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Web Application for Road Geometric Design

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Abstract: Transportation infrastructure includes geometric components such as horizontal, vertical curve, sight distance, super elevation, widening, and others, especially when it comes to highway amenities. The "Website for Geometric Design of Highway" project comprises a full geometric design as well as the resolution of engineers' issues in computing highway design parameters using a computer program. Geometric design elements are crucial in determining the traffic operational efficiency of a route.
Traffic operations are influenced by the number and width of lanes, the width of shoulders, and the horizontal and vertical curves of the roadway.
Keywords: Road Geometric Design, Geometric Design, Highway Design, Transportation.

I. INTRODUCTION

Highway Engineering, as a large-scale comprehensive engineering, has the characteristics of complex technology, a broad range, and difficult management. With the construction of the Highway Engineering project becoming increasingly difficult and the construction scale becoming increasingly large, the traditional manual management mode has been gradually phased out. At the moment, it has become the consensus of Highway Engineering enterprises to adopt flexible computer technology and a highly information management system in each construction link of Highway Engineering in order to ensure construction quality and improve construction efficiency.
As a result, this project examines existing Highway Engineering problems in design and construction management, as well as demonstrates the specific application of computer technology in civil engineering exploration, planning, and construction management.

II. PROBLEM STATEMENT

Problems Faced by Civil Engineer During Designing Highway
1) Highway construction has tight Construction programmed or schedule. Any slippage/delays in the programmed will put much pressure to complete tasks progressively.
2) Substandard materials, poor workmanship, rushed jobs, incorrect construction methodologies, non-compliances, Works not properly checked/inspected, etc. These will have detrimental issues down the track. Defects and maintenance will always cost more after construction has been completed.
3) Under the background that the construction of the civil engineering project is more and more difficult and the construction scale is more and more large, the traditional manual management mode has been gradually eliminated.
4) At present, in order to ensure the construction quality and improve the construction efficiency, it has become the consensus of civil engineering enterprises to adopt flexible computer technology and highly information management system in each construction link of civil engineering.

III.OBJECTIVES

In leading countries there is a tendency to synchronize the management of both traffic flows and objects of infrastructure. Using innovative developments in the modeling and management of transport flows and infrastructure elements, it becomes possible:

A. Objectives Of Road Geometric Design
1) To reduce calculation time of highway design.
2) To offer a sophisticated alternative to manual process.
3) To help civil engineers improve design quality and speed project delivery

IV. METHODOLOGY

A. Geometric Design of Highway

In the real world of Engineering designing problems are often solved by going through supplier catalog information doing handbook calculations. This program is not just from making the needed calculations but also the Engineer opportunity to rapidly try out alternative parameters and approaches, different components. They can discover problem area and modify their designs to find better solution. Programming language is a computer language to communicate with computers. It is a set of instructions written in any specific language to perform a specific task. Programming mainly uses a variety of computer languages such as C, C++ and Java etc. Programming a solution means not only defining a solution but also creating a means to input the needed information and to format and output the results.

This program would be able to handle any Highway Design related problem thrown at it. It would allow the user to define the necessary parameters then the program would choose appropriate solution method from among many it had available and attempt a solution. All this would be done in very simple manner.

B. Highway Parameters That Can Be Designed by This Program

1) Sight Distance

Sight distance is the distance along a road at which a driver from a specified height above the carriageway has a visibility of objects and can safely stop his vehicle or overtake another vehicle. Sight distance requirement is needed in the design of vertical curves and it also governs the setback distances of building or any other obstructions adjacent to the carriageway on a horizontal curve.

Sight Distance Considered by IRC in Highway Design Are;

1.1 Stopping Sight Distance (SSD) Non-Passing Sight Distance
1.2 Overtaking Sight Distance (OSD) Passing Sight Distance
1.3 Safe Sight Distance required for entering in an intersection
1.4 Intermediate Sight Distance (ISD)
1.5 Head Light Sight Distance (HSD)

Sight Distance on A Highway Depends Upon the Following Factors;

- *Speed of Vehicle*

  Speed of vehicle is directly related with the sight distance. More will be the speed of vehicle more will be the sight distance required.

  Note: If Speed of vehicle is not mentioned in the problem, then consider the design speed if highway as the speed of vehicle.

- *Driver's Reaction Time*

  Reaction time is the time taken by the driver from the instant of seeing the object to the instant when the brakes are applied. Total reaction time is measured on the basis of PIEV theory which varies from 0.5 seconds for simple situations to 3-4 seconds for complex situations.

  Note: IRC recommends reaction time of 2.5 seconds for stopping sight distance and 2.0 seconds for overtaking sight distance calculations.

- *Brake's Efficiency*

  Efficiency of the brakes depends upon the age and characteristics of vehicle. If we say the brakes are 100% efficient. It means vehicle will stop at the moment of applications of brakes.

  But practically 100% efficiency of brakes is not achieved, otherwise skidding will occur which is uncontrollable and dangerous for the vehicle and the road users.

  Note: For the design purpose of highway, we consider only 50% brake efficiency of vehicle.

- *Gradient of Pavement*

When we are going down on a gradient, gravitational force also comes into action which causes the vehicle to take more time to stop the vehicle means more sight distance is required. While climbing up a gradient less sight is required because the time taken to stop the vehicle will be less.

- *Frictional Resistance*

Less distance is required by vehicle to stop when frictional resistance is more, but more friction will cause more wear and tear in the tire which is not beneficial for the vehicle.
That's why IRC recommend the value of longitudinal friction in between 0.35 to 0.40

Speed (kmph)	20-30	40	50	60	65	80	100
Longitudinal Coefficient of Friction, f	0.40	0.38	0.37	0.36	0.36	0.35	0.35

a) Stopping Sight Distance

Stopping sight distance is minimum distance over which the driver travelling at design speed can apply brake and bring the vehicle to stop position safely without collision with any other obstruction. It is also known as minimum sight distance or non-passing sight distance. Stopping sight distance should be provided throughout the length of all roads.

Stopping sight distance composed of two components:

- *Lag Distance (d):*

It is the distance travelled by the vehicle in total reaction time, if v is the design speed in m/s and t is the total reaction time in sec, then,

lag distance (d) = Vt meters
if V is design speed in kmph and t in seconds, then
d = 0.278 Vt meters

- *Braking Distance (l):*

It is the distance travelled by vehicle after the application of brakes. It is obtained by equating the work done in stopping the vehicle and kinetic energy stored in the vehicle. Let us consider, F is the maximum frictional force developed and l is the braking distance, then the work done against friction in stopping the vehicle will be Fl.

Where Frictional Force, F = fW
Where, 'W' is the total weight of vehicle and 'f' is coefficient of friction
So, work done in stopping the vehicle = fWl ……(i) While the kinetic energy stored in vehicle = ½ mv^2 = ½ Wv^2 / 2g (W = mg)……(ii) Now by using the law of conservation of energy,
Work done in stopping the vehicle = Kinetic energy stored in vehicle

$fWl = Wv^2/2g$ $l = v^2/ 2gf$
Note: If braking efficiency is η, the braking distance $l = vt + (v^2/ 2gf\eta)$
Therefore,
Stopping Sight Distance (SSD) = Lag Distance + Braking Distance
SSD = vt + (v^2/ 2gf)
Where, v is design speed in m/s, g is the acceleration due to gravity in m/s^2, t is the total reaction time in sec and f is coefficient of friction.
The values of stopping sight distance recommended by IRC on the basis of design speed are given in table below

Design Speed (kmph)	20	25	30	40	50	60	65	80	100
Safe Stopping Sight Distance (m)	20	25	30	45	60	80	90	120	180

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- *Overtaking Sight Distance (OSD)*

Overtaking is necessary operation because all vehicles do not travel with a uniform speed. Overtaking is only possible when driver has sufficient sight distance to complete the whole operation.

It is the minimum distance visible to the driver of a vehicle who is intending to overtake the slow-moving vehicle ahead safely against the traffic of opposite direction. It is measured along the center line of road over which driver with his eye level 1.2m above the pavement surface can see the top of an object of height 1.2m above the road surface

Note: Generally, in overtaking operations, a vehicle overtakes another vehicle, not any other object, so height of object is fixed to1.2m above road surface.

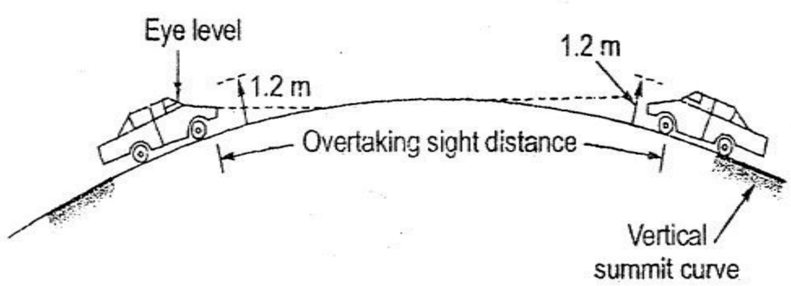


Fig: Measurement of overtaking sight distance

Factors affecting the overtaking sight distance

- Speed of overtaking, overtake and vehicle coming from opposite direction
- The spacing between overtaking and overtaken vehicle
- Skill and reaction time of driver
- Rate of acceleration of overtaking vehicle.
- Gradient of road

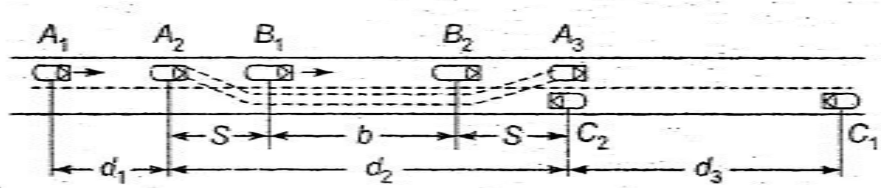
- *Analysis of overtaking sight distance*

Let us suppose,

Vehicle A = Travelling at design speed of highway

Vehicle B = Slow moving vehicle which is to be overtaken by vehicle A Vehicle C = Travelling in opposite direction of vehicle A and B

The whole process of overtaking is split into three parts d1, d2, and d3 as shown in fig



Where,

d1 = Distance travelled by overtaking vehicle A during the reaction time ‘t’ sec

d2 = Distance travelled by overtaking vehicle A during actual overtaking operation in time ‘T’ sec

d3 = Distance travelled by vehicle C comes from the opposite direction Vb = Speed of slow-moving vehicle (in kmph)

Note: IRC recommends the total reaction time (t) of 2 sec for overtaking sight distance.

