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"TO ENHANCE THE QUALITY MANAGEMENT OF STRUCTURE & MATERIAL BY APPLYING QUALITY MANAGEMENT SYSTEM IN DOUBLE DECKER FLYOVER, AT UNIVERSITY CIRCLE PUNE

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Abstract - An abstract summarizes, in one paragraph The construction of flyovers is a complex process that requires careful attention to detail, particularly in terms of the materials and structures used. The quality of these components can have a significant impact on the safety and longevity of the final product, as well as the overall success of the project. As such, it is crucial to develop a comprehensive quality management system to ensure that materials and structures are of the highest possible standard.

The first stage of the quality management system involves the selection of materials. This includes identifying the appropriate materials for the specific requirements of the flyover, taking into account factors such as load capacity, durability, and environmental factors. The selected materials will then undergo rigorous testing to ensure that they meet the required standards, including testing for strength, elasticity, and resistance to weathering. Once the materials have been selected and tested, the next stage of the quality management system is to implement quality control measures during the construction process. This involves ensuring that all materials are used according to the specified standards and that all construction work is carried out to the highest possible standard. In addition to the above, the quality management system will also involve monitoring and maintenance of the completed structure. This includes regular inspections to identify any issues or defects that may have arisen since construction was completed, as well as regular maintenance to ensure that the structure remains in good condition over time. This may involve regular cleaning, painting, and repairs as necessary, as well as regular monitoring of the structure's performance to identify any signs of wear or damage. Overall, the development of a comprehensive quality management system for the construction of a flyover is essential to ensure that the final product is of the highest possible quality. By carefully selecting and testing materials, implementing quality control measures during construction, and monitoring and maintaining the completed structure, it is possible to ensure that flyovers are built to the highest possible standards of safety, durability, and reliability. This, in turn, will lead to improved infrastructure and a better quality of life for communities that rely on these structures for safe and efficient transportation.

KEYWORDS: Safety, Quality, Management, Materials, Monitoring, Measures

I. INRODUCTION

A quality management system (QMS) is defined as a formalized system that documents processes, procedures, and responsibilities for achieving quality policies and objectives. A QMS helps coordinate and direct an organization's activities to meet customer and regulatory requirements and improve its effectiveness and efficiency on a continuous basis.

1.1 About the project

Pune Metropolitan Region Development Authority represented by the Metropolitan Commissioner and CEO (the "Authority"/ "PMRDA") was constituted by the Government of Maharashtra and is the planning, development, coordinating and implementing agency to ensure balanced regional development with sustainable growth of the Pune Metropolitan Region, which covers an area of about 6972 square kilometres. PMRDA has Undertaken Pune Metro Line-3 Hinjewadi to Shivajinagar project on Design, Build, Finance, Operate, Transfer (DBFOT) model with Public Private Partnership (PPP). In order to cater the traffic at Pune University chowk and to avoid obstruction on Ganesh-khind Road it was decided to demolish existing one-way flyover and construct Flyover and Metro Viaduct on single pier. The existing flyover was dismantled in the month of July – August 2020. Further Integrated double decker structure is planned at Pune university Chowk comprising of Flyover at first level and metro at second level. As the Integrated double decker structure is part of Pune metro Line 3 project it is being executed through EPC Contractor on BOQ basis.

1.2 SALIENT FEATURES OF THE PROJECT

- Length of Double decker flyover – 881M
- Span- 30 Nos of Spans
- Foundation - Pile foundation
- Super structure - pre-stressed I Girders & Steel Girder

II. OBJECTIVES

1. To enhance overall project/structure quality while using QMS
2. To improve continuous quality while implementing QMS
3. TO check the quality of materials and monitor the structures during construction.
4. To project can enhance minimize quality deficiency and establish a reputation for upcoming project.
5. Ultimately contributes to the project's success by maintaining consistent quality standards and minimizing deviations or errors.
6. Overall, increase the structural life and durability.
7. To recommend solutions to maintain the quality of structures.

