A COMPARISON BETWEEN MANUAL AND CIVIL 3D SOFTWARE-BASED GEOMETRIC DESIGN

Hemant Chakole[1*], Dr.Prafull J.Wadhai[2], Dr.Sujesh Ghodmare[3]

Abstract-
India is a country whose population is growing rapidly, indicating that traffic is also increases. The development of rural areas also increases its means furthering of transportation facilities are also developed.Roads offer a vital contribution to sustainability and economic growth, offering major social benefits. Roads are important for growth and development. Roads to open more regions and promote socio-economic development. The location of design for the centreline of the highway on the surface is called alignment. The primary requirement for alignment is to be short, easy, safe, and economical. Horizontal alignment, vertical alignment, and cross-section are the three main components of geometric design. This paper demonstrates the usual design of the roadway with the assistance of AutoCAD Civil 3D and manual method. It is modelling software helps to accomplish modeling in a convenient and relaxed way. Civil 3D modelling is quick and easy to understand to construct alignment.The objective of this project is to design the road alignment in a less time with high accuracy using Civil 3D. The geometric design manages the dimensions and layout of visible features of the road such as alignment, sight distance, cross-section and intersections. When geometric design performed manually, it is time-consuming and highly susceptible to very costly errors.The survey data is must be necessary for road creation. By utilizing a total station study can be completed quickly and can shorten the time. Total station is utilized for import the points in Civil 3D which is as x, y, z coordinates that are easting, northing, and elevation. These coordinates of the ground data is very useful to generate the surface, design the alignment and other geometric features.

Keywords: Civil 3D Software, Geometric Design, Road, Manual Method, IRC, Design Speed, Super-elevation

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I. INTRODUCTION

It is crucial planning and build the road using safe, effective, economical, and simple traffic movement in mind, as well as to gather information from various research. Every road has a geometric design that is significant to the alignment of the route. Professionals and civil engineers use the software programme AutoCAD Civil 3D to plan and design the projects. Using AutoCAD Civil 3D software, this project lavishes on a complete geometric design of the road. By combining production drafting with associate design in AutoCAD Civil 3D, more design modifications may be implemented faster and more situations can be evaluated. Although there are many aspects that impact the highway's design, the ideal To use geometrical patterns provide the greatest traffic operation efficiency with contentment safety features at an affordable price. Transportation is essential for almost all of our daily activities in the modern world. According to the type of vehicle and movement, there are various different modes of transportation, including highway, rail, air, and water. Highways continue to handle the majority of global transportation today. Road network planning and land use planning are essential ideas for effective transportation systems, and they should be handled jointly. For environmentally friendly transportation by reducing obstructions and enhancing traffic safety, the needs created by various land uses, and many network designs techniques are to be established for different lansd uses. In order to distribute the various land use patterns, such as residential neighbourhoods, shopping centres, trade districts, industrial facilities, and others, correct zoning plans and a road network should be created. The geometric layout of roadways is the most important part of highway engineering. It deals with the size and layout of the road's obvious features. The purpose of road geometry is to provide requirements for drivers and vehicles, such as efficiency, safety, etc. The cross section, sight distance, intersection, vertical alignment, and horizontal alignment are the characteristics that are typically taken into account. Accidents and their severity will be reduced with proper geometric design. Therefore, the purpose of geometric design is to guarantee optimal safety and effectiveness in traffic operation at a fair price. Autodesk creates Civil 3D software. Engineering software called Civil 3D is used to design, plan, and manage projects related to civil engineering, such as those involving roads, highways, water, land development, and rail. Typically, civil engineers and other specialists use this programme. Civil 3D is typically used to reduce design time and assess various scenarios. It also aids in the swift, bright, and even more certain completion of tasks. It is used to create 3D models for projects involving water, land, or transportation while maintaining connections to the original data, such as contours, corridors, and grading. In both large and small building projects, civil 3D is widely employed and has a solid reputation in the civil engineering community. The selection, sizing, and positioning of highway geometry components are supposed to take into account factors including sight distance, vehicle stability, driver comfort, drainage, economy, and aesthetics. There is some drafting involved in the design process, as well as numerous computations and analysis. The design engineer is typically responsible for creating the road alignment, plotting the road profile using coordinates (or bearings), stations, and elevations, computing sight distances, radii of horizontal curves, lengths of vertical curves, computing earthwork quantities, and performing a variety of other analyses and calculations to determine the best alignment while meeting design requirements and constraints. The position and number of vehicle, bicycle, and sidewalk lanes, as well as their cross slopes, shoulders, drainage ditches, etc., are displayed on the highway cross section. The project's goal was to show how quickly, easily, and precisely roadway geometric design may be accomplished. The process for designing roads with AutoCAD Civil 3D has been described. The identical route was also manually designed, and the outcomes were favourably compared to those of AutoCAD Civil 3D.

