GEOMETRIC DESIGN OF ELEVATED ROAD CORRIDOR FROM EASTERN FREEWAY (ORANGE GATE) TO GRANT ROAD AREA

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE MASTER OF TECHNOLOGY In TRANSPORTATION ENGINEERING

By

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ABSTRACT

Rapid urbanization and increasing vehicular demand have resulted in severe traffic congestion in metropolitan cities such as Mumbai. One of the major congestion points in South Mumbai is the lack of direct connectivity between the Eastern Freeway and the Grant Road–Tardeo corridor. The present study focuses on the geometric design of proposed elevated road corridor connecting Orange Gate on the Eastern Freeway to the Grant Road area. The study evaluates existing traffic conditions, identifies bottlenecks, and develops an alignment based on traffic demand and urban constraints. Proposes alignment integrated with existing and upcoming infrastructure such as the Mumbai Trans Harbour Link (MTHL) and Coastal Road Project. Design parameters such as design speed, horizontal curvature, vertical alignment, and sight distance are developed based on guidelines of the Indian Roads Congress. Autodesk Civil 3D and Google Earth Pro were used for alignment planning, geometric design, and corridor modelling. The proposed elevated corridor is expected to reduce travel time from approximately 30–40 minutes to nearly 6–7 minutes, thereby improving traffic mobility and reducing congestion on major arterial roads in South Mumbai. The study demonstrates that elevated infrastructure can provide an effective solution for mobility challenges in densely populated urban environments.

Keywords: Elevated Corridor, Geometric Design, Urban Transportation, Traffic Congestion, Civil 3D

INTRODUCTION

Urban transportation systems in rapidly growing cities are facing increasing pressure due to population growth and rising vehicle ownership. Mumbai, one of the most densely populated cities in the world, experiences severe traffic congestion due to limited land availability and high travel demand.

The Eastern Freeway was developed to improve connectivity between South Mumbai and the eastern suburbs. However, the absence of a direct connection between the freeway and the Grant Road–Tardeo corridor results in significant congestion on arterial roads such as Dr. B. R. Ambedkar Road and PD'Mello Road.

To address this issue, this research investigates the development of an elevated road corridor connecting Orange Gate on the Eastern Freeway to the Grant Road area has been proposed. The elevated structure is expected to provide grade-separated traffic flow, reduce congestion, and improve travel efficiency.

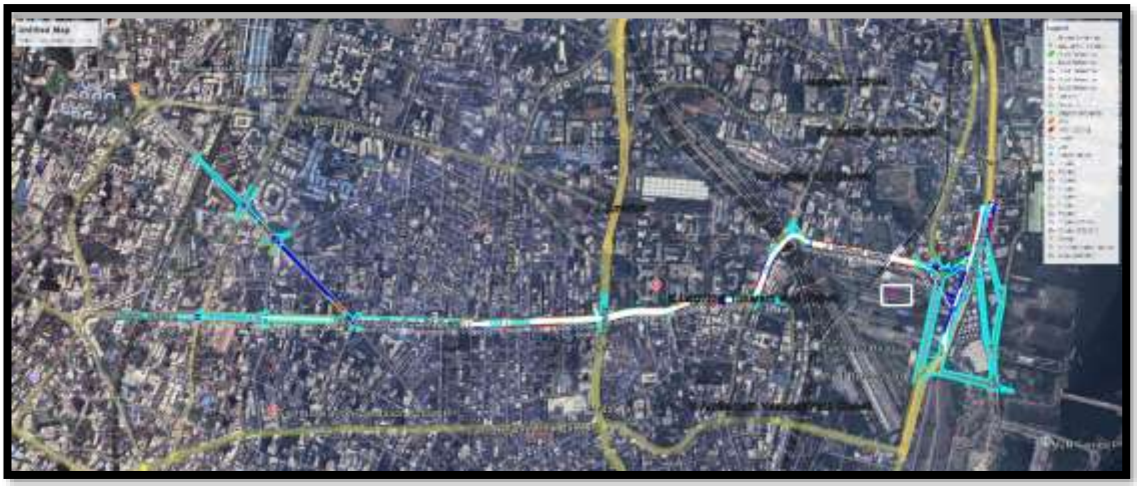

Figure 1: Alignment of Eastern Freeway to Grant Road

OBJECTIVES

The major objectives of this study are:

