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A Study and Design of Two Lane with Paved Shoulder in Green Filed Corridor, By Using Civil 3D

Vivek Gajanan Sukalkar[1], Kunal Pawar[2], Dr. P. L. Naktode[3]

[1]P.G Student, MTech Transportation Engineering, Planning/ Sandeep University Nashik, Maharashtra, India
[2]Assistant Professor/Civil Engineering Department, Sandeep University Nashik, Maharashtra, India
[3]H.O. D, Civil Engineering Department/ Sandip University, Nashik, Maharashtra, India

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ABSTRACT

Geometric design is important component, which have a majority of effect while designing a new alignment of the road as per present trends, which is skeleton of any alignment of road. It is combination of cross-sectional elements, horizontal alignments, sight distance considerations and vertical alignment details, attributes of intersection. It also considers other macro factors like design speed, terrain or topography, traffic plying and expected, design hourly volume and estimated capacity, along with environmental factors. While aligning a new road, it should be short, easy, safe and economic and it is expected to be comfort and safe for the movement. Rural road is a road network with a low volume traffic and low design speed which provides market access to farms, employment and connects different communities. Rural roads are classified into Another District Road (ODR) and Village Road (VR). These roads are able to reach the group of villages in rural area of the country and to provide connectivity. It is owned by local authorities. AutoCAD Civil 3D is a software application used by civil engineers and professionals to plan and design the projects for building constructions, road engineering projects, water include construction of dams, ports, canals, embankments etc. AutoCAD civil 3D associate design and production drafting, greatly reducing the time it takes to implement design changes and evaluate multiple situations. A change made in one place immediately updates an entire project, helping your complete projects faster, smarter and more accurately. Civil 3D provides to create 3D models of the project and helps to adopt for both small- and large-scale projects. It helps to imagine the things in 3D visualization, reduces the time and budget. It also inherits many benefits of using civil 3D. Total station is a combination of Electronic Distance Measurement (EDM), an electronic digital theodolite, and a computer in one unit used to measure horizontal angles, vertical angles and sloping distances of the objects. It takes a part by providing all the three co-ordinates of the observed points that is northing, easting, and elevation. These points are further transferred into AutoCAD civil 3D.

The term is used in Carriageway, Shoulder, Earthen Shoulder, Typical Cross Section, Utility Corridor, Horizontal and Vertical Alignment, Sight Distance,

Design Speed, Topography, Intersection, Traffic Survey etc. The object of the project was to demonstrate how roadway geometric design can be Design in Green Filed Corridor a very short time with much ease and precision. Also, to understand the Green Field Design and its aspects. the road design procedure using AutoCAD Civil 3D has been presented. Manual geometric design of the same road was also performed, the results of which was compared favourably with that of AutoCAD Civil 3D.

Also, In this study is to examine in detail the availability of road/highways transport infrastructure and working of the roads/highways at national level. To identify and analyze the problems associated with the roads/highways in India with respect to design per say.

Keywords : Geometric Design, Horizontal and Vertical Alignment, Assembly, Corridor.

I. INTRODUCTION

Transportation is one of core parts of infrastructure activities of any economy. Broadly speaking, a well-developed transport system provides a vital link between production centers, distribution of goods and the ultimate consumers. It influences directly or indirectly all economic activities of the country. Transport provides the basic infrastructure requirement for the growth of industry and agriculture. A study finding suggests that productivity increases in transportation are the most important determinants of structural changes in the world economy (ECMT, 2003).

A study of transport is a study of movement or displacements of individuals and things, in both space and time. The inherent spatial characteristic of this activity and its repercussions on a firm's cost structure, the presence of externalities of significant magnitude, the fact that users do not want this product by itself but only as a mean to solve some other need, the unavoidable restriction faced by all individuals of having to organize their activities, travel among them, within a 24-hour time frame, and the rather public nature of this market which forces national and regional authorities to design, evaluate and finance transport projects with social welfare in mind, make this field of knowledge a very special and challenging one (Jara-Díaz, 2007). Thus, transport is a service rarely in demand for its own characteristics. Demand for public transport, road freight facilities or an airline service is usually derived from some other function (Cole, 2005). The important means of transport are Railways, Water Transport, Air Transport and Roads Transport.

