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Construction of stone masonry — Code of practice — Part 2: Ashlar stone masonry

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS 631-2 was prepared by Technical Committee RSB/TC 9, *Civil engineering and building materials*.

In the preparation of this standard, reference was made to the following standard:

1) IS 1597: 1992 (Reaffirmed in 2021), *CONSTRUCTION OF STONE MASONRY — CODE OF PRACTICE — PART 1: ASHLAR STONE MASONRY*

The assistance derived from the above source is hereby acknowledged with thanks.

DRS 631 consists of the following parts, under the general title *Construction of stone masonry — Code of practice*:

— *Part 1: Rubble stone masonry*

— *Part 2: Ashlar masonry*

Committee membership

The following organizations were represented on the Technical Committee on *Civil engineering and building materials* (RSB/TC 9) in the preparation of this standard.

ASTRIK International

CAMOSAG Ltd

Cleaner Production and Climate Innovation Centre (CPCIC)

Consulting Engineering Group (CEG Ltd)

HOSHAN LTD

Independent Experts

NPD Ltd

Rwanda Housing Authority (RHA)

Rwanda Inspectorate, Competition and Consumer Protection Authority (RICA)

Rwanda Transport development Agency (RTDA)

University of Rwanda – College of Science and Technology (UR-CST)

Rwanda Standards Board (RSB) – Secretariat

Introduction

Use of stone masonry work is known and practised from the earlier days and natural stone is extensively available in many parts of Rwanda. The types of stone masonry construction followed depends on local factors like physical characteristics of the stone, climatic conditions, workmanship, etc. Certain broad principles in laying, bonding, breaking of joints and finish should be complied with in order that the masonry develops adequate strength and presents a neat appearance.

This standard (Part 1) covers rubble masonry which is commonly used in stone work in most cases. Part 2 of the standard covers ashlar masonry.

Construction of stone masonry — Code of practice — Part 2: Ashlar stone masonry

1 Scope

This Draft Rwanda Standard provided code of practice for the design and construction of ashlar stone masonry.

This standard does not apply to:

a) stone facing and veneering work, and

b) masonry for dams and other masonry work.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

RS 515 *Natural stone — Terminology and classification*

DRS 631-1 *Construction of stone masonry — Code of practice: Part 1: Rubble stone masonry*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions given in RS 515, DRS 631-1 and the following apply.

3.1

ashlar

stone masonry using dressed square stone blocks to a given dimension and laid in courses

3.2

arris

sharp edge formed by two planes (see Figure 8)

4 Necessary information

For efficient planning, design and execution of the works detailed information with regard to the following shall be furnished. to those responsible for the work:

a) Layout plan showing the orientation of the structure.

b) Dimensioned details of the structure with details of sections (to a suitably large scale, that is, l/20 or I cm = 20 cm) and levels of foundations, finished ground levels, clear floor to floor height of rooms, sizes of openings, etc.

c) Type of stone and class of masonry, types of bond and final finish for the masonry; the mixes of mortar to be used, etc; details of architectural features, moulding and other special work.

d) Location and other details of openings, chases, embedments of service lines, such as for water supply, drainage and electrical installations, and location and details of hearths, flues and chimneys.

5 Materials

5.1 Materials to be used for ashlar masonry shall be the same as in DRS 631-1.

6 Selection of stone

In selecting stone, the situation in which it is to be used, has to be considered. The recommended use of common types of stones for various situations has been shown in Table 2 of DRS 631-1.

7 Design consideration

7.1 7.1 Types

7.1.1 7.1.1 Plain Ashfar (see Fig. 1)

Stone blocks of the same height in each course, are used and every stone is fine tooled on all beds, joints and, faces, full and true.

7.1.2 7.1.2 Sunk or Moulded (see Fig. 20)

The exposed faces of each stone block shall be gauged, cut, grooved, rebated, sunk or plain moulded as the case may be. Stone blocks of same height in each course are used.