- The objective of this assignment is to give feasible solution for smooth traffic dispersal and reduce the congestion by connecting Eastern Freeway from Orange Gate to Grant Road.
- To analyses existing traffic conditions, bottlenecks, and travel patterns on the existing surface routes between these points.
- To evaluate the impact of the proposed corridor on traffic congestion, travel time, and vehicle operating costs (VOC).
- To assess the integration of this corridor with upcoming and existing infrastructure like the Mumbai Trans Harbour Link (MTHL) and Coastal Road Project.

Project Need

Mumbai faces severe traffic congestion, particularly in South Mumbai and its connectivity to eastern suburbs. The Eastern Freeway has improved regional connectivity, but the absence of a direct link to the Grant Road–Tardeo corridor remains a major bottleneck. The existing 4.6 km stretch currently takes 30–40 minutes during peak hours due to heavy traffic and junction delays. The proposed elevated corridor from Orange Gate to Grant Road aims to reduce this travel time to 6–7 minutes.

It will significantly decongest key arterial roads like Dr. B. R. Ambedkar Road and PD'Mello Road. With increasing traffic demand and the impact of the Mumbai Trans Harbour Link, efficient east–west connectivity has become essential. The project will enhance urban mobility, reduce congestion near major nodes like CSMT and Mumbai Central, and support sustainable transport development.

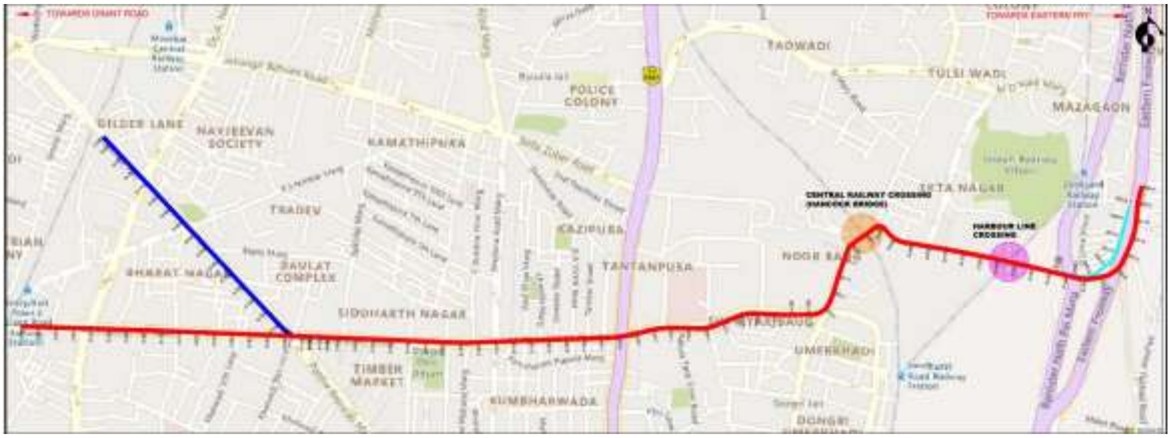

Figure 2: Pictorial representation of Eastern Freeway to Grant Road

Geometric Design & Specification of Alignment

Si No	Road Geometrics	Details
1	Design speed	40/60 Kmph
2	Lane Configuration	2/3/4 laning
3	Single Lane width	3.5 m
6	Edge Strip	0.50m
7	Camber	-2.50%
9	Ruling/Maxmium gradient	4.00% As per IRC SP 92
10	Horizontal Alignment	As per IRC 38

The geometric design of the elevated corridor was carried out according to standards recommended by the Indian Roads Congress.

The alignment was designed to ensure smooth traffic flow, safety of road users, and compatibility with the surrounding urban environment. Special attention was given to minimizing land acquisition and avoiding major utilities or structures along the corridor. These parameters ensure safe and efficient traffic movement along the elevated corridor.

