Geometric Design Of A Highway Using Mx Road

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Abstract- *This study addresses the need for road widening to accommodate increasing traffic intensity on the Vijayawada Highway (30.8 km). Road widening can improve traffic performance by increasing capacity, though it may also attract more users. The research involves analysing the effects of road widening on traffic flow and safety, using Bentley MX Road software for road geometric design. The project includes importing existing road geometry into the software, applying design standards, and generating alternatives for optimization. The redesign aims to improve efficiency, safety, and compliance with standards while minimizing costs and environmental impact.*

Keywords- road widening, traffic performance, road capacity, geometric design, Bentley MX Road, Vijayawada Highway, safety, traffic flow.

I. INTRODUCTION

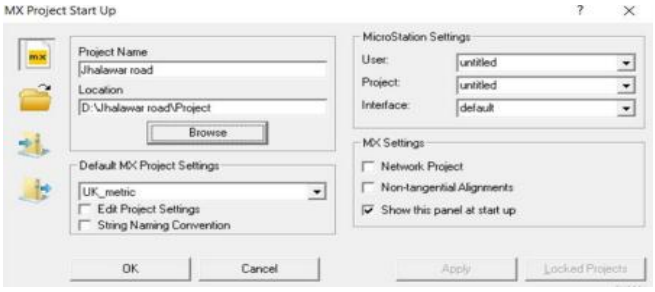
Roads are the primary mode of transportation in India, with a vast network extending over 5.89million kilometres, making it the second-largest road network globally, just behind the United States with its 6.65 million kilometres. These roads are vital for the movement of people and goods across the country. India's national highways, connecting major cities, are classified based on the width of their carriageways. However, the country's main roads are currently under immense strain, requiring significant modernization to keep up with the growing demands of theonomy's traffic volumes in India continue to rise, maintaining existing roads and expanding them to accommodate more vehicles is essential. Widening roads to handle increased traffic flow will also facilitate higher average travel speeds. Therefore, it is critical to redesign the current road infrastructure to support the surge in vehicle movement efficiently. The expansion of road projects across India underscores the need for precise, efficient design methods to meet modern transportation demands.

Another major concern is the increasing number of road accidents, often attributed to poor road design. In India, many accidents are caused by inadequate sight distance, particularly on curved roads. Designing curves with appropriate sight distances is both a challenging and time consuming task. For example, the Krishna district road stretch is surrounded by buildings, shops, offices, schools, and parks, with sharp curves that have very small radii—some as tight as 50 meters—forcing a significant reduction in design speed. A rigid pavement is constructed from cement concrete or reinforced concrete slabs. Ground concrete roads are in the category of semi-rigid pavements.

Research by Jesna N.M. and M.V.L.R. Anjaneyulu on two-lane highways has shown that the safety of horizontal curves is primarily dependent on their radius. Their findings indicate that as the curve radius increases, so does the safety or reliability index. Larger curve radii allow for safer, smoother travel.

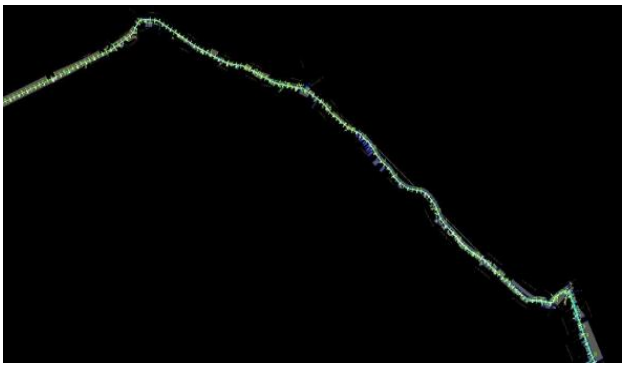
To address these challenges, advanced road design software such as MX Road or Open Roads Designer by Bentley can be employed. These tools enable efficient and accurate road design, providing precision in calculations and saving valuable time. MX Road, for example, offers 3D visualization, giving designers a comprehensive view of the road layout, including earthwork and horizontal and vertical profiles. In this project, the road's horizontal and vertical alignments will be reconfigured to ensure adequate sight distances and increased curve radii, allowing vehicles to travel at higher speeds while maintaining safety.