Road Transport is a critical infrastructure for the economic development of a country. It impacts the pace, structure and pattern of development. The tasks and responsibilities of the Ministry of Road Transport and Highways encompass, inter alia, construction and maintenance of National Highways (NHs); administration of the National Highways Act,1956; National Highways Authority of India Act, 1988; National Highways Fee (Determination of Rates and Collection) Rules, 2008; Motor Vehicles Act 1988; and Central Motor Vehicles Rules 1989.

also, formulation of broad policies relating to road transport and automotive norms, besides making arrangements for movement of vehicular traffic with neighbouring countries (MoRT&H-2021). The road length or network comprises National Highways, State Highways, District Roads, Rural Roads, Urban Roads and Project Roads. It shows that there is a remarkable growth and development in road sector in India over a period of time.

There are different lane configurations in India for roads, like single lane, intermediate lane, two lane, four lane, six lane, eight lanes, etc. Each categories of lane have different width and size and configuration as per the Indian Road Congress (IRC).

Two Lane Roads/Highways with Paved shoulder in Rural areas are economically and financially viable, as they provide a good connectivity within the region with due consideration to factors like, Traffic, Topography, Climatic Conditions like Rainfall & Temperature. Geometric Design of Two Lane Paved Shoulder includes different aspects of Horizontal & Vertical Geometry, along with due consideration to Transverse & Longitudinal Drainage. To provide better connectivity and reducing the prevailing travel time, between remote places as well as towns & cities connected, construction of new roads is being taken up in India at greater pace

The Organization of this document is as follows in Section 2 Problems Statement. I'll give details of problem in Road Connectively in Assam State. In the section 3 Objectives of Case study 4. Study Area Characteristics this Chapter is to indicate some of the insights of Assam state with respect to its demographic, socio-economic, income, infrastructure -roads and highways, etc. components growth and development over a period of time. 4.Literature Review this chapter give the study and overview on Roads at National and International Level.5 Methodology this chapter give the Detailed Mythology of Project Design.6 Conclusion and Result this chapter gives the conclusion and result of the green filed design corridor.

II. PROBLEM STATEMENT

Given the background of a growing concern of safety and security of passengers, freights and national assets of infrastructure facilities in the road transport sector, researcher have attempted, in this study, a critical assessment of the productivity and efficiency of roads in India in regard to design concerns specially greenfield roads, capacity constraints, efficiency constraints, limited availability of traditional sources of funds, and market access to check the technical, engineering, economic and operational viability of roads in India by using recent analytical techniques developed in the design engineering literature. A case study on Design of Greenfield Two-Lane Paved Shoulder Road with Special Reference to Kharamakha to Ghoirali Road in the State of Assam has been undertaken to technically analyze some of these issues.

III. OBHECTIVES

1. To examine in detail the availability of road/highways transport infrastructure and working of the roads/highways at national level.
2. To identify and analyse the problems associated with the roads/highways in India with respect to design per say.
3. To understand the Green Field Design and its aspects
4. To evaluate and empirically analyse the design of roads in terms of their efficient operations.
5. To review and present the recent trends in roads/highways privatization, regulation, control and management.
6. To suggest and recommend, if possible, certain policy guidelines on the basis of this study.

IV. STUDY AREA CHARACTERISTICS

The basic idea for providing this Chapter is to indicate some of the insights of Assam state with respect to its demographic, socio-economic, income, infrastructure -roads and highways, etc. components growth and development over a period of time. Assam is the largest state among the North Eastern states of India in terms of population and acts as gateway for the entire North Eastern (NE) states i.e., Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and shares its border with the state of West Bengal and two countries viz. Bangladesh and Bhutan. Its fiscal and economic situation has been improving since last decade, efforts of the government has helped the state to accelerate its Gross State Domestic Product (GSDP). Its geographical location demands huge thrust on the development of road infrastructure in the region thereby enhancing the region's economy. Road infrastructure assets are the key factors of economic development, mobility and social equity for any region or nation. They are not only costly to build but also expensive to maintain in order to adequately meet the public expectations. The key issue is how to manage existing assets in a way that it delivers maximum benefit to public with the limited financial resources. The answer is Road Asset Management System (RAMS) which offers a comprehensive and structured approach to the delivery of the community benefits through management of road networks. The road network traffic demand has increased considerably since the last decade. Between 2001 and 2011 the Assam population grew by around 17%, while during the same period of time the number of motor vehicles on Assam roads is estimated to have grown by 160% (16% per year) and the road network has grown by around 4% per year. 33% of present network needs capacity augmentation/ widening. It is expected to increase to 46% in 3 years and 61% in 10 years.

