

## GEOMETRIC DESIGN OF A HIGHWAY USING MXROAD

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### Abstract

Geometric outline concerns the plan of street arrangement that fits in with the site requirements and models. The fundamental destinations are to improve productivity and wellbeing while at the same time limiting expense and natural harm. Once a street/roadway build knows about the nuts and bolts of street geometric outline, the subsequent stage to upgrade their esteem is by learning programming for the utilization of this essential information. The aim of this examination is import street geometric outline into the product and in addition relate with the plan principles connected into the product. It will have the capacity to outline street geometric from checking of study information, even and vertical plan, super-height and generation of street cross segments. Bentley MXROAD is a propelled, string-based displaying apparatus that empowers the fast and precise outline of all street writes. With MXROAD, you can rapidly make outline other options to assemble the perfect street framework. After a last outline elective is chosen, you can computerize a great part of the plan itemizing process, sparing time and cash. At its center, MXROAD utilizes 3D string displaying innovation .An intense yet brief strategy for making 3D surfaces.

**Keywords:** Geometric design, road alignment, design standards, MXROAD software.

### Introduction

Transportation assumes a huge part in our regular day to day existences. Every one of us voyages some place relatively consistently, regardless of whether it is to get the chance to work or school, to go shopping, or for excitement purposes. Also, nearly all that we devour or utilize has been transported from some point. There are such huge numbers of methods for transportation, yet in this record we worry on street transportation. Expressways are the imperative piece of our life, the economy of the general public and also it is Part of the framework. The development of a great street

organize straightforwardly builds a country's monetary yield by lessening venture times and costs, making an area more appealing monetarily. The better of this structure is the quicker, more powerful and less expensive, can be the limits of the general public utilized. The improvement of viable street transport framework is essential need of any creating nation. Additionally redesigning of existing street organize is basic for created nations to complete its transportation capacities easily similarly as with expanding movement volume urban and non-urban streets reach to their immersion level in section of time. The outline of course arrangement and asphalt structure choose cost of task which absolutely rely upon time taken for same. So for this activity the best accessible Highway Geometric Design Software must be conveyed. Keeping this in see we have utilized MXROAD Software for the geometric plan to enhance its geometric highlights and updating it from two paths to four paths. The Software utilizes 3D string displaying innovation and gives the coveted estimations of various segments of geometric plan, for example, Horizontal and Vertical Curves, Super height, Shoulder, and so on.

### Objectives

- Carry out detail studies and prepare Detail Project Reports.
- To give provision of a road that is safe to travel on for all road users at the suitable travel speed
- To provide vertical and horizontal geometry improvement
- To design geometric design of propose road

### Methodology

- Detailed investigation :this will include existing topo condition width type of area existing lane
- Preparation of conceptual design :in this propose design the road alignment fundamentals such as

horizontal alignment, vertical alignment etc based on software mxroad.

### Mx Road Software

The MX programming was at first created by three neighborhood experts in the UK, in the late 1970s. back at that point, it was known as greenery till 1988. Mxroad developed accordingly with the converging of infra delicate constrained and Bentley frameworks restricted amid travel, 2003.

Bentley mxroad is a propel, string – based demonstrating gadget that permit fast outlining of all sort with precision. Utilizing mxroad, formation of plan choice for the structure of a model street system can be dealt with effortlessly. Once an outline procedure can likewise be mechanized while utilizing mx street demonstrating instrument, sparing both time and in addition cash.

Mx Street is overwhelmingly apply in the outline of interstates plans. recently, mx programming has additionally discovered its application in an extensive variety of ventures, for example, mining fields green and furthermore air movement.

