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Planning of Intersection Facilities of Pune Ring Road; Pertaining to the Safe System Approach

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ABSTRACT: Pune Metropolitan area is developing very fast with major IT and Automobile industries located in and around Pune. At present the entire traffic from these Highways is passing through Pune city Road along with the local traffic. As such it was proposed to build a 172 KM long Ring Road around Pune city to serve huge traffic demand. The Pune Ring Road is divided into two parts as Eastern & Western Ring Road. As there are Seven major National Highways, Expressway and Ten State Highways are passing through Pune city. There is need to design and develop proper Interchanges. There are 18 interchanges planned. It is need of hour to design accommodative, Safe and economical interchanges for faster and uninterrupted traffic flow.

I. INTRODUCTION

The Metropolitan population of Pune area, as per 2011 census is more than 50 Lakhs. Seven major National Highways, Expressway and Ten State Highways are passing through Pune city. At present the entire traffic from these Highways is passing through Pune city Road along with the local traffic. The vehicular population of Pune and Pimpri-Chinchwad is almost above- 33 Lakhs with growth rate of 8.64% per year.

The population of Pune, vehicle density and Highway traffic using city roads have added to the congestion, pollution and traffic jams leading to wastage of fuel, time and many fold increase in accidents. In view of this it was felt necessary to divert the traffic which wants to cross Pune city to travel to further destinations, for which a ring road around Pune city is necessary. So it was planned to develop 172 KM long Ring Road by the Ministerial Infrastructural Committee to facilitate the movement of such traffic. The Pune Ring Road is divided into two parts as Eastern & Western Ring Road. As there are Seven major National Highways, Expressway and Ten State Highways are passing through Pune city. There is need to design and develop proper Interchanges. There are 18 interchanges planned. It is need of hour to design accommodative, Safe and economical interchanges for faster and uninterrupted traffic flow. The design of Interchanges is based on IRC -92 2017 guidelines. So while designing factors like Design Vehicle, Ramps, Grade and Profile, Road Cross-Section, Ramp Terminals, Geometric Clearance, Super-Elevation on Ramps, Cross-Section of Major and Minor Road are taken in to consideration.

• Objective:

The basic objectives of this project is 1. To study the factors affecting design of interchange 2. To find conflict points and provide uninterrupted traffic flow between traffic of two Highways 3. To provide Safe access across Expressway and other NHs 4. To increase capacity by replacing critical intersections on an expressway 5. To design interchange according to topography to reduce cost.

II. LITERATURE REVIEW

Aram Ali (2010) studied the safety factor of the horizontal curve of a Two-Lane Highway and added that the horizontal curve has a higher accident rate than the straight part of the same length and traffic composition. This

difference becomes apparent when the radius is less than 1000m. The increase in collision rate below a radius of 200 m is especially noticeable.[1]

Aswad Mohammed Hameed (2013) The shoulder widths above 2.25 m were stated to provide additional security. The average single-vehicle accident rate on the freeway curve is about four times the average single-vehicle accident rate on highway tangents. Horizontal curves are more dangerous when combined with slopes and surfaces with a low coefficient of friction. There is only a slight decrease in speed expected by the driver approaching the turn with a radius significantly smaller than the minimum radius specified for the design speed. Horizontal rotation is more dangerous when combined with sloped or low friction surfaces. Horizontal curves have a higher accident rate than straight sections of similar length and traffic composition. Differences become apparent with radii less than 1000m. The increase in fall rate is especially noticeable at radiuses of less than 200 m. [2]

Fitzpatrick Kay et. al. (2008) developed AMEs for median characteristics on urban and rural freeways and on rural multilane highways. A series of negative binomial regression models was used to determine the effects of independent variables on crashes. [3]

Hadi Mohammad A. et al. (1995) Negative binomial regression analysis was used to estimate the impact of cross-sectional design factors on overall accident mortality and injury rates on different types of rural and urban highways at different traffic volumes. The results show that increasing lane width, average width, and inner road shoulder width can help reduce accidents, depending on the type of expressway investigated.[4]

