for the facework.
- 4 The variation in depth, front to back of stones for natural stone facework shall not exceed that described in IM IM Appendix 24/1 and the space between the facework and the backing shall be completely filled as the work proceeds with concrete strength class C12/15 and a maximum aggregate size of 10 mm conforming to Series 1700.

Double Stone Walls with Concrete Infill

- 5 The Contractor shall provide a detailed method statement for construction for the approval of the Overseeing Organisation.
- 6 The Contractor shall provide a sample wall of 10m or an actual constructed length for the approval of the Overseeing Organisation prior to commencement of the Works – This shall be similar to the
- 7 The cavity between the stone walls and shall be completely filled with concrete as the work proceeds. The concrete grade shall be as indicated in the drawings.
- 8 The reinforcement details within the infill shall be as shown in the Drawings.

2413 Unreinforced Masonry Arch Bridges

General

- 1 The masonry and associated work requirements for unreinforced masonry arch bridges shall conform to this Series.

Natural Stone Work

- 2 Natural stone shall conform to MSA EN 1996-1-2 and shall be selected on the basis of proven durability and weather resistance as described in IM IM Appendix 24/1.

Mortar Work

- 3 Mortar shall be in accordance with Clause 2404 and the following.
- 4 Mortar designation shall be in accordance with Table 2400-3. Materials and mix proportions shall be in accordance with sub-Clauses 2404.1 to 2404.6, and 2413.6, as appropriate.

Table 2400-3: Mortar Designation

Location/Element	Mortar Designation
Below a level of 150mm above finished ground level	(i) or (ii)
Above a level of 150mm above finished ground level	(ii) or (iii) (iii)
<ul style="list-style-type: none"> i) Abutments, spandrel/wing walls, ii) Piers & parapets iii) Arch rings 	

- 5 A set of mortar prisms shall be made for each type of mortar designation used on each arch structure. The mortar used shall be representative of the mortar used in the structure. The prisms shall be made and tested for compressive strength in accordance with MSA EN 1015-11. Each set comprises three prisms each divided in two to give six individual tests. The mean of the six tests shall be within the limits shown in Table 2400-4.

Table 2400-4: Mortar Compressive Strengths

Mortar designation	28-day mean compressive strength in N/mm ²	
	Minimum	Maximum
(i)	9.9	11.5
(ii)	4.1	4.7
(iii)	2.3	2.6

- 6 In cases, such as where an existing arch with lime mortar is being widened or where additional tolerance of movement is considered desirable, lime mortar may be used. In such cases the mortar shall comply with the recommendations of 'Best Practice Guide for Hydraulic Lime Mortar for Stone, Brick and Block Masonry'.

Workmanship for stonework

- 7 Workmanship shall be in accordance with Clauses 2410 and 2411 and MSA EN 1996-1-2 MSA EN 1996-1-2.
- 8 Forms of bonding in which the rings of masonry are jointed by mortar alone, as with concentric rings in stretcher bond, shall not be used unless stated in IM IM Appendix 24/1.
- 9 Masonry in an arch ring shall be flush jointed.
- 10 Exposed surfaces of masonry shall be regular, clean and have an acceptable appearance.
- 11 Finished surfaces of buried masonry to be waterproofed shall have no abrupt irregularities greater than 3 mm.
- 12 Masonry shall not be subjected to loading, including its own weight, within 28 days of construction which will induce a stress exceeding 1/3 of its strength at the time of loading.
- 13 Removal of centring to the arch ring shall only take place after the material has gained sufficient strength. The centring shall not be removed until at least 7 days after completion of the arch ring.

Waterproofing

- 14 Unless otherwise described in IM IM Appendix 24/1, the waterproofing system shall be a permitted system conforming to Clauses 2003 and 2005.

Protection of Waterproofing

- 15 Waterproofing systems shall be protected with a single leaf of masonry or in-situ concrete when unbound materials are used as a permeable backing.
- 16 Waterproofing systems with a permeable backing of porous no fines concrete or precast hollow concrete blocks in accordance with Clause 513 shall require no further protection.

Permeable Backing to Structures

- 17 Permeable backing to spandrel/wing walls and abutments shall comply with Clause 513.
- 18 Where Class 6N or 6P fill is used, permeable backing to the arch ring shall be a granular material or porous no-fines concrete in accordance with Clause 513.1.

Fill

- 19 Fill shall be Class 6N and 6P conforming to Clause 606 conforming to Clause 1033.
- 20 Fill shall be placed and compacted in accordance with Clause 606.

- 21 Plant for compaction of material within 1 metre, or within one fifth of the span if greater, of the arch ring shall be:
- a) vibratory rollers having a mass per metre width of roll not exceeding 750 kg;
 - b) vibrating plate compactors having mass not exceeding 750 kg;
 - c) vibro-tampers.
- 22 For bridges carrying public highways, a minimum depth of fill of 300 mm shall be provided between the crown of the arch and the underside of the pavement as described in IM IM Appendix 24/1.
- 23 Unless otherwise described in IM IM Appendix 24/1, fill shall be drained by a 150 mm minimum diameter pipe with rodding facilities provided at springing. Drainage pipes and rodding facilities shall conform to Series 500.