Project's objectives include:

1. To research the different geometrical elements of roads.
2. To research the function of the geometric elements of roads.
3. Using civil 3D software to build geometric features.
4. Using a manual way, create geometric features.
5. To compare studies of geometric features conducted manually and utilising civil 3D software.
6. Identifying safe geometric elements for a route to reduce accident rates.

II. LITERATURE REVIEW

A road link or a network of new roads must be planned, designed, and built as part of a National Highway project. After a highway is built, the adjacent area is developed, making it very difficult to change the alignment of geometric standards in the future. A poorly aligned highway not only increases the risk of a traffic accident but also raises the expense of transportation and puts a burden on both the drivers and the passengers. Therefore, thorough research and planning are crucial for a road project, bearing in mind both the current demands of the community and its future growth. By addressing people's need for travel and goods' need for transportation, transportation has been crucial in the growth of civilizations since very early times. Road and transportation are now an essential component of every person's life in the modern world. However, it is noted that over the past ten years, the number of fatalities has increased by 50%. Over the previous ten years, about 1.2 million Indians have died in auto accidents—one every four minutes on average—and 5.5 million have suffered major injuries. In India, national highways make only 1.7% of the overall road network, but they are responsible for 40% of all traffic and 29% of all traffic accidents.

Study of road geometry and accident frequency

Sagar B. Patil1, Saniya Attar, Divya Dugani, Tejaswi Desai, Simran Mahabri (2019), Finding various geometric features of the road using a post- and pre-analysis approach is the goal of the study of geometric features of roads and accident rates. It impacts accident rate and geometric characteristics. Traffic volume is the foundation of the investigation. Speed, horizontal radius, poor visibility, extreme height, sharp gradient, and vertical gradient all contributed to fatal incidents. For the analysis technique, a combined total of 18749 cars from 8 am to 8 pm on Waghbil road were gathered. The analysis displays the vehicle count ratio for intervals of 15 minutes. This investigation's goal was manual calculation. The project's primary focus is on road and human safety, using a fundamental methodology to facilitate understanding. The fundamental strategy for this endeavour is research, analysis, and determination. In this study, the physical elements of the highway, such as the s the super elevation, the horizontal radius, the horizontal alignment, the visibility, the gradient, and the analysis, were examined at the site of Waghbil. The providing a shortcut, posting speed limits, divergence road studs and signs should therefore make be to promote safe motoring in order to lower the rate of accidents. Waghbilroad prevention measures: A lot of traffic is on this road. imposed speed and divergence indicators need to be available to help reduce traffic. Road studs should be installed at curves to prevent accidents and promote safe driving.

Highway Geometric Design Using Autocad Civil 3d

S.A. Raji, A. Zava, K. Jirgba, A.B. Osunkunle (2017), Using bearings or coordinates (easting and northing), stations, and elevations of sites along the intended route, one can create the road alignment and draw the alignment profile. are some of the tasks involved in roadway geometry design. Other tasks include computing earthwork quantities, the sight distances, the length of vertical curves, and the radii of horizontal curves, as well as a variety of various calculations and analyses aimed at determining best alignment while adhering to design guidelines. In geometrical design, incredibly laborious, the duration, and prone to costly mistakes when done manually. The use of computer programmes for designing roadway geometry is in vogue right now. The programmes are extremely precise and offer significant time and effort savings. Using AutoCAD Civil 3D software, this article shows a detailed geometric design of a conventional roadway. The project's goal was to show how quickly, easily, and precisely roadway geometric design may be accomplished. The process for designing roads with AutoCAD Civil 3D has been described. The identical route was also manually designed, and the outcomes were favourably compared to those of AutoCAD Civil 3D. When AutoCAD Civil 3D is used for the geometric design of highways, the procedure may be finished quickly, easily, and with incredible perfection. These features of AutoCAD Civil 3D minimise the main drawbacks of manual design methodology, which is laborious, labor-intensive and prone to expensive mistakes.

A Civil 3D Study of the Geometric Design of a Road Project

Yogesh Bajpai, Er. Atul, Shivam Pandey (2019), India's population is expanding quickly, which suggests that traffic is also growing. Rural region development boosts its capacity for furthering the development of transportation infrastructure. The road's alignment, sight distance, cross-section, and crossings are only a few examples of the dimensions and layout that the geometric design controls. Geometric design requires a lot of time when done manually, and mistakes can be very costly. The geometry of roads is currently designed using a variety of software programmes, including Bentley MX Road, HEADS, AutoCAD Civil 3D, etc. In order to design roadway geometry using computer programmes, prevailing patterns have been adjusted. A user can benefit from this software's clarity, time and effort savings. The thorough examination of employing Civil 3D, the geometric planning of a road project software is the focus of this research. Engineering software called Civil 3D is used to civil engineering planning, designing, and managing projects. Typically, civil engineers and professionals utilise this programme. The goal to accomplish the following use Civil 3D to quickly and accurately design the road alignment. The survey information must be important for building roads. A entire station investigation can be conducted more rapidly and in less time. The points from the total station are imported into Civil 3D using the x, y, and z coordinates for elevation, easting, and northing. These ground coordinates are crucial for creating surfaces, designing alignments, and creating other geometric characteristics.

an investigation on the geometric layout of a road using Civil 3D 2020.

