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Preparation and testing of mortars

(confection et essais sur mortiers)

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1 Preparation and testing of mortars

1.1 Introduction

Mortar is a thorough mixture of binder, sand, and water, made to achieve a paste with suitable plasticity for proper application and proper setting of the cement. In any construction, it is essential to bond the different elements (concrete blocks, bricks, precast concrete elements, etc.) using cement mortar or another binder.

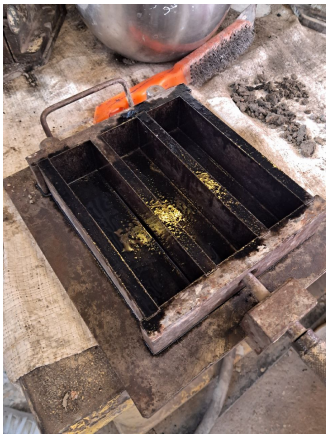
1.2 Objective

The mortar is studied in the following areas:

- **Preparation of Specimens (4x4x16 cm)**: Preparation of resistance and shrinkage tests on mortar specimens.
- **Tensile, Compression, and Flexural Strength of 4x4x16 Specimens**: Defining the tensile, compressive, and flexural strength qualities of cement.
- **Shrinkage with a Refractometer**: Evaluating the shrinkage or swelling caused by cement on normal mortar specimens.

1.3 Equipment :

- Molds
- Impact testing machine
- Mixer
- Trowel
- A precise scale
- Straightedge





1.4 Operating Procedure

Material Preparation

Recommended Sand: It is recommended to use standardized sand. If unavailable, it can be recreated in the laboratory by sieving dry sand.

Mixing Proportions:(EN 196-1)

- 450 g of cement
- 1350 g of sand
- 225 g of water

Mortar Mixing

- **Weigh Materials:** Weigh cement and water with precision (± 1 ml for water).
- **Start Mixing:** Add water and cement to the bowl within 10 seconds. Start the mixer at low speed as soon as they contact, and begin timing.
- **Add Sand:** After 30 seconds, add all the sand evenly over the next 30 seconds.

- **Increase Speed:** Switch to high speed and mix for 30 more seconds.
- **Pause Mixing:** Stop the mixer for 90 seconds. During the first 30 seconds, scrape the mortar from the walls and bottom and place it in the center.
- **Final Mixing:** Resume high-speed mixing for 60 seconds.
- **Mold the Samples:** Mold the samples immediately after the mortar preparation.

Flexural Strength Test

- Install the prism in the testing device.
- Apply the load vertically using a loading roller at a rate of (50 ± 10) N/s until failure.
- Calculate flexural strength R_f using the formula:

$$R_f = \frac{1.5 \times F_f \times l}{b^3}$$

Where:

  - R_f is the flexural strength .
  - b is the side of the square section .
  - F_f is the applied load at failure.
  - l is the distance between supports .

Compressive Strength Test

- Test both halves of the broken prism by applying load to the lateral faces.
- Gradually increase the load at a rate of (2,400 ± 200) N/s until failure.
- Calculate compressive strength R_c using the formula:

$$R_c = \frac{F_c}{1,600}$$

Where:

  - R_c is the compressive strength.
  - F_c is the maximum rupture load .
  - $1,600$ is the area (40 mm x 40 mm)

1.5 Expression of results

Sample	$R_f(MPa)$	$R_c(MPa)$	
1	2.6	12.08	11.77
2	3.29	23.91	18.01
3	-	18.01	13.91

TABLE 1.1: Flexion and Compression Test Results

Discussion

The average compressive strength $R_c = 16.28\,\text{MPa}$ of the mortar is very low. This can be attributed to the use of non-normalized sand and expired cement.

1.6 Conclusion

These results highlight the importance of material selection and quality control in achieving higher strength and durability in future mortar formulations. The low compressive strength observed underscores the need for using standardized sand and fresh cement to improve the overall quality and performance of the mortar.