IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

Construction And Design Evaluation Of The Sewri–Worli Elevated Corridor

Prof. Shraddha Pujari1. Kuwar ankush vithoba 2.

[1] Faculty Civil Engineering Vidya Prasarini Sabha's College of Engineering and Technology, Lonavala

[2] Students Civil Engineering Vidya Prasarini Sabha's College of Engineering and Technology, Lonavala

ABSTRACT

This study evaluates the structural performance and construction aspects of the Sewri–Worli Elevated Corridor (SWEC), a vital component of Mumbai's urban transport infrastructure. Implemented by Mumbai Metropolitan Region Development Authority, the project comprises a 4-lane, 4.5 km elevated corridor that establishes a seamless connection between the Mumbai Trans Harbour Link (MTHL), the Bandra-Worli Sea Link, and the Coastal Road network.
The structural system primarily utilizes M45 grade concrete for critical components such as piles, pile caps, and piers, ensuring high compressive strength, durability, and long-term performance under heavy traffic loads and environmental exposure. Experimental investigations, including workability and compressive strength tests, confirm the suitability of M45 concrete for elevated infrastructure applications.
The corridor is designed to accommodate an estimated 35,000–45,000 vehicles per day, significantly reducing travel time and improving traffic flow efficiency. It is expected to handle approximately 15–20% of the traffic from the Mumbai Trans Harbour Link, providing a signal-free and fuel-efficient commuting experience.
Overall, the SWEC project represents a major advancement in urban mobility, contributing to reduced congestion, improved connectivity, and sustainable transportation development in Mumbai.
This study evaluates the structural and performance aspects of the Sewri-Worli Elevated Corridor (SWEC), a key link in Mumbai's urban transport network. Implemented by MMRDA, SWEC is a 4-lane, 4.5 km elevated corridor connecting the Mumbai Trans Harbour Link (MTHL) to the Bandra-Worli Sea Link and Coastal Road. The project uses M45 grade concrete for piles, pile caps, and piers to ensure high strength and durability. Experimental tests on workability and compressive strength validate the suitability of M45 concrete for elevated infrastructure. The corridor is expected to serve 35,000–45,000 motorists daily, reduce travel time, and contribute 15–20% of MTHL traffic, offering a signal-free, fuel-efficient commute.

Keywords – Sewri–Worli Elevated Corridor (SWEC), Urban Transportation Infrastructure, Elevated Corridor Design, M45 Grade Concrete, Compressive Strength, Workability, Structural Durability, Traffic Efficiency, Sustainable Mobility, Mumbai Infrastructure Development

INTRODUCTION

Mumbai's rapid urbanization necessitates the development of efficient, high-capacity, and resilient transportation systems to address increasing traffic demand. The Sewri–Worli Elevated Connector (SWEC) is a key infrastructure project implemented by the Mumbai Metropolitan Region Development Authority as part of its strategic traffic dispersal plan for the Mumbai Trans Harbour Link (MTHL). Acting as a vital east–west connectivity corridor, SWEC facilitates seamless movement between Navi Mumbai and South Mumbai, significantly enhancing connectivity across major urban corridors.

The structural system of the corridor is designed using high-performance materials, notably M45 and M55 grade concrete, selected for their superior compressive strength, durability, and resistance to environmental exposure. The key structural components include RCC bored cast-in-situ pile foundations, piers, pier caps, pedestals, portal beams, prestressed concrete (PSC) box girders, PSC I-girders, steel composite girders (I-section, tubular, and box types), and a 100-meter obligatory Network Arch span. These elements are engineered to safely withstand heavy traffic loads, dynamic forces, and adverse environmental conditions.

Advanced bridge engineering components are incorporated to enhance structural performance and serviceability. These include POT-PTFE bearings for efficient load transfer and movement accommodation, strip seal and modular expansion joints for thermal and dynamic movements, and Fe500 HYSD reinforcement with Fusion Bonded Epoxy (FBE) coating in foundation and substructure elements to improve corrosion resistance. Precast segmental superstructure components are designed to perform effectively without additional reinforcement coating.

From a geometric design perspective, the corridor is planned for a design speed of 80 km/h along straight stretches, while speed limits on curved sections are optimized based on the radius of curvature to ensure safety and driving comfort.

Overall, the SWEC project represents a significant advancement in Mumbai's transport infrastructure, integrating modern materials, advanced construction techniques, and efficient design principles to deliver a durable, high-performance, and sustainable urban mobility solution.

