

Final Report on Mix Design proportioning and Validation of
M25 Grade Site Concrete Mix with and without Corrostop-15

Customer	Laal Chemicals, Chennai
Project	Residential and Commercial Projects

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Institute For Construction Materials And Technologies Private Limited
(NABL accredited Laboratory incubated by IIT Madras)

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1 Executive Summary

Introduction

Laal Chemicals, Chennai, approached ICOMAT to design and validate M25 Grade Site Concrete with and without Corrostop-15, a Corrosion Inhibiting Chemical Admixture of Laal Chemicals. This mix is expected to be used in the construction of small to medium size Residential and Commercial buildings.

Concrete Mix criteria and Trial mix plan

ICOMAT carried out mix proportioning based on the physical properties of aggregates and adopted the following criteria to design the mix.

Criteria	Requirements
Grade	M25
Cement Content	370 kg/cum
Maximum w/c ratio	0.55
Slump value	100 +/-25 mm

Trial mixes were conducted to verify the performance of the two mixes through following test plan;

- Slump Test and
- Cube Compressive Strength Test

Comments – as reported on 31 December 2020

- After mix designs were proportioned, two trial mixes were conducted, one without Corrostop-15 and another with Corrostop-15.
- It is to be noted that water content in the mix with Corrostop-15 was reduced by 5 kg/cum as 1.5kg/cum Corrostop-15 was to be added.
- The slump measured for the first mix without Corrostop-15 was 90mm and for the mix with Corrostop-15 the slump measured was 100mm. This showed that there was no significant difference.
- 1 day, 3 day and 7 day cube compressive strength test results of both the mixes were almost similar without any significant difference.
- 28 day cube compressive strength test results are awaited.
- Details of Mix Design adopted and Trial Mix results are mentioned in this report in the following pages.

Current update

- 28 day cube compressive strength test results were measured to be 32.0 MPa for the control mix without Corrostop-15, and 33.4 MPa for the mix with Corrostop-15, thus exhibiting a minor increase in strength in the mix with Corrostop-15.

For ICOMAT

Sd/-
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Managing Director

2 Trial mix designs

Grade / Type of Mix	M25 without Corrostop-15	M25 with Corrostop-15
Trial Mix Reference no	LT0092	LT0093
Date of Trial Mix	24.12.2020	24.12.2020
Material	Design (kg/cum)	
Coromandel 53 Grade	370	370
Coarse Aggregate 20 to 4.75 mm	987	994
Fine Aggregate- Crushed Stone Sand	831	838
Water	205	200
Total	2393	2402
Corrostop-15	Nil	1.5 kg/cum
Water to Binder ratio	0.55	0.54

Note:

- Corrostop-15 dosage was as recommended by Laal Chemicals
- No Super-plasticizer was added in both the mixes

3 Trial mix results

Grade / Type of Mix	M25 without Corrostop-15	M25 with Corrostop-15
Trial Mix Reference no	LT0092	LT0093
Date of Trial Mix	24.12.2020	24.12.2020
Workability – Slump Test Value		
Initial @ 15 minutes	90 mm	100 mm
Cube compressive Strength Test results		
1 day	9.9 MPa	10.4 MPa
3 day	16.2 MPa	15.6 MPa
7 day	20.8 MPa	22.0 MPa
*28 day	32.0 MPa	33.4 MPa

* Current update

Note:

- The test results are pertaining to the raw materials used and the mix design adopted. Any change in the mix design and or raw material properties will affect the test result.
- It must be noted that the laboratory results tend to be higher due to accuracy maintained in weighing and higher degree of control exercised in the entire process.