III. PROBLEM STATEMENT

In Construction, many materials are used to perform the work. These raw materials are the backbone of the future infrastructural project. It has a lot of importance in the context of safety and quality of the work. Hence, I studied and monitored the raw materials which were being used on site and tried to analyse them. The major materials which were monitored are cement, sand, steel and concrete.

3.1 Cement

A cement is a binder, which is a chemical substance that hardens, sets, and adheres to other materials to bind them together. Cement is rarely used on its own; rather, it is used to bind sand and gravel (aggregate) together. Masonry mortar is made from cement mixed with fine aggregate, and concrete is made from cement mixed with sand and gravel. In terms of consumption, concrete is the most widely used material on the planet, trailing only water. Cements used in construction are typically inorganic, often based on lime or calcium silicate, and can be classified as hydraulic or non-hydraulic, depending on their ability to set in the presence of water. On site, there was mainly the work of piling and casting of pile cap and piers was going on. And for that purpose, mainly Ordinary Portland Cement (OPC) was being used. The grade of OPC was used 43 and 53. The grade of cement is determined as per IS: 8112. There are several which are performed on cement to ensure its quality. On the site, we performed consistency test, fineness test, temperature test etc. The other tests such as initial and final setting time, strength test, and soundness test were done in laboratory under controlled conditions and the reports were sent to the site engineers. Later it was checked and approval was given for its further usage. The tests on cement are mentioned in the IS516:1959, and it is referred for the conduction of the tests.

3.2 Crushed Sand

Crush sand, also known as crushed sand or manufactured sand, is produced by crushing rocks, quarry stones, or larger aggregates into smaller pieces. It is an alternative to natural sand and is widely used in the construction industry for various purposes. Crush sand is angular and has a rough surface texture. It is free from silt and clay particles, making it ideal for use in construction. Crush sand is an affordable alternative to natural sand and is readily available in most areas. It is also free from impurities and has consistent quality. Crush sand can be used for a variety of applications, including concrete production, bedding material for pipes and cables, and road construction.

3.3 Steel

Steel is a versatile and frequently utilized alloy that has helped shape the contemporary world. It is an iron-based alloy comprised mostly of iron and carbon, with the addition of manganese, chromium, nickel, and other metals. Steel has exceptional strength, durability, and versatility, making it a critical material in a variety of industries such as construction, manufacturing, transportation, and infrastructure. Several reinforcement bars are available, but the most common are High Yield Strength Deformed (HYSD) bars and Thermo Mechanically Treated (TMT) bars, among others. In this project, the HYSD type of steel reinforcement bars were used. The size that is length and the diameter of the bars were used according to the type of structures. For example, in the pile foundation, there were bars used of diameter 10mm, 12mm, 16mm, 20mm etc. It is all decided by the structural designers. As consultants of the project, we did proof checking of the reinforcement placing, binding, quantity etc. The bar bending schedule was prepared in

order to get the quantity of steel used and the cost of the same. Bar bending schedule also helps to understand that if the quantity used is as per the drawings or not.

3.4 Concrete

Concrete is a widely-used building material made by mixing cement, water, and aggregates (such as sand, gravel, or crushed stone). The mixture forms a paste that hardens over time and becomes a strong and durable material that is ideal for construction applications.

Composition: As mentioned earlier, concrete is composed of cement, water, and aggregates. The proportions of these components can vary depending on the desired strength, workability, and other characteristics of the final product.

Strength: The strength of concrete depends on several factors, such as the proportions of the components, the curing process, and the age of the concrete. Concrete strength is usually measured in pounds per square inch (psi) or mega Pascals (MPa).

Workability: Workability refers to the ease with which concrete can be mixed, placed, and finished. Factors that affect workability include the amount of water in the mixture, the size and shape of the aggregates, and the use of admixtures.

Curing: Curing is the process of maintaining a proper moisture level and temperature in the concrete during the initial setting and hardening process. Proper curing is essential for achieving maximum strength and durability.

