

Highway Network System: A Case Study of Jaipur-Jabalpur Highway (NH-12)

Gitish Manish Gupta¹, Himanshu Meena², Arvind Meena³, Lovkush Meena⁴, Khushiram Meena⁵, Ishfaq Ul Abass^{6*}

^{1,2,3,4,5}B.Tech. Student, Department of Civil Engineering, Vivekananda Institute of Technology, Jaipur, India

⁶Assistant Professor, Department of Civil Engineering, Vivekananda Institute of Technology, Jaipur, India

Abstract: This responsibility is crucial for our works, it assists with interfacing special city groups and makes certain their health even as on the equal time voyaging. Through these introductions, we want to disclose to you the way to interface exclusive city regions and cities, the way to foster them, and raise mechanical location around them by means of associating them with a standard thruway. The thruway organizing framework facilitates interfacing unique towns, metropolises, urban groups, and the essential waste framework into geologically and profoundly vicinity. The critical need in Jaipur is to do the contemporary stone condition. The stone type is basalt whose porosity listing is extremely excessive. The cartoon of the project cowl under these entries thru moving/sloping panorama of Kota. This sketch is going predominantly thru thane dist. The arrangement's width is extraordinary from 6m-9m. The venture street is a course roadway the street geometrics are terrible and this is some sharp bend and corporation slope at numerous regions. There are 40 courses and 1 bridge. Which required a best for giving structures management frameworks. Pradesh and in the long run close an intersection with NH-12 near Kota, RJ. The project street is stretches of NH12 framing a part of task street go through 4 locales of Rajasthan viz. Jaipur, Kota, and Jabalpur. The whole length of NH-12 is 875Km a record map showing the challenging road appended.

Keywords: alignment, cross section, intersection, materials, NH-12, road network.

1. Introduction

NH-12 is a National Highway in India that runs altogether in West Bengal. It runs from its intersection with NH-27 at Dalkhola ending at Bakkhali. NH-12 begins from its intersection with NH-27 at Dalkhola in Uttar Dinajpur region and passes by means of Karandighi, Raiganj, Gajol, Malda, disregards the Farakka Barrage across the Ganges River and afterward passes through Farakka Barrage Township, Morgram, gets the Bhagirathi and goes through Baharampur, Beldanga, Rejinagar, Palashi, Debagram, Dhubulia, Krishnanagar, Shantipur, Phulia, Ranaghat, Kalyani, Barasat Barasat (NH-12 from Barasat to Sonatikri is greater famous as Jessore street, and thereafter it's miles extra famous as Nazrul Islam Sarani or VIP road), Teghoria, Bidhannagar, then, at that point will turn out to be important for E.M. pass in Kolkata until Rajpur Sonarpur and goes through Narendrapur, Harinavi,

Baruipur and Amtala, in which it transforms into part of Kolkata-Diamond Harbor road till Diamond Harbor, lastly passes by means of Kulpi, Kakkdwip and Namkhana with ship crossing all through the Hatania, Doania river and ends at Bakkhali, legitimate at the Bay of Bengal. The piece of NH 12 from Dalkhola to Barasat transformed into ahead of time known as NH-12. The piece of NH-12 from Amtala to Bakkhali transformed into ahead of time a piece of NH-12.

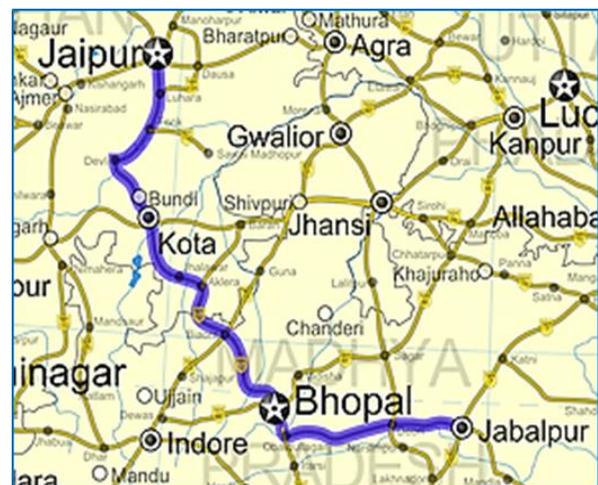


Fig. 1. Road map of NH-12

Streets are a major part of the transport of India. India has an organization of more than 5,897,671 kilometers (3,664,643 mi) of streets starting at 31 Walk 2017. This is the second-biggest street network on the planet, after the US with 6,645,709 kilometers (4,129,452 mi).