If Vb value is not given then assume Vb = v- 4.5 m/s

Vb = V – 16 kmph

Where, v or V is the design speed in m/s or kmph

- *During calculations of d1, d2, d3 we made following assumptions:*
  i. It is assumed that the vehicle A is forced to reduce its speed to speed of slow-moving vehicle (Vb)
  ii. Spacing between vehicle A and vehicle B is s, till there is an opportunity for safe overtaking operation and distance travelled by vehicle A during this reaction time

d1

Now, d1 is the distance travelled by the vehicle A in reaction time which is given as d1 = vbt meters

Where,

Vb = Speed of slow moving vehicle in m/s

Spacing between the vehicle A and B just before the starting of overtaking operation (i.e. at position A2 and B1) when both the vehicles moving with the speed of Vb m/s is given by an empirical formula

S= 0.7 Vb + length of vehicle

Generally, length of vehicle considered is 6 meters

S= 0.7 Vb + 6 meters … (vb in m/s)

OR

S= 0.2 Vb + 6 meters … (vb in kmph)

Let, 'b' is the distance travelled by the vehicle B in complete overtaking operation time 'T' sec

b = Vb T meters

d2 = b+ 2s meters … (i)

And

d2 = VbT + ½ aT2 meters …(ii)

Equating equation (i) and (ii), we get,

b + 2s = Vb T + ½ a T2

= Vb T + 2s = VbT + ½ a T2

= 2s = ½ a T2

T = √4s/ a (Where a is in m/s)

Or

T = √14.4 S/ A (Where A is in kmph/ sec)

Speed		Maximum overtaking acceleration	
V (kmph)	V (m/s)	A (kmph/sec)	A (m/s^2)
25	6.03	5.00	1.41
30	8.34	4.80	1.30
40	11.10	4.45	1.24
50	13.86	4.00	1.11
65	18.00	3.28	0.02
80	22.20	2.56	0.72
100	27. 80	1.92	0.53

Table : Maximum overtaking acceleration at different speeds

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Now,
d2 = Vb T + 2 S meters
The distance travelled by vehicle C moving at design speed v m/s during the overtaking operation of A
d3 = v T meters Therefore,
OSD = d1 + d2 + d3 meters
OSD = Vb t + Vb T + 2S + vT meters (Vb and v in m/s, t and T in sec)

Note: On divided highways with one way traffic the overtaking distance need to be only (d1 + d20, because no vehicle is expected from the opposite direction

The values of overtaking sight distance recommended by IRC are given in table

Speed (kmph)	40	50	60	65	80	100
Safe Overtaking Sight Distance (m)	165	235	300	340	470	640

Table no.3.4: Overtaking Sight Distance

a. Effect of Gradient on overtaking Sight Distance

On an ascending gradient, the overtaking sight distance required is more due to reduced acceleration of overtaking vehicle and vehicle coming from opposite direction is likely to speed up. Effect of gradient is compensated by reducing the speed of overtaken vehicle

b. Overtaking Zone

It is desirable to construct highway such that the length of road visible ahead is sufficient for safe overtaking operation. But practically seldom it is not possible to provide overtaking sight distance throughout the length. In that case we provide particular zones marked with wide road for overtaking operation in the highway.
These zones which are meant for overtaking are called overtaking zones.

The desirable length of overtaking zone is kept five times the overtaking sight distances.

Note: Minimum length of overtaking zone is taken as 3 times of overtaking sight distances.

- *Impact Factor*

This is defined as the ratio of the maximum centrifugal force to the weight of the vehicle and is expressed as a percentage.
The centrifugal force P is given by, $P = (W/g) \times (V^2/r)$
Where,
W= weight of vehicle in kg V= Speed in m/s
R= Radius of curvature in m at that particular instant

Centrifugal force is maximum when r is minimum, which occurs at the end of the transition curve i.e., when r = R

$P_{max} = (W/g) \times (V^2/R)$ If I is the impact factor, then
$I(\%) = (P_{max}/ W) \times 100 = (V^2/gR) \times 100$
As R = L/ 2N and v = 0.28 V, Where V is in kmph
I (%) $(0.28V)^2/(9.81 \times L/2N)$ **x 100 = 1.59 (Nv^2/ L)**

2) Design of Superelevation

Design of superelevation for mixed traffic condition is completed problem because different vehicles move with different speeds. Maximum value of superelevation by neglecting the lateral friction is safer for fast moving vehicle but inconvenient for slower vehicle. While lower superelevation, depending more on later friction would be unsafe for faster vehicle.

So, for practical condition IRC recommends that superelevation should be provided to fully counteract the centrifugal force due to 75% of design speed by neglecting the lateral friction.

Following design steps are involved into the design of superelevation

- Step 1: Calculate the superelevation corresponding to 75% of design speed and neglecting the role of lateral friction.

  $e + 0 = (0.75\ V)^2 / 127R$

  equilibrium = V2/225R

  If ecalculated < emaximum then provide e = eequilibrium If ecalculated > emaximum then provide e = emaximum
- Step 2: Provide $e = e_{maximum,}$ and find the value of lateral friction'f'

  $e + f = V^2 / 127\ R$

  $f = (V^2 / 127\ R) - e_{maximum}$

  If, $f < 0.15$, then provide $e = e_{maximum}$ If, $f > 0.15$, then fix $f = 0.15$

- Step 3: Now take $f = 0.15$, $e_{maximum}$ and find the actual velocity will be provided on the highway

  $e + f = V_a^2 / 127\ R$

  $e_{max} + 0.15 = V_a^2 / 127\ R$

  If Vdesign < Vactual , then OK

  If $V_{design} > V_{actual}$, then restrict the speed by providing speed limits sign.

3) Extrawidening

Additional width of carriageway that is required that is required on horizontal curve is referred as extrawidening. The rear wheels follow the linear path on the curve as compared with the front wheels. The phenomena are called off tracking.

- Reasons to provide Extrawidening are;
  1. To avoid offtracking due to rigidity of wheel base
  2. To counteract transverse skidding
  3. To increase the visibility at curve
  4. To encounter psychological tendency while overtaking operation
- Extrawidening is split into two parts;

a) Mechanical Widening

It is provided due to the rigidity of the wheel base, when a vehicle travels on a horizontal curve, only front wheel can be controlled and rear wheels does not follow the same path as front wheel.

Let, R1 = Radius of path traversed by the outer rear wheel (in m) R2 = Radius of path traversed by the outer front wheel (in m) l = Length of wheel base (in m)

W_m= Mechanical widening (in m)

$R2^2 = R1^2 + l^2$

$R2^2 = (R2^2 - W_m)^2 + l^2$

$R2^2 = (R2^2 - 2R_2W_m + W_m^2 + l^2$

$2R_2W_m - W_m^2 = l^2$

$\mathbf{W_m} = (l^2)/(2R2 - Wm) \approx (l^2)/2R$ (Where R is the radius of curve)

If a road has n lanes, then the mechanical extrawidening is

$\mathbf{W_m = nl^2/2R}$

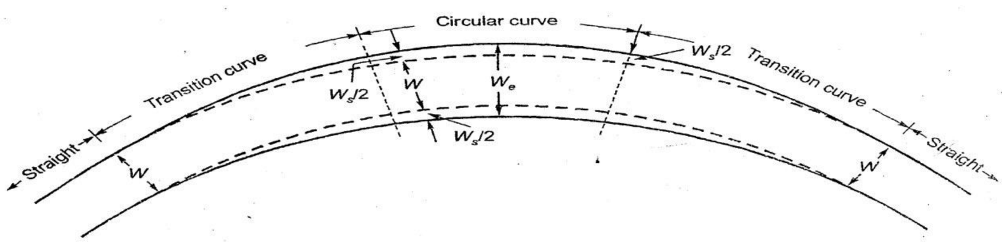

Fig: Extrawidening of pavement on horizontal curve

b) Psychological Widening

There is a tendency for driver closer to the edges of the pavements on curves. So psychological widening is also required to provided, IRC proposed an empirical formula for the psychological widening.

$Wps= V/9.5\sqrt{R}$

Therefore, the total extrawidening (W_e) needed to be provided on a horizontal curve will be given as

$W_e = W_m + W_{ps}$

$W_e = ((nl^2)/2R) + (V/(9.5\sqrt{R}))$

Note: IRC recommended values for extrawidening for single- and two-lane pavement are given below

If R > 300m, then extra widening is not provided

If R < 50m, then extrawidening is provided at inner edge

If 50 < R < 300m, then extrawidening is provided at both the edges

4) Curves

- *Grade Compensation Curves on Hill Roads*

When there is a horizontal curve in addition to gradient then there will be increased resistance to traction due to both curve and gradient. Therefore, it is necessary to compensate the gradient at horizontal curve.

Grade compensation as taken is minimum of **(30+R)/R % or 75/R %** where ‘R’ is the radius of Curve in meters.

Compensated Gradient = Gradient – Grade Compensation

According to IRC grade compensation is not necessary for the gradient flatter than 4%

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- *Transition Curves*

When a vehicle travelling on a straight road enters into a horizontal curve instantaneously, it will cause discomfort to the driver. To avoid this, it is required to provide a transition curve. This may be provided either between a tangent and a circular curve between two branches of a compound or reverse curve

- *Length of transition curve*

The length of transition curve is designed to fulfill three conditions i.e.,

2.3.2.1 Rate of change of centrifugal acceleration to be acceleration to be developed gradually
2.3.2.2 Rate of introduction of the designed super elevation to be at a reasonable rate, and
2.3.2.3 Minimum length by IRC empirical formula

The length of transition curve fulfilling all the three conditions (for the highest of the three values) is generally accepted.

Length of transition curve by rate of change of radial acceleration

Radial acceleration at any point on a circular curve is (v^2/R) m/s^2 Where, V= Velocity of the vehicle in m/s

R= Radius of the curve in m

In order to have a gradual change of radial acceleration so as not to cause discomfort to the drivers, the curvature (1/R) must change at a definite rate from zero to a designed value. At the tangent point the radial acceleration (v^2/R) is zero and as the radius R if infinity.

At the end of transition curve the radius 'R' has the minimum value of 'R_m'. Hence the rate of change of radial acceleration 'C' is given by

$$C = \frac{\frac{7^2 - 0}{R}}{t} = \frac{V^2}{Rt} \qquad \text{... (i)}$$

Let the length of transition curve is 'L_s' (in m) and't' is the time taken by vehicle in second to travel the transition length at uniform speed of 'V' m/s

$$t = \frac{LS}{V} \qquad \text{... (ii)}$$

From equation (i) and (ii), we get, C = V2/ R (LS/7) = V^3/ R.LS

$$Ls = \frac{V3}{CR} = \frac{0.0215\,V^3}{CR} \qquad \text{(Here, V is in kmph)}$$

Subject to a maximum of 0.8 and minimum of 0.5

Length of transition curve by an arbitrary rate of change of super elevation the length of transition curve can be such that the superelevation (e) is applied at a uniform rate of 1 in N.