7.1.3 7.1.3 Rock (Quarry) Faced (see Fig. 2B)

The faces oi each stone block exposed to view, shall have only chisel draft 25 mm wide alround the edges and between the drafts be left rough as the stone comes from the quarry;

7.1.3.1 7.1.3.1 Chamfered (see Fig. 2C)

In the case of chamfered masonry, the edges are bevelled to 45” for a depth of about 2’5 cm. Stone blocks of same height in each course are used.

7.1.4 Rough Tooled or Punched (see Fig. 2A)

The faces of each stone block exposed to view, shall have a fine dressed chisel draft 2’5 cm wide all-round the edges and be rough tooled between the drafts and on all beds and joints. Stone blocks of same height in each course are used.

7.1.5 Block-in-Course (see Fig. 3)

This is hammer-faced or pitch-faced regular coursed masonry in large blocks. It is a superior type of coursed rubble masonry.

7.2 Weather Protection

Generally, ashlar masonry is not given any further protective rendering or finish.

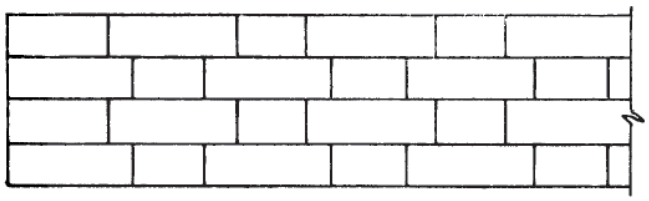
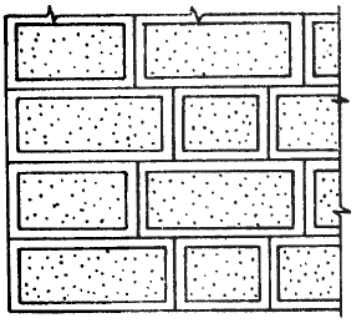
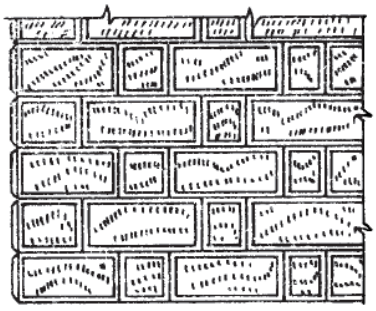


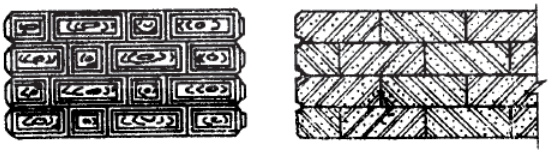
FIG. 1 PLAIN ASHLAR



2A Rough Tooled or Punched



2B Rock or Quarry Faced



2C Chamfered 2D Sunk or Moulded

FIG. 2 ASHLAR MASONRY

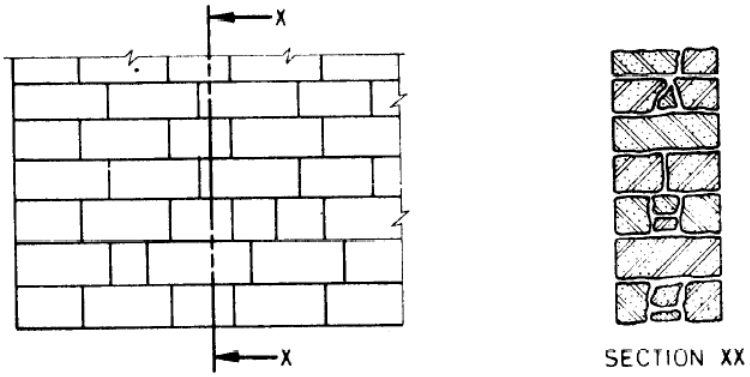


FIG. 3 BLOCK-IN-COURSE ASHLAR MASONRY

7.3 Rain Protection

Information regarding rain protection is the same as in DRS 631-1.

7.4 Types of Mortar

Information regarding types of mortar to be used in the same as in DRS 631-1.

7.5 Damp-Proof Course

For the functions, materials to be used, and the places where damp-proof course is provided, reference be made to relevant applicable standards.

7.6 Structural and Functional Characteristics

7.6.1 Structural Stability and Strength

The design with regard to the structural strength and stability should refer to the relevant applicable standards.