The various efforts are under progress to tackle the problem of backlog in basic minimum services and infrastructure needs of the North-East. The road network in Assam is extensive in terms of road density, that is, road length per thousand sq. km, of all roads. However, in terms of density of surfaced road Assam is way behind India and the gap is increasing.

However, the density of national highways is higher in Assam and more have been added in recent years. This would imply that the state government has invested on extending the road network rather than on improving the quality of roads. Yet all-weather roads connecting villages remain inadequate. With emphasis on new roads, inadequate attention is paid to maintenance of existing roads. Many roads are in poor state and all-weather connectivity for many villages is limited. With poor connectivity farmers get lower price for their produce while urban consumers pay a higher price. The villages should be connected with all-weather roads.

Faulty strategy was also reflected in wrong type of capital investment, declining capital investment, inadequate and low-quality infrastructure such as power, roads and other rural infrastructures. On the other hand, the state government failed to create a favorable environment for private investment to supplement its efforts. It is true, however, that low fiscal capacity has always a great handicap to make best use of even available central assistance

V. LITERATURE REVIEW

An Overview of Studies on Roads at National Level. As part of Bharatmala Pariyojana, the government has planned for development of greenfield roads, highways and expressways to increase freight and passenger speeds and logistics efficiency between major economic centers. The NHAI has proposed construction of 23 new access-controlled highways/ expressways, which are expected to be operationalized by March 2025 (FICCI, 2021).

The objective of the programme is to optimize the efficiency of freight and passenger movement across the country by bridging critical infrastructure gaps through the development of greenfield expressways, economic corridors, intercorridors and feeder routes.

GoI, MoRT&H (2019): - The Government of India, Ministry of Road Transport & Highways, presented its Seventh Report to Seventeenth Lok Sabha on 09 February, 2021 which is prepared by the Committee on Estimates (2020- 21), on the subject 'Estimates and Functioning of National Highway Projects including Bharatmala Projects'. The report highlighted many of road and highway projects are marred with various issues related to complaints of long delays, cost-escalation, environmental issues, land acquisition issues, rehabilitation and compensation issues, disputes and litigation issues, alignment issues, bad quality and bad design, lack of maintenance and repair, tolling issues, safety and security issues, accidents, etc. In the light of these issues, the Committee have taken up the subject for detailed examination. The Committee have analyzed these issues/points in detail and have made Observations/Recommendations in the report

GoI, MoRT&H (2021): -. The Case study gave the project road is aimed to provide congestion free, safe and smooth road to the population residing along project road and other users travelling through the project road. The other objective of widening and strengthening of the project road is (with required cost effectiveness, coupled with environmental management standard) for achieving sustainable development of the region, state and ultimately to the country. This project has benefits of the green highway, green initiatives, GHG emissions reductions and climate resilient initiatives adopted in the project and estimated GHG emissions reduction and environmental sustainability. This study will help to bring out some of the indication for greenfield road corridor as a model designing parameters which can be adopt in any study.

S.A. Raji et.al (2017) the case study they gave an overview of AutoCAD Civil 3D Design Procedure as Import survey data (comprising easting, northing and levels and saved in Note Pad format) into the AutoCAD Civil 3D environment. Create existing ground surface. Create alignment by linking points on the existing ground using polyline. Apply the design criteria Generate the existing ground profile. Create the formation level (finished) using the profile creation tools. Create the Assembly, which defines the cross-sectional component of the design. The assembly is constructed by connecting individual subassembly objects. Create the corridor, which is the resulting dynamic 3D model representation built from the combination of horizontal, vertical and cross- sectional design elements. Corridors may be used to calculate earthworks and quantity take-offs, to perform sight and visual analysis, to generate surfaces, and to extract information for construction purposes. Generate volume table report.