The length of transition curve 'L_s' is given by

When pavement is rotated about inner edge

$L_s = eN(W = W_e)$

Where,

1= Rate of change of superelevation

N = 150 (Plain and rolling terrain) N = 60 (Hilly Area)

W = Width of pavement W_s = Extra widening

When pavement is rotated about centre

$$L_s = eN\,\frac{W+We}{2}$$

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Empirical formula for the length of transition curve recommended by IRC

For plain and rolling terrain, $L_s = 2.7 \, (V^2/R)$ m

For Mountainous and steep terrain, $L_s = \frac{V^2}{R}$

- *Setting out of transition curve*

When a transition curve is introduced between a straight and circular curve, then circular curve has to be shifted so that the transition curve meets the circular tangentially. The shift(S) of a circular curve is given by

$$S = \frac{L_s^2}{24R} \qquad (L_s = \text{Length of transition curve})$$

Plan and Rolling terrain							Mountainous and Steep terrain					
Curve radius (m)	Design speed (kmph)						Curve radius (m)	Design speed (kmph)				
	100	80	65	50	40	35		50	40	30	25	20
Transition length (m)							Transition length (m)					
45	-	-	-	-	NA	70	14	-	-	-	NA	30
60	-	-	-	NA	75	55	20	-	-	-	35	20
90	-	-	-	75	50	40	25	-	-	NA	25	20
100	-	-	NA	70	45	35	30	-	-	30	25	15
150	-	-	80	45	30	25	40	-	NA	25	20	15
170	-	-	70	40	25	20	50	-	40	20	15	15
200	-	NA	60	35	25	20	55	-	40	20	15	15
240	-	90	50	30	20	NR	70	NA	30	15	15	15
300	NA	75	40	25	NR	-	80	55	25	15	15	NR
360	130	60	35	20	-	-	90	45	25	15	15	-
400	115	55	30	20	-	-	100	45	20	15	15	-
500	95	45	25	NR	-	-	125	35	15	15	NR	-
600	80	35	20	-	-	-	150	30	15	15	-	-
700	70	35	20	-	-	-	170	25	15	NR	-	-
800	60	30	NR	-	-	-	200	20	15	-	-	-
900	55	30	-	-	-	-	250	15	15	-	-	-
1000	50	30	-	-	-	-	300	15	NR	-	-	-
1200	40	NR	-	-	-	-	400	15	-	-	-	-
1500	35	-	-	-	-	-	500	NR	-	-	-	-
1800	30	-	-	-		-						
2000	NR	-	-	-		-						

Minimum transition length for different speed and radii

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V. TECH-STACK WEBSITE FOR GEOMETRIC DESIGN OF HIGHWAY PROTOTYPE

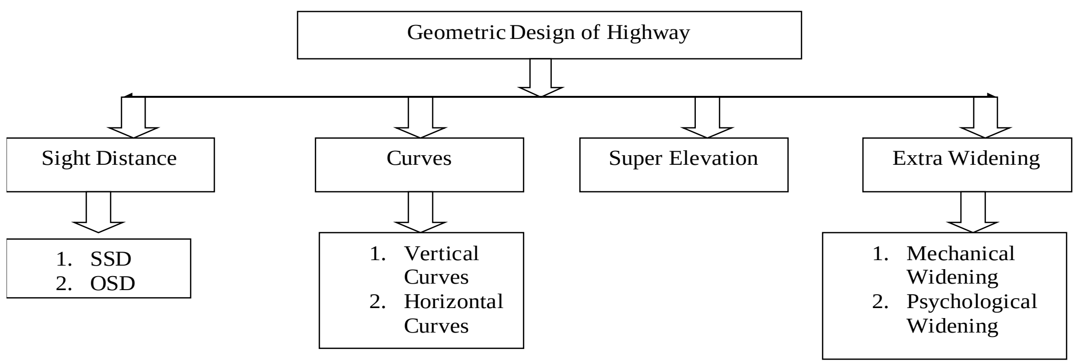
A. Front-End: -
- HTML
- CSS
- JavaScript
- Bootstrap

B. Required Hardware
- Laptop or Desktop
- 2 GB or higher RAM
- Intel or AMD Chip with 2GHz or more clock speed
- Internet Support

C. Required Software for users
- Web Browser- Chrome or Firefox

D. Required Software for Developers
- Web Browser- Chrome or Firefox
- Web Development IDE – VS Code or any other preferred IDE

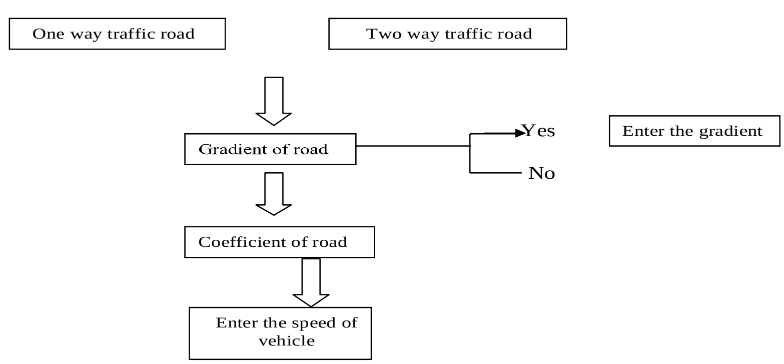
VI. WORKING OF WEBSITE OD ROAD GEOMETRIC DESIGN



Flow chart no..1

For Example.

To Calculate Stopping Sight Distance : -



Flow Chart no. 2

VII. SOURCE CODE

A. Front Page

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="utf-8">
<meta name="viewport" content="width=device-width, initial-scale=1">
<link rel="stylesheet" href="https://www.w3schools.com/w3css/4/w3.css">
<link rel="stylesheet" href="https://www.w3schools.com/lib/w3-theme-light-blue.css">
<title>Rakhi project</title>
<script src="https://unpkg.com/feather-icons"></script>

<style>

body {
  background-image: url("map.jpg"); /* The image used for background */
  background-position: center; /* Center the image */
  background-repeat: no-repeat; /* Do not repeat the image */
  background-size: cover; /* Resize the background image to cover the entire container */
}

.container {
  width: 100%;
  height: 100%;
  padding-right: 15px;
  padding-left: 15px;
  margin-right: auto;
  margin-left: auto;
}

.name {
  margin-top: 15px !important;
}

.w3-theme-d3 {
  background-color: rgba(42, 169, 219, 0.6) !important;
}

.w3-theme-d3:hover {
  background-color: rgba(42, 169, 219, 0.8) !important;
}

a {
  font-size: x-large;
}

.w3-border {
  border: 3px solid #ccc !important;
}
```

```css
.links-container {
  display: flex;
  flex-direction: column;
  align-items: center;
}

.links-container a {
  width: 80%;
}

.profession {
  font-size: 14px;
}

.subscribe {
  font-size: 15px;
}

.submit form {
  display: flex;
  flex-direction: column;
}

.submit form button {
  margin-top: 5px;
  background-color: rgba(27, 122, 159, 0.9) !important;
  color: #fff !important;
}

.submit form button:hover {
  background-color: rgba(15, 67, 87, 0.9) !important;
  color: #fff !important;
}
.submit form input {
  width: 100% !important;
}
.submit form input::placeholder {
  color: #fff;
}

.icons {
  display: flex;
  gap: 40px;
}

.icons a {
  text-decoration: none;
}
```

```
.icons a svg {
  fill: #d0ecf7;
  transform: scale(1.5);
}

@media screen and (min-width: 768px) {
  .link {
    width: 100%;
  }
}
@media screen and (min-width: 576px) {
  .container {
    max-width: 540px;
  }

  .profession {
    font-size: 24px;
  }
}
</style>
  </head>

  <body>
    <!-- Content container -->
    <div class="container">

      <!-- Image and name container. Change to your picture here. -->
      <div class="" style="text-align: center">
        <img src="C:\Users\GS2248\Documents\PRo\img\civil_logo.jpg" class="w3-round" alt="person image" width="250px"
height="200px" style="border-radius: 50%; border: 5px solid #4ab6e0 !important; margin-top: 16px;">
        <p class="name"><br><span class="w3-padding w3-theme-l1 w3-margin w3-round" style="font-weight: bolder; font-size: x-
large; border: 3px solid #1b7a9f;">PCCOER, Pune</span></p><br>
        <p><span class="profession w3-padding w3-theme-d5 w3-round" style="font-weight: bolder; ">Road Geometric Design &
Intelligent Transport System</span></p><br>
      </div>

      <!-- Links section 1. Replace the # inside of the "" with your links. -->
      <div class="links-container">
        <a href="C:\Users\GS2248\Documents\PRo\Geometricdesign.html" class="w3-button w3-round w3-theme-d3 w3-border link"
target="_blank">Road Geometric Design</a>
        <br>
        <a href="C:\Users\GS2248\Documents\PRo\html.html" class="w3-button w3-round w3-theme-d3 w3-border link"
target="_blank">Intelligent Transport System</a>
        <br>



        <div class="icons w3-padding">
          <a href="#" target="_blank">
            <i data-feather="facebook"></i>
          </a>
```

```
      <a href="#" target="_blank">
        <i data-feather="instagram"></i>
      </a>
      <a href="#" target="_blank">
        <i data-feather="linkedin"></i>
      </a>
      <a href="#" target="_blank">
        <i data-feather="twitter"></i>
      </a>
    </div>
  </div>

</div>
<script>
  feather.replace()
</script>
</body>  </html>
```

B. Road Geometric Design

```
<!DOCTYPE html>
<html>
<head>
<meta name="viewport" content="width=device-width, initial-scale=1">
<style>
body {
  background-image: url('C:\Users\GS2248\Documents\PRo\img\civil_logo.jpg');
  background-repeat: no-repeat;
  background-attachment: fixed;
  background-size: 100% 100%;
  background-color: #ceebcb;
}
.dropbtn {
  background-color: #04AA6D;
  color: white;
  padding: 16px;
  font-size: 16px;
  border: none;
  cursor: pointer;
}

.dropbtn:hover, .dropbtn:focus {
  background-color: #3e8e41;
}

#myInput {
  box-sizing: border-box;
  background-image: url('searchicon.png');
  background-position: 14px 12px;
```

```
  background-repeat: no-repeat;
  font-size: 16px;
  padding: 14px 20px 12px 45px;
  border: none;
  border-bottom: 1px solid #ddd;
}

#myInput:focus {outline: 3px solid #ddd;}

.dropdown {
  position: relative;
  display: inline-block;
}

.dropdown-content {
  display: none;
  position: absolute;
  background-color: #f6f6f6;
  min-width: 230px;
  overflow: auto;
  border: 1px solid #ddd;
  z-index: 1;
}

.dropdown-content a {
  color: black;
  padding: 12px 16px;
  text-decoration: none;
  display: block;
}

.dropdown a:hover {background-color: #ddd;}

.show {display: block;}
</style>
</head>
<body>
<h1>HIGHWAY ENGINEERNG</h1>
<p>Click on the button to open the dropdown menu, and use the input field to search for a specific dropdown link.</p>

<div class="dropdown">
  <button onclick="myFunction()" class="dropbtn">Geometric Design of Highway</button>
  <div id="myDropdown" class="dropdown-content">
    <input type="text" placeholder="Search.." id="myInput" onkeyup="filterFunction()">
    <a href="C:\Users\GS2248\Documents\PRo\sight.html">Sight Distance</a>
    <a href="#base">Curve</a>
    <a href="#blog">Super Elevation</a>
    <a href="#contact">Widening</a>

  </div>
```

```
</div>

<script>
/* When the user clicks on the button,
toggle between hiding and showing the dropdown content */
function myFunction() {
  document.getElementById("myDropdown").classList.toggle("show");
}

function filterFunction() {
  var input, filter, ul, li, a, i;
  input = document.getElementById("myInput");
  filter = input.value.toUpperCase();
  div = document.getElementById("myDropdown");
  a = div.getElementsByTagName("a");
  for (i = 0; i < a.length; i++) {
    txtValue = a[i].textContent || a[i].innerText;
    if (txtValue.toUpperCase().indexOf(filter) > -1) {
      a[i].style.display = "";
    } else {
      a[i].style.display = "none";
    }
  }
}
</script>