### Project Highway

The Road Construction Department, Government of Jharkhand, has appointed M/s Ranchi Design Consultancy Pvt. Ltd., Ranchi as consultants for carrying out “Preparation of Detailed project Report (DPR) for Widening and strengthening /Reconstruction of Existing Pavement to Two Lane with Paved Shoulder including Replacement of Culverts and Bridges of stretch from near Nawadih to Chandwa of NH 99 in the State of Jharkhand-Tentative Length-38.00 Km

### Research Methodology

**Step1: Case Study:** The Project Road starts from NH-99 near Nawadih to Chandwa of Bokaro districtan dlatehar district passes via Balumath town and terminates on NH-39. Total length of the project road as per survey is 32 km. The initial reconnaissance survey has already been done. Now the detail financial assessment will be submitted after getting the traffic data and tentative up gradation cost and will be submitted in next report. The total length as per TOR provided is 120 km and during reconnaissance survey it is found that the length of project road is around 119+550 km.

### Existing Cross Sectional elements

The project road is an intermediate/Two lane carriageway with average carriageway width of 5.5/ 7.0 m up to km 93+200 to km 99+200. The formation width varies from 7.0m to 10.0m. The entire road is having bituminous surface. The existing pavement condition is generally satisfactory except for some stretches.

The shoulders are of earthen type with width varying from 1 m to 2 m on either side. The embankment height varies from

nil to 2.0 m. There appears to be need of raising the existing carriageway lot of places due to submergence/water logging and where ever the vertical geometry is improved.

### Geometry

The existing geometry of the road is generally poor except for few stretches. Some part of the project road passes through villages, forest & rolling terrain where there are sharp curves. The existing vertical curves are generally satisfactory except at bridge approaches, the existing camber generally is generally flat. The existing super elevation in most of the curves is found inadequate.

Sl.no	From	to	Distance	remark
1	94+700	95+500	800	Sharp S-Curve
2	95+800	96+100	300	Sharp
3	96+400	96+900	500	Sharp Curve

### Design Standards & Specifications

#### Design Basis

The design basis for the Project Road have been adopted with the objective of strengthening and widening the existing two-lane road to a 2-lane with paved shoulder and divided 4 lane road with paved shoulder. The General Technical Specification has been the specification for Road and Bridge works (Fifth Revision-2013) of MORT&H. The following guiding principles have been kept in view during evolving the designs for the project stretch under this package.

#### 4 lane with paved shoulder in (rural section)

##### Concentric Widening (TCS - 2L-5)

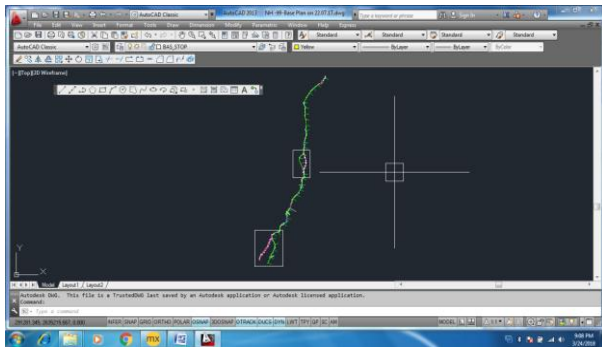
- Main carriageway width – 7.5m.on either side
- Shoulder width (Paved) on either side– 2.50 m each
- Raised footpath/ Drain/ Utility Duct – 2.5 m each
- Median – 1.0 m each
- Embankment Side Slope – 2(H): 1(V)
- Cross-Fall – 2.5% - Paved carriageway

#### Input survey data and view model data

##### Data Import:

Input the survey data onto the data base, The users can input the data from, DNG, DXF, Comma separated variable (CSV),Txt (GENIO file),Google earth ,MX Survey Data (\*.inp),Eagle Point Triangulation, Land XML, Auto CAD DWG (\*.dwg)