At 1.80 kilometers (1.12 mi) of streets per square kilometer of land, the quantitative thickness of India's street network is equivalent to that of Germany, and considerably higher than the US (0.68 km, 0.42 mi), China (0.49 km, 0.30 mi), Brazil (0.18 km, 0.11 mi) and Russia (0.09 km, 0.056 mi). Adapted to its enormous populace, India has roughly 4.87 kilometers (3.03 mi) of streets per 1,000 individuals, which is a lot lower contrasted with created nations.

It contributed 4.7% to India's GDP. This is in contrast with

*Corresponding author: ishfaqulabass@vitj.ac.in

rail routes, which contributed 1% from 2009 to 2010. Kerala with a street organization of 5,268.69 km per 1,000 sq. km outperforms any remaining states while Tripura with a street thickness of 3,026.23 km per 1,000 sq. km positions second, according to figures of the year 2008 in monetary overview 2011-12.

Since the 1990s, significant endeavors have been in progress to modernize the back road's framework. The length of public roadways in India has expanded from 70,934 km (44,076 mi) in 2010–11 to 132,500 km (82,300 mi) in 2019. As of May 2017, India had finished and set into utilization more than 28,900 kilometers (18,000 mi) of at least four path roadways.

A. Rajasthan Network System

The all-out street length which was only 13,553 km in 1949 expanded to 2,17,707.25 km up to Walk, 2016. The street thickness in the state is 63.61 km per 100 sq. km toward the finish of 31 March 2016, which is much beneath the public normal of 166.47 km.

Various public parkways join Rajasthan to different pieces of India. The most popular parkway in the state is Public Roadway 8. It is the most seasoned roadway with 4-8 paths in the country. The street organization of Rajasthan is profoundly noteworthy and called Rajasthan Public Thruway or "RJ SH". Altogether there are 20 Public Roadways that reach out to 5,713 km along with 85 Public Interstate which is stretched out up to 11,716 km.

B. Scope of the Project

The scope of the project is based on the NH-12 which is connecting the two cities named Jabalpur and Jaipur. We consider the different points to check the proper construction and find out the different faults in it and also give the solution. The different considerations are as Development, Alignment, Highway material, Design Parameters, Subgrade investigation.



Fig. 2. Pic Showing Carriageway of NH-12

2. Literature Review

Rod Troutbeck, Dennis Walsh, Miranda Blogg, (2016), Worldwide Discussion on Improving Roadway ELSEVIER Execution Overseeing motorways and metropolitan arterials in Australia: Nation Report for Australia 122 Bar Trout beck,

Dennis Walsh and Miranda Troutbeck and Partners, Australia and Queensland College thought of the metropolitan blood vessel organization. It is subsequently essential to consider the to be in general taking note of that drivers will in general change their courses so both the motorways and the blood vessel should work as one to give the degree of administration to the client. It is consequently significant that the exhibition of the blood vessel street framework be amplified.

Promotes Saha, Khaled Ksaibati, An Enhancement Model for Improving Thruway Wellbeing Promotes Saha, Ph.D., Post-Doctoral Exploration Partner, Khaled Ksaibati, Educator, Head of Wyoming LTAP. Diary of Traffic and Transportation Designing (English Release) Date: 2 November 2015 Updated Date: 29 January 2016 Acknowledged Date: 31 January 2016 kindly refer to this article as Saha, P., Ksaibati, K., An Enhancement Model for Improving Thruway Wellbeing, Diary of Traffic.

