Section A-Research paper

CASE STUDY ON DELHI MUMBAI EXPRESSWAY

[1]Dr. Krishan Kumar Saini, [2]Rohit Choudhary, [3]Praveen Kumar Gahlot

[1]Assistant Professor, Civil Department Jaipur Engineering College and Research Centre, Jaipur, India

[2,3]Ph.D. Scholar, MBM University, Jodhpur, Rajasthan, India

ABSTRACT: *The Delhi-Mumbai Industrial Corridor is Only One of the largest and very important roads in the India, linking the country's financial hub with the national capital. There are currently around 80 Thousand PCUs on average in the corridor and predicted to increase to 100 Thousand PCUs during the next two to three years. Although the existing Delhi-Mumbai National Corridor has mostly six lanes, more capacity is urgently needed because the current infrastructure cannot handle the current traffic and growth needs. However, the development of continuous lanes along the road limits the widening of the Present road. Also, the Price of purchasing land and using electricity to expand existing road capacity is very Costly. The only way to increase the capacity of the highway between Delhi and Mumbai is to develop ground lines from scratch.*

The entire project will use around 8 million tons of Cement. The Delhi Mumbai Project will c rate job opportunities for thousands of civil engineers and more than half a million highway workers. By 150 km, the route will cut the present 24-hour travel time between Delhi and Mumbai to 13 hours.

Key words: *Greenfield Corridor, Golden Quadrant, National Capital, Travel Time, Infrastructure.*

INTRODUCTION

The government of India's visionary project, the Delhi-Mumbai motorway, connects the two largest economic centres of the nation: Mumbai, India's financial hub, and the country's recent capital, Delhi. The longest motorway in India is eight lanes, but depending on the volume of traffic, it could be expanded to twelve. Construction is ongoing, and NHAI is maintaining the Delhi-Mumbai Parkway (national Highways Authority of India). The Sohna-Dausa section of the Delhi-Mumbai motorway was officially opened on February 12th, 2023 by Prime Minister Modi. The inauguration ceremony also included the presence of Union Ministers Gajendra Singh Shekhawat, Nitin Gadkari, and VK Singh. Since the 14th Ferburary, the stretch of road has been accessible to everyone.

The 1350 km long, eight-lane Delhi–Mumbai throughway was built with the goal of cutting the travel time between the two largest cities in India in half. The First stone was laid by Minister Of Road Transport & Highways , Nitin Gadkari for the Delhi-Mumbai Freeway on March 9, 2019. The Mumbai-Delhi limited-access highway route will go through five states, including Gujarat (426 km), Madhya Pradesh (244 km), Rajasthan (373 km), and Maharashtra (129 km) and Haryana (171 km). The Delhi to Mumbai throughway has taken up more than 15,000 hectares of land in these 5 states. The motorway will start in Haryana at Gurgaon and travel through Rajasthan at Sawai Maduhopur and Jaipur , The path then continues.

Improved access to economic centres including Jaipur, Ajmer, Kota, Udaipur, Bhopal, Ujjain, Ahmedabad, Indore and Vadodara will result from the construction of the Delhi to Mumbai Limited-Access Highway. Approximately 80 lakh tonnes of cement could be used for the entire project. More than fifty lakh workers for throughway construction and a large number of skilled civil engineers are expected to find work thanks to the Delhi-Mumbai limited-access highway.

METHODOLOGY

Design Basis: With some changes and alterations as thought essential and negotiated with the National Highway Authority of India (NHAI) during several review sessions, the main methodology has been established usually keeping standard practises / IRC principles.

Collection and review of earlier report: In order to better understand the project and to receive comments as part of the Services, the Consultants have gathered and examined the relevant study reports. The following research studies are being taken into consideration for review:

- The Concept Report for the Development of the Delhi–Mumbai Motorway Project,
- The Road Development Plan in the Influence Area,
- The Master Plan studies within the Project Influence Area.

Additionally, additional information is gathered and compiled to create recommendations by taking the Details on

- The quarry or borrow area
- The results of soil tests, and
- Reports from geotechnical investigations.
- Studies on Traffic
- Improvement Plans for Key Communities and Locations With the Project Road.
- Existing Utility Services/Utility Plans.
- The accessibility of building supplies and the unit costs for work items.
- Current purchase rates for various land and immovable property categories

Material Investigations

As well as assessing their general accessibility, mechanical properties, and quantity, viable sources of building materials must be identified a material investigation for road construction has been conducted. This is one of the most crucial elements for the road program's steady, economical. These following material:

- Granular material for subbase works below the surface.
- Crushed stone aggregates for cement concrete works and the base, the surface, and the top sub-base.
- Sand for use as clean resources, as well as concrete, sub-base, and cement and filler.
- Manufacture materials for use in other connected projects, such as steel, bitumen, geotextiles, cement, etc.