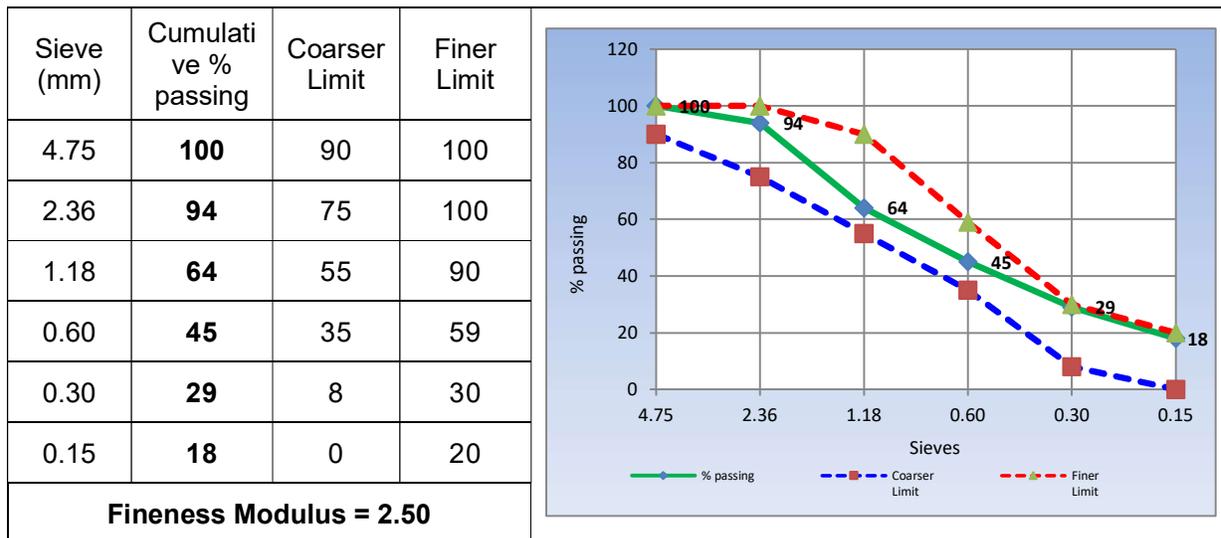


4 Raw Materials Data

Specific gravity and Water absorption

Raw Material	Type / Source	Specific Gravity	Total Absorption
Cement	Coromandel OPC 53 Grade	3.15	NA
Coarse Aggregate	20 mm to 4.75mm	2.79	0.45
Fine Aggregate	Crushed Stone Sand – VSI Manufactured	2.65	1.70
Admixture	Corrostop-15	---	----
Water	Suitable for Construction Purpose	1.00	---

Particle size distribution of CS Sand



5 Recommendations for Concrete Manufacturing

Quality control

- Maintaining mix design in SSD condition in the batching system is very important
- Moisture correction shall be effected when coarse aggregates and fine aggregates are wet
- Absorption correction shall be effected when coarse and fine aggregates are dry
- Water correction shall be effected during rain
- Monitoring and controlling Grading of Fine Aggregates shall be given importance to maintain the uniformity in concrete
- Storage of raw materials, weigh batching, sampling and testing shall be carried out as per relevant standards and specifications
- Addition of water in fresh concrete shall not be allowed.

Factors Influencing / Affecting Mix Performance

- Addition of Chemical Admixture – Improves workability and flowability
- Presence of Silt and Clay content in River Sand –adversely
- Grading of Aggregates
- Shape and Size of Aggregates
- Micro fines (Dust content) in coarse aggregates and in Crushed Rock Fines -adversely
- Cement – Fineness, Normal Consistency and Setting time.
- Cement –Admixture Compatibility
- Over dosing of admixture - Prolongs setting time
- Fly Ash – Fineness & water reduction characteristic
- Ambient Temperature
- Batch variation
- Delay in Handling – Leads to tampering of concrete

6 Cube Compressive Strength Criteria as per BIS

- Sampling, Curing, Testing & Test Results are as per IS 456
- Cubes specimen shall be cast, cured and tested at 28 days in accordance with IS 516

Test Results of Sample:

The test results of the sample shall be the average of the strength of three specimens.

- The individual variation should not be more than 15% of the average. If more, the test results of the sample are invalid.

Concrete shall be deemed to comply with the strength requirements when both the following conditions are met:

- a) The mean strength determined from any group of four consecutive test results complies with the appropriate limits in col 2 of Table 11
- b) Any individual test result complies with the appropriate limits in col 3 of Table 11.

Table 11

specified Grade	Mean of the Group of 4 Non-Overlapping Consecutive Test Results In N/mm ²	Individual Test Results In N/mm ²
(1)	(2)	(3)
M 20 or above	$f_{ck} + 0.825 \times \text{established SD (rounded off to nearest } 0.5 \text{ N/mm}^2)$ Or $f_{ck} + 3 \text{ N/mm}^2$, whichever is greater	$> f_{ck} - 3 \text{ N/mm}^2$

Note:

- Actual data of Target Mean Strength, Standard Deviation and Average Strength could be found out with the minimum of 30 sets of cube results.