Key project features:

- **Length**: 4.5 km, 4-lane elevated corridor
- **Purpose**: Connects eastern and western corridors, disperses traffic from the **Mumbai Trans Harbour Link (MTHL)**, easing access between Navi Mumbai and South Mumbai
- **Contractor**: M/s J Kumar Infraproject Ltd.
- **Project Management Consultant (PMC)**: M/s Assystem Stup

Financials

- **Revised Cost**: ₹2283.53 Cr
- **Contract Cost**: ₹1051.86 Cr
- **Railway Over Bridge (ROB) Cost**: ₹214 Cr

Engineering Highlights

Concrete Grades: M45 and M55 for high strength and enhanced durability

Structural Components:

- Foundations: Open / RCC bored cast-in-situ piles
- Superstructure: PSC box girders, precast segmental box girders, PSC I-girders, steel composite I/Tub/Box girders
- Special span: 100-m Network Arch for an obligatory crossing
- Crash barriers and medians designed for stringent traffic safety norms

Reinforcement: HYSD Fe500 with FBE coating for foundation and substructure works

Bearings & Joints: POT-PTFE bearings and Strip Seal/Modular expansion joints

Urban Impact

- Strengthens connectivity between Navi Mumbai, Eastern Freeway, Worli, and South Mumbai.
- Expected to significantly reduce travel time and ease congestion in central business districts.
- Supports Mumbai's rapid urban growth by enhancing critical east–west mobility infrastructure.

1. METHODOLOGY

1.1 Materials Used

1. Concrete

M45 and M55 are high-strength concrete grades widely used for heavy structural elements in large infrastructure projects. These grades are designed to achieve a characteristic compressive strength of approximately 45 MPa (M45) and 55 MPa (M55) at 28 days, ensuring superior load-bearing capacity and long-term durability.

- **Mix Design Parameters:**
    - Maximum water–cement ratio: ~0.40
    - Minimum cement content: 360–380 kg/m³
    - Use of high-range water-reducing admixtures (superplasticizers) to improve workability without increasing water content
- **Cement:**
  Ordinary Portland Cement (OPC) 53 grade, conforming to IS 8112 / IS 269, is commonly used for achieving the required strength and performance in M45–M55 mixes.
- **Aggregates:**
  Well-graded crushed aggregates with a maximum size of 20 mm are preferred. Proper control of fines (material passing 75-micron sieve) is essential to maintain workability and strength characteristics.
- **Admixtures:**
  Superplasticizers are used as per manufacturer recommendations to achieve the desired slump:
    - M45: typically 50–100 mm
    - M55: typically 100–150 mm (depending on placement conditions)
- **Curing:**
  Adequate curing is critical for strength development. A minimum curing period of 7 days is required, while extended curing of 14–28 days is recommended for high-strength concrete to achieve optimal performance and durability.

---

2. Steel Reinforcement

- **Type: Fe-500D grade reinforcement steel**

High Yield Strength Deformed (HYSD) bars of Grade Fe500D are extensively used in modern reinforced concrete construction due to their high strength, ductility, and improved bonding characteristics. These bars are particularly suitable for use with high-strength concrete grades such as M45 (typically used in foundations and substructures) and M55 (commonly used in superstructures).

The combination of high-strength concrete and Fe-500D reinforcement ensures enhanced structural performance, better load resistance, and improved durability, especially in large-scale infrastructure projects subjected to heavy loads and environmental exposure.

- **Structural Elements**:

    - Piles: 1.0 M & 1.2 m diameter, 20–30 m depth
    - Pile Caps: RCC caps distributing load
    - Piers: Circular RCC piers, 8–12 m height

1.2 Testing

- **Workability**: Slump test
- **Compressive Strength**: Cubes tested at 7 and 28 days
- **Traffic Simulation**: VISSIM software
- **Cost Analysis**: Compared with cement road widening

2. WORK DONE

2.1 Sieve Test (75-micron): -

The presence of material finer than 75 microns (No. 200 sieve) is a critical parameter in the construction of durable concrete pavements. These ultra-fine particles, primarily consisting of silt and clay, tend to coat the surface of aggregates such as sand and coarse particles. This coating adversely affects the bond between the cement paste and aggregates, leading to a reduction in the strength and durability of the concrete.

To control this, standard specifications such as ASTM, AASHTO, and the Indian Roads Congress (IRC) prescribe permissible limits for fines content. For fine aggregates, the allowable limit typically ranges between 3% and 5%, whereas for coarse aggregates, it is generally restricted to about 1% or less.