</body>
</html>
```

C. Sight Distance

```
<!DOCTYPE html>
<html>
<head>
<style>
.button {
  border: none;
  padding: 16px 32px;
  text-align: center;
  text-decoration: none;
  display: inline-block;
  font-size: 16px;
  margin: 4px 2px;
  transition-duration: 0.4s;
  cursor: pointer;
}

.dropbtn {
  background-color: #04AA6D;
```

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```
  color: white;
  padding: 16px;
  font-size: 16px;
  border: none;
}

.dropdown {
  position: relative;
  display: inline-block;
}

.dropdown-content {
  display: none;
  position: absolute;
  background-color: #f1f1f1;
  min-width: 160px;
  box-shadow: 0px 8px 16px 0px rgba(0,0,0,0.2);
  z-index: 1;
}

.dropdown-content a {
  color: black;
  padding: 12px 16px;
  text-decoration: none;
  display: block;
}

.dropdown-content a:hover {background-color: #ddd;}

.dropdown:hover .dropdown-content {display: block;}

.dropdown:hover .dropbtn {background-color: #3e8e41;}

</style>
</head>
<body>
  <div class="" style="text-align: center">
    <img src="C:\Users\GS2248\Documents\PRo\img\civilbgjpg.jpg"  alt="person image" width="250px" height="200px"
style="border-radius: 50%; border: 5px solid #4ab6e0 !important; margin-top: 16px;">
<h1>Sight Distance</h1>

<div class="dropdown">
  <button class="dropbtn">Stopping Sight Distance</button>
  <div class="dropdown-content">
    <a href="C:\Users\GS2248\Documents\PRo\SSD1way.html">One Way traffic Road</a>
    <a href="C:\Users\GS2248\Documents\PRo\SSD2way.html">Two way traffic Road</a>
  </div>
</div>

<script>
```

```
function myFunction() {
  location.replace("https://www.w3schools.com")
}
</script>
<div class="dropdown">
  <button class="dropbtn">Overtaking Sight Distance</button>
  <div class="dropdown-content">
    <a href="C:\Users\GS2248\Documents\PRo\OSD1way.html">One Way traffic Road</a>
    <a href="C:\Users\GS2248\Documents\PRo\OSD2way.html">Two way traffic Road</a>
  </div>
</div>

</body>
</html>
```

D. Stopping Sight Distance- One Way Traffic Road

```
<!doctype html>
<html>
<head>

<script>
let l, B, V, y, s, T0, b, L, f, M, D, res, temp, numTwo;
function fun()
{
  V = parseFloat(document.getElementById("one").value);

    temp = document.getElementById("res");
    temp.style.display = "block";

    l = V * 2.5 ;
    document.getElementById("V").value = l;

    res = 2.5;
    document.getElementById("T").value = res;

    f = V;
    {
    if ((f>=5.55 && f<= 8.33)){ // thodsa chukly
       f = 0.11
    }
    else if(f == 11.11) {
       f = 0.105
    }
    else if (f== 13.89)
    {
       f = 0.102
    }
```

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```
   else if (f == 16.67)
   {
     f = 0.1
   }
   else if (f == 18.05)
   {
     f = 0.1
   }
   else if (f == 22.22)
  {
     f = 0.093
   }
    else if (f == 27.78)
    {
     f = 0.093
     }
   else {
     A = 0
   }
   document.getElementById("f").value = f;
  }

  B = ( Math.pow(V, 2) / ((2 * 9.81) *f));
   document.getElementById("B").value = B;

  s = (l + B);
  document.getElementById("s").value = s;

  M = s * 2;
  document.getElementById("M").value = M;

}
</script>
</head>
<body>
  <div class="" style="text-align: center">
     <img src="C:\Users\GS2248\Documents\PRo\img\civilbgjpg.jpg"  alt="person image" width="250px" height="200px"
style="border-radius: 50%; border: 5px solid #4ab6e0 !important; margin-top: 16px;">
  <h1 style="border:2px solid rgb(233, 47, 208);">Stopping Sight Distance </h1>
  <h2>One Way Distance </h2>
<p id="input">Enter the design speed of vehicle in m/s: <input id="one">
<br/><br/>
<p><button onclick="fun()">Ans</button></p>
<p id="res" style="display:none;">
Lag distance = <input id="V"><br/><br/>
Breaking distance = <input id="B"><br/><br/>
Coefficient = <input id="f"><br/><br/>
T = <input id = "T"><br/><br/>
Stopping sight distance = <input id = "s"><br/><br/>
<b>Stopping sight distance for Single Lane = <input id = "M"><br/><br/></b>
```

```
</body>
</html>
```

E. Stopping Sight Distance- Two Way Traffic Road

```
<!doctype html>
<html>
<head>

<script>
let l, B, V, y, s, T0, b, L, f, M, D, res, temp, numTwo;
function fun()
{
  V = parseFloat(document.getElementById("one").value);

    temp = document.getElementById("res");
    temp.style.display = "block";

    l = V * 2.5 ;
    document.getElementById("V").value = l;

    res = 2.5;
    document.getElementById("T").value = res;

    f = V;
    {
    if ((f>=5.55 && f<= 8.33)){ // thodsa chukly
      f = 0.11
    }
    else if(f == 11.11) {
      f = 0.105
    }
    else if (f== 13.89)
    {
      f = 0.102
    }

    else if (f == 16.67)
    {
      f = 0.1
    }
    else if (f == 18.05)
    {
      f = 0.1
```

```
    }
    else if (f == 22.22)
   {
      f = 0.093
    }
     else if (f == 27.78)
     {
      f = 0.093
       }
    else {
      A = 0
    }
    document.getElementById("f").value = f;
   }

   B = ( Math.pow(V, 2) / ((2 * 9.81) *f));
    document.getElementById("B").value = B;

   s = (l + B);
   document.getElementById("s").value = s;

   y = s;
   document.getElementById("y").value = y;

}
</script>
</head>
<body>
   <div class="" style="text-align: center">
      <img src="C:\Users\GS2248\Documents\PRo\img\civilbgjpg.jpg"  alt="person image" width="250px" height="200px"
style="border-radius: 50%; border: 5px solid #4ab6e0 !important; margin-top: 16px;">
   <h1 style="border:2px solid rgb(233, 47, 208);">Stopping Sight Distance </h1>
   <h2>Two Way Distance </h2>
<p id="input">Enter the design speed of vehicle in m/s: <input id="one">
<br/><br/>
<p><button onclick="fun()">Ans</button></p>
<p id="res" style="display:none;">
Lag distance = <input id="V"><br/><br/>
Breaking distance = <input id="B"><br/><br/>
Coefficient = <input id="f"><br/><br/>
T = <input id = "T"><br/><br/>
Stopping sight distance = <input id = "s"><br/><br/>

<b>Stopping sight distance for Two Lane = <input id = "y"><br/><br/></b>

</body>
</html>
```

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F. Overtaking Sight Distance- One Way Traffic Road

```
<!doctype html>
<html>
<head>

<script>
let V, v, s, T0, b, L, A, M, D, res, temp, numTwo;
function fun()
{
 V = parseFloat(document.getElementById("one").value);

   temp = document.getElementById("res");
   temp.style.display = "block";
   v2 = V - 4.5 ;
   document.getElementById("V").value = v2;
   s = (0.7*v2)+6;
   document.getElementById("s").value = s;
   A = V;
   {
   if (A == 6.93){
      A = 1.41
   }
   else if(A == 8.34) {
      A = 1.31
   }
   else if (V == 11.10)
   {
      A = 1.24
   }

   else if (A == 11.86)
   {
      A = 1.11
   }
   else if (A == 18.00)
   {
      A = 0.92
   }
   else if (A == 22.20)
  {
      A = 0.72
   }
    else if (A == 27.80)
    {
      A = 0.53
      }
   else {
      A = 0
   }
```

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```
    document.getElementById("A").value = A;
   }

    res = 2;
    document.getElementById("T").value = res;

   b = (Math.sqrt(s/A));
   T0 = b * 2;
   document.getElementById("T0").value = T0;

   L = ((v2*2) + ((v2*T0) + (2*s)) );
   document.getElementById("L").value = L;

   M = 3 * L ;
   document.getElementById("M").value = M;

   D = 5 * L ;
   document.getElementById("D").value = D;

}
</script>
</head>
<body>
   <style>
       background-image : url("civilbgjpg.jpg");
   </style>

   <div class="" style="text-align: center">
      <img src="C:\Users\GS2248\Documents\PRo\img\civilbgjpg.jpg"  alt="person image" width="250px" height="200px"
style="border-radius: 50%; border: 5px solid #4ab6e0 !important; margin-top: 16px;">
   <h1 style="border:2px solid Tomato;">Overtaking Sight Distance </h1>
   <h2>One Way Distance </h2>
<p id="input">Enter the design speed of vehicle in m/s: <input id="one">
<br/><br/>
<p><button onclick="fun()">Ans</button></p>
<p id="res" style="display:none;">
V2 = <input id="V"><br/><br/>
s = <input id="s"><br/><br/>
A = <input id="A"><br/><br/>
T = <input id = "T"><br/><br/>
T0 = <input id = "T0"><br/><br/>
<b>Overtaking sight distance L = <input id = "L"> m/s<br/><br/></b>
<b>Minimum length of overtaking zone M = <input id = "M"> m/s<br/><br/></b>
<b>Desirable length of overtaking zone D = <input id = "D"> m/s<br/><br/></b>

</body>
</html>
```

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G. Overtaking Sight Distance- Two Way Traffic Road

```
<!doctype html>
<html>
<head>

<script>
let V, v, s, T0, b, L, A, M, D, res, temp, numTwo;
function fun()
{
 V = parseFloat(document.getElementById("one").value);

   temp = document.getElementById("res");
   temp.style.display = "block";
   v2 = V - 4.5 ;
   document.getElementById("V").value = v2;
   s = (0.7*v2)+6;
   document.getElementById("s").value = s;
   A = V;
   {
   if (A == 6.93){
      A = 1.41
   }
   else if(A == 8.34) {
      A = 1.31
   }
   else if (V == 11.10)
   {
      A = 1.24
   }

   else if (A == 11.86)
   {
      A = 1.11
   }
   else if (A == 18.00)
   {
      A = 0.92
   }
   else if (A == 22.20)
  {
      A = 0.72
   }
    else if (A == 27.80)
    {
      A = 0.53
      }
   else {
      A = 0
   }
```

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```
   document.getElementById("A").value = A;
  }

   res = 2;
   document.getElementById("T").value = res;

  b = (Math.sqrt(s/A));
  T0 = b * 2;
  document.getElementById("T0").value = T0;

  L = ((v2*2) + ((v2*T0) + (2*s)) );
  document.getElementById("L").value = L;

  M = 3 * L ;
  document.getElementById("M").value = M;

  D = 5 * L ;
  document.getElementById("D").value = D;