8 General requirements for masonry construction

8.1 Setting Out

Details of setting out the masonry construction works shall refer to the applicable code of practice for setting out the construction works.

8.2 Dressing of Stones

The dressing of stone shall be as specified for individual types of masonry work and it shall also conform to the. general requirements for dressing of stones given in the relevant standards.

8.3 Scaffolding

Double scaffolding having two sets of vertical support shall be used in accordance with the relevant applicable standards.

8.4 Handling

The use of grip in the tops of stones is preferable to any method of holding the stone at the ends, because it enables the stone to be set in final position before the tackle is released. Due care shall be taken to protect finished surfaces and edges of stone against damage during handling.

The various methods employed in different situations for lifting stone are shown in Fig. 10 of 1S 1597 (Part 1): 1992.

8.5 Tools

Tools that are required for stone masonry work, are plumb bob and line, straight edges, mason's square, spirit level and trowel, and various types of mason's hammer, and chisels compiling to the relevant approved standards.

8.6 Watering

Stones shall be sufficiently wetted before laying to prevent absorption of water from mortar.

8.7 In all types of ashlar masonry, the following shall be complied with

8.7.1 The natural bed of the stratified stone shall be so laid that the pressure is always perpendicular to the strata.

8.7.2 The courses shall be built perpendicular to the pressure which the masonry will bear. In case of battered walls, the beds of stone and the plane of courses shall be at right angle to the batter.

8.7.3 Where the depth of courses vary, the largest stone shall be placed in the lower course. The thickness of courses shall also decrease gradually to the top.

8.7.4 Stones shall break joint on the face for at least half the height of the course and the bond shall be carefully maintained throughout.

8.7.5 All connected masonry in a structure shall be carried up nearly at one uniform level throughout but when breaks are unavoidable, the joint shall be raked back to a maximum angle of 30” to the horizontal so as to prevent cracks developing between new and old work.

8.7.6 All necessary chases for joggles, dowels and cramps should be formed on the stone beforehand.

8.7.7 The walls, pillars shall be carried up truely plumb or to specified batter.

8.7.8 All courses shall be laid truely horizontal and all vertical joints shall be truely vertical.

8.7.9 Storey rods showing the heights of all doors and windows and other necessary information should be used at the time of construction of masonry.

8.8 Fixing of frames

The information regarding fixing of frames is given in 8.8 of DRS 631-1.

8.9 Bearing of floor

The information regarding bearing of floor is given in 8.9 of DRS 631-1.

8.10 Jointing and pointing

All joints shall be full of mortar. Pointing shall be avoided as far as possible, but where unavoidable it shall be carried out as the work proceeds using the same mortar as for bedding. If carried out by raking out the joint, later on after hardening, specially prepared mortars shall be used. The maximum thickness of joints shall be 3 mm except for block in course where it shall be 6 mm. The various types of pointing are shown in Fig. 10 of

8.11 curing

Green work shall be protected from rain by suitable covering. Masonry work and cement of composite mortar shall be kept constantly moist in all the faces for a minim urn period of 7 days.

The top of the masonry work shall be left flooded with water, with the close of the day. Watering shall be done carefully so as not to disturb or wash out green mortar and use of perforated rose spout may be suitable. In the case of lime mortar, curing should commence two days after laying of masonry and shall continue for seven days.

9 Construction

9.1 Plain Ashlar

9.1.1 Dressing

Every stone shall he cut to the required size and shape, chisel dressed on all beds and joints so as to be free from bushing dressed surface, shall not show a depth of gap of more than 3 mm from straight edge placed on it. The exposed faces and joints 6 mm, from the face shall be fine tooled so that a straight edge can be laid along the face of the stone in contact with every point. All visible angles and edges shall be true and square and free from chippings. The corner stones (quoins) shall be dressed square and corner shall be straight and vertical.