Takashi Oguchi, Tokyo, Japan (Got February 4, 2008) Upgrading of the traffic framework on thruways, roads and roads is very significant, when viewpoints, for example, network plan, mathematical plan, traffic light, activity, guideline and implementation of streets are considered as a bound together framework. Transport work comprises of traffic capacity and access capacity, and there are a few organization classes relying upon the equilibrium of these two capacities for every street classification. Every street network class could have an objective Degree of Administration (LOS). The way toward updating the vehicle framework on parkways.

Pu Wang, Like Liu, Xiamiao Li, Guan Liang Li, Marta C González, (2005) the open access diary at the cutting edge of physical science. Experimental investigation of long-range associations in a street network offers new element for route advancement models Pu Wang, As Liu, Xiamiao Li, Guan Liang Li and Marta C González School of Traffic and Transportation standards for ideal vehicle organizations; notwithstanding, the movement cost of long-range associations was not considered in past models. We characterize long-range association in a street network as the briefest way between a couples of hubs through expressways and exactly break down the movement cost properties of long-range associations.

Xiaojing Wang, Fan Zhang, Bin Li, Jian Gao, Strategy diary landing page www.elsevier.com/find/cstp Formative example and global participation on shrewd vehicle framework in China Xiaojing Wang, Fan Zhang, Container Li, Jian Gao Exploration Establishment of Roadway, Service of Transport and Public Keen Vehicle Frameworks Focal point of Designing and Innovation, No.8 Xi Tu Cheng Street, Beijing social and monetary turn of events. What's more, arising of the advancements are likewise connected with the social and financial turn of events. Appropriately, Savvy Transport Framework (ITS) has developed with Chinese social and financial change. During the 1990s, China began an enormous scope development of street framework.

Xiaoming Lyu, Qi Han, Bauke de Vries, Procedural metropolitan demonstrating of populace, street organization and land use Xiaoming Lyu, Qi Han, Bauke de Vries Eindhoven College of Innovation, PO Box 513, 5600MB Eindhoven, the

Netherlands Unique This paper presents a metropolitan recreation framework creating metropolitan designs with populace, street organization and land use layers. The ideal metropolitan spatial construction is acquired by producing populace map dependent on populace thickness models. The street network is produced at three spatial levels comparing to the street progressive system.

3. Methodology

A. General task street points of interest

The errand road occurs off from Km 549.200 of NH-3 in Kalyan and terminations at Km 336.600 (junction of NH 222 with NH 211). The outright length of the endeavor road portion is 284.600 Km. The stretch from Km 232.000 to Km 284.000 isn't significant for the endeavor road. The length covered under this pack is from Km 64 to Km 101.

Existing Alignment/Geometrics: The stretch of the endeavor road cover end under this pack goes through rolling/a lopsided area of Kota. This stretch goes basically through Jaipur Dist. The Option to continue changes from 15m to 20m. The advancement width varies from 6m to 9m. The endeavor road is 2 Path thoroughfare. The road geometrics are poor and there are some sharp twists and solidified tendency at various regions.

Terrain: The Street region goes through a rolling and uneven area.

B. Cross Sectional Details

- *Right of Way (ROW):* The column differs from 15m to 20m as seen at the site and halfway joined from state PWD. Anyway, precise ROW is being gathered from State Revenue Authorities.
- *Roadway:* - The development width goes from 7m to 10m in moving regions and it goes from 6m to 9m in uneven regions in Kota.
- *Carriageway Width:* - Project Street as asphalt of 7.0m width.
- *Pavement condition:* The black-top condition of the current road is sensible having surface appearance such as breaking, potholes and black-top surface is bitumen achieving pitting proper to loss of bitumen folio and dislodgement of absolute particles at places.
- *Junction:* There are all out 32 convergence out of which 23 nos are LHS intersection, 8nos are RHS intersection and 1nos is Culverts. There are 40 nos. of courses in this stretch of the undertaking street, the kind of existing ducts are as per the following:
 - Hume Pipe Culverts: 36 Nos.
 - Slab Culverts: 04 Nos.
 - *Bridges:* There is 01 framework on this stretch and this is a minor augmentation.
 - *Service Road:* There is no assistance street on the venture street segment.