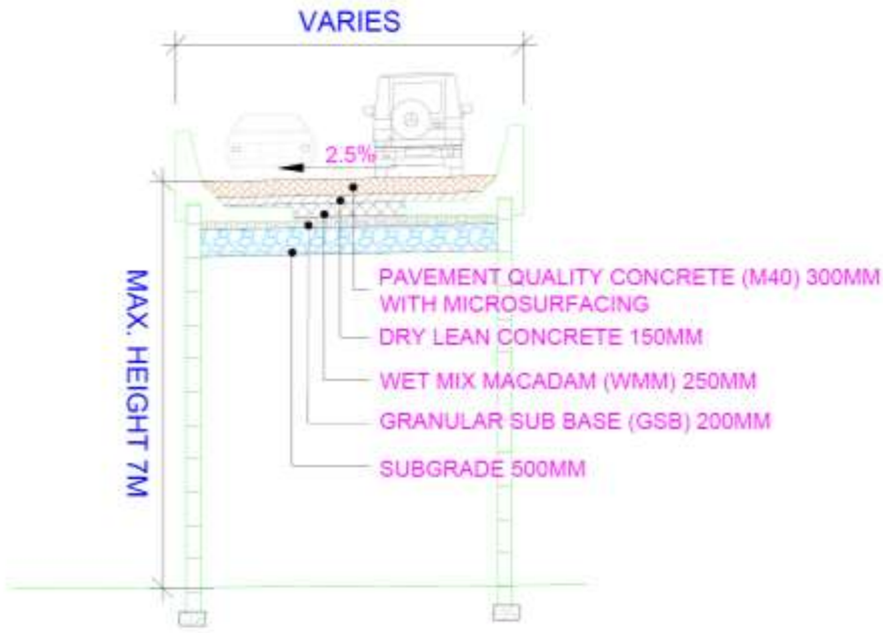

Figure 3: Typical Cross Section

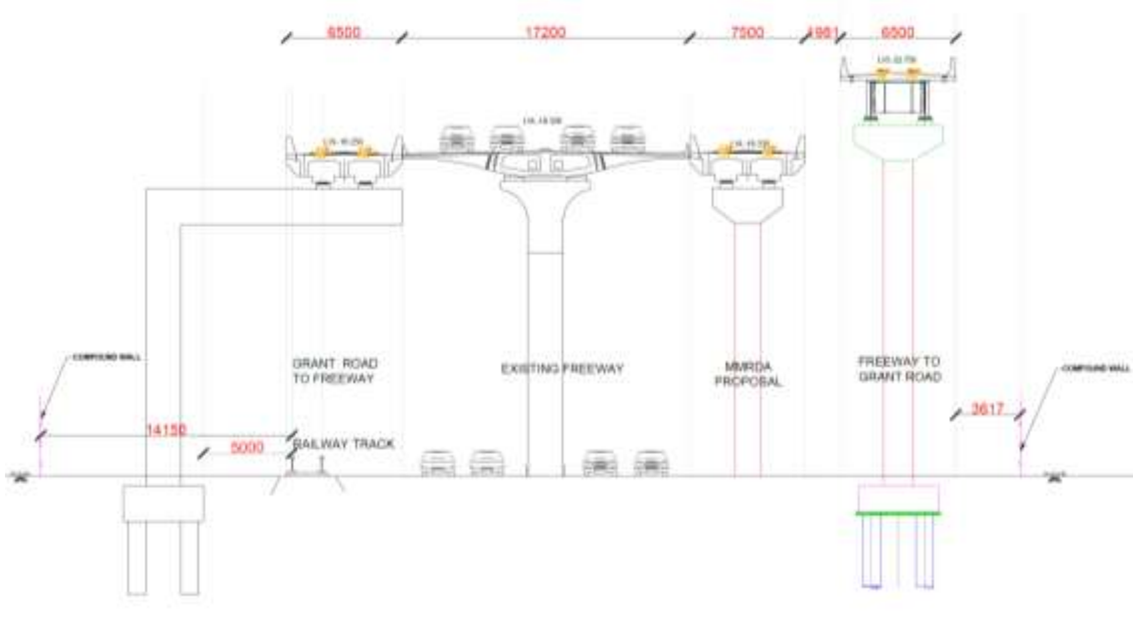

Figure 4: Typical Cross Section

PAVEMENT DESIGN

PAVEMENT OPTIONS & DESIGN METHODS

Two types of pavement options are considered, i.e. flexible pavement & rigid pavement. The principal methods of pavement design for new carriageway are based on IRC: 37 for flexible pavement and IRC: 58 for rigid pavement.