Method for attaining super-elevation

Super-elevation is achieved by using a dual - inner edge pivot on both carriageways at various chainages. The central reservation levels are kept the same by adopting this technique.

Super – Elevation

This equation is use to determine the super elevation at curves:

$$E+F=v^2/GR$$

V = Speed of vehicle (m/s),

G = the acceleration caused in meters per second.

E = Super - elevation ratio

f = Friction Coefficient b/w a car's tyres and the ground (given as 0.15).

R = Radius, measured in metres, is represented by R.

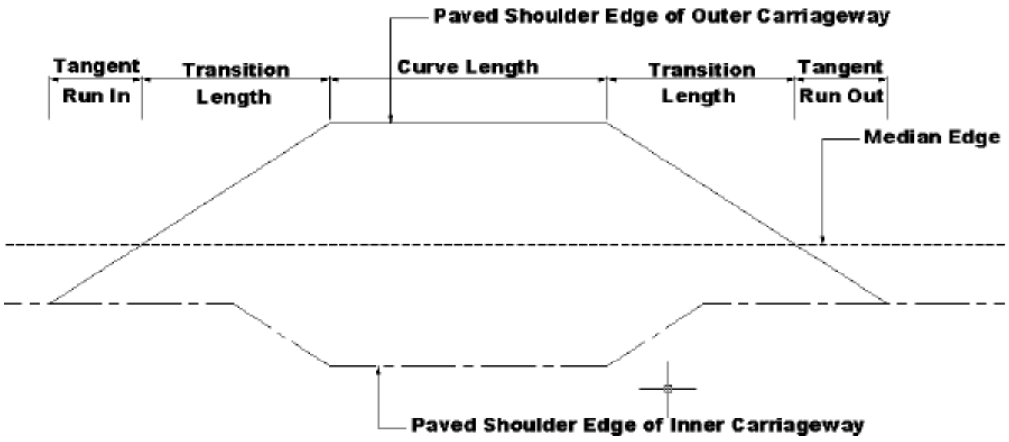

Fig 1: Technique for achieving super-elevation

The horizontal radii and gradient at various curves are taken into consideration while calculating the super elevation.

Description of the Material

Cement-Aggregate mixture(Concrete): The concrete grades are either comparable to or superior to which listed in the most recent Indian road congress: 112.

Bar(Steel): This complies with rules outlined in Part I of IS: 1786 and IS: 432.Steel for reinforcement

- Deformed bars with high yield strength that adhere to Hybrid bar or Thermal Bar (Fe500).
- Fe250 bar should not use.
- Pre-stress bar.

Guidelines for Expressways Design Approach

The greatest flood level and lowest scour levels of the bridge piers and abutments planned forthe revised alignments are designed using the hydrological and Design of hydraulic of bridges, Is a significant factor in determining the minimum required waterway. The following listcontains the many design guidelines that have been adopted most recently for bridges' hydrological and hydraulic designs.

Drainage and Protection Works

Through the DTM created from topographical survey data, the project road's and the neighborhood's drainage needs are evaluated. By include a drainage layer and, separately, camber, the internal and external drainage of the pavement are both ensured. In order to provide self-cleaning velocity during a storm, longitudinal slopes in central drains and roadside ditches are typically equal.

TRAFFIC SURVEY

Analysis and Projections Only the traffic surveys necessary for accurately forecasting the volume of traffic along the proposed route will be conducted.

- Surveys of O-D and commodity movement
- Classification of Traffic Volume Counts

For conducting traffic surveys, standard practises outlined in IRC Codes have been used. The information obtained based the surveys, there evaluated to find out the ADT of the road close to the project intended route and travel characteristics.

The following studies were undertaken in order to meet the required goals:

- Classified traffic volume in various areas
- Locations for one-day (24 hours in each direction) origin-destination surveys for passenger and commodity movements

Following a site reconnaissance, the stations for these surveys' traffic surveys were chosen, taking into account the following criteria:

- The stations covering all Roads from which traffic is diverted to the required motorway;
- Stations should be out of the influence of urban areas
- The stations should be situated good visibility.

Origin-Destination Survey

In order to better understand how commodities and people move along the research corridor, an origin-destination survey was conducted. The findings will be helpful for developing tolling techniques, identifying the toll plazas on the project road, determining the influence area of the proposed road, predicting the growth rates of traffic, and measuring the amount of traffic that can be diverted to it. A day is divided into twelve hours each for the purpose of counting, and various groups of enumerators were allocated to each shift along with a supervisor.

