- It shall be ensured that there are no *through joints* in successive course and the lap is not less than half the width of brick.
- All cross-joints and bed joints shall be properly flushed and bedded with mortar so that no hollow spaces are left.
- In case of thick walls (2 brick thick and over), joint shall be grouted at every course in addition to bedding and flushing with mortar.
- The surface of each course should be thoroughly clean of all dirt before another course laid on top. If the mortar in any course begun to set, the joints should be raked out to a depth of 12 mm before another course is laid.
- Bricks with 20 mm deep frog shall be used frog-down. Bricks with 10 mm deep frog shall be used either frog- up or frog-down.
- Header course should never start with queen closer, and brickbats should not be used in the work except when it is absolutely necessary for obtaining the specified bond.
- *During laying i.e. for bedding and flushing, thinning of mortar should not be done.*

(b) ***During progress of work:*** The walls shall be raised up truly plumb. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Vertical joints in alternate course shall come directly one over the other. Thickness of brick courses shall be kept uniform.

Verticality of the work and the horizontality of the course shall be checked very often with plumb bob and spirit level/storey rod respectively.

- Both the faces of walls of thickness greater than one brick, shall be kept in vertical plane. In case of one/half brick thick wall, at least one face should be kept smooth and plane, even if the other side is slightly rough.
- The joints shall be raked to a depth of atleast 12 mm by raking during the progress of work when the mortar is still green, so as to provide proper key for subsequent plastering. The depth of raking shall be 15 mm if the joints are to be pointed. Where plastering or pointing is not required to be done, the joints shall be struck flush and finished at the time of laying.

V. Curing:

- Work shall be kept moist constantly for a minimum period of 7 days, commencing 24 hours after the course is laid. It should be discontinued slowly so as to avoid quick drying.
- Work shall be protected from rain by suitable covering while the mortar is still green.

VI. General consideration for brick work :

- Layout plan, specification of work, location and other details of openings, chases, embedment of service lines etc. shall be available at site.
- *Expansion and slip joint* shall be provided as specified.
- The course at the top of the plinth and sills at the top of the wall just below the roof/floor slab and at the top of parapet, shall be laid with header course (preferably with brick on edge) unless otherwise specified. At corners and deadends the bricks shall be properly radiated and keyed into position by using cut-bricks.
- The brickwork shall be built in uniform layers. No part of a wall during its construction shall rise more than *one metre* above the general construction level, to avoid unequal settlement and also improper jointing. Corners and other advanced work shall be racked back at an angle not exceeding 45^0.
- Toothing may be done where future extention is contemplated but shall not be used as an alternative to racking back.
- All iron fixtures, pipes, outlets of water, hold-fasts for doors and windows etc., which are required to be built in walls shall be embedded in cement mortar or in cement concrete as specified, in their correct position as the work proceeds.
- *Scaffolding* used for the work shall be as specified. Normally, double scaffolding shall be provided. Single scaffolding may be used in unimportant work by providing hole in a header course. Only one header for each pole shall be left in such cases. Such holes shall not be made/provided in pillars less than one metre in width. Holes left in masonry for supporting scaffolding shall be filled and made good before plastering or pointing.
- For construction only standard tools e.g. trowel, brick-axe, hammer, boaster, bevel etc. shall be used.
- ***A set of tools****- straight edge, spirit level, square, 1-m rule, line & pin, plumb rule & bob, storey rod shall be kept at the site of work for proper check during the progress of work.*

The contents of this pamphlet are for guidance only and are not statutory. It also does not supersede any existing instructions from Railway Board, RDSO and Zonal Railways & the provisions of IRWM, BIS Code and reports on the subject.

If you have any suggestion & comments on contents of the pamphlet, please write to: ***Director (Civil), CAMTECH, Maharajpur, Gwalior (M.P) 474 020***

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सत्यमेव जयते

QUALITY ASSURANCE FOR BRICK MASONRY

(In Cement Mortar)

CAMTECH/C/2005/QA-BM/1.0

July - 2005

Centre *for* Advanced **M**aintenance TECHnology

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QUALITY ASSURANCE - BRICK MASONRY

Brick masonry is a construction, in which brick units are bonded together with mortar in a particular pattern. Strength and durability of brickwork mainly depends upon quality & strength of brick, type of mortar, method of bonding and nature of workmanship & supervision, beside structural geometry.