}
</script>
</head>
<body>
  <style>
     background-image : url("civilbgjpg.jpg");
  </style>

  <div class="" style="text-align: center">
    <img src="C:\Users\GS2248\Documents\PRo\img\civilbgjpg.jpg"  alt="person image" width="250px" height="200px"
style="border-radius: 50%; border: 5px solid #4ab6e0 !important; margin-top: 16px;">
  <h1 style="border:2px solid Tomato;">Overtaking Sight Distance </h1>
  <h2>One Way Distance </h2>
<p id="input">Enter the design speed of vehicle in m/s: <input id="one">
<br/><br/>
<p><button onclick="fun()">Ans</button></p>
<p id="res" style="display:none;">
V2 = <input id="V"><br/><br/>
s = <input id="s"><br/><br/>
A = <input id="A"><br/><br/>
T = <input id = "T"><br/><br/>
T0 = <input id = "T0"><br/><br/>
<b>Overtaking sight distance L = <input id = "L"> m/s<br/><br/></b>
<b>Minimum length of overtaking zone M = <input id = "M"> m/s<br/><br/></b>
<b>Desirable length of overtaking zone D = <input id = "D"> m/s<br/><br/></b>

</body>
</html>
```

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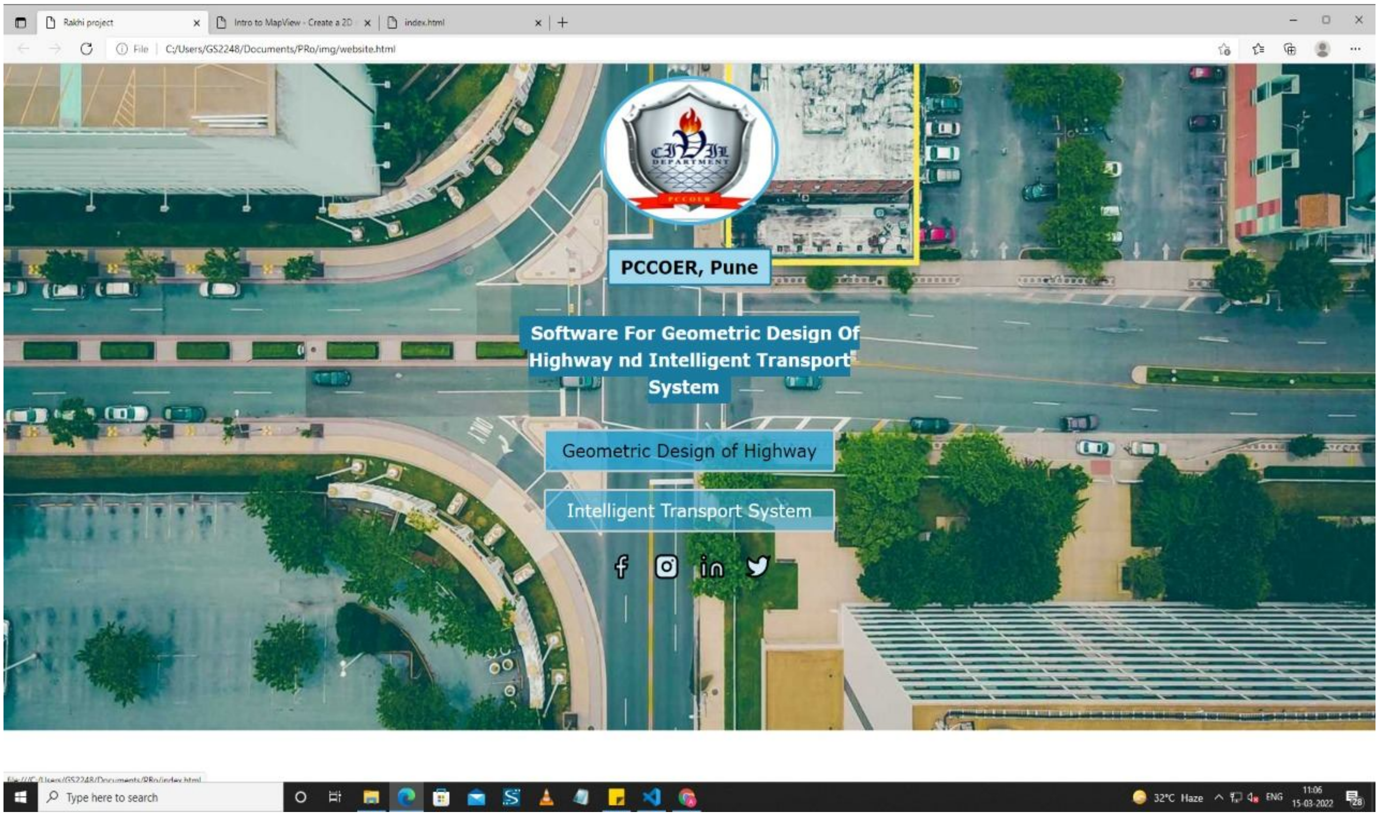
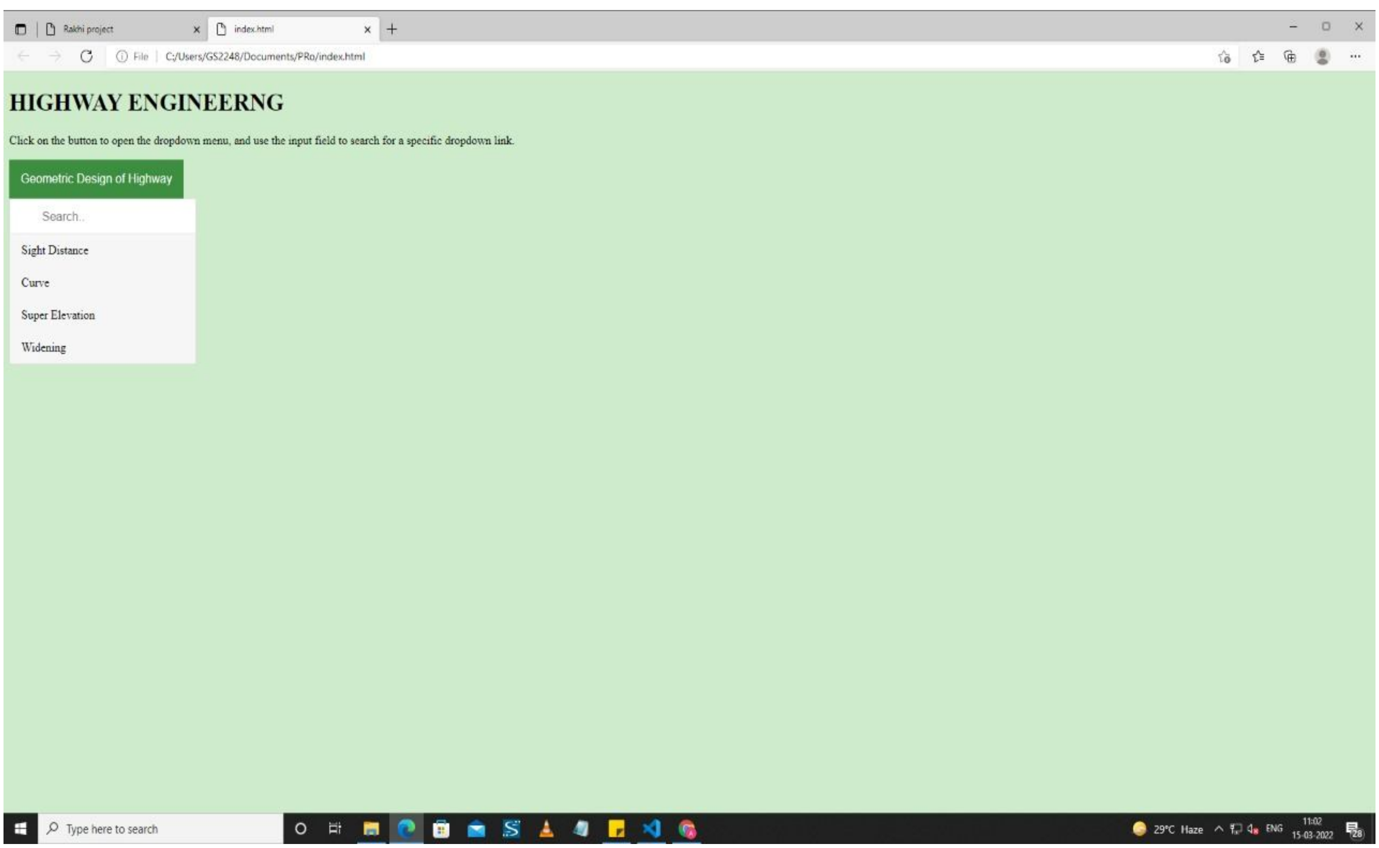
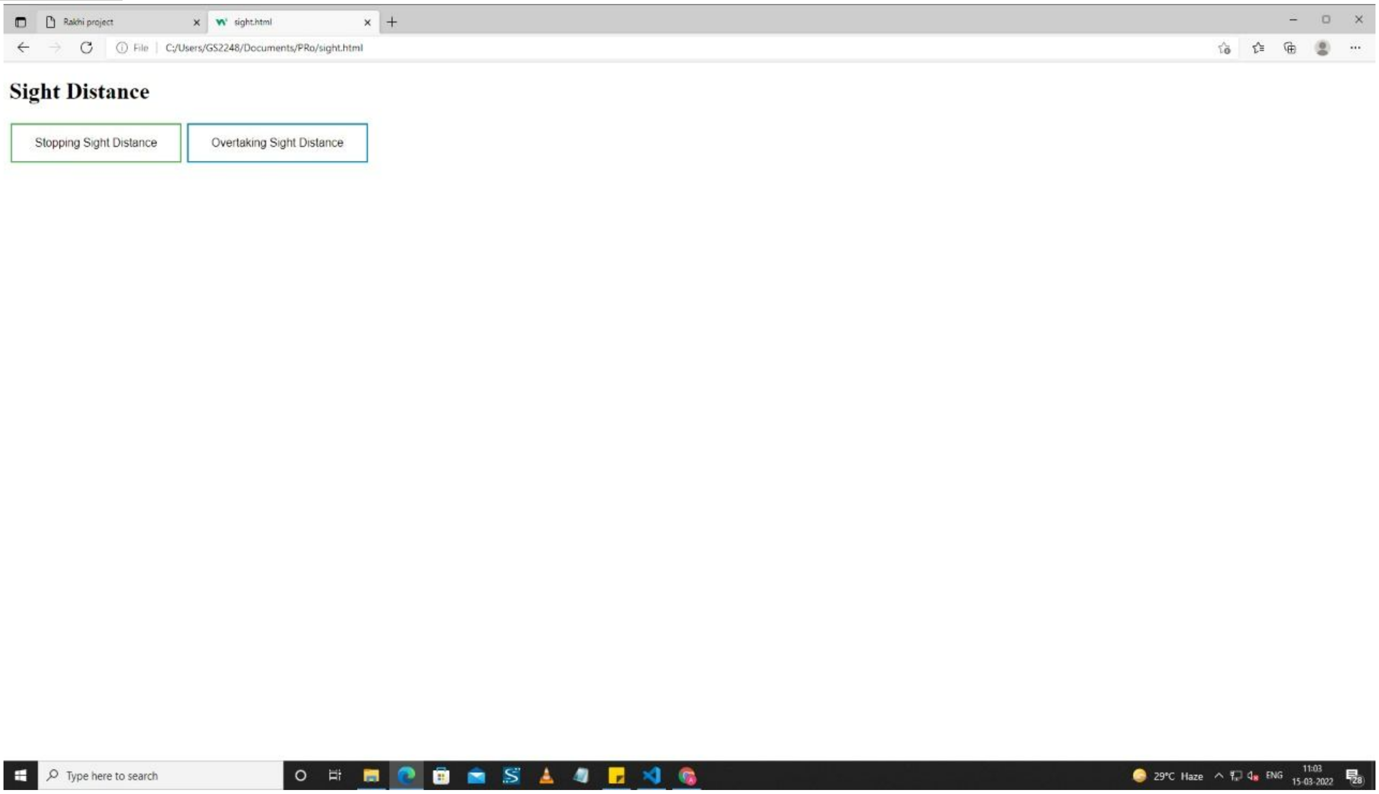
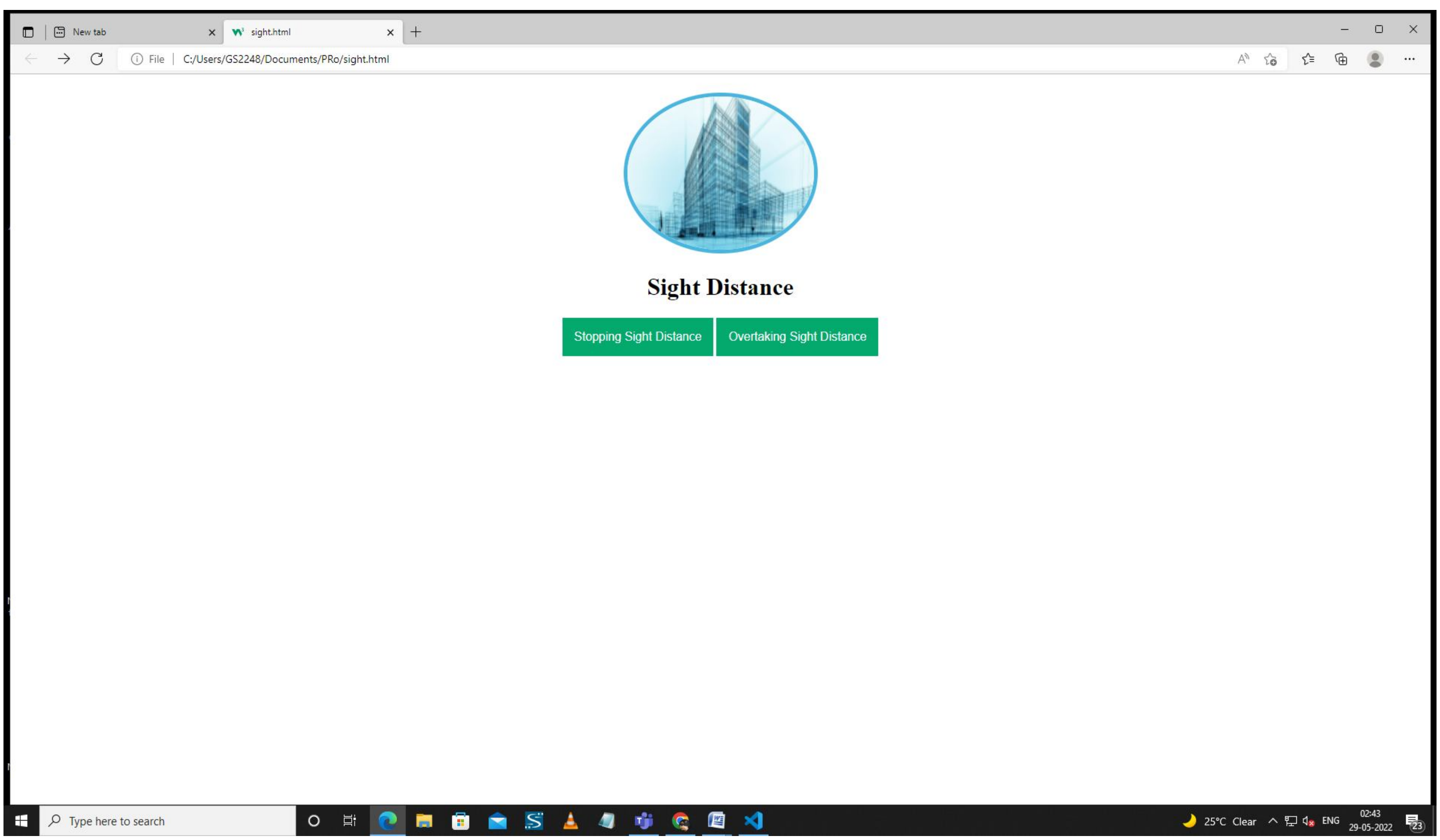
VIII. SNAPSHOT OF SOFTWARE FOR ROAD GEOMETRIC DESIGN AND INTELLIGENT TRANSPORTATION SYSTEM






Rakhi project
sight.html
C:/Users/GS2248/Documents/PRo/sight.html
Sight Distance
Stopping Sight Distance
Overtaking Sight Distance
Type here to search


New tab
sight.html
C:/Users/GS2248/Documents/PRo/sight.html
Sight Distance
Stopping Sight Distance
Overtaking Sight Distance
Type here to search

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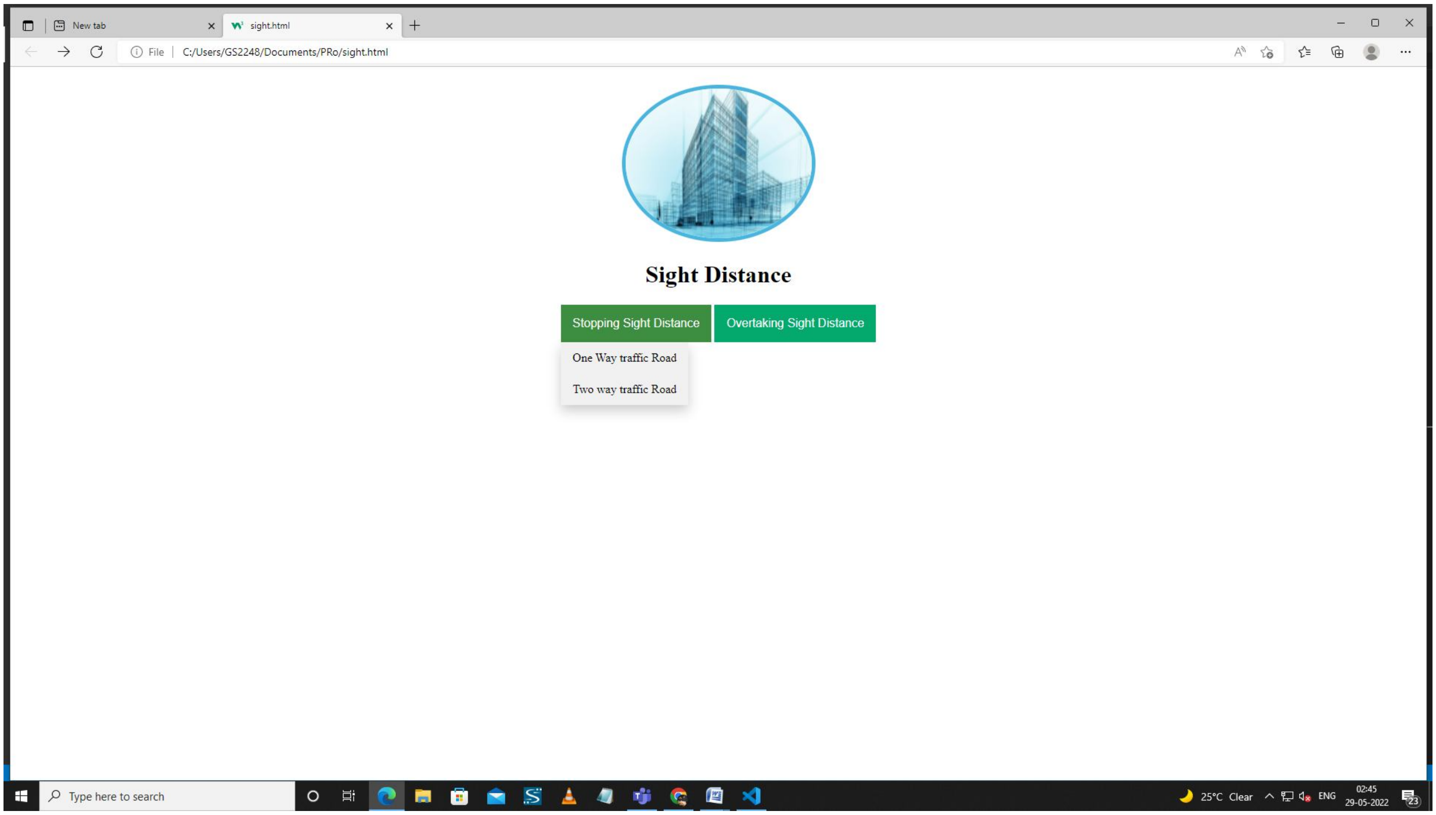
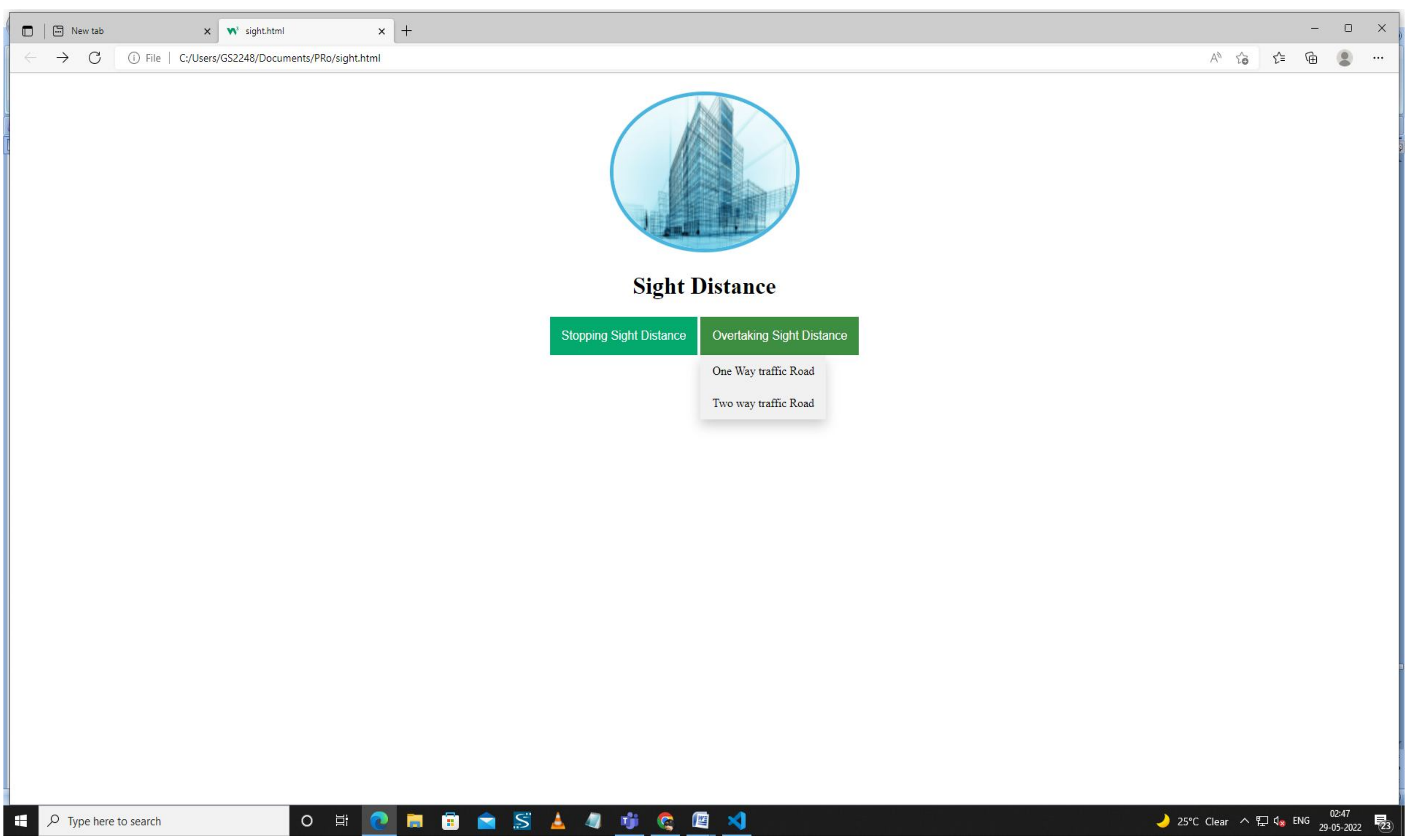
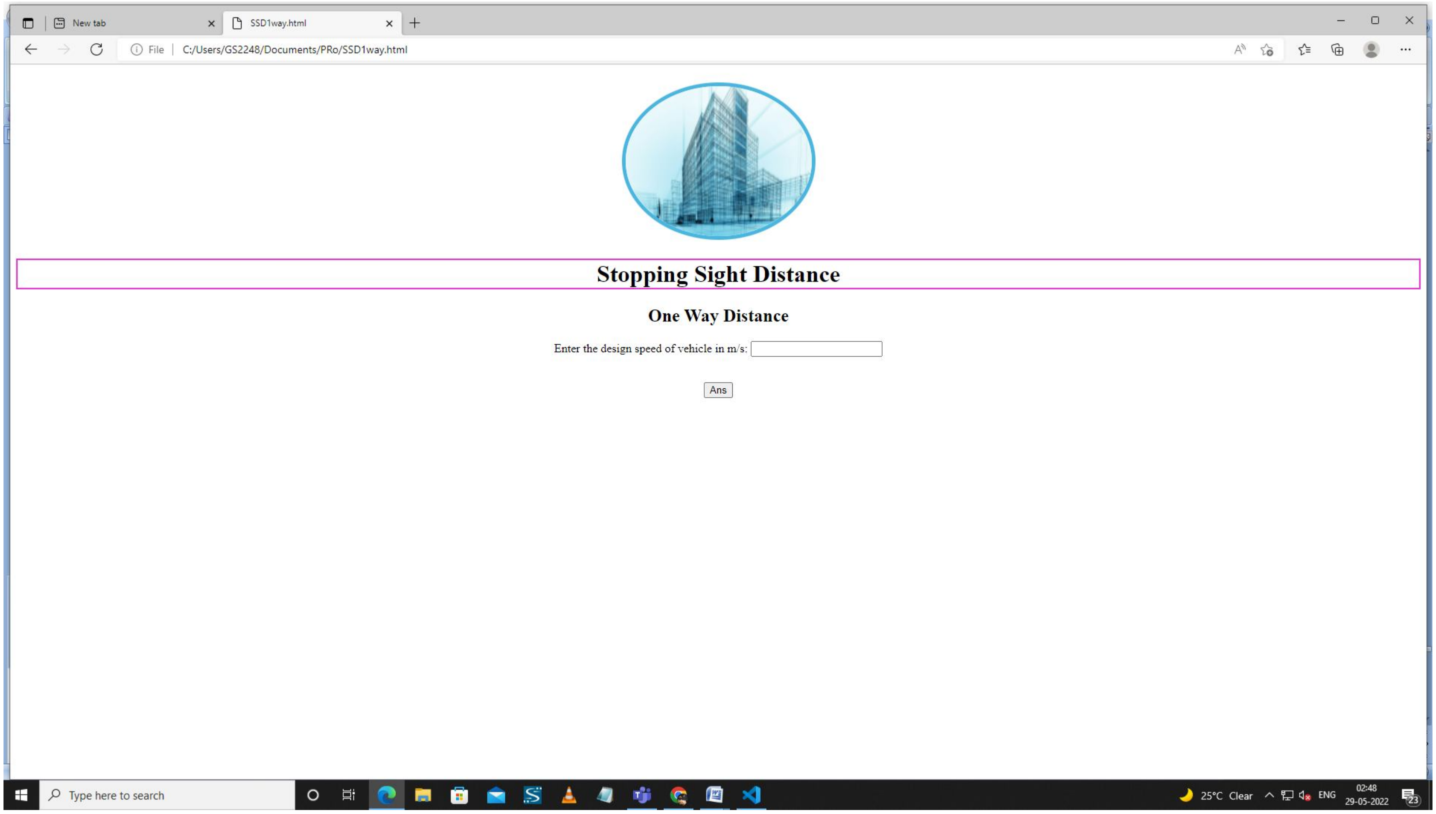