Asma Abdul Al-Jabbar Hadi et.al (2018) In This Case Study carried out a case study on project to determine the earthwork quantity of filling and cutting for construction of proposed alignment. The basic process of determining earthwork quantity estimates is the same for the design consultant and the earthwork contractor by: 1-Creating digital 3D model of the existing surface, accounting for stripping of topsoil 2-Calculate the volume difference between the existing and proposed surfaces. 3-Generate reports or cut-and-fill maps.

***An Overview of Studies on Roads at International* Level: IAECST (2019)**: - The authors Gensheng Han, Wu Zeng, Hua Liang, Dan Wang, Shegang Shao and Jian Wang written on discussion on practice of green highway construction based on high quality objectives. The authors pointed out that the creating

green roads is an objective requirement for the transformation and development of the transportation industry. It is also an objective requirement for advancing the supply-side structural reform of the transportation industry and building a satisfactory transportation for the people. It is also an objective requirement for achieving a beautiful China. The author puts forward some practical experiences of green highway construction through the construction of the typical demonstration project of the Guangji expressway green highway in China.

South Africa (1999), the African Development Bank, Private Sector Department written on the 'Summary of the Environmental Impact Assessment', for the N3 Toll Road Project, South Africa, in the year March 1999. The National Route (N3) is the most important commercial road in South Africa, carrying freight and acting as a tourism conduit between the two most important provinces in South Africa. The toll road concept makes the user pay principle, and in so doing, money can be borrowed to build the road. Over the period of operations and maintenance the toll money received goes towards maintaining and managing the road and the redemption of the loan.

VI. METHODOLOGY

Data Collection The project road Kharamakha to Ghoirali has a length of 36.937 Km and lies in the district of Sonitpur. The project road is majorly Greenfield alignment passing through remote villages between Kharamakha and Ghoirali which currently do not have direct connectivity to MDR's and State Highways in their vicinity. The district of Sonitpur has been curved out of Darrang district in 1983. However, mythologically, the present districts of Sonitpur and Darrang along with their surrounding territories were known as Sonitpur. In terms of area, Sonitpur district is the second largest district of Assam after Karbi Anglong district. It is spread over an area of 5324 square km. on the northern banks of Brahmaputra River. Sonitpur falls in the Northern Assam Division with it headquarter being Tezpur.

The Methodology has been drawn to clearly put forward the sequence of works and methods that have been adopted for successfully designing the corridor. The chart representing the methodology has been presented as shown in Figure.

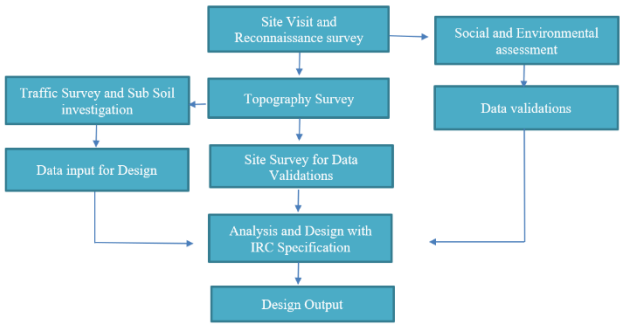

Figure 1. Methodology Flow Chart

Topography Survey: - Topographical survey is the backbone of any highway design. Accuracy of the information collected during this survey has a direct bearing on all the design activities involved in project preparation. The first activity at the start of the topographical survey is the collection of Survey of India topographical maps. The main objective of the topographic survey is to capture the essential ground features at the study areas for working out improvements. Before starting topographic survey all the survey instruments were checked for errors and approved by the site engineer.

The surveyor was maintaining a field book, in which all relevant observations would be noted along with field sketches. The methodology followed for the topographic surveys are as following:

- Identification of suitable location for DGNSS Control Points at an approximate interval of 5.00 km.
- Establishing survey networks by conducting horizontal and vertical traverse connecting all DGNSS Control Pillars. Ensuring survey networks

are connected with an accuracy of 1:20,000 for horizontal and 12√K for vertical control.