3.4.1 Tests on Concrete

The tests on concrete are mentioned in the Indian Standard code IS 516:1959, titled "Methods of Tests for Strength of Concrete." This code provides guidelines for testing the compressive strength of concrete cubes, as well as other relevant tests such as tests for the workability of concrete, flexural strength, and splitting tensile strength. It outlines the procedures, equipment, and acceptance criteria for conducting these tests. IS 516 is widely referenced and followed in India for testing the strength of concrete in various construction projects.

Slump Test:

The slump test is a widely used standard test method to measure the workability of fresh concrete. It is a simple and quick test that is conducted on-site or in a laboratory to ensure the consistency of the concrete mix. The slump of the concrete is measured by placing a ruler or a specially designed slump cone next to the concrete mould and measuring the difference in height between the top of the mould and the highest point of the concrete surface. This difference is known as the slump value. The value of slump is different for different use cases. For example, in the PQC work, slump required is very less, while for the concreting of pile cap on site, the required slump was between 150 to 200 mm. It is an easy test and should be performed before any concreting work.

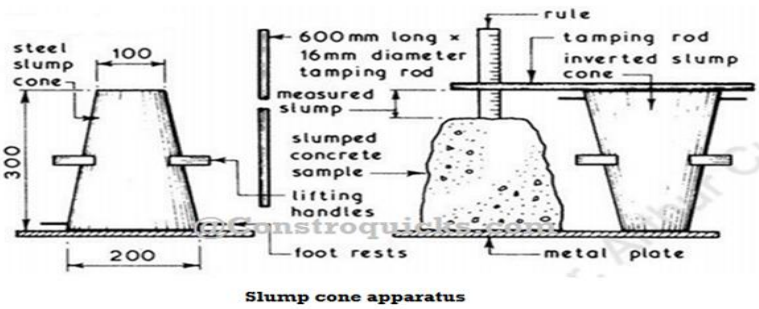

Fig. 4.4.1 Slump Cone Test.

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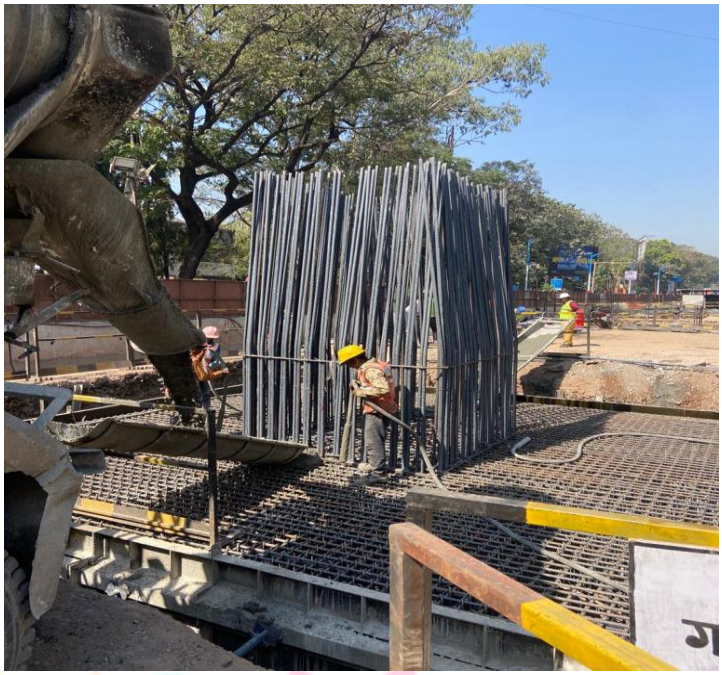
3.4.2 Precautions that should be taken while concreting:

Planning of Concreting
Pouring
Curing
Timing
Moisture
Temperature
Duration



3.5 Pile Foundation

Pile foundations are a deep foundation system that is used to shift a structure's loads further into the ground. When shallow foundations, such as spread footings, are insufficient to sustain the structure or when the soil conditions at the site are unsuitable for shallow foundations, they are used. A pile foundation is made up of long, slender, vertical structural pieces known as piles. These piles, which are often built of reinforced concrete, steel, or timber, are driven or drilled into the earth in order to reach a load-bearing stratum or a stronger layer of soil or rock beneath the surface. In the project, Pile Foundation of 3x3, 3x2 arrangement was constructed. Its diameter was 1200mm cast in situ. It was bored by the boring machines. The depth of the pile depends upon the depth of hard strata. The geotechnical engineer had provided the level of hard rock under the ground and using that data, the depth of pile is decided. After that the socketing depth is calculated. Socketing is the depth to which the pile is embedded into the underlying rock. Here, the socketing depth was decided to be 1.5xD. The D here is the diameter of pile, which is 1200mm. That means the socketing depth for pile is 1.5x1200 = 1800mm.