To ensure quality brickwork, quality assurance checks are required to be carried out at every stage of construction including material used. Some such checks are enumerated as under :

I. Brick: Bricks used for the work should be as specified. However, for good quality brick work;

- Bricks shall be *well -burnt bricks,* free from vitrification having a uniform red, cherry or copper colour. They shall be homogeneous in texture and shall produce a clear metallic ringing sound when struck.
- *Size of bricks* shall be as specified and the dimensions shall be within the prescribed tolerances.
- Bricks shall be rectangular and uniform in shape and size, free from any chipping of edges, surface cracks or flaws, which will affect the soundness of the bricks.
- *Average compressive strength* of bricks shall be as specified.
- *Water absorption* shall not be more than as specified (normally 20 % of dry weight of brick) when immersed for 24 hours in cold water.
- *Efflorescence rating,* when tested as per the laid down procedure, shall not be more than as specified.
- Brick shall not be used for a period of *atleast 2 weeks in summer and 3 weeks in winter* after unloading from kilns for masonry work. It should be kept exposed to atmosphere during this period.

II. Mortar: Mortar bonds/holds individual bricks together to act as a compact mass, imparting strength and durability to the brickwork.

Cement mortar used for the work shall be as specified. However, to ensure good quality brickwork following quality checks are required.

(a) Ingredient :

- ***Cement :*** Cement used for the work shall be as specified. *Set or partially set cement* shall not be used for the work. Where the cement has been stored for a long time or there is a reason for doubting its soundness, it should be used only after representative samples has been tested and found suitable.
- ***Sand :*** Sand used for the work shall be as specified. It shall be hard, durable, chemically inert, clean and free from adherent coatings organic matter and harmful impurities.

  Grading of the sand shall be as specified. Normally, sand confirming to zone IV grading is used for brickwork.

  Silt content shall not be more than as specified. Normally, not more than 8% when determined by *decantation test* in field.
- ***Water :*** Water used for mortar shall be clean and free from injurious quantities of deleterious materials. *Potable water is generally considered satisfactory for use in masonry mortar.*

(b) Proportioning: Proportioning of ingredients shall be carried out as specified. Normally, proportioning is done by volume using gauge boxes of suitable capacity. Sand is measured on the basis of its dry volume. *In case of damp sand its quantity shall be increased suitably to allow for bulkage.*

Water used for preparation of mortar shall be just sufficient to obtain the *working consistency* i.e. required for maintaining fluidity of mortar during application. Thinner joints require greater fluidity whereas bed joints subject to heavy pressure will require stiffer mortar.

(c) Mixing : Mixing of ingredient for mortar shall be done as specified, either by mechanical means or by hand.

- ***Mechanical mixing :*** Cement and sand in the specified proportions shall be first mixed dry thoroughly in a mixer. Water shall then be added gradually and wet mixing continued for at least three minutes after the addition of water. Care shall be taken, not to add water more than that required for working consistency. Only that quantity of mortar which can be *used within 30 minutes* of its mixing shall be prepared at a time. Mixer shall be cleaned with water each time before suspending the work.
- ***Hand mixing :*** The measured quantity of sand shall be levelled on clean watertight platform and cement bags emptied on top. The cement and sand shall be thoroughly mixed dry to a homogenous mixture of uniform colour by being turned over and over, backwards and forwards several times. The quantity of dry mix, which can be *used within 30 minutes* shall then be mixed in masonry trough with quantity of water required for working consistency.

III. Bonding: Bonding is essential to tie the brickwork both longitudinally and transversely, and to eliminate continuous vertical joints both in the body as well as in the face of wall, thereby imparting strength to masonry. Bricks can be arranged in a variety of patterns giving rise to different types of bonds *e.g. English, Flemish bond etc.*

Unless otherwise specified, the brickwork shall be laid in ***English bond***, which consists of alternate course of headers and stretchers with vertical joints in respective courses, coming over each other in the same line.

IV. Laying: Bricks shall be laid as per specified pattern/bond in each course. Before laying, bricks shall be soaked in water for a period sufficient to wet the full depth of brick. However, to ensure that the bricks are not too wet, and are *skin dry* at the time of use, bricks shall be removed from the soak tank well before laying.

The surface over which the brickwork is to be started shall be slightly wetted. The first course itself shall be made horizontal by providing enough mortar in the bed joint to fill up any undulations in the bed course.

For proper quality work, following aspects shall be taken care of during laying :

(a) *During laying of course*: A layer of mortar shall be spread on full width for a suitable length of the lower course. Then, each brick is first laid in the required pattern so as to project over the lower course, both at the end and at the side.

- Brick shall be then pressed/malletted down into the mortar in final position, to correct line and level, and the vertical/cross joints flushed full with a trowel edge.
- Cross-joints in any course shall not be nearer than a quarter of brick length from those in the course below or above it. Joints in header course shall be thinner than stretcher course.
- No bed joint shall be thicker than 12 mm.