Akash Surendra Kolamkar, Prof. Kalyani P. Nichat (2020), India's population is expanding quickly, which suggests that traffic is also growing. Rural region development boosts its capacity for furthering the development of transportation infrastructure. The road's alignment, sight distance, cross-section, and crossings are only a few examples of the dimensions and layout that the geometric design controls. The main goals are to maximise highway safety and traffic efficiency while reducing costs and environmental harm. The fundamentals of road geometry are known to those who design roads, and the next step to improving their value is understanding how to use software. Using bearings or coordinates (easting and northing), stations and elevations of locations along the proposed route, lengths of vertical curves, computation of earthwork amounts, and several other studies and calculations, one can create the road alignment and map the alignment profile. Are all part of the geometric design of roads. These calculations are all done in an effort to find the best alignment while adhering to design standards and constraints. Geometric design requires a lot of time when done manually, and mistakes can be very costly. Currently, a variety of software programmes, including Bentley MX Road and The geometry of objects is designed using AutoCAD Civil 3D.

In order to design roadway geometry using computer programmes, current patterns have been adjusted. Using AutoCAD Civil 3D software, this dissertation shows an entire geometric design for a road project. The project's main goal to illustrate how precise geometric design may be done in short period of time. The process for designing roads with AutoCAD Civil 3D has been described. A user can benefit from this software's clarity, time and effort savings. Engineering software called Civil 3D is used to design, plan, and manage civil engineering projects. Typically, experts and civil engineers utilise this programme.

A Civil 3D Study of the Geometric Design of a Road Project

Ashish Kale, Vishal Gajghate, Ravina Potey (2021), Geometric design is a key element of the current style and has a significant impact on lining up a new route. Every road alignment is built on a solid geometric foundation. intersection components, specifics of the horizontal and vertical alignment, sight distance concerns, and important factors factors for things like design speed, topography or terrain, and traffic, create environmental, hourly volume and capacity models considerations, with other elements are all covered in this document. When lining up a new road, it should be quick, simple, secure, and affordable, as well as comfortable and secure for the movement. The horizontal, vertical, and cross-sectional orientation are the three essential parts of the highways' geometric design. Which, when put together, create a three-dimensional road design. Curves, tangents, and transitions are the three geometric elements that make up horizontal alignment. A longitudinal section that includes geometric additives like crest curves, sag curves, and slopes is called vertical alignment.

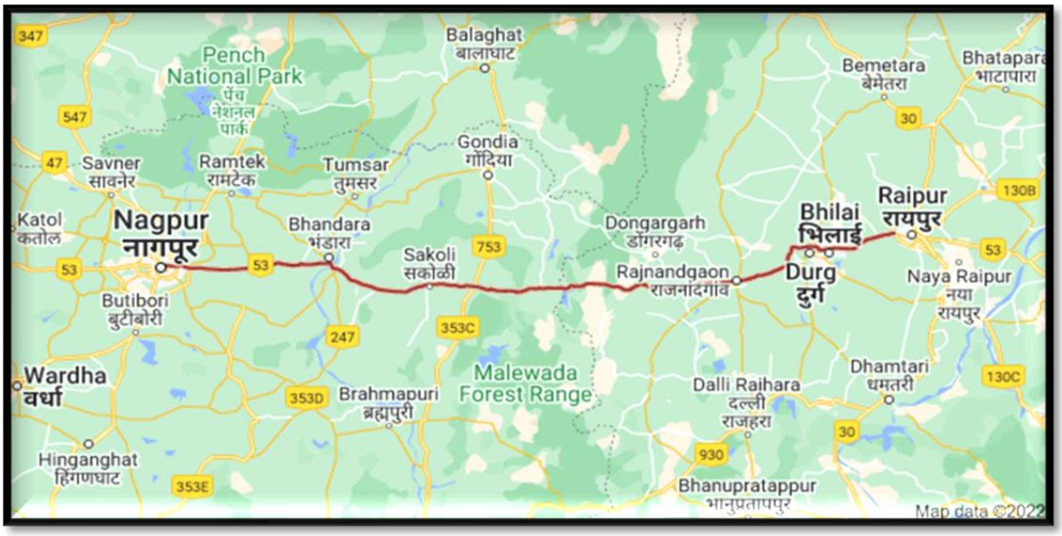
The selection, estimation, and subsequent application of highway geometry formulations is based on a number of design criteria, including sight distance, vehicle stability, driver comfort, drainage, economy, and aesthetics. Many computations and measurements are used to further the design process. This paradigm has been altered by the civil 3D upgrading so that design and development are done simultaneously. Geometrical design can be exceedingly laborious, time-consuming, and vulnerable to expensive mistakes when done manually. The traditional method is also dependent, in particular, based on a two-dimensional study that cannot be relied upon a pleasing arrangement. To help professionals from the developing world employ road design, this study aims to demonstrate how geometrical design may be completed swiftly and flawlessly. With the use of AutoCAD Civil 3D, this paper illustrates a typical roadway design while saving time and resources. Without 3D modelling, designing a highway confronts enormous difficulties. To cut and fill those amounts takes a lot of work. You can employ the volume computing strategy.