**NH -99-Base Plan Auto cad dwg (\*dwg)**



**Figure1**

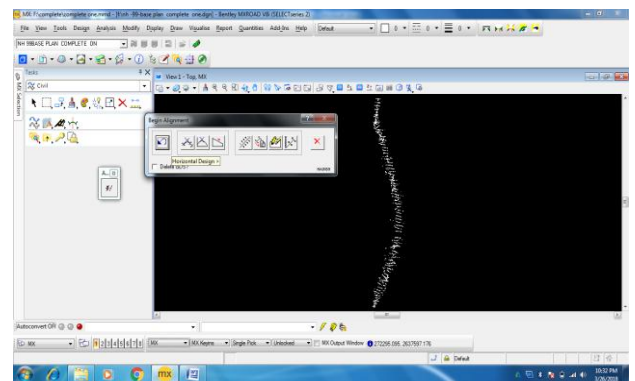
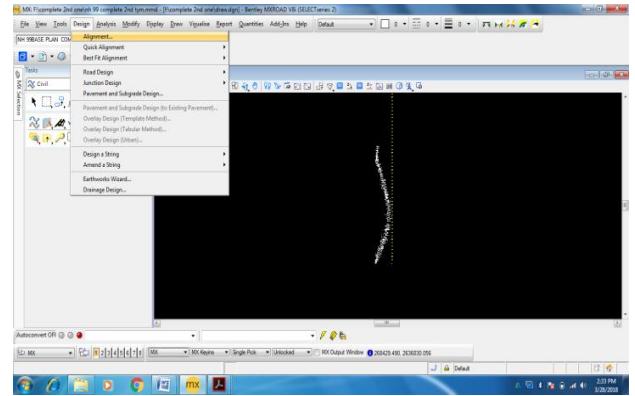
**Design Data:** Design Speed - 100 Km/h and 60 Km/h, Right of Way - 30.0 m, Setback distance between building line & road periphery - 3.0m to 5.0m, Roadway Width - 12.00 m, Carriageway Width - 7.00m, Shoulder width - 2.50 m, Bituminous surface - 2.50% , Earthen surface - 3.0% Embankment slant -1 V : 1.5 H, SSD - 120.0 m , ISD - 240.0 m , OSD - 470.0 m, Super Elevation - max 7.0% , Radius of Horizontal Curve - Ruling Min 230.0 m

Radius at which no super elevation is required - > 1200.0 m, Radius at which 7% super elevation is achieved - 230.0 m, Extra Widening of Carriageway at Curves - 0.60 m, Ruling Gradient maxi - 3.30 % , Limiting Gradient maximum - 5.0% , Minimum Gradient - 0.3% , Min length of vertical curve - 50 m, Mini 'K' (Rate of change of vertical acceleration) of Summit Curve - 40. Mini 'K' (Rate of change of vertical acceleration) of valley Curve - 30.

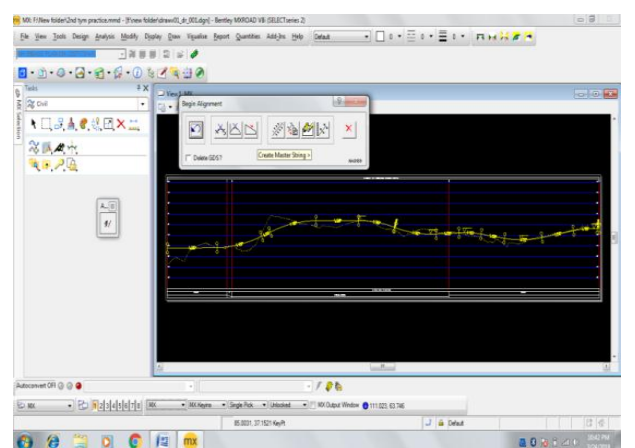
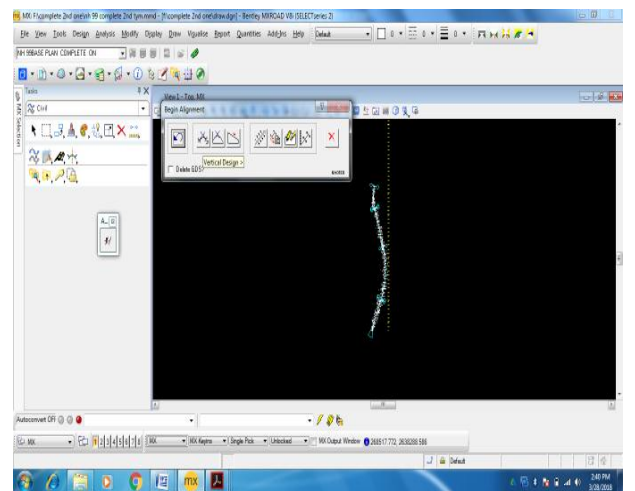
**Standard String Naming:** - The MX standard string naming tradition (SNC) has been shaped to give programmed combination to any outline delivered from any of the MXROAD alternative. Strings made by the MXROAD choice are doled out names which store the accompanying data, string compose, related ace arrangement which characterizes the string gathering, particular street highlights and side of ace arrangement on which the string was made