C. Development of NH12

In 2020, a stretch of 66 km were augmented from Jagulia to

Krishnanagar in Nadia. In 2021 association financial plan, focal government designated interstate tasks for four political decision bound states, of which ₹25,000 crore was dispensed for the advancement of 675 km of this expressway. Additionally, in 2020, request is pass in NHAI to reproduce the asphalt between two locale named (Krishnagarh & Kota) and this undertaking cost ₹500 crore up to the length of 285 km.

D. Alignment of NH-12

The Current street arrangement goes through Center Space of Mukundra Slopes Tiger Hold from km 291 to km 298. The arrangement goes through a few towns and towns some of which have developed mixtures in closeness to the street. Some of significant towns, for example, Sarvada, Dabadeh, Suket, Jhalawar and Jhalrapatan will expect sidesteps to try not to exist blocked stretches and to guarantee consistent progression of traffic and save travel time too.

E. Material used in NH-12

A wide assortment of materials are utilized in the development of streets these are soils (normally happening or prepared), totals (fine totals or coarse totals got from rocks), covers like lime, bituminous materials, and concrete, and incidental materials utilized as admixtures for improved execution of streets under hefty loads and traffic. Soil establishes the essential material for the establishment, subgrade, or even the asphalt (for minimal expense streets with low traffic in country regions). At the point when the interstate is built on a bank at the ideal level, soil establishes the essential dike material; further, since all designs need to eventually lay on and send burdens to 'mother earth', soil and rock likewise fill in as establishment materials. Consequently, base courses, sub-base courses and surprisingly the surface or wearing courses require the utilization of these materials.

a) Soil: Soils can be concentrated successfully on the off chance that they are ordered by specific standards into an unmistakable framework. A framework is an arranged gathering of specific components in order as indicated by pre-characterized standards. Similarly, as arrangement or gathering is drilled in logical trains like science, zoology, and herbal science, it is utilized in Geotechnical Designing too. A dirt characterization framework might be characterized as a principal division of the different kinds of soil into bunches as per certain boundaries like its actual properties, constituents or surface, field execution under load, presence of water, etc. There is a couple of field's recognizable proof tests that have been produced for fundamental ID in the field.

b) Aggregate: Stone total, or mineral total, as it is called, is the main part of the materials utilized in the development of streets. These totals are gotten from rocks, which are shaped by the cementation of minerals by the powers of nature. They are utilized for granular bases, sub-bases, as a feature of bituminous blends and concrete cement; they are likewise the essential segment of a moderately less expensive street, called water-bound macadam.

c) Bituminous Materials: Bitumen was utilized as a holding and water-sealing specialist millennia prior. Nonetheless, the

utilization of bitumen for street making got distinctly in the nineteenth century. As the mission for energizes like oil to run vehicles developed and the refining of raw petroleum arose as a significant refining industry, the buildups known as bitumen and tar discovered expanding use in developing bituminous surfaces, which gave predominant riding surface.

F. Design parameters of NH-12

General: Criteria for deciding the asphalt (adaptable). Thickness is an upward compressive strain that goes to the subgrade because of the standard hub loaded of extent 8.17 KN (8170 kg) if more than this causes perpetual distortion in the type of rutting. The greatest rutting can be acknowledged in Town Street as 50 mm before upkeep and the insightful assessment should be possible as per IRC: 37. For unbending and semi-inflexible asphalt ductile pressure is taken as the plan measures. There are surfacing workers for hire like Harris Surfacing who can help you.

Traffic: According to the IRC: 37 configuration traffic ought to be 0.1 to 2 MSA (million standard axles). The weight of a business vehicle (loaded) is considered as 3 tons or more. For configuration traffic, we think about the current traffic and pace of development. Traffic study should be done consistently with the Indian Road Congress Code: 9.

Design life: The no. of years to be taken until the significant remaking. Plan life relies on the natural conditions, materials utilized, support, and so on for parkway streets plan a life of 10 years is thought of. In low-volume streets for the slight bituminous surfacing plan life of 5 years is thought of.

Cross Drainage Structure in NH-12: The plan cycle can be parted into three compartments, specifically,

- Siting or finding
- Hydrological perspective
- Design (shape and material).
- General condition.
- Connectivity of seepage turnouts into the regular geology.
- Condition in cut areas.