III. THE PROPOSED METHOD

3.1 RESEARCH AREA AND SITE LOCATION

[National Highway 53, Nagpur, Gondia, Maharashtra] The Bombay-Nagpur-Calcutta Road, which spans a length of 99.37 kilometres, is the sole national route to travel through the neighbourhood.

Bombay-Nagpur-Calcutta Road: The district of Bhandara is solely crossed by only one national highway. After leaving the Nagpur district, it enters the Bhandara district's western boundary at milepost 32/0, close to the village of Kharbi, and departs the area at milepost 92/4, close to the village of Sirpur. It traverses the district's whole length (through Bhandara and Sakolitahsils). The district's roads are 60 miles and 4 furlongs long in total (97.37 km). During its route, it spans the Chulband, Wainganga, and Bagh rivers via bridges. On this route, there are five significant bridges: the Wainganga River Bridge at Milepost 39/0, a bridge at Milepost 41/5, a bridge at Milepost 64/2, a bridge over the Chulband River at Milepost 69/5, and a bridge over the Bagh River at Milepost 92/4. Near Bhandara, it crosses the wide gauge railway line between Bhandara Road and Jawaharnagar in mile number 37/4 and the Jabalpur-Chanda Fort small gauge railway line close to Soundad in mile number 68/7. The following locations are touched at the mileage stated next to them: Shahapur 32/5, Bhandara Town 38, Kardha 39/6, Dhargaon 41, and Gadegaon 47/6. Lakhani 51, Sakoli 62, Soundad 68, Sawangi 71, Kohamara 72, Duggipar 73, Deori 87, and Sirpur 92/4 are among the other candidates.



[Fig.3.1: Map of National Highway 53, Nagpur, Gondia, Maharashtra]

3.2 Survey Data Gathering

The geometry of roadways must be designed using the current ground surface data. The company in charge of managing the road's development provided the survey data for the suggested path. The survey data comprised heights, eastings, and northings of several points along the suggested route.

3.3 Design Standards

The following design criteria were applied considering the horizontal geometry of the centre line, as well as to the roadway's cross section and profile, in accordance with the Geometric Design Standards Manual (IRC: SP: 20 - 2002).

- Design speed is 65 km/h, and the
- maximum superelevation rate is 7%.
- Minimum K for sag curves is 33,
- minimum K for crest curves is 17, and the c
- Coefficient of friction is 0.15.
- Shoulder width = 1.875 m;
- Carriageway width = 3.75 m;
- Roadway width = 7.5 m

3.4 Design Methodology

- ➢ Surface is created.
- ➢ Import point files into the AutoCAD Civil 3D environment that include northing, elevation, and easting and are saved in Excel format.
- ➢ Using the alignment creation tool, create alignment.
- ➢ Determine superelevation using the provided alignment.
- ➢ In this project, use the IRC design criteria.
- ➢ Establish a surface profile.
- ➢ Using the profile creation tools, create grade lines and vertical curves.

- Establish the Assembly. Individual subassemblies are added to create the assembly.
- Construct a corridor, a 3D model that combines elements from the vertical, horizontal, and cross-sectional planes. Additionally, corridors are used to determine the amount of earthwork needed, analyse sight distances, and gather information for building projects.
- Create a report for the volume table.
- Produce a perspective view.

3.5 Design of Horizontal Alignment

A road's orientation and placement in plan view are described by its horizontal alignment. Tangents (straight sections), circular curves, and spiral transitions between tangents and curves make up its three geometrical parts. The capacity of the roadway is increased, and the design speed performance is enhanced by proper alignment design. Survey information including easting, northing, and elevations were imported into Civil 3D in Excel format. This produced the current ground surface on its own. After defining the design requirements to be used on the alignment, the road alignment was drawn using the alignment creation tool. The circular and spiral curves were drawn and an report on alignment curve was obtained using the "Geometry Editor" tool.

Horizontal Curve Radius: A key element of the geometric design is the horizontal curve radius. the horizontal curve's radius determines the highest tolerable speed. Even while it is technically possible to build the curve with the highest Coefficient of friction and superelevation, doing so is not recommended because it would necessitate re-alignment should the design speed increase in the future. As a result, by assuming the highest superelevation and the friction coefficient, a ruling minimum radius *Rruling* can be determined.

$$Rruling = \frac{v^2}{g(e+f)}$$

The curve's radius should ideally be greater than R_{ruling}. Large curves, however, are also not preferred. It becomes challenging to lay out huge curves in the field. Additionally, it makes driving more difficult.