**Surface Analysis:** - his alternative is utilized for examining the surface on which the outline must be built. This is fundamental to confirm that the transported in information is right and contains no mistakes. Ordinarily the analysis is will high light mistakes in level and will likewise give a graphical portrayal of the current surface.

**Alignment Design:-** The arrangement outline alternative are utilized to make the arrangement for the street plan by choosing element alignment choice, Horizontal Design, Vertical profile should be possible in restricted time duration. The arrangement is changed over to a master string which is by and large utilize das the Centerline along which a carriage way and different highlights can be planned. Arrangements are made in two phases



**Figure.2 Horizontal Alignment (Both)**



**Figure.3 Vertical Design (Both)**

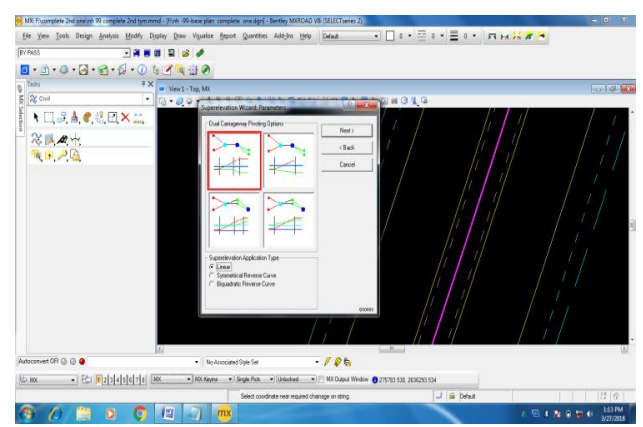
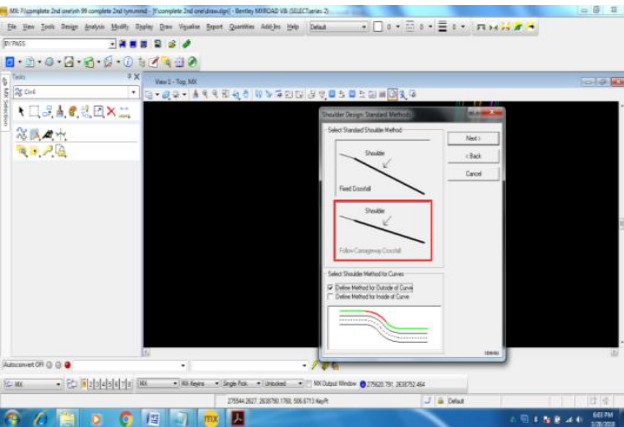
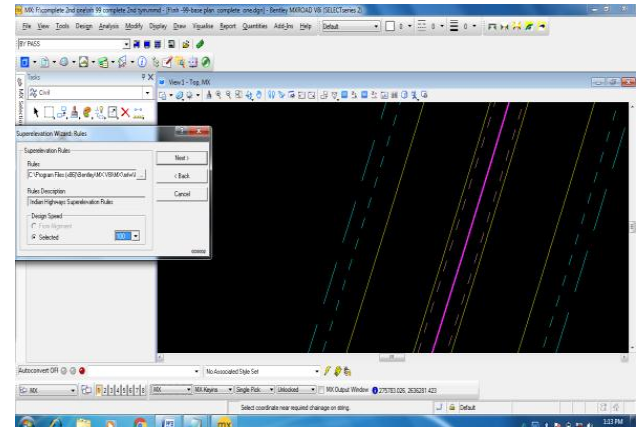
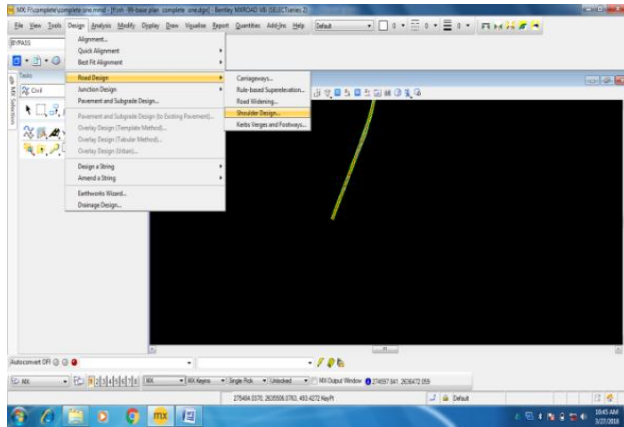