- Conducting detailed topographic survey including longitudinal section at every 25m intervals and cross section at 50m intervals for a width of 30m on either side of the center line of the existing road.
- Collection of details of all physical features for a width of 30m or up to first row of buildings

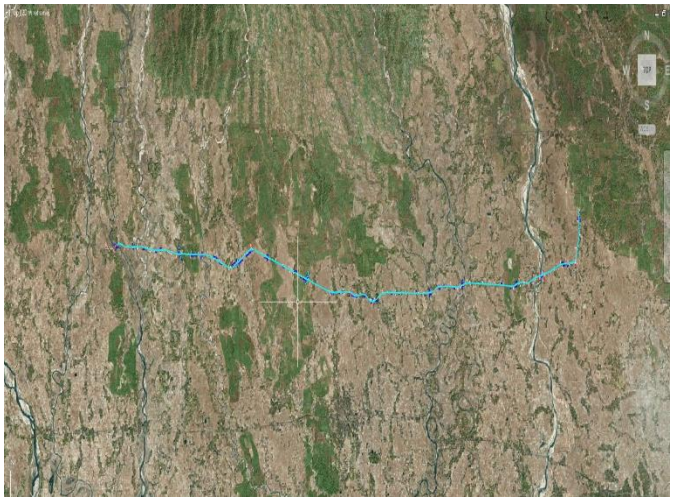

Figure 2. Topographical Data

Traffic Survey and Analysis: - Traffic surveys such as mid-block Classified Traffic Volume Counts (TVC) by manual systems, Origin-Destination (OD) surveys are conducted on selected locations and Turning Movement Counts (TMC) are carried out at identified major junctions to understand the existing traffic pattern and to check the adequacy of the number of homogenous sections of the project road. The locations for the surveys were finalized based on the reconnaissance survey. All surveys have been carried out as per IRC: SP: 19-2001, guidelines.

Currently there is no direct road from Kharamakha to Ghoirali on this proposed road alignment. Therefore, to meet the direct link/connectivity number of major river bridges has been proposed on Pasnoi, Sopai, Dhirai, Gorjuli, Belsiri, Kolakuchi, Gabharu, etc. rivers. For estimating the base year or initial traffic Consultant has used traffic which is moving currently on the available existing route i.e., from Kharamakha, Hugrajuli, Dhekiajuli road, Belsiri, Missamari, Ghoirali T.E. section. Further, because of no existing road alignment fully, Consultant used alternative routes (Balipara-Old Missamari Road Connecting to NH-15) in project influence areas to carry out the traffic surveys for estimating the likely diverted traffic on the proposed facilities

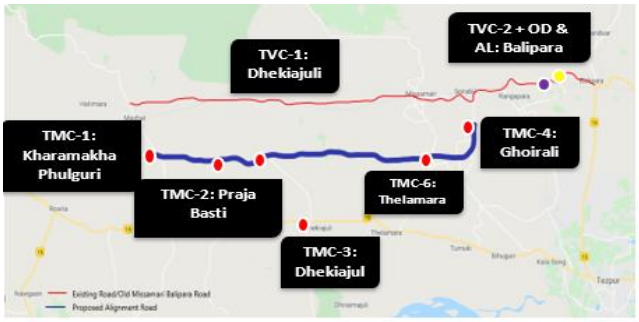

Figure 3. Traffic Data Collection Location Map

DESIGN METHODOLOGY: - The highway geometry design should be designed to provide optimized efficiency in traffic operation and maximum safety with reasonable cost. It is possible to design and construct the pavement of road at stage construction, but it is very expensive and rather difficult to improve the geometric element of the road at stage construction later date. It is important to plan and design the geometric feature of the road at initial, the future growth is considering in the traffic flow and possibility of road being upgraded in high category and take the design and standard in higher at later stage, the major element of geometry of highway design are Given below: -

Cross Sectional Element: - Under the cross-sectional element detail of pavement width, formation width and land, type of shoulder, utility corridor and surface characteristic, cross slope of Pavement are included. Standardized lane width is followed with reference to IRC SP 73-2018. The width of a basic traffic lane is proposed to be 3.50m in open area, width of traffic lane is proposed to be 3.50m in built-up area where the carriage way is provided with paved shoulder and the

width of traffic lane is proposed to be 3.75m in built-up area where carriage way is directly adjoined to the built-up drain. depicts the elements of Typical Cross Section.