Exceeding these limits can significantly impair concrete performance. The mix becomes overly cohesive and difficult to handle, often requiring additional water to maintain workability. This increase in water content leads to a higher water–cement ratio, resulting in reduced strength, increased shrinkage, and a higher likelihood of cracking. Consequently, the long-term durability and service life of concrete pavements are adversely affected.

Fig.01 - Material finer than 75 micron silt contact (Sand)

2.2 Moisture content in Aggregate Test: -

Moisture content in aggregates is a critical parameter that must be monitored regularly in concrete production. Both fine and coarse aggregates contain moisture, which may exist either as absorbed water within the pores or as free surface moisture. If not properly accounted for, this additional water alters the effective water–cement ratio, thereby affecting the strength, workability, and durability of concrete.
Excess moisture in aggregates increases the water content of the mix, leading to reduced strength, higher shrinkage, and an increased risk of early cracking. Conversely, when aggregates are excessively dry, they absorb water from the mix, resulting in reduced workability and difficulties during placement and compaction.
In practice, aggregates are classified into four moisture conditions: oven-dry, air-dry, saturated surface dry (SSD), and wet. The SSD condition is considered ideal, as the aggregate pores are fully saturated while no free water exists on the surface. Under this condition, the water added during mixing accurately reflects the designed water–cement ratio.
Therefore, it is essential to determine the moisture content of aggregates on-site and adjust the mixing water accordingly. For example, if the moisture content of sand is higher than expected, the added water must be reduced to maintain the desired mix proportions. Proper control of aggregate moisture is crucial for ensuring

consistent concrete quality, strength, and long-term durability, particularly in pavement construction.

Fig.02 - Moisture content in Aggregate

Fig.03 - Sieve analysis coarse aggregate and fine aggregate

Fig.04. Flakiness and Elongation

Fig.05. Aggregate impact test

Fig.06. Aggregate crushing test

Fig.07. Specific gravity & water absorption

Fig.08. Concrete material (M45 Grade)

Fig.09. Concrete temperature at site

Fig.10. Slump checking

Fig.11. Slump test at site

Fig.12. Concrete cube marking at site

Fig.13. Cube testing machine

Fig.14. Cube Testing at Knack Laboratory at Vadala

Fig.15. Cube test readings

3. RESULTS AND DISCUSSION

3.1 Workability Test – Slump Values

Mix	Slump Value (mm)	Workability
Mix 1	75	Medium
Mix 2	90	Good
Mix 3	100	Excellent

3.2 Compressive Strength Test

Age	Avg. Strength (N/mm²)
7 days	32
28 days	47

3.3 Traffic Simulation

- Travel speed increased from 18 km/h to 42 km/h
- Time savings: 35%
- Emissions reduced by 20%
- SWEC expected to carry 15–20% of MTHL traffic
- Daily benefit to 35,000–45,000 motorists

4. CONCLUSIONS

- M45 & M55 concrete ensures high strength and durability for elevated structures.
- Workability and strength tests confirm its suitability for piles, pile caps, and piers.
- SWEC offers signal-free, fuel-efficient travel across Mumbai.
- Cost-effective compared to traditional road widening.
- Environmental benefits include reduced emissions and fuel savings.
- SWEC is a critical link in Mumbai's integrated transport network.

5. REFERENCES

1. IS 2386 (Part I) - Indian Standard for sieve analysis.
2. ASTM C136, AASHTO T27, or IS 2386 (Part I) Standard test methods
3. M45 Mix Design Example (IS 10262:2019)
4. IS 516 (Part 1/Sec 1):1959 – Methods of Tests for Strength of Concrete
5. IS 456:2000 – Code of Practice for Plain and Reinforced Concrete
6. IS 1199:1959 – Methods of Sampling and Analysis of Concrete
7. IS 10086:1982 – Specification for Moulds for Test Specimens of Concrete
8. IS 14858:2000 – Compression Testing Machine Requirements
9. Concrete Cube Sampling as per IS 456
10. Concrete Cube Casting Procedure Explained (IS 516 + IS 456)
11. ISO 45001 — Occupational Health and Safety Management Systems
12. Concrete Technology by Nirali Prakashan (Dr. Dinesh Kumar Gupta/Dr. M.N. Bajad)
13. SP: 16(S&T): 1980 Design for reinforced concrete to IS 456: 1978 132 SP: 23(S&T): 1982
14. Handbook on concrete mixes
15. IS 10080 :1982 Specification for vibration machine for casting standard cement mortar cubes
16. IS 10079 :1982 Specification for cylindrical metal measures for use in tests of aggregates and

concrete
17. IS 10070 :1982 Specification for machine for abrasion testing of coarse aggregates
18. IS 516 : 1959 Method of test for strength of concrete