3.6 Super-elevation design:

It is safe to provide higher Super-elevation for vehicles travelling quickly without taking coefficient of friction into account since the weight of the vehicle or super-elevation completely offsets centrifugal force. Since centrifugal force is countered by friction coefficient and superelevation, giving lower superelevation for slowly moving vehicles is safe.

IRC advises using the following design process:

Step 1: Neglect f and find $e_1 = \frac{(0.75v)^2}{gR}$ for 75% of the design speed.

Step 2: If $e_1 = 0.07$, proceed to step 3. Otherwise, if $e_1 > 0.07$, proceed to step 2.

Step 3: Calculate f_1 for the maximum e and the design speed, which is $f_1 = \frac{v^2}{gR-e} = \frac{v^2}{gR-0.07}$

The limit e = 0.07 is safe for the design speed if $f_1 = 0.15$; otherwise, proceed to step 4

Step 4: Calculate the maximum speed va at e = 0.07 and f= 0.15, with va = $022gR$

If $va = v$, the design is sufficient; otherwise, utilise speed control strategies, adopt control measures, or look for speed control strategies.

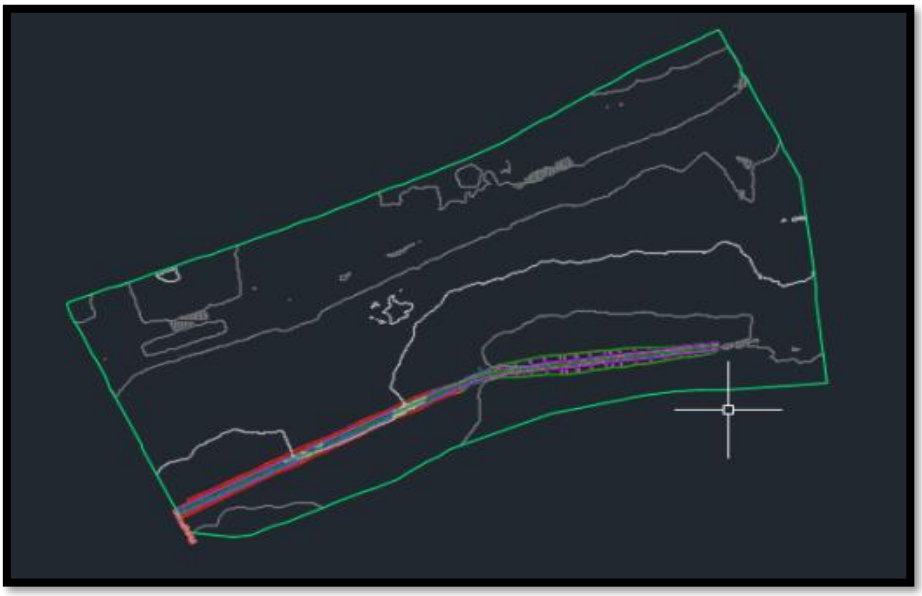
Procedure for AutoCAD Civil 3D Design:

• Import survey data into the AutoCAD Civil 3D environment, including easting, northing, and levels data saved in Note Pad format.
• Improve the ground surface
• Use polylines to create alignment by connecting points on the current ground.
• Use the design standards. The AASHTO design guidelines were chosen for this project.
• Produce the current ground profile.
• Utilize the profile generation tools to create the formation level (completed).
• Produce the Assembly, which outlines the design's cross-sectional element. Individual subassembly objects are connected to form the assembly.
• Construct the corridor, a dynamic 3D model that is the result of combining horizontal, cross-sectional and vertical design elements. The creation of surfaces, computation of earthworks and quantity takeoffs, sight and visual analysis, and data extraction for building can all be done using corridors.
• Produce a report on a volume table.

IV. RESULTS AND DISCUSSIONS

4.1 Horizontal Alignment Design

Survey information including easting, northing, and elevations were imported into Civil 3D in Excel format. This automatically created the ground's current surface. After defining the design requirements to be used on the alignment, the road alignment was drawn using the alignment creation tool. Using the "Geometry Editor" tool, the spiral and circular curves were generated, and an alignment curve report was obtained.



[Fig.4.1: Horizontal Alignment generated by AutoCAD Civil 3D Software]

4.2 Design of Vertical Alignment

The longitudinal portion of the road is referred to as the vertical alignment. It is made up of vertical curves and gradients, and it also affects how comfortably fast-moving cars can see and stop. Vertical alignment can then be constructed after the horizontal alignment has been fixed. To achieve this, the vertical alignment is constructed on the perspective of the ground profile after the horizontal alignment ground profile has been developed. Applying minimum K design guidelines for vertical curves of sag and crest that satisfy the fundamental requirements for stopping sight distance, accessibility, and attractiveness criteria led to the selection of the profile geometry.

