NIT ROURKELA

Transportation Engineering

Assignment-1

by

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1. **Identify at least two different locations on the campus where the extra-widening is provided. Design the extra-widening of those identified locations and compare the results.**

    - The extra width of the carriageway required on a horizontal curved section of the road above the width required on a straight alignment is called the extra widening of the pavement.

The width of the extra widening is the sum of two components:-

1. Psychological Widening
2. Mechanical Widening

- Total Widening:-

The total widening required is the sum of psychological widening and mechanical widening.

Wextra = Wpsy + Wmech
Wextra = v / (9.5 * R^(1/2)) + (n * l^2) / (2*R)

For the given road:

Design speed = 40km/hr

Radius =0.00678 km

no. of lanes = 2

length of vehicle = 4.5

Wextra = Wspy + Wmech

Wextra = V/(9.5(R)^1/2) + nl^2/2R

Wextra = 11.11/(9.5* 6.78^1/2) + (2*4.5^2)/2*6.78 = 3.43m

Wextra = 3.43m

For the given road:

Design speed = 40km/hr

Radius = 0.00629km

no. of lanes = 2

length of vehicle = 4.5 m

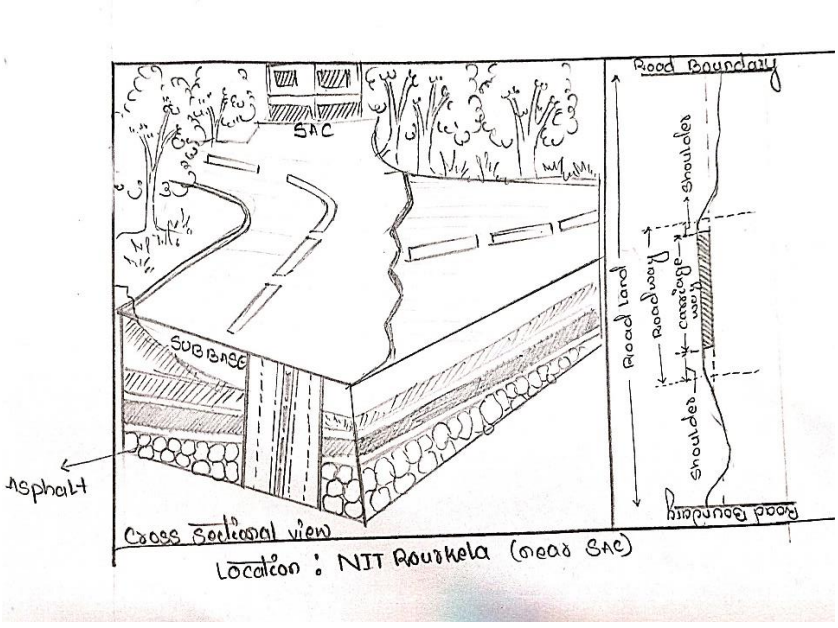
Wextra = Wspy + Wmech

Wextra = V/(9.5(R)^1/2) + nl^2/2R

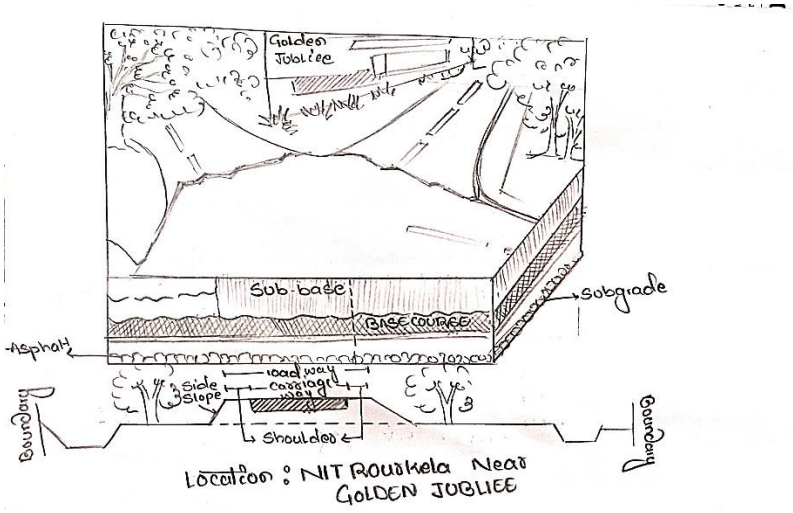
Wextra = 11.11/(9.5*6.29^1/2) + (2*4.5^2)/2*6.29

Wextra = 3.68m

2. **Identify at least any two locations of the road inside the campus considering cutting and filling for road construction. Draw a neat sketch of both the locations identifying the cross-sectional elements provided with photos.**

