THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATION COUNCIL
DIPLOMA IN TECHNICAL EDUCATION EXAMINATION

784 **BRICKWORK AND MASONRY**

Time: 3 Hour. **ANSWERS** **Year: 2006**

Instructions

1. This paper consists of sections **six (6)** questions.
2. Answer question number **one (1)** and any other **four (4)** questions.
3. Question 1 carries **thirty-two (32)** marks and the rest carries **seventeen (17)** marks each.
4. Non-programmable calculators may be used.
5. Communication devices and any unauthorized materials are **not** allowed in the examination room
6. Write your **Examination Number** on every page of your answer booklet.

1. You are supervising the construction of a two-storey classroom block using blockwork.
(a) List three key factors to consider before starting walling works on the first floor.

Before starting walling works on the first floor, it's essential to confirm that the slab below has fully cured and gained adequate compressive strength to support the weight of the walls above. This avoids cracking or settlement.

Secondly, ensure vertical alignment of the lower walls and proper positioning of starter bars or reinforcement left during ground floor walling. Misalignment affects load transfer and wall stability.

Thirdly, confirm the layout measurements and wall thickness to avoid deviation from design, especially for load-bearing walls which must align with beams and columns for load continuity.

(b) Describe two possible consequences of ignoring these factors.

Ignoring slab curing time can cause premature loading, leading to hairline cracks or sagging due to insufficient strength development in concrete.

If wall alignment and starter bars are not checked, the upper walls may lean, crack, or experience stress concentrations, compromising structural stability and aesthetics.

(c) How would you ensure quality and structural integrity of block walls at upper levels?

To ensure quality, use high-strength, well-cured blocks and consistent mortar mix ratios. Maintain straightness using plumb lines and check levels frequently during construction.

Install vertical and horizontal reinforcements according to design, especially around openings and corners. Also, stagger vertical joints to maintain good bonding and prevent weakness lines.

2. (a) What is a control sample in brick or block production?

A control sample is a standard test specimen selected during production to represent the overall batch quality. It undergoes specific tests in a laboratory to assess properties such as strength, absorption, and durability before the product is used on site.

(b) Outline four laboratory tests performed on masonry units before approval.

Compressive strength test determines how much pressure a block can withstand without failing, ensuring it meets structural load requirements.

Water absorption test measures how much water the unit can absorb, indicating its porosity and suitability for moisture-prone areas.

Efflorescence test identifies the presence of soluble salts, which can lead to surface staining and durability issues in walls.

Dimensional tolerance test checks the consistency in size and shape, which affects laying uniformity and bond strength.

(c) Describe how each test relates to field performance in real construction projects.

A block with high compressive strength can safely carry wall and slab loads, reducing the risk of collapse or cracks under stress.

Low water absorption ensures durability in wet conditions and reduces the likelihood of dampness or internal wall damage.

Efflorescence testing helps prevent aesthetic defects and long-term deterioration caused by salt deposits.

Accurate dimensions enable neat joints and strong bonding, improving overall wall alignment and workmanship quality.

3. During inspection, a wall shows diagonal cracking near window openings.
(i) Suggest three likely causes of this defect.

One likely cause is thermal or shrinkage movement, where temperature changes cause the wall to expand or contract, leading to diagonal stress around weak areas like window corners.

Another cause is inadequate lintel support, where the load above the opening is not properly transferred, concentrating stress on the brickwork.

A third possibility is differential settlement of the foundation, causing twisting or shifting of wall sections near the opening.

(ii) Propose step-by-step remedial actions.

Start by assessing the severity and pattern of the cracks. For minor cracks, rake out and refill with non-shrink grout or epoxy resin.

For structural cracks, install a reinforced lintel or arch over the window to redistribute loads. Stainless steel crack stitching bars may be added across the crack for reinforcement.

Address the root cause—check for foundation movement or install expansion joints to reduce future cracking.

(iii) Recommend how future construction around openings should be handled to prevent recurrence.

Always install reinforced concrete or steel lintels above openings to safely transfer loads to the wall sides.

Include movement joints near large windows or door openings, especially in long walls or in areas with large temperature variation.

Provide adequate wall reinforcement at corners and junctions, and avoid placing openings too close to wall ends or each other.

4. (a) Define the term "wall tie corrosion".

Wall tie corrosion refers to the rusting or degradation of metal wall ties that connect the inner and outer leaves of cavity walls. Over time, exposure to moisture and air causes unprotected steel ties to corrode, expanding and weakening the wall structure.

(b) List four effects of wall tie failure in cavity walls.

Corroded wall ties lose their tensile strength, resulting in separation between the wall leaves, which compromises stability.

Expansion of rusted ties causes horizontal cracking in mortar joints, often visible as tell-tale signs of hidden failure.

Wall panels may bulge or bow outward due to loss of structural restraint, especially under wind load.

There is an increased risk of wall collapse in extreme cases if tie failure is not addressed.

(c) Explain how modern construction techniques minimize this risk.

Modern ties are manufactured from stainless steel or galvanized materials with corrosion-resistant coatings, extending their lifespan.

Installation now includes using plastic sleeves and spacers that reduce direct exposure of ties to mortar, limiting corrosion risk.

Proper wall tie spacing and orientation guidelines are followed to ensure uniform distribution of stress and load transfer across wall leaves.

5. A new estate is being developed in an earthquake-prone zone using unreinforced blockwork.
(i) Identify four structural challenges that may arise.

Unreinforced blockwork lacks tensile strength, making it prone to cracking or collapse under lateral earthquake forces.

Joints between blocks may separate due to vibration and shaking, weakening the wall integrity.

Corners and junctions are particularly vulnerable and can easily fail without reinforcement.

The lack of ductility in blockwork means it cannot flex or absorb energy, leading to brittle failure during seismic movement.

(ii) Explain how reinforcement can be incorporated into blockwork without altering the visual finish.

Vertical steel bars can be inserted into hollow cores of blocks and grouted to provide internal reinforcement without visible changes.

Horizontal reinforcement strips or bed joint reinforcement mesh can be laid in mortar joints, hidden from sight.

Ring beams or tie beams at window and door lintel levels can be embedded within the wall finish to integrate seamlessly with architectural design.

(iii) Suggest design adaptations that improve seismic resistance in masonry buildings.

Introduce reinforced concrete frames around masonry walls to act as the primary load-bearing structure.

Add shear walls or bracing elements within the layout to resist lateral forces.

Limit the height-to-width ratio of walls and avoid large, unbraced wall panels, ensuring symmetry in building layout for balanced response.

6. (a) Explain the role of movement joints in long boundary walls.

Movement joints are intentional separations built into long masonry walls to allow for natural expansion, contraction, and settlement without causing uncontrolled cracking. They absorb stress caused by temperature changes, moisture, or structural movement.

(b) What materials are used for movement joint fillers and sealants?

Filler materials include compressible foam strips like closed-cell polyethylene, rubber pads, or bituminous boards, which accommodate movement while supporting adjacent masonry.

Sealants used include silicone, polysulfide, or polyurethane-based compounds that provide weatherproofing and flexibility to the joint while preventing debris or moisture ingress.

(c) Illustrate, with a labeled diagram, a vertical movement joint placed between two wall panels.

Vertical joint shown as a clean, straight vertical gap between two panels.

- Inside the joint: compressible filler material (labeled).
- Front sealant bead applied over the joint face (labeled).
- Joint width approx. 10–20 mm.
- Wall ties placed with movement sleeves across the joint (labeled), allowing differential motion.