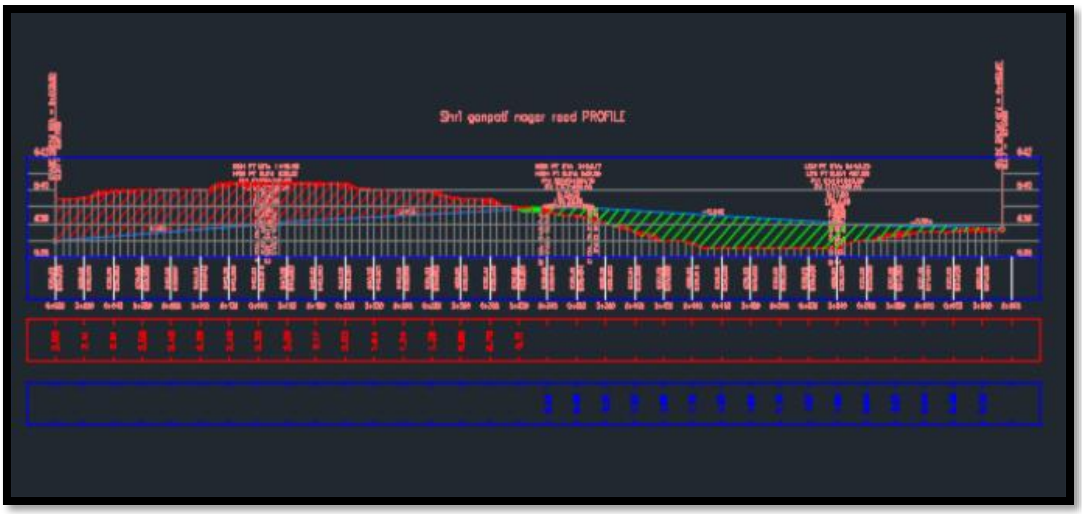
The formula L=KA was also used to manually determine the vertical curve lengths.

Where ,

K is the amount of time needed for a 1% grade change.

length of the vertical curve, L.

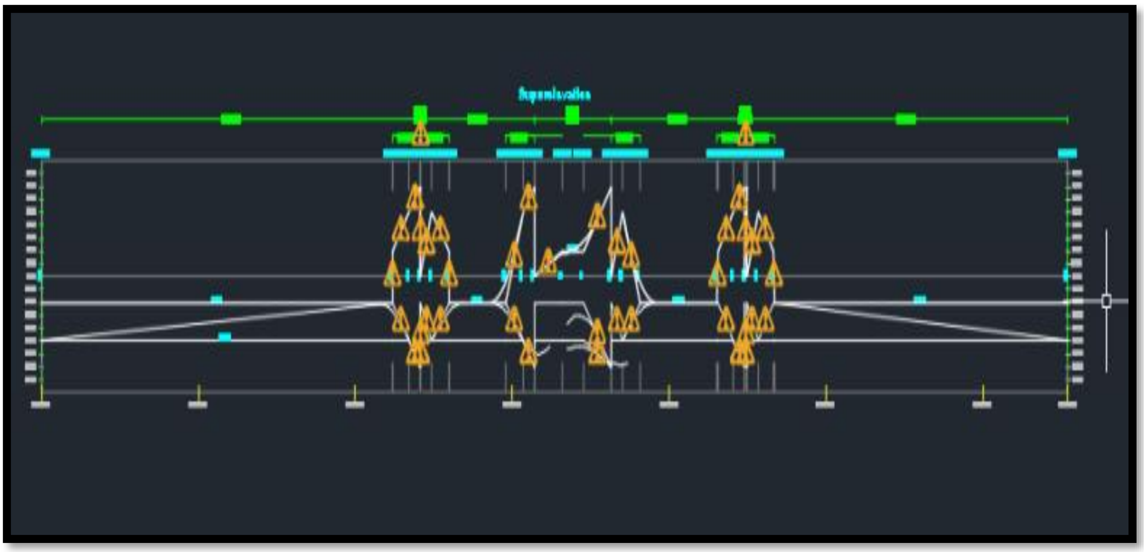
A denotes a grade difference of %.



[Fig.4.2: Vertical alignment generated by AutoCAD Civil 3D Software]