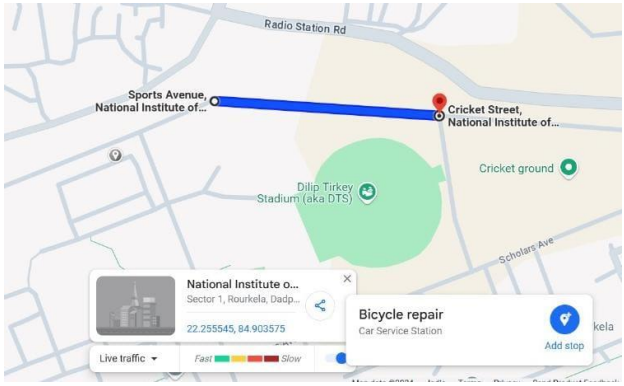


Location- SAC, NIT ROURKELA



Location:- NEAR GOLDEN JUBILEE, NIT ROURKELA

3. **Calculate the SSD, and OSD for the given location on the campus. Assume relevant data. (Google map)**



SSD = vt+(v2)/2gf

V = 30 kmph (Campus Speed limit) = 8.333 m/s

According to IRC Reaction time (t) = 2.5 Seconds,

For Velocity 30 kmph, f = 0.4

SSD = 8.33x2.5 + (8.332)/2*9.81*0.4 = 29.68 meters

For OSD, Speed of overtaking Vehicle (Va) = 30 kmph (Campus Speed limit) = 8.33 m/s

According to IRC Speed of overtaken Vehicle (Vb) = Va – 16 kmph = 14 Kmph = 3.89 m/s

OSD = D1 + D2 D1 = vb x t = 3.89 x2 (According to IRC Reaction time = 2 sec) = 7.78 m

D2 = 2s+B

Spacing Between Vehicles, s = vb x t + L

According to IRC, Length of Vehicle(L) = 6m and Reaction time(t) = 0.7 sec

s = 3.89 x 0.7 + 6 = 8.723 m

Let T be the duration of actual overtaking, T = (4s/a)0.5

Let a be 1.2 m/s2 , so T = (4x8.723/1.2)0.5 = 5.4 seconds

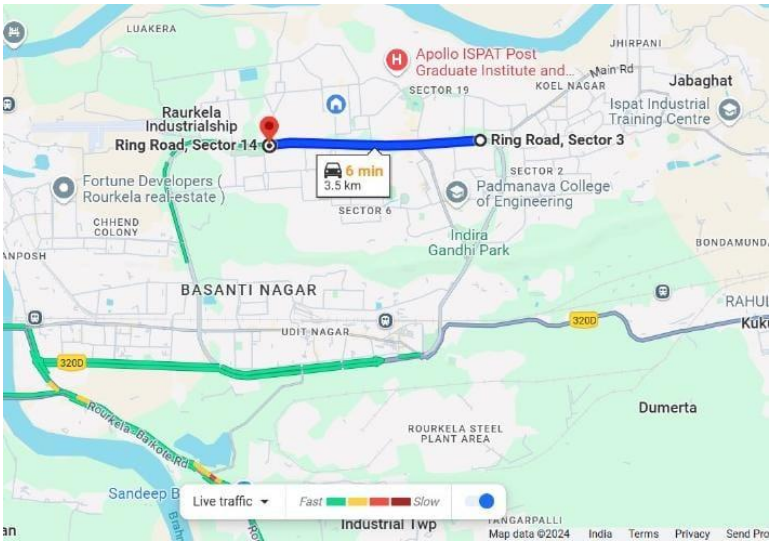
B = vb x T = 3.89 x 5.4 = 21 meters

So , D2 = 2 x 8.723 + 21 = 38.45 meters

OSD = D1 + D2 = 7.78 + 38.45 = 46.23 meters

Answers - SSD = 30 m , OSD = 47 m

4. **Calculate the SSD, and OSD for the given location outside the campus. Assume relevant data. (Google map)**



SSD = vt+(v2)/2gf

V = 60 kmph = 16.67 m/s

According to IRC Reaction time (t) = 2.5 Seconds,

For Velocity 80 kmph, f = 0.35

SSD = 16.67x2.5 + (16.672)/2*9.81*0.35 = 82.14 meters

For OSD, Speed of overtaking Vehicle (Va) = 60 kmph = 16.67 m/s

According to IRC Speed of overtaken Vehicle (Vb) = Va – 16 kmph = 44 Kmph = 12.22 m/s