Figure.4 Shoulder Design (Both)

Figure.6 Superelevation Design (Both)

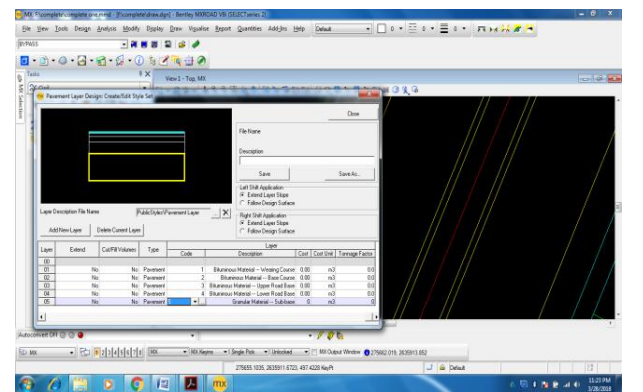
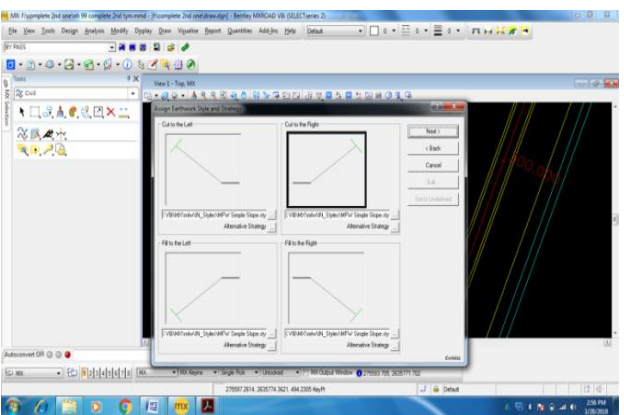
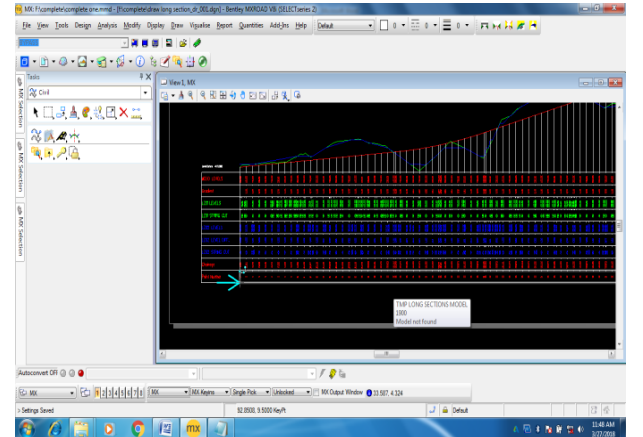
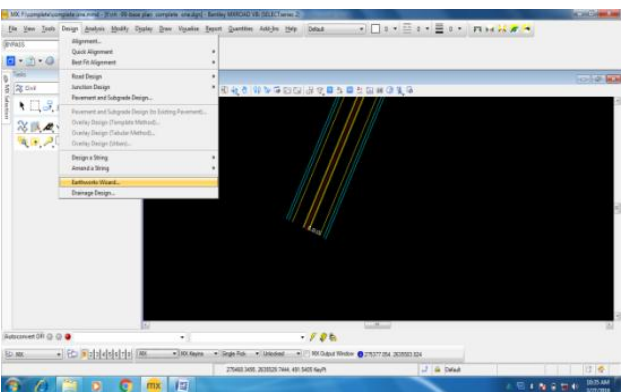