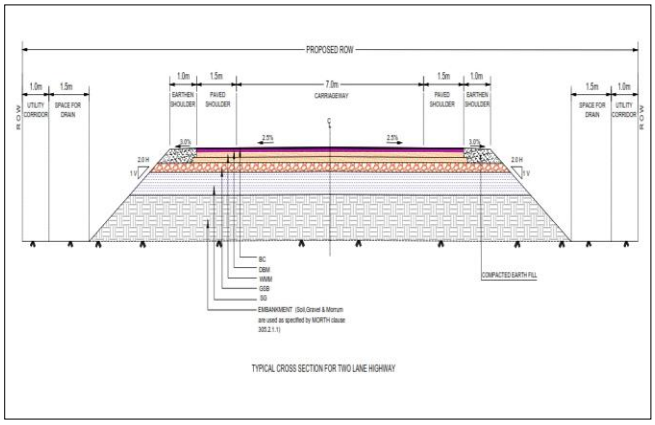

Figure 4. Typical Cross Section

Interpretation of Geometric Design Using CIVIL 3D: - The "Surface style" dropdown provides several ways of visualizing your surface. Researcher setup the surface to display "Contours 1m and 5m". How else can research visualize the surface? First, let's examine the triangulations used to create the surface. Select "Contours and Triangles" and click Apply.

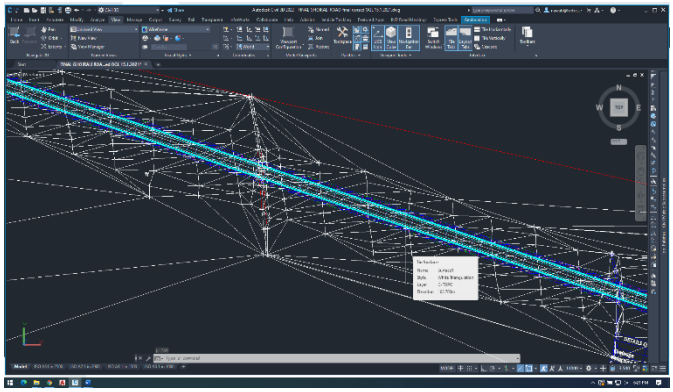

Figure 5 Surface Creation in Civil 3D

The screen now shows how the surface was created and every triangulation calculation used between the survey points. The denser the web, the denser the number of survey points in an area. Inspecting this triangulated irregular network (TIN) is especially useful if the generated surface shows something unexpected, which may arise due to a surveying error or in areas that are not adequately surveyed. This is an important visualization tool, because it shows the location of your surveyed points (at the vertices of the web). You could surmise that there may be inaccuracies in the locations with less survey points. You can specify the shape of the boundary used to create this TIN surface. For example, you may want to move the boundary in closer to the river where you have more survey points. This is left for you as a future exercise.

A. **Horizontal Alignment:** - Horizontal alignment is one of the most important features influencing the efficiency and safety of a highway. A poor design will result in lower speeds and resultant reduction in highway performance in terms of safety and comfort, the essential elements of the horizontal alignment are as under: **Radius of the Horizontal Curve**

The basic considerations for the horizontal alignment will be as under:

1. The curves will be designed to have the largest possible radius and in no case less than the minimum value corresponding to the design speed.
2. Sharp curves will not be introduced at the end of the long tangent
3. Long Curves with Suitable Transitions will generally be provided.
4. Reverse Curves will be avoided as far as possible
5. Horizontal Alignment will be coordinated well the vertical alignment