OSD = D1 + D2

So, D1 = vb x t = 12.22 x2 (According to IRC Reaction time = 2 sec) = 24.44 m

D2 = 2s+B

Spacing Between Vehicles, s = vb x t + L

According to IRC, Length of Vehicle(L) = 6m and Reaction time(t) = 0.7 sec

s = 12.2x 0.7 + 6 = 14.554 m

So, Let T be the duration of actual overtaking, T = (4s/a)0.5

According to IRC, acceleration a = 0.72 m/s2

so T = (4x14.55/0.72)0.5 = 9sec

B = Vb x T = 12.2 x 9 = 109.8 meters

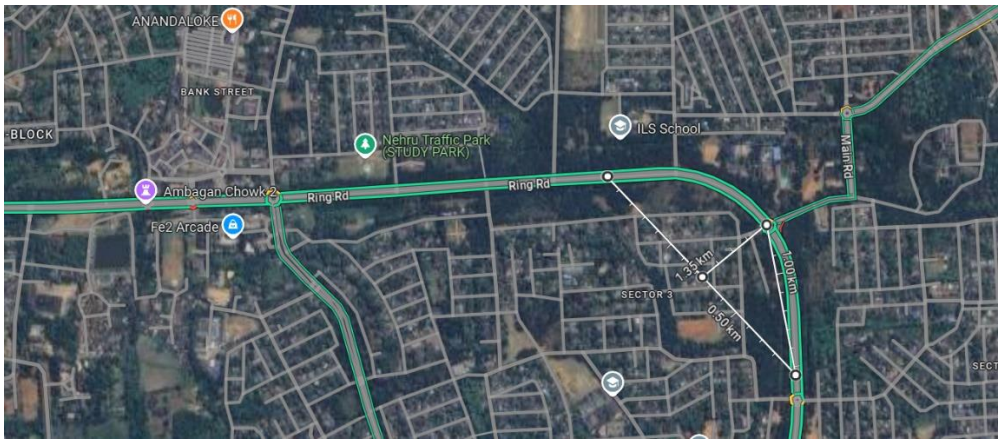
So , D2 = 2 x 14.554 + 109.8 = 138.90 meters

OSD = D1 + D2 = 24.44 + 138.90 = 163.34 meters

Answers - SSD = 25 m , OSD = 164 m

5. **Design the Superelevation for any location on the ring road. (Mention the details of the location).**

Location:-



Radius obtained from map : 301.74 m

Superelevation(e) = (0.75V)^2 / 127R = (0.75 x 65)^2 / 127 x 301.74 = 0.062

As e = 0.062 which is less than the emax = 0.07, so given superelevation can be allowed Therefore,

e = 0.062 (Answer)

6. **Identify the types of cambers provided in the roads of the campus (At least 5 locations with details and photos).**

Location- NIT ACADEMIC GATE-> JAGDA GATE

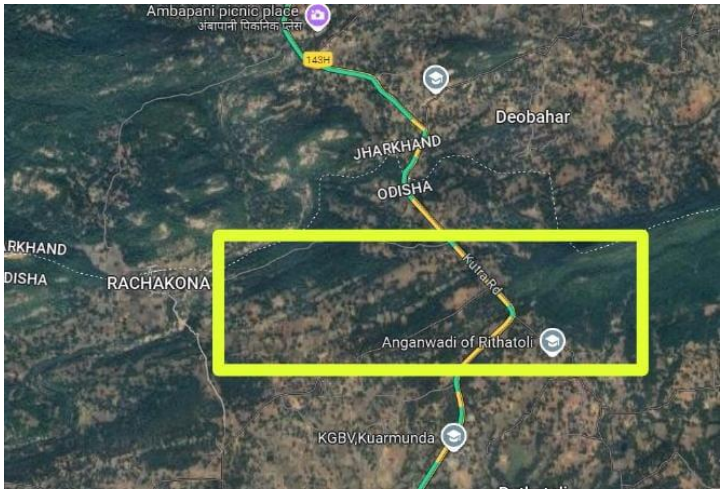
Location-MANGLA GATE -> MAIN ACADEMIC BUILDING

Location- BESIDE DTS

Location- CVR

LOCATION- LIBRARY -> TIIR

7. **Calculate the length of transition curve for any location on NH 143(Mention the details of the location)**.



Radius obtained from map: 296.15m

Speed on NH = 80 kmph

Superelevation(e) = (0.75V)^2 / 127R = (0.75 x 80)^2 / 127 x 296.15 = 0.09

As e = 0.09 which is greater than the emax, so superelevation = emax = 0.07

E+f = V^2 / 127R = (80)^2 / 127 x 296.15 = 0.170

So, f = 0.170-0.07 = 0.100

Length of transition curve (Maximum value is to be considered among the below options)

1)Based on the rate of change of centrifugal acceleration, c

Ls1 = v^3 / c x R

C = 80/(75+V) = (80)/(75+80) = 0.52 m^3/s

Ls1 = (22.22)^3 /(0.52 x 296.15) = 71.23 m

2)Based on the rate of change of superelevation (e)

1. Superelevation attained

by rotation about the centre

Ls2 = Ne(W + We)/2

We = nl^2 / 2R + V/(9.5 x R^0.5)

No of lane (n) = 4

Length of wheelbase (l) = 6m

We = 4 x 6^2 /(2 x 296.15) + 80/(9.5 x 296.15^0.5) = 0.779 m

W = 4 x 3.5 = 14 m

Ls2 = Ne(W + We)/2 = 150 x 0.07(14+0.779)/2 = 77.5m

N = 150 for plain and rolling terrain

3)Based on IRC formula

Ls3 = 2.7V^2 / R, for plain and rolling terrain

Ls3 = 2.7x80^2 /296.15 = 58.34 m

Length of transition curve = max(Ls1,Ls2,Ls3) = 77.5 m

Ans- 77.5m