The survey used the roadside interview technique. Police used random sampling to stop the cars, and trained personnel documented data on the Destination of the journey, its length and frequency categories, loading patterns, and trip purpose as appropriate for different Motor Object. In order to estimate the number of tollable cars, this trip frequency will be employed. The following places were used for the survey's origin and destination points.

Evaluation of Survey Results

Analysis of Traffic Volume Count

A standardised unit known as a passenger car unit was created from the several vehicle kinds, each of which had distinct sizes and features. The Indian Road Congress' guidelines, which were outlined in "Guidelines for Capacity of Roads in Rural Areas", IRC-64-1990, were used to determine the passenger car equivalents for various vehicles. The adopted passenger car unit values (PCU). Using the survey data, it was possible to determine the features of peak hours and the hourly and daily variations in traffic composition, intensity, and composition.

Table3.1PCUvariablesusedintheanalysis (IRC64-1990)

<table>
<tr><td colspan="3">Fast Vehicles</td><td colspan="2">Slow Vehicles</td></tr>
<tr><td colspan="2">Vehicles Group</td><td>PCU Factor</td><td>Vehicles Group</td><td>PCU Factor</td></tr>
<tr><td colspan="2">Car, Jeep, Van (Passenger Vehicles)</td><td>1</td><td>Bicycle</td><td>0.5</td></tr>
<tr><td colspan="2">Auto Rickshaw < 3</td><td>1</td><td>Cycle Rickshaw</td><td>2</td></tr>
<tr><td colspan="2">Auto Rickshaw > 3,<12</td><td>1</td><td>Animal/Hand drawn</td><td>4</td></tr>
<tr><td colspan="2">2 Wheeler</td><td>0.5</td><td>Other (HCM/EME)</td><td>4.5</td></tr>
<tr><td colspan="2">Taxi</td><td>1</td><td colspan="2" rowspan="6"></td></tr>
<tr><td rowspan="2">Mini Bus</td><td>Government
School</td><td rowspan="2">1.5</td></tr>
<tr><td>Private</td></tr>
<tr><td>Standard Bus</td><td>Private</td><td>3</td></tr>
<tr><td rowspan="2">Light Commercial Vehicles (LCV)</td><td>LCV (4 Wheeled)</td><td rowspan="2">1.5</td></tr>
<tr><td>LCV (6 Wheeled)</td></tr>
<tr><td colspan="2">2 – Axle Vehicles</td><td>3</td></tr>
</table>

3 – Axle Vehicles	3	
Multi Axle Vehicles (4-6 Axle)	4.5	
Multi Axle Vehicles (> 6 Axle)	4.5	
Agriculture Tractor	1.5	
Agriculture Tractor & Trailer (Single Axle)	4.5	
Agriculture Tractor & Trailer (> Single Axle)	4.5	

Traffic Forecasting Methodology

We used the elasticity approach to estimate the growth rate of traffic. The elastic technique links changes in the relevant economic parameters to changes in traffic growth. IRC-108, 1996 states that the following could be used to create an elasticity-based econometric model for highway projects:

$$\mathbf{LogeP=A0+Al.loge(EI)}$$

P = Transportation/Traffic volume (all types vehicles)

EI = stands for Economic Indicator

A1 = is the Regression co-efficient, while A0 is regression constant.

Traffic Design

Equivalency Factors

Numerous studies have been conducted to determine appropriate values for various vehicle kinds' passenger car equivalency (PCE) in response to the need to express capacity in passenger car units (PCUs). The MoSRT&H and CRRI's road user cost studies (RUCS) are noteworthy among the studies conducted in India. It is accepted that for any particular type of vehicle, the PCE values change depending on the amount of traffic, the makeup of the route, and other factors. A factor known as the equivalency factor is used to indicate the capacity of a road by combining combining a variety of traffic into one unit. The passenger car unit (PCU) is typically used.

Table2:EquivalencyFactor

S.NO.	TypeofVehicle	FactorofEquivalency
1.	MotorVehicle	0.50
2.	vehicleforpassengers,pickup	1.00

3.	light vehicle,Agriculturetractor	1.50
4.	HeavyBusandTrucks	3.50
5.	TrailerandTractor	4.50

CONCULSION

Therefore, the ambitious Delhi–Mumbai motorway project by India aims to build a strong economic foundation with a globally competitive environment and cutting-edge infrastructure to stimulate local commerce, increase foreign investment, and achieve sustainable development.

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