FPA BULLETIN

Magazine from Flat Promoters Association
Chennai South

Year 2023 - 24 | Vol : IV

JANUARY - MARCH 2024

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ARE THE BUILDINGS CONSTRUCTED IN THE RECENT PAST REALLY DURABLE ? YES / NO / DOUBTFUL

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I. Preamble

India – one of the fastest growing economies in the world, with lot of IT hubs, automation industries, Health care infrastructure etc.is blessed with 7516.6 kM of coastal belt. Being a developing country witnessing infrastructure development in terms of metro rail, fast track highway corridors, airports, ports & harbours, roads & bridges, special economic zones, industrial parks etc. in a huge way in the past two decades. Chennai being a capital of Tamil Nadu is considered as Medical and Automation capital of India. Tamil Nadu possess a significant coastal length of 1076 KM in which 150 KM between Chennai to Pondicherry is considered important considering massive growth of industries and residents.

Due to recent technological advancements, there is an awareness among construction firms about quality construction materials and efficient construction practices. Much importance is given to quality of cement, fine aggregate (M-sand), coarse aggregate (blue metal – jelly), and other construction chemicals. However, few iconic building infrastructures constructed in the 2010's in Chennai are under severe distress, and the reports by eminent academic institution recommended for demolition of few of these infrastructures. This is really an eye opener for all the construction firms to retrospect themselves and come out with a strategy to avoid this menace.Among the construction materials, quality of M-sand and water used for construction is compromised in many projects without the knowledge of construction firms in field conditions considering the fast nature of work progress.

II. Unique Problems of Construction Firms in Chennai

The following are the nature of problem and its consequences

A. Construction related

- Situated in a coastal belt: The influence of marine environment is spread up to 20 kMs, and the reinforcement rods are under severe corrosion risk due to penetration of chloride laden air in concrete.
- Indifferent quality of water: Non-availability of potable water satisfying Indian Standards for concrete / mortar preparation and curing, leading to corrosion of steel reinforcement and efflorescence in plastering work.
- Quality of M-sand: Non-availability of mass quantity of standardized (uniform quality) M-sand from a single source. This leads to chloride / sulphate contamination in concrete if M-sand is washed with poor quality of water. In another context the sticking of M-sand mortar to the brick surface is not on par with River sand mortar due to increased water requirement to prepare the mortar of required consistency.

B. Environment related

- Situated in Cyclone zone with expected heavy rain fall in shorter duration of time in rainy season: This leads to water seepage through terrace, and walls causing corrosion of reinforcement rods.

- Release of high amount of carbon-di-oxide by vehicles and industries: The CO2 penetration through concrete surface reduces the alkalinity (i.e., pH) of concrete and leads to corrosion of reinforcement rods.
- Chloride laden air: The interaction of chloride laden air with external plastering weakens the integrity of cement mortar and leads to disfigure of paint films and encourage water penetration.

III. Way Forward

A. Prevention is better than cure

The following checks on construction materials are required at site despite of adopting excellent construction practices at site:

- Ensuring the quality of water for construction standards at regular intervals: The water used for concrete / mortar preparation, and curing shall be tested at source and at site at regular intervals.
- Checking the quality of M-sand: The presence of chloride / sulphate / other detrimental agents in procured M-sand shall be tested in laboratory at regular intervals for its conformity with Indian standards.
- Testing of Cement and Reinforcement rods at regular intervals by following standard operating procedure for its conformity with relevant standards.
- Staking of reinforcement in site at elevated places with cover to prevent atmospheric corrosion.

B. Proactive Measures

I. Corrosion prevention in Reinforced Concrete: Application of anticorrosive coating to steel rebars / incorporation of corrosion inhibitor in concrete.

(I) As a first line of defence, a simple cement polymer anticorrosive coating can be given to reinforcement rods after cutting and bending operation is over.

The typical steps involved are:

Step 1: Cleaning of loose rust (if any) from the reinforcement rods using steel wire brush. In case new rebars, surface cleaning is not required.

Step 2: Application of one coat of cement polymer anticorrosive coating by mixing 1 part of cement polymer anticorrosive solution to 1.5 part of ordinary Portland cement.

Step 3: Drying in atmospheric conditions for 6 hours.

(ii) Admixing Corrosion Inhibiting Admixture in concrete at 500 ml to 1 ltrs. Per bag of cement. The salient steps involved are:

Step 1: Preparing concrete in the mixture machine in a just wet condition (i.e., by adding 75% of water)

Step 2: Addition of 500 ml to 1 ltr. of corrosion inhibitor in the wet concrete, and add 25% of water and rotate the mixer machine for 2 min. to ensure uniform mixing.

Figure 1 : Application of Cement Polymer Anticorrosive Coating (CPAC)

Figure 2 : View of CPAC Coated Reinforcement Rods at Site

Figure 3 : Preparation of Corrosion Inhibitor Admixed Concrete

(iii) Waterproofing of Terrace Slabs / Sunken areas / sloped roofs: Polymer modified mortar or concrete is the simple, feasible and economical way of waterproofing of reinforced concrete elements.

Procedure for preparation of polymer modified concrete

Step 1: Mix Cement + Sand + jelly in desired proportion in a dry manner without adding water.

Step 2: Mix 500 ml. styrene acrylate co-polymer in 20 to 25 ltrs water in a plastic bucket/ container and stir well and have it separately.

Step 3: Add polymer mixed water [Step 2] to Dry concrete Mix [Step 1] and prepare a workable concrete for use.

Curing: Water quenching / spraying for 7 days.

Note: For polymer modified mortar, follow the steps given for concrete without adding jelly.

IV. Conclusions

- Proactive and preventive strategies shall be adopted in the construction project with the emphasize on durability of buildings for a trouble-free service life.
- Steel reinforcement shall be stored properly in the construction site. The excellent bond between steel rebar and concrete is essential for the good performance of reinforced concrete members. This will not happy if we use pre-rusted steel reinforcement rods in concrete.
- As a protective strategy, the practice of application of cement polymer anticorrosive coating to steel rebars, and addition of corrosion inhibitor in concrete is recommended for durable concrete. This is a cost-effective solution for preventing steel rebar from corrosion during the design life of structures.
- The usage of cost-effective polymer modified mortar / concrete for water proofing of sunken slabs, sloped roofs, and terrace is recommended for enhancing service life of buildings.
- All the precautionary and proactive strategies are complementary to the good construction practices adopted in site.
- Buildings are very much alive. If mistakes happened it will respond accordingly.

Figure 4: Preparation of Polymer Modified Concrete

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