Pavement layer Material Parameters

Rigid pavement consists of different layers of materials. Design Period – Design period is considered as 30 years.

Various pavement layers adopted in the design procedure are given below,

- Pavement Quality Concrete (PQC) = 300mm
- Dry Lean Concrete Base (DLC) = 150mm
- Granular Sub-base (GSB) = 200mm
- Subgrade with 6% CBR = 500mm

Pavement Design for side strips

Flexible Pavement adopted for side strips with following parameters as per IRC: 37-2018:

Sr. No.	Description	Details
1	Design Life	20 Years
2	Design Traffic Axle Load	60 MSA
3	Subgrade Strength	CBR value 6%
4	Traffic Growth Rate	5%

- 50mm = BC
- 125mm = DBM
- 250mm = WMM
- 200mm = GSB
- 500mm = Subgrade with CBR of 6%

METHODOLOGY

Alignment selection methodology is based on the five aspects, viz. Engineering, Environment, geometric design, Social, Traffic and Road Usability.

The study methodology includes:

- **Traffic data collection** (volume counts, origin–destination surveys, travel time & delay studies).
- **Bottleneck identification** and geometric alignment planning.
- **Traffic simulation modelling** (existing vs. proposed scenarios).
- **Feasibility assessment** covering geometric design, environmental considerations, and right-of-way constraints.

Traffic Data Collection

Traffic data was collected to understand existing traffic patterns in the study corridor. This included:

- Traffic volume counts
- Origin–destination surveys
- Travel time and delay studies

Field Investigation

Field & Topo surveys & Drone survey were conducted to assess road geometry, traffic movement, and right-of-way availability.

Design Standards and Methodology

Primary objective of highway engineering is to design the project road as per the recommendations provided in the Indian Road Congress (IRC) guidelines and International best practices. Proposed design standards for the project road were presented at inception stage of the project and approved from BMC.

Alignment Planning

Potential alignment alternatives were developed based on traffic demand and urban constraints.

Software Tools

Two major software tools were used:

- Google Earth Pro – alignment identification and terrain analysis
- AutoCAD Civil 3D – geometric design and corridor modelling

RESULTS AND DISCUSSION

The proposed elevated corridor provides a direct link between the Eastern Freeway and Grant Road.

Key outcomes include:

- Reduction in travel time from **30–40 minutes to approximately 6–7 minutes.**
- Improved traffic flow and decongestion on existing arterial routes like Ambedkar Road, PD'Mello Road, and Mumbai Central area.
- Reduced congestion around CSMT and Mumbai Central
- Better integration with major infrastructure projects such as the Mumbai Trans Harbour Link.

The corridor also supports long-term urban mobility planning by providing efficient east–west connectivity in South Mumbai.

CONCLUSION

The study demonstrates that the proposed elevated road corridor between Eastern Freeway and Grant Road is a feasible and effective solution to address traffic congestion in South Mumbai. The proposed infrastructure significantly reduces travel time and improves traffic mobility while minimizing land acquisition challenges. Integration with major transportation projects further enhances its strategic importance. Overall, elevated road infrastructure can play a critical role in improving urban transportation efficiency in densely populated cities.

LITERATURE REVIEW

Several studies highlight that rapid urbanization and increasing vehicle ownership have significantly increased traffic congestion in metropolitan areas. Research studies indicate that conventional road widening is often impractical in dense urban environments due to land acquisition constraints. As a result, grade-separated infrastructure such as elevated corridors and flyovers has become a widely adopted solution. Studies conducted for the Mumbai Metropolitan Region Development Authority and the Comprehensive Mobility Plan for Mumbai recommend the development of high-capacity road corridors to address increasing travel demand. Previous research on elevated corridors suggests that such infrastructure improves traffic mobility, reduces congestion, and enhances connectivity between major transportation corridors.

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