4.3 Super-elevation

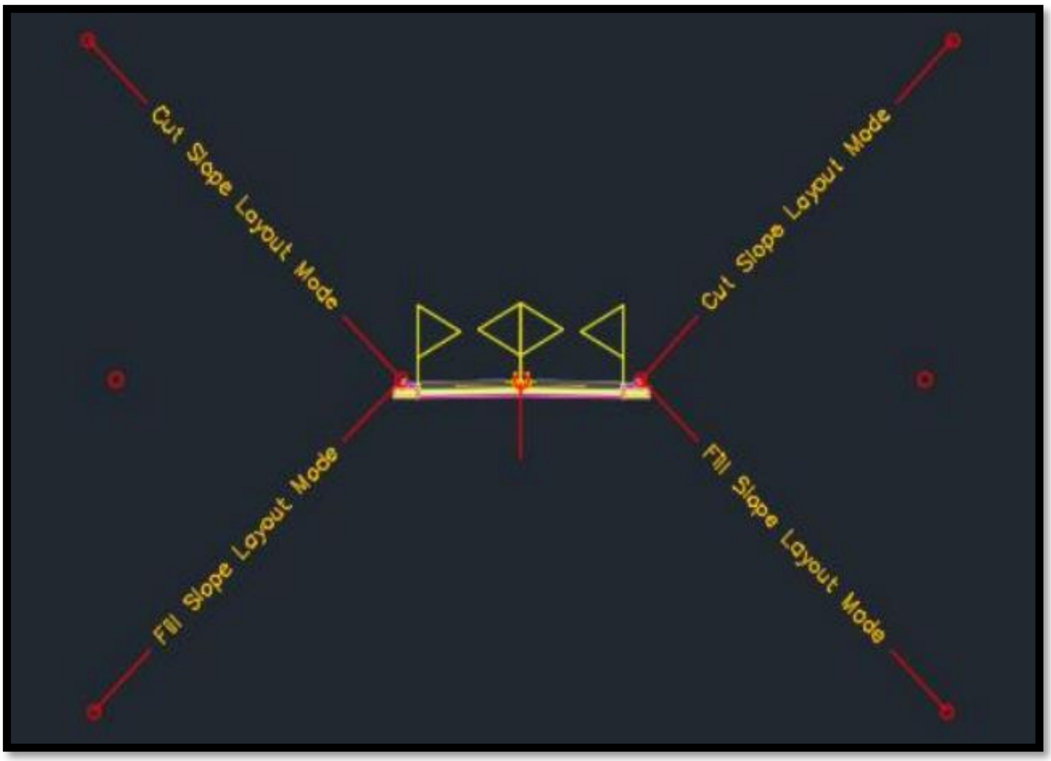
By increasing the pavement's outer edge toward its inner edge, The transverse slope is known as superelevation supplied in order to oppose the centrifugal force impact and lessen the potential for vehicles to flip over and skid laterally outward. After determining the horizontal curve radius, superelevation is discussed. The "Edit Superelevation" command applies superelevation to the alignment segment.



[Fig.4.3: Super-elevation View generated by AutoCAD Civil 3D Software]

4.4 Assemblies

In Civil 3D Software, assembly is utilised to define a platform. Platform, Assembly's "Subassembly" command specifies things like a shoulder, median, and lane to make a typical road cross section. With subassemblies, the The middle of the platform receives additions to the right and left. Using pre-existing subassemblies or making your own subassemblies are the two possibilities when designing an assembly.



[Fig.4.4: Assembly generated by AutoCAD Civil 3D Software]