9.1.2 Bond Stones

Through bond stones shall be provided in walls up to 60 cm thick and in case of walls above 60 cm in thickness. a set of two or more bond stones overlapping each other by at least 15 cm shall be provided m a line from face to back. In case of highly absorbent type of stones (porous lime stone and sand stone. etc.) the bond stone shall extend about two third into the wall, as through stones in this case may give rise to damp penetration and hence for all thicknesses of such walls a set of two or more bond stones overlapping each other by at least 15 cm shall be provided. Each bond stone or a set of bond stones shall be provided at 1’5 m to 1’8 m apart clear in every course.

9.1.3 Laying

The face stone shall be laid headers and stretchers alternatively. The headers shall be so arranged to come as nearby as possible in the middle of stretchers above or below. Stones shall be laid in regular courses of not less than 30 cm in height and all courses shall be of the same &eight unless otherwise specified. No stone shall be less in breadth than its height or less in length than twice its height; unless otherwise specified.

9.2 Ashlar sunk or moulded

9.2.1 Dressing

Dressing shall he done in the same manner as in plain ashlar. The faces shall then be gauged, cut, grooved, rebated, sunk or plain moulded as required for the work. For this purpose, a full size layout of the moulding shall be prepared on platforms for which sheet templates shall be cut and the stone dressed to the templates to a uniform and fine finish. The dressed surface shall not be more than 3 mm from straight edge placed on it. All visible angles and edgy shall be true and free from chippings. The joints, 6 mm from the face shall also be fine tooled so that a straight edge placed on it is in contact with every point.

It shall be finest surface that can be given to a stone with the chisel and with rubbing.

9.2.2 The requirements regarding bond stones and laying shall be the same as in plain ashlar (see 9.1.2 and 9.1.3).

9.3 Ashlar rock faced

9.3.1 Dressing

The dressing of stone blocks in case of ashlar rock shall be similar to ashlar rough tooled (see 9.4.1) except that the exposed faces of the stone between the drafts shall be left rough as the stone comes from the quarry; but no rock face or 'bushing' shall project more than 7'5 cm from plane of drafts.

9.3.2 The requirements regarding bond stones and laying shall be the same as in plain ashlar (see 9.1.2 and 9.1.3).

9.4 Ashlar chamfered

9.4.1 Dressing

Stones required for ashlar chamfered masonry shall be dressed as above except that the edges round the exposed face of each stone shall be bevelled off to 45" for a depth of about 2'5 cm or more as specified.

9.4.2 The requirements regarding bond stones and laying shall be the same as in plain ashlar (see 9.1.2 and 9.1.3).

9.5 Ashlar rough tooled

9.5.1 Dressing

The dressing of stone blocks shall be similar to plain ashlar except that face exposed in view shall have a fine chisel draft 2'5 cm wide round the edges and shall be rough tooled between the draft such that the dressed surface shall not deviate more than 3 mm from the straight edge placed over it.

9.5.2 The requirements regarding bond stones and laying shall be the same as on plain ashlar (see 9.1.2 and 9.1.3).

9.6 Ashlar block in course

9.6.1 Dressing

The stones are dressed all squared and laid lo fine joints (see 8.10) the faces usually being hammer dressed. The stones selected, may be of larger size than for plain ashlar.

9.6.2 The requirements regarding bond stone and laying shall be the same as in plain ashlar (see 9.1.2 and 9.1.3) except that the courses vary between 20 to 25 cm in the thickness. This type of masonry is, therefore, slightly superior to coursed rubble masonry.

9.7 Ashlar masonry for special works

9.7.1 Arch dome or circular moulded works

9.7.1.1 The dressing shall be done in the same manner as for ashlar sunk moulded except that for arch or dome work, the stones shall be dressed to the required wedge shape so that the joints shall be truly radial.

9.7.1.2 The requirements regarding bond stone and laying shall be the same as in plain ashlar (see 9.1.2 and 9.1.3). Cantering and shuttering required for this work should be of approved quality.

9.7.2 Moulded and carved columns

9.7.2.1 The dressing shall be done in the same manner as for plain ashlar (see 9.1.1). The joints with the adjoining stones shall be truly vertical, horizontal, radial and circular as the case may be. The face shall be dressed to uniform curves of planes as required for the work in accordance with the method prescribed for ashlar plane (see 9.1).

9.7.2.2 Other details shall be the same as for plain ashlar.

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