1. Importing necessary data
2. Rename the data file as 'spot.csv'.
3. Create a folder on the drive named 'Jhalawar Data' and include two subfolders within it named 'Raw Data' and 'Processed Data'.
4. Copy the 'spot.csv' file into both the 'Raw Data' and 'Processed Data' folders.
5. When opening the data processing software, a dialogue box will appear; click on 'Create New Project'. Name the project 'Jhalawar Data' and click on 'Browse'.
6. In the browse tab, navigate to D:/Jhalawar Data/Processed Data and click 'OK'.

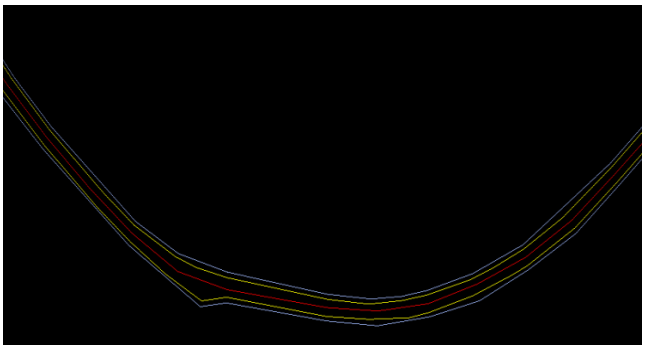


Creating new model

1. In the data conversion tool, create a model named 'DATASET'.
2. Within the 'DATASET' model, define all relevant parameters such as Categories, Fields, Data Types, and Labels based on the requirements for the new data structure.
3. Next, navigate to Display > Clear Display…, and then Display > View with Style Set…, select the 'DATASET' model and click OK.
4.A new window will open, displaying the selected parameters from the existing data profile.
Rigid pavements are those which posses note worthy flexural rigidity.



GROUND model displaying the selected parameters for new design



Steps:
Now go to Design> Quick Alignment> Horizontal Design…, in the displayed tab create a new model 'DESIGN' and name string as 'MC00' and click Next.

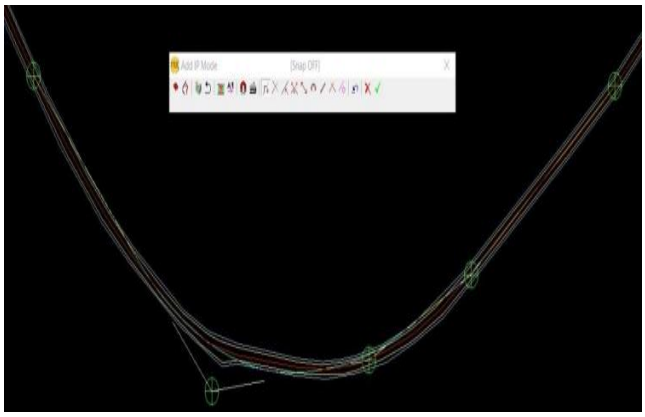
Defining Intersection points for new centreline

1) A new dialogue box, as illustrated below, will appear to define key intersection points for the new data alignment.
2) After defining these points, click the checkmark. The new data alignment will be displayed with the specified values, provided there are no conflicting data intersections.