4. Results and Discussion

According to the Traffic Reports, the project features are as follows:

- 149 km of 4-lane pavement.
- 36.76 km of service road
- 01 major bridge
- 23 minor bridges
- 04 flyovers
- 124 culverts
- 03 pedestrian underpasses
- 05 cattle underpasses
- 11 vehicular underpasses
- 25 major intersections
- 32 bus bays
- 02 toll plaza complexes.

After the study on National Highway-12, we all found that the construction of highway is done in a very commendable

way. The obligatory points that taken by surveyor of company done excellent job.

And also the embankment is constructed by red soil with perfect compaction and also the material used in pavement construction is also good.

The physical qualities of NH-12 is astatically very nice Near Kota city due to the major bridge near Kota city on river Chambal (named as hanging bridge). Also the laying of pavement is done by engineers is very well and the camber is perfectly constructed very wall.

5. Conclusion

- In this venture we need to show the investigation of National Highway-12 by the actual speciation's and furthermore with the astatically see and furthermore by the nature of the material they use in development.
- We identify all the design which are built on NH-12 resemble as courses, significant extension, minor scaffold, bends sidestep, cost plazas, and so forth. The NH-12 is a 4-Lane Highway with Bituminous and Concrete likewise at sidesteps and the width of NH is additionally build based on Indian Road Congress.
- In National Highway the camber is given 2% which is additionally great according to IRC. The span of the bends and super height is likewise correct and because of this, there are no hazardous bends are there where a high no of mishaps occur.
- The cross waste of asphalt is significantly developed so no amassing of water is takes place. It is generally acknowledged that Government offices in the street development and the board business area mean to accomplish an incentive for their speculation as they secure street development industry administrations.
- As Government declares any street development undertaking and looks for obtainment for administrations, a few project workers apply, and it is mind-boggling to survey advancement in these recommendations on a similar premise.
- This requires a few factors, e.g. clear undertaking definition, what's happening (advancement), past experience for the proposed project. Notwithstanding, it's difficult to evaluate development on a near delicate appraisal premise. The point of this paper is to dissect distinctive contextual analyses with regard to development in the street development industry.

References

- [1] Government of Rajasthan Public Works Department. Point by point Project Report, 4 Lanning by giving CC Pavement from Kota to Dara (Kota - Jhalawar region) from 256/500 - 289/550 within the district of Rajasthan.
- [2] Khanna, S. K., Justo, C. E., & Veeraragavan, A. Highway Materials And Pavement Testing, 2015.
- [3] Madhya Pradesh carriageway Development Corporation Ltd. (2012). Request for Qualification (RFQ) For Construction of 4 Lanning of Jabalpur - Bhopal (Nh-12) On Bot Basis (462 011).
- [4] Service of Law and Justice. (2013). The proper to reasonable remuneration and straight for wardness in land procurement, recovery and resettlement act 2013 (DL-(N)04/0007/2003-13). <http://indiacode.nic.in/acts-in-pdf/302013.pdf>

- [5] Research, Development, and Technology Turner-Fairbank Highway research facility (1999). Safety Effects of the Conversion of Rural 2-Lane Carriageway to 4-Lane Carriageway.
- [6] D. B. Payne and J. R. Harsh, "Frequency exchanged passively coupled single-mode optical organization," in Proc. IOOC-ECOC, 1985.
- [7] Richard W. Lyles, Abrar Siddiqui, M. William C. Taylor, Bilal Z. Malik, Gregory Sivy & Tyler Haan. (2012)". Michigan Department of Transportation. pp. 585–590
- [8] Tiza Michael. T, & Bhavesh Joshi. (2016). Impact of Horizontal Alignment on Traffic Flow Characteristics of National Highway NH - 12. *International Journal of Engineering, Science and Computing*, 4(6), 3886-3893.
- [9] IRC: 37 "Tentative Guidelines for the Design of Flexible Pavements", Indian Roads Congress, Indian Roads Congress, New Delhi, 2012.
- [10] IRC: 9, "Traffic census in non-urban roads", Indian Roads Congress, Indian Roads Congress, New Delhi, 1972.