Hong Sung-Joon et. al. (2005) It was discussed to properly evaluate the actual geometric design of the highway and to propose a balanced design policy, especially considering the driver's perception and behavior. In this task, after classifying all the design elements, we will introduce and consider a new concept of backward calculation speed as a road layout evaluator. Analysis of the actual linear backward calculation speed on Japanese highways reveals the driver's perception of the physical limits imposed by the road alignment. The vehicle detector database is then used to estimate and analyze the actual operating speed of the vehicle. Using the 5-minute average speed of observing only one vehicle with the central lane detector of Japan's highway network of 7,000 km or more, the speed during self-sustaining driving is reasonably "driving speed" (free speed). You can guess. Finally, speed values are evaluated using highway design factors such as horizontal radius of curvature and vertical slope. Road shapes should be designed with vehicle traffic safety and efficiency in mind, especially on highways and highways where traffic functionality is paramount. The horizontal radius of each point is approximately proportional to the square of the calculated inverse velocity of in the future, the back-calculated speed will be changed to reflect not only the shape of the road but also the factor of safety.[5]

Jha Manoj k. and Schonfeld Paul (2004) It turns out that optimizing highway alignment based on cost minimization requires comprehensive formulation of routing-sensitive costs and the development of efficient solution algorithms. To solve real-world problems, optimization algorithms need to work directly with GIS to store relevant geographic information such as land boundaries, environment-sensitive areas, and terrain data. Highway route optimization models that integrate GIS with genetic algorithms also consider optimization in confined spaces that realistically reflect the various costs of route selection and the limitations of road improvement projects. [6]

Karlaftis Matthew G. and Golias Ioannis (2001) Using a rigorous nonparametric statistical technique known as hierarchical tree-based regression, we focused on the relationships between local road geometry, accident rates, and their predictions. You have two goals. First, we developed a methodology to quantitatively evaluate the effects of various geometrical properties of highways on accident rates, and then we developed simple yet basic and mathematical methods for predicting accident rates on local roads. Provides a healthy way to. The results show that the importance of isolated variables differs between two-lane and multi-lane roads, but the "geometric design" and "road conditions" variables are the two most important factors influencing accident rates. [7]

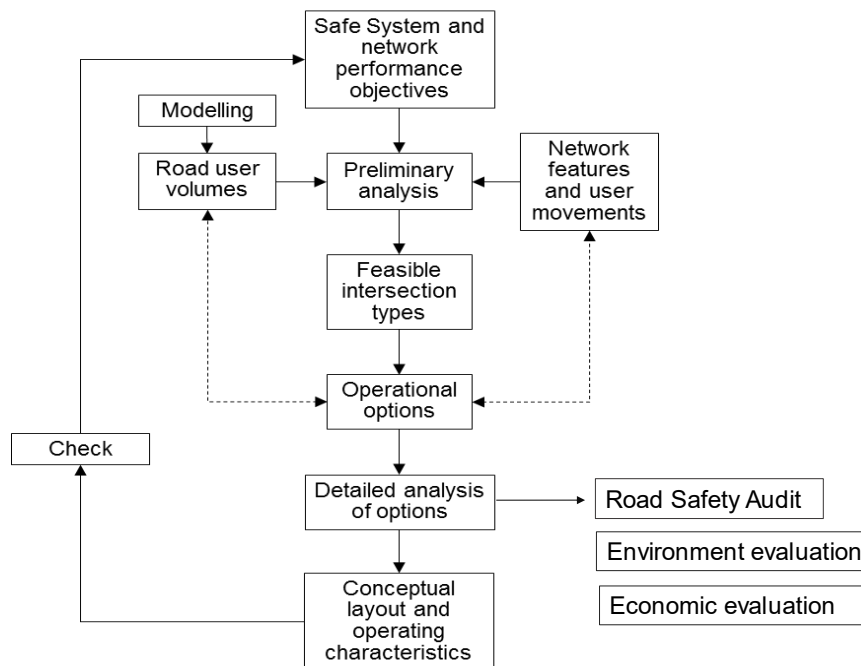
Kumar Ashok et al. (2015) used MXROAD Software for the geometric design of the existing state highway (SH 131) in Maharashtra to improve its, geometric features and upgrading it from two lanes to four lanes. The Software uses 3D string modelling technology and gives the desired values of different components of geometric design such as Horizontal and Vertical Curves, Superelevation, Shoulder, etc. [8]