Figure.5 Earthwork Design (Both)

Figure.7 Pavement & Sub grade Design (Cross-Section)



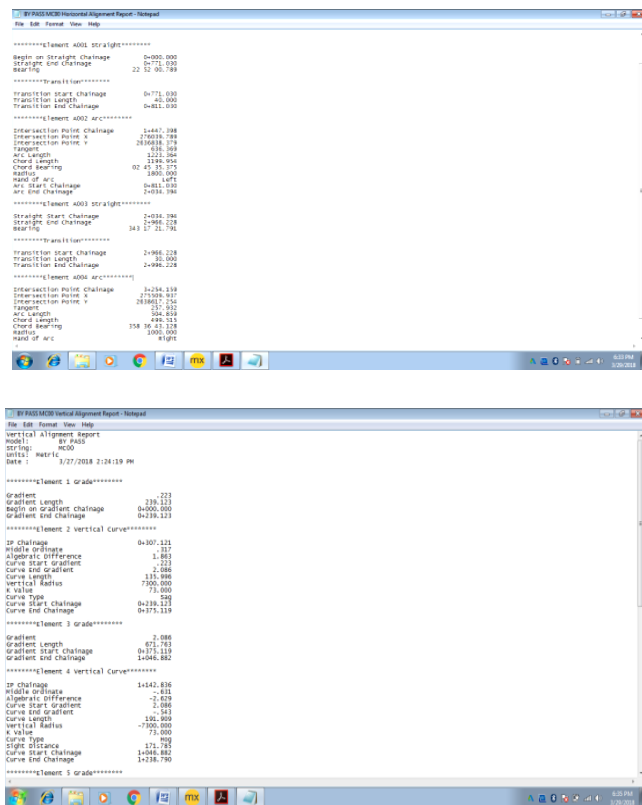


Figure 8 Alignment Reports

### Results and Discussion

Arrangement has intended for 100Kmph. Almost 80% of the current street is utilized. Geometrics of the street has been improved Road is outlined according to IRC standards and furthermore viewed as all security measures. Horizontal design has been developed. Vertical profile has been drafted. Working cross segment is developed. Super Elevation has been ascertained and connected.

### Applications

The mxroad provides broad applications which are grouped into safety and volume applications (comfort applications). The safety applications are those which provide vehicle safety by avoiding accidents and volume application volume and cost of project. Safety application in design of Horizontal Alignment, Vertical Alignment, Carriageway Design, Rule Based Super elevation Shoulder Design Kerbs, Footways, and Verges earth work wizard Road Widening, volume application are Create the profile & Cross Section pavement, sub grade design, earthwork volumetric analysis

### Social Relevance

On survey it was found that, many people got seriously injured or lost their lives in road accidents. This is either due to Sharpe curves, change of direction or sudden change in gradient of, improper design of road. Hence, Geometrics of the road has been designed and Super Elevation has been calculated and applied as per IRC. The proposed alignment encounters minimum horizontal curve radius at minor junctions, where the speeds are restricted to minimum. High

design precision and saving in time were achieved with considered all safety measure

### Acknowledgements

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### Conclusion

1. Alignment has designed for design speeds are formulated ruling design speed 100Kmph and minimum design speed is 65 Kmph. Almost 80% of the existing road is utilized
2. Geometrics of the road has been designed as per IRC and also considered all safety measure
3. Horizontal plan has been developed. Vertical profile has been drafted. Working cross section are developed.
4. Super Elevation has been calculated and applied.
5. The proposed alignment encounters minimum horizontal curve radius at two minor junctions, where the speeds are restricted to minimum.
6. Limiting gradient values are adopted for few sections where site restriction prevails.
7. High design precision and saving in time were achieved by using MXROAD

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