3.5.1 Maintaining and Monitoring Quality of Pile Foundation:

A well-designed pile foundation is critical for assuring structural integrity and load-bearing capacity. Soil conditions, structural requirements, and expected loads should all be considered in the design. Employ the services of a skilled geotechnical engineer or foundation specialist to create a complete design based on site studies and soil testing. In the project, the majority of piling work was completed before only. So our main job at the site was to check the piling is done as per the drawings and specification given by the structural engineers. As consultants and proof checkers, following steps were carried out:

Material Testing: Conducted thorough testing of the pile materials, such as concrete, steel reinforcement, or timber, to ensure compliance with the specified standards. We maintained proper documentation of material test results and certificates.

Inspections: We inspected the site on a regular basis to ensure that the construction practices and processes are in conformity with the quality control plan. Also, examine the piles for flaws such as fractures, corrosion, or misalignment. To maintain the foundation's quality, address any faults as soon as possible. By implementing these measures, closely monitoring the construction process, and conducting appropriate testing and inspections, the quality of the pile foundation can be effectively maintained, ensuring its reliability and long-term performance.

3.6 Piers and Pier Caps:

Piers are vertical structural elements in construction that support and stabilize various types of constructions. Piers are structures that are meant to carry loads from the superstructure (such as a bridge, pier, or wharf) to the underlying soil or bedrock. They are crucial in distributing loads and resisting lateral forces, hence preserving the structural integrity of the supported structure. Piers are important in construction because they support and stabilize structures like bridges, piers, wharves, and elevated platforms. Piers and the structures they support require proper design, construction, and maintenance to maintain their integrity and lifespan. It is best to consult with qualified engineers and specialists to ensure that piers are designed and built to meet specific project needs.

3.6.1 Maintaining and Monitoring Quality of Piers:

It is critical to maintain quality when building piers to ensure structural integrity and long-term performance. Here are some important steps to ensure quality during pier construction:

Quality Control Plan: Create a quality control plan that is appropriate to pier construction. This plan should detail the methods, standards, and specifications that will be followed during the construction process. Material selection, construction techniques, testing procedures, and acceptability criteria should all be addressed.

Material Testing: Maintaining quality when building piers is critical thoroughly test the materials used in the building of piers, such as concrete, reinforcement, or structural parts. Strength, durability, and other important attributes should be tested on the materials.

Monitoring: Daily monitoring of structures is very important to observe any harm or defect in the structure. A daily schedule was prepared to monitor the curing, shuttering etc. By applying these steps and continuously monitoring the construction process, you can ensure the structural integrity and long-term performance of piers during construction. It is best to consult with expert engineers and professionals to ensure correct pier design, construction, and maintenance for individual project requirements. To summarize, this section of project gives an idea of how monitoring and assessment of materials and structures can be done on site. Also, it signifies the importance of regular monitoring and assessment of materials and structures. By doing this, it helped to find out the methods with which it can be done effectively and efficiently. Hence it led to find out to solution to the maintenance of materials and structures.

IV. PROJECT METHOLOGY

A quality system is a framework for quality management that enables organizational confirmation, procedure, and process to comply with quality management. Furthermore, quality standards benefit a wide range of industries, businesses, governments, regulatory bodies, professionals, suppliers, and

customers of products and services in both the public and private sectors. Furthermore, there has been critical economic and social reflection and providing governments with a technical foundation for safety, health, and environmental regulation.

Client
Project
Design
Contract
Material
Contractor
Supplier
Workmanship
Equipment
Subcontractor
Site-layout
Systems
Staff
Document
Financial Issues

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