Reddy Marri Srinivasa et al. (2019) Demonstrates the complete geometric design of a typical highway using Autodesk Civil3D software. The purpose of this project was to show how to carry out the geometric design of roads easily and accurately in the shortest possible time. A road design process using Autodesk Civil 3D was presented. The same manual geometric design was also performed, and the results were comparable to the results of Autodesk Civil 3D. [9]

III. RESEARCH METHODOLOGY

- **Aim of Designing an Interchange with SSA:**
- Safe System approach: To provide a safe road and traffic surroundings in which death rate of responsible road user or serious injuries as a result of a crash should be minimum or nil.
- Interrelationship between road infrastructure, travel speeds, road users and vehicles.
- Potential collisions are avoided.
- Pune Ring Road is designed as Expressway for speed of 120 KMPH so every intersection is designed as an interchange.

IV. CONCLUSION



➤ **With help of Safe System approach the original designs of interchanges of Pune Ring Road are changed to adopt for**

1. Smooth, safe and faster traffic flows on all Expressways and NHs.
2. By fitting System Interchanges at all Intersections undue congestion on the feeder roads is avoided an uninterrupted traffic flow is obtained on expressway.
3. The interchange at Expressway is designed according to topography to reduce cost.

➤ **Scope for Future Study**

- More complex problems may be studied to check the capabilities of software in handling complex situations.



- Software like Civil 3d, Bentley OpenRoads Designer, Bentley MX Road and other road designing software available in the market may also be incorporated in future studies to recommend the most suitable software in the market.

REFERENCES

1. AASHTO, 2001, A Policy on Geometric Design of Highways and Streets (Fourth Edition), Washington, D.C.
2. Department of Transport and Main Roads, 2014, Road Planning and Design Manual (Second Edition) Queensland Government
3. Design Manual, 2015, Washington State Department of Transportation
4. Dubey. M., et al., (2015). Traffic Flow Characteristics for Merging Sections on Arterial Roads, New Delhi: School of Planning and Architecture
5. Dubey Mayank, Dr. Ram Sewa, Sanyal D., (2013). Capacity of Weaving Sections on Urban Roads, Urban Mobility India
6. <http://www.kurumi.com/roads/interchanges/gloss.html>
7. <http://dictionnaire.sensagent.leparisien.fr/Road%20interchange/en-en/#Diverging> diamond_interchange
8. <http://onlinemanuals.txdot.gov/txdotmanuals/lad/interchanges.htm#i1003242>
9. **10. National Codes and Guidelines**
10. IRC 72- 2017"
11. IRC:106 "Guidelines for Capacity of Urban Roads in Plain Terrain" IRC:35 "Code of Practice for Road Markings"
12. IRC:SP:84 "Manual of Specifications and Standards for four-laning of Highways through Public Private Partnership"
13. IRC:78 "Standard Specifications and Code of Practice for Road Bridges" IRC:SP:42 "Guidelines of Road Drainage"
14. IRC:67 "Code of Practice for Road Signs"
15. IRC:37 "Tentative Guidelines for the Design of Flexible Pavements" IRC:SP:90 "Manual for Grade Separators & Elevated Structures" IRC:SP:21 "Guidelines on Landscaping and Tree Plantation"
16. IRC:SP:19 "Manual for Survey, Investigation and Preparation of Road Projects"
17. New Jersey Department of Transportation, 2008, Bicycle and Pedestrian Safety Needs at Grade-Separated Interchanges, New Jersey Bicycle and Pedestrian Resource Center
18. **International Codes and Guidelines** 1. CD 109 Revision 1 Highway link design- DMRB. CD 127 Cross-sections and headroom's- DMRB.



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