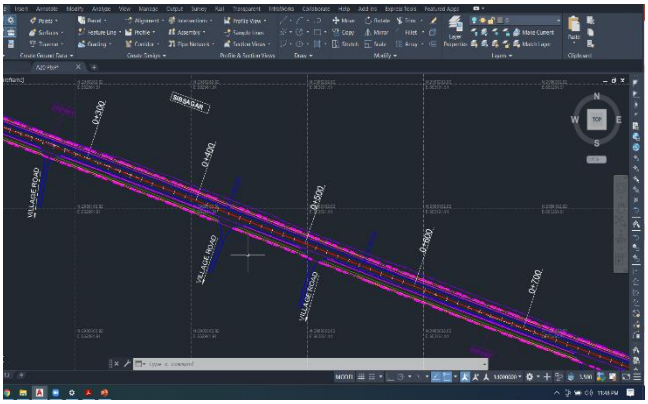

Figure 6 Horizontal Alignment

B. Super-elevation

In the order to counteract the effect of centrifugal force and reduced the tendency of vehicle overturn and skid, the outer edge of the pavement is raising with respect the Inner edge thus the providing the transverse slop throughout the length of the horizontal curve. This transverse inclination with pavement surface is called super elevation. The super is design for mix traffic adopted 75% of design speed for calculation of super elevation.

C. The formula is
D. e =V2/225xR
E. where,
F. e = super elevation
G. V = speed, km/h
H. R = Radius of Curve in m
I. Maximum Super elevation shall be limited to 7% for the curve less than 400m radius (for plain and rolling terrain)
J. Maximum Super elevation shall be limited to 5% if the radius of curve is more or equal to 400m (for plain and rolling terrain)

Vertical Alignment: - The vertical alignment of road is designed to provide the smooth longitudinal profile. Grade changes are kept as minimum as possible to avoid the kinks and visual discontinues in the profile. The gradient specified by IRC.

The profile will be drawn automatically in the civil 3D and easy to be done the 3d modelling, create vertical profile as simple as that. the software will analysis the required earthwork and cut fill of the design road .it is also analysed the sight distance, super elevation, and data validation

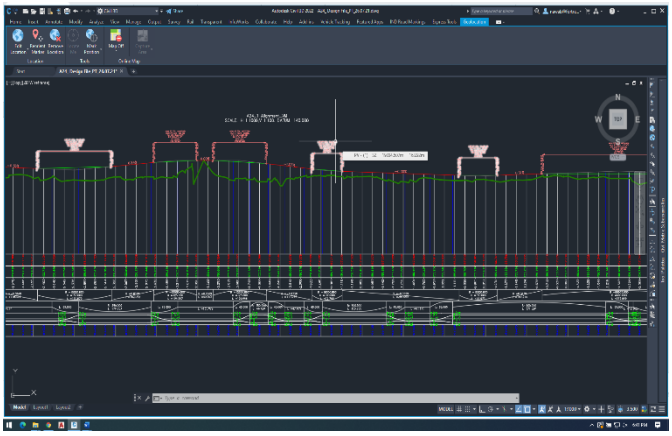

Figure 7 Vertical Profile in Civil 3D

VII. Conclusion and Result

1. The corridor has been designed as per the standard provisions and specification that is completely in line with the IRC. The design does not deviate the provisions of IRC as the site constraints like the built-up area, forest land, etc needs not to be taken into consideration.
2. Implementation of Green Field Corridor emphasis more on the connectivity and development of the adjoining areas with special focus on the socio-economic upliftment of the people dwelling in the region.
3. New techniques for the designing of pavement like CTSB, CTB method can be used to optimize cost of constructing pavement.
4. The Benefits of green filed Highway design It helps in removals of many issues which authority are facing in implementation of roads and highways policy, such as land acquisition, rehabilitation and resettlement, utility shifting, forest clearances, environmental clearances, compensations, social-economical obstacles, etc.
5. In the implementation of Green Field Corridors, Land Acquisition plays a major role. This needs to be properly handled for the successful complementation of project

6. The Constructability issues get minimize in case of green field alignment. accordingly, priority in future for green field alignment to be decided.
7. To Analyze Accurate design inputs and outputs data are playing very crucial role. Therefore, adequate data and information collection is very important in designing of green filed alignment and using of civil 3D software
8. The use of AutoCAD Civil 3D for highway geometric design makes the design process to be completed within a very short time and with much ease and amazing precision.
9. The geometry of the road was intended in accordance with the IRC and also regarded all safety measures.
10. AutoCAD Civil 3D supports design checks for different codes and thus provides global platform for design and analysis

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