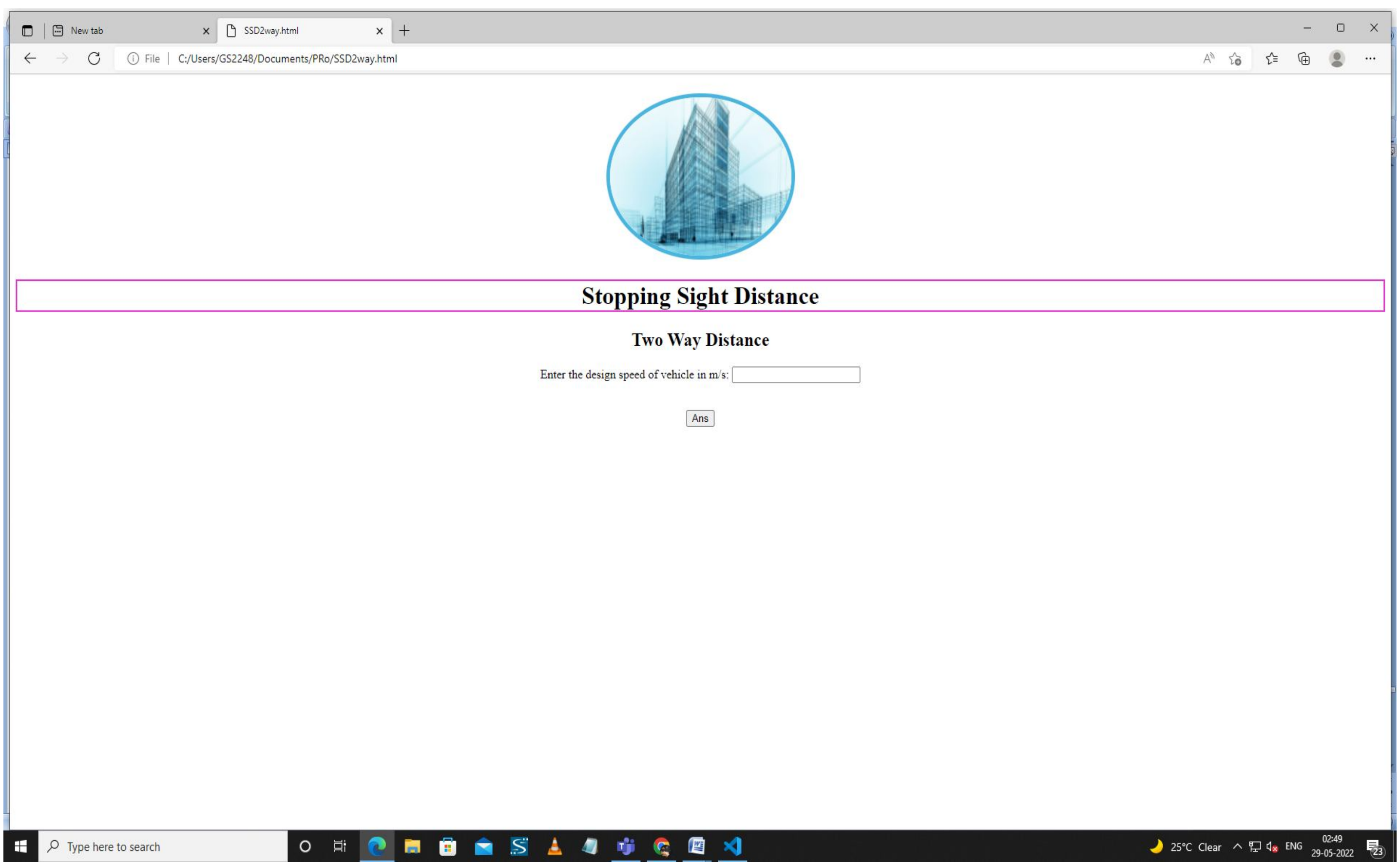
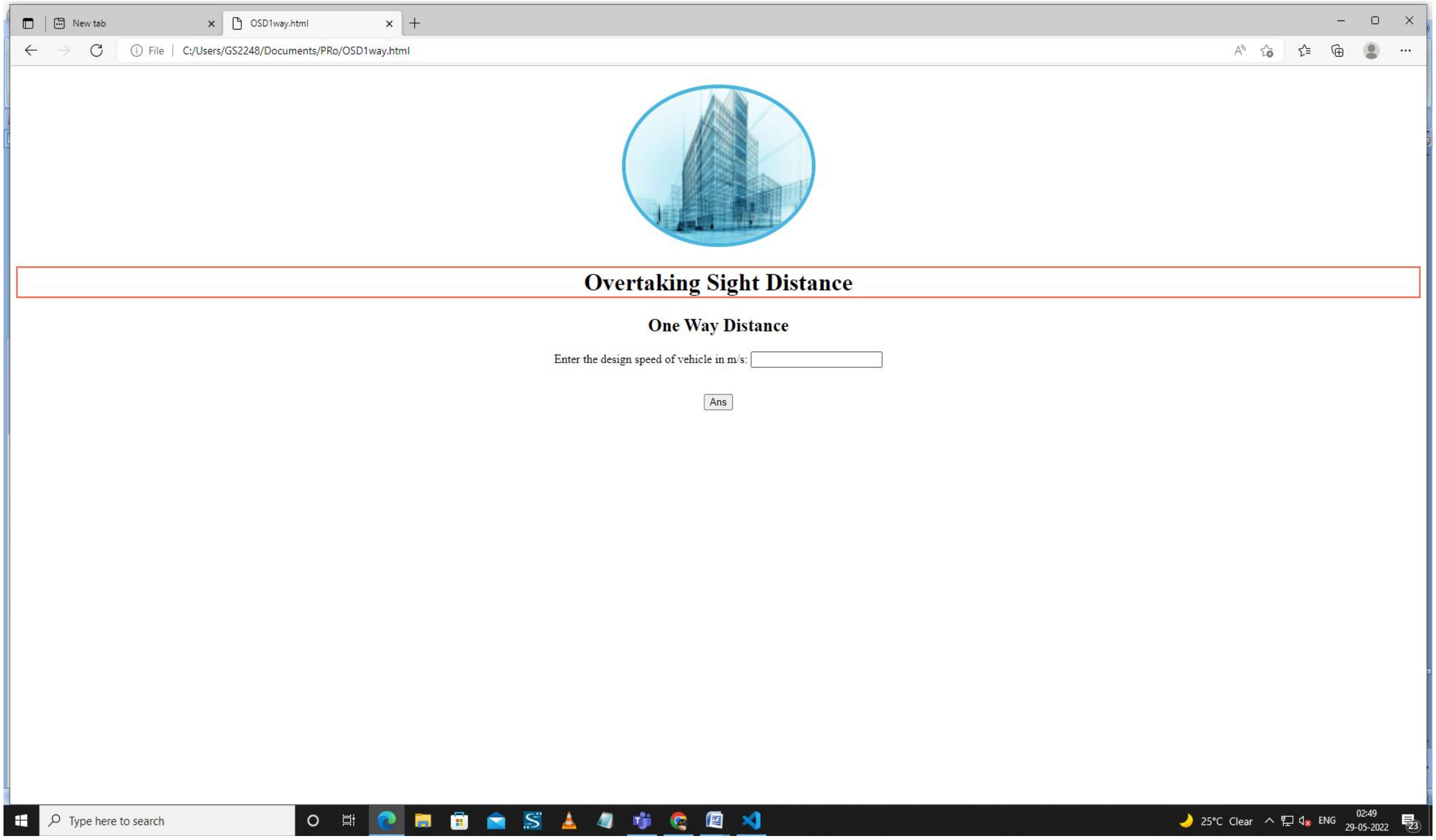





New tab
SSD1way.html
File
C:/Users/GS2248/Documents/PRo/SSD1way.html
Stopping Sight Distance
One Way Distance
Enter the design speed of vehicle in m/s:
Ans
Type here to search
25°C Clear
ENG
02:48
29-05-2022


New tab
SSD2way.html
File
C:/Users/GS2248/Documents/PRo/SSD2way.html
Stopping Sight Distance
Two Way Distance
Enter the design speed of vehicle in m/s:
Ans
Type here to search
25°C Clear
ENG
02:49
29-05-2022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One Way Distance
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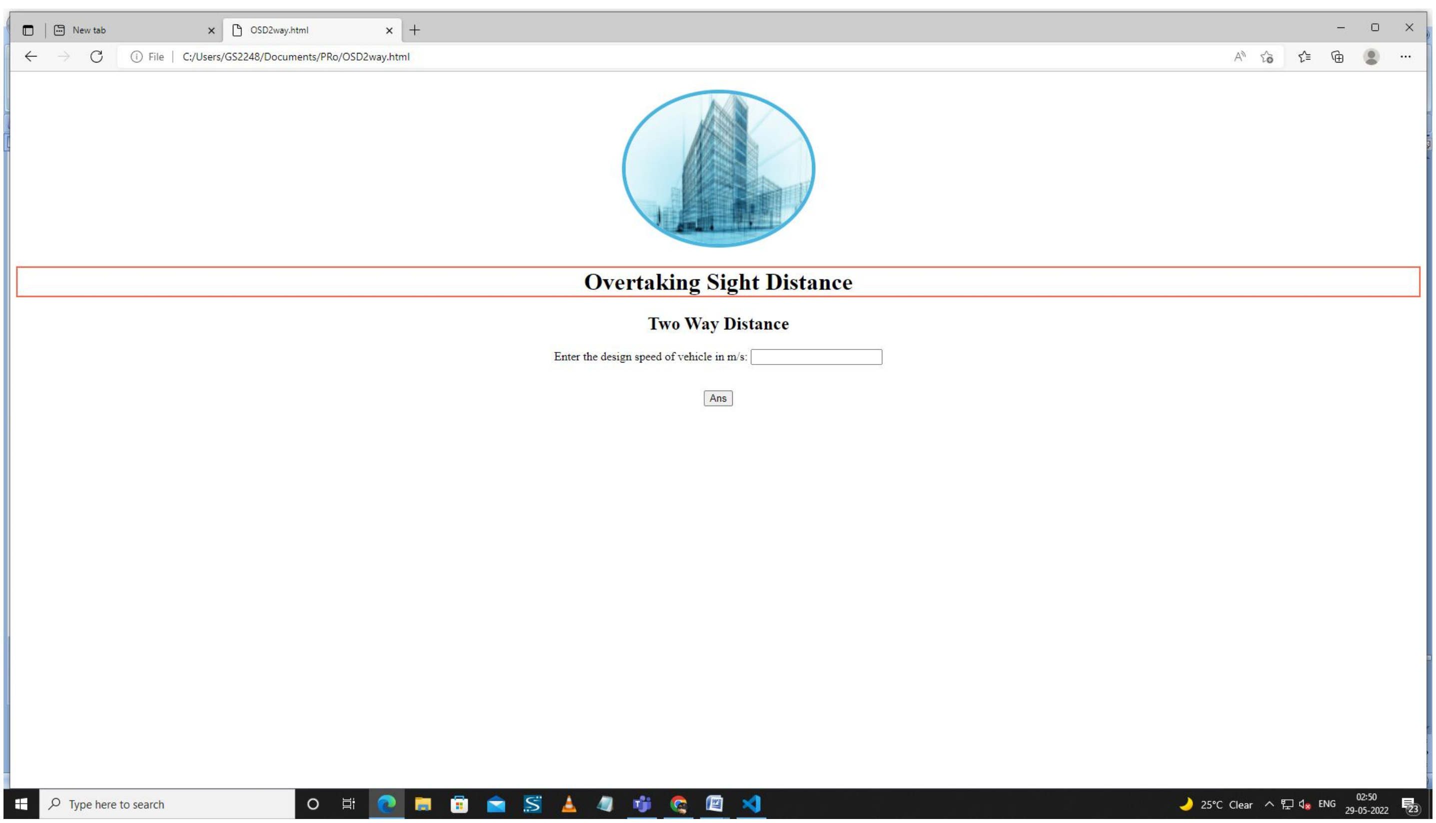
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IX. CONCLUSION

In comparison to the old technique, the online tool aids engineers in better understanding the various aspects of geometric design. The goal