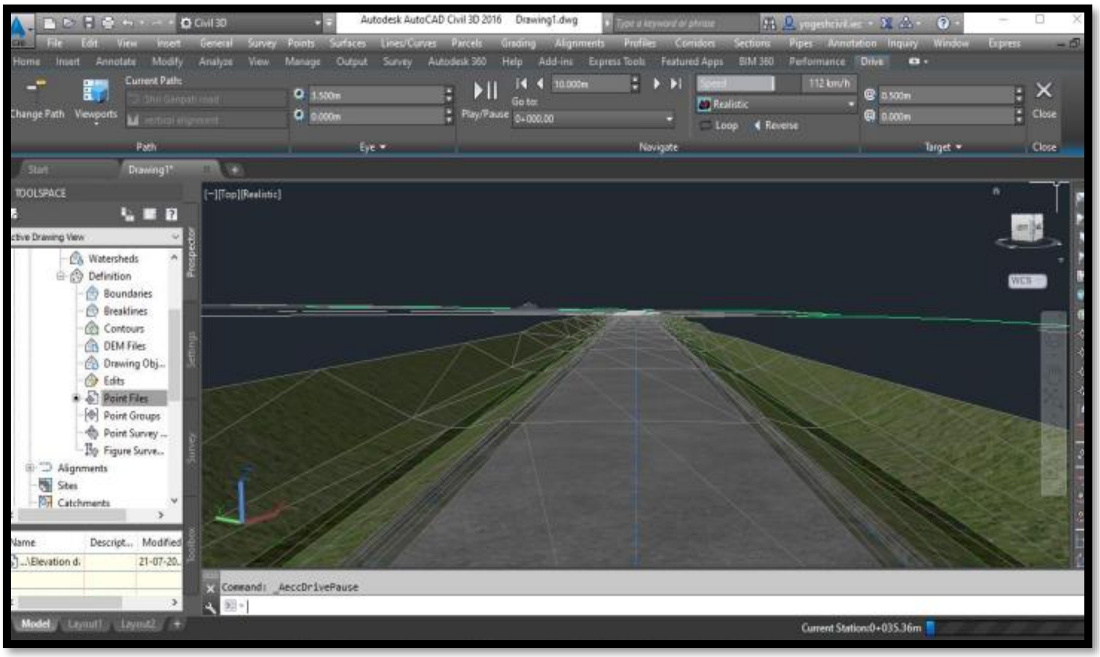
4.5 Cut and Fill Calculation

A function in AutoCAD Civil 3D makes it possible to quickly determine how much earthwork will be needed for a project. AutoCAD Civil 3D makes it simple to create a comparison surface after creating the ground surface and the suggested completed grade surface. This surface shows the volume between the two surfaces and computes the elevation difference. On the Modify tab, select "Surfaces" to start the earthwork calculation process.

Station	Cut Area (Sq.mt)	Cut Volumn (Cu. M.)	Reusable Volume(Cu. M.)	Fill Area (Sq. M.)	Fill Volume (Cu.m.)	Cum. Cut Volume(C u. M.)	Cutting Reuseble Vol. (Cu. M.)	Cum. Fill Vol. (Cu. M.)	Cum. Net Vol. (Cu. M.)
0+000.000	47.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0+020.000	47.87	957.46	957.46	0.00	0.00	957.46	957.46	0.00	957.46
0+040.000	48.67	965.39	965.39	0.00	0.00	1922.85	1922.85	0.00	1922.85
0+060.000	50.28	989.54	989.54	0.00	0.00	2912.40	2912.40	0.00	2912.40
0+080.00	49.10	993.86	993.86	0.00	0.00	3906.26	3906.26	0.00	3906.26
0+100.00	46.49	955.93	955.93	0.00	0.00	4862.18	4862.18	0.00	4862.18
0+120.000	48.07	945.60	945.60	0.00	0.00	5807.78	5807.78	0.00	5807.78
0+140.00	45.32	933.87	933.87	0.00	0.00	6741.65	6741.65	0.00	6741.65
0+160.00	40.42	889.60	889.60	0.00	0.00	7631.25	7631.25	0.00	7631.25
0+180.00	38.25	840.62	840.62	0.00	0.00	8471.87	8471.87	0.00	8471.87
0+200.00	32.88	786.73	786.73	0.00	0.00	9258.60	9258.60	0.00	9258.60
0+220.00	29.84	711.35	711.35	0.00	0.00	9969.95	9969.95	0.00	9969.95
0+240.00	24.39	627.21	627.21	0.00	0.00	10597.17	10597.17	0.00	10597.17
0+260.00	17.17	542.28	542.28	0.00	0.00	11139.44	11139.44	0.00	11139.44
0+280.00	12.65	415.52	415.52	0.00	0.00	11554.96	11554.96	0.00	11554.96
0+300.00	6.13	298.16	298.16	0.00	0.00	11853.12	11853.12	0.00	11853.12
0+320.00	2.17	187.86	187.86	0.61	6.00	12040.99	12040.99	6.00	12034.99
0+340.00	0.10	83.26	83.26	0.46	10.21	12124.25	12124.25	16.21	12108.04
0+360.00	0.00	22.83	22.83	2.26	26.57	12147.08	12147.08	42.78	12104.30
0+380.00	0.00	0.99	0.99	6.55	87.94	12148.07	12148.07	130.72	12017.35

4.5 Using the Drive command to view in perspective

Choose your alignment, Feature line, and then select Drive from the Analyze menu. Change the settings, then press the play/pause button to move through the corridor.



[Fig.4.5: Perspective viewgenerated by AutoCAD Civil 3D Software]

V. CONCLUSION

Highways are supposed to guarantee the both ease and security of users, to enable effective traffic flow, and to command the least expensive construction and maintenance costs. Highways are also anticipated to harm the environment as little as possible and to be aesthetically beautiful when completed. These requirements are satisfied by geometric design. Geometric design "focuses on the specific measures that provide for efficient and appropriate operation of the road, as well as provide for all the specific details that make roads safe and compatible with social and environmental circumstances surrounding the road," according to the American Association of State Highway and Transportation Officials (AASHTO).

- The shape of the road was planned with the IRC and other safety precautions in mind.
- AutoCAD Civil 3D helps to expeditiously and comfortably complete the design process while also saving a significant amount of time and work.
- We can effectively align the route that is practicable and sound with the help of the collection of traffic data and the evaluation of the current study area.
- The alignment was made horizontally. It was drafted a vertical profile. Cross sections that work are being produced.
- AutoCAD Civil 3D makes it possible to complete the design process quickly and comfortably while also saving a great deal of time and work.
- Superelevation was computed and put into practise.
- The AutoCAD Civil 3D's capabilities minimise the primary drawbacks of a manual design approach that is laborious, time-consuming, and incredibly prone to costly errors.
- This project presents the whole geometric layout of the road in AutoCAD civil 3D.

VI. ACKNOWLEDGMENT

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