Steps:

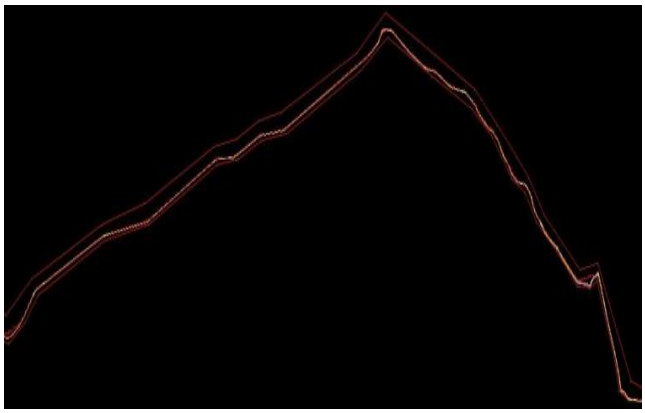
1)Now go to Design> Quick Alignment> Horizontal Design…, in the displayed tab create a new model 2)DESIGN' and name string as 'MC00' and click Next.
Defining Intersection points for new centreline

A new dialogue box, as illustrated below, will appear to define key intersection points for the new data alignment.



ANALYSIS OF VERTICAL ALIGNMENT

First, clear the display and load the 'DATASET' model as defined earlier.
• Next, go to Modify > Edit Records > Create a Record Dynamically… A dialogue box will appear. Define the boundary where the data triangulation is to be performed.



PAYMENT DESIGN

Go to Design> Pavement and Subgrade Design…, enter reference model as 'DESIGN' and reference string as 'MC00' in the dialogue box shown and click Next.

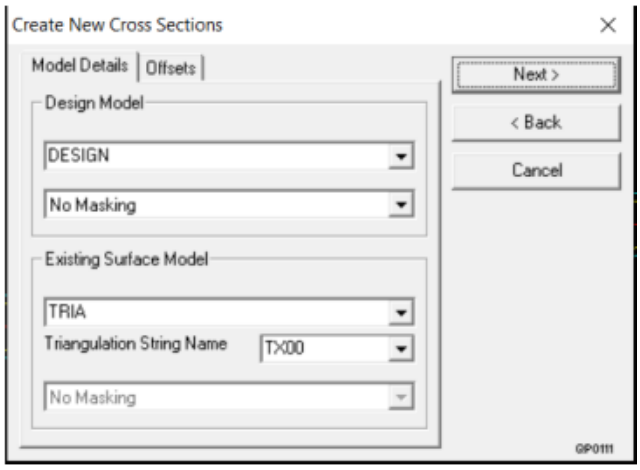
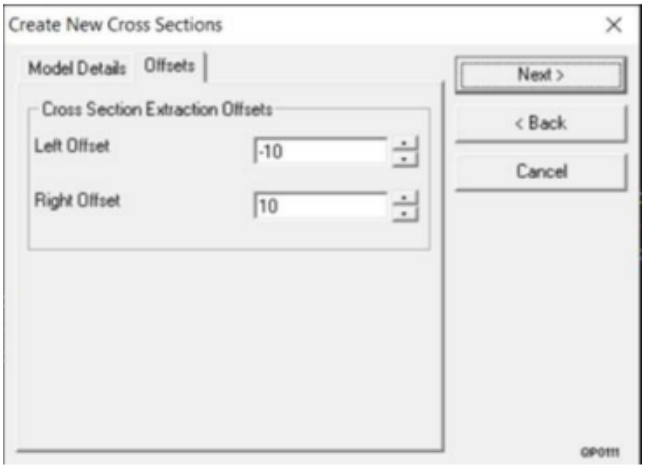


Fig. No. 4.9.1 Defining models and strings



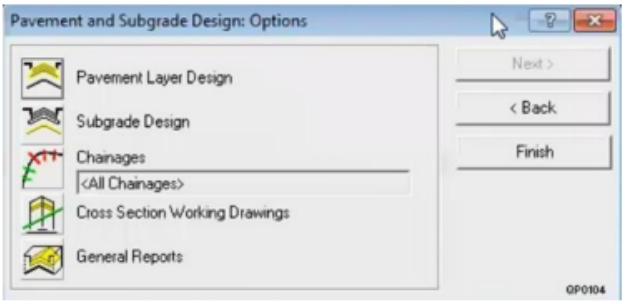


Fig. No. 4.9.3 Design options

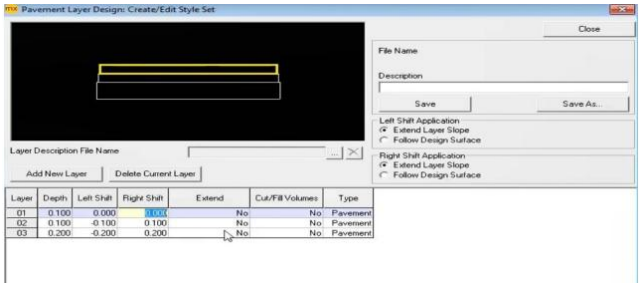
Select the existing surface model and define the offsets as -10 and 10, as shown above, then click Next.