of adding ROAD into geometric design instruction is not to minimize or dismiss the value of the underlying mathematics, calculations, or theory. The purpose is to assist engineers in better understanding the geometric design issues that transportation engineers encounter. Problem-solving engineers to comprehend geometric design equations and calculations. Another assignment to recreate the same single- curve using road design software is recommended to instructors to allow engineers extra time to acquaint themselves with road design software. This will allow us to compare the learning experience of roadway design using software to the old method.

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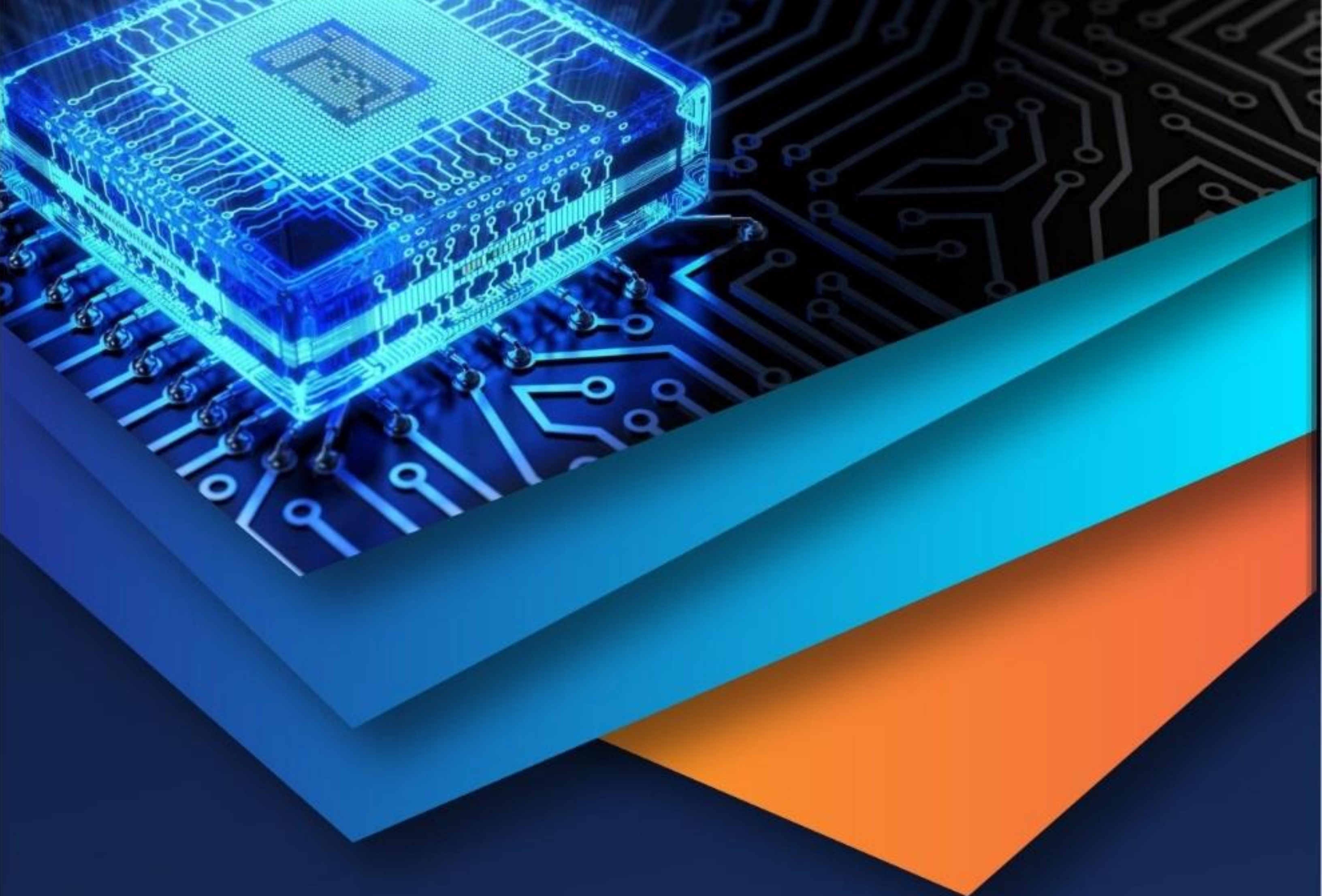

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TOGETHER WE REACH THE GOAL

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