• A new dialogue box will appear. Click on Pavement Layer Design, and then proceed to 'Create/Edit Style Set'.

Defining different layers of pavement

Click on Add New Layer and define the layer parameters such as depth, left shift, right shift, and other relevant details. Additional layers can be added and defined in the same way.

• After defining all the parameters, save the file as "pavement_design."
• Next, follow the steps for creating cross-sections as described earlier



II. CONCLUSION

Compared to conventional methods, software tools have significantly saved time and resources. Using MX Road software, the time required to design a road and estimate volumes and construction costs is greatly reduced. In this project, the primary focus was on reducing costs and enhancing road safety. This was achieved by redesigning the alignment of the existing road and decreasing the overall length by increasing the radius of curves. As a result, the distance and the number of curves were reduced, shortening the travel time between Jhalawar and Payli. The new design was then compared to the previous one to calculate changes in volume and cost reduction, summarized below.

From the above earthworks report it can be concluded that:

Reduction in volume cut and fill= (4688.432 – 4444.956) + (49886.17 – 47305.95) = 243.476 + 2580.22= 2823.696 m3

Therefore, cost reduced in volume cut and fill= 3960875.1 – 3755912.1= Rs 204963

From the above pavement layers report it can be concluded that:

Reduction in volumes of different layers:

BC= 4758.52 – 4352.6= 405.92 m3

DBM= 7340.16 – 7000= 340.16 m3

WMM= 31246.8 – 30021.46= 1225.33 m3

III. APPENDIX

This is to certify that the dissertation entitled **"GEOMETRIC DESIGN OF A HIGHWAY USINGMXROAD"**

being submitted by **KOMMINAGANGADHARA VENKATA SAI PAVANKALYAN with** Regd.No. **423232913014** in partial fulfillment of the requirements for the award of **MASTER OF TECHNOLOGY in civil engineering with the specialization of TRANSPORTATION ENGINEERING** is an authentic work carried out by **MS.GOWRI**
M.Tech under their supervision and guidance. To the best my knowledge, the matter emboided in this seminar report as not been submitted to any other University/institute for award of any degree of engineering

IV. ACKNOWLEDGMENT

Would like to express my sincere gratitude to all those who supported and guided me through the course of this project. First and foremost, I am deeply thankful to my research **MS.GOWRI ,M.Tech.** Assistant professor and **Dr.M.MADHURI, Mtech.Ph.D**for their invaluable guidance, unwavering support, and continuous encouragement. Their expert advice and insightful feedback were instrumental in shaping the direction and quality of this research,

Would also like to extend my gratitude to the faculty and staff of the civil engineering at **SANKETIKA VIDYA PARISHAD ENGINEERING COLLEGE** for providing the Necessary Resources and a Conducive Research Environment. Special thanks to their assessment in the laboratory experiments and material preparation, which greatly facilitated the research process.

Am also grateful to my colleagues, [**SVP ENGINEERING COLLEGE**], For their constructive discussions, teamwork, and friendship, their collaboration Helped enhance the overall outcome of this project. I Would Like To Acknowledge Any External Organizations, Institutions, For Funding Bodies For Providing Financial Support, Materials, Or Any Necessary Tools that contributed to the successful completion of this study. Finally, I wish to thank my family and friends for their emotional support, understanding, and patience during the course of this research. Their constant encouragement gave me the strength to overcome challenges and continue with my work. Feel free to adjust the names and specific details to suit your actual acknowledgments.

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