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Proposal of Underpass at Katapady Junction

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Abstract— - Katapady is one of the developing city besides of NH-66. Two roads SH-37 and a village road (Mattu beach) connects NH forming an at grade intersection. Due to improper connection of state highway traffic jam is commonly observed in peak hours and many accidents are already recorded in this place. The policemen are putting their great effort to control the traffic flow and minimize the number of accidents at the junction. The solution for this problem can be providing traffic signals, constructing a fly over, constructing an underpass. It is observed that constructing underpass will be easier, economical and suitable for topographical conditions compared to other methods. Adopting our project will result in considerable reduction in accidents, traffic jams and reduces the work of policemen and also systematic traffic movement can be observed.

Index Terms—Underpass, Katapady, at grade, hassle free movement.

1 Introduction

Katapady is an emerging city growing beside the National Highway-66. City is large and on both side of the highway intercity traffic will be higher and always disturbing the traffic of National Highway. At present at grade intersection is provided which is creating higher conflict point and causing higher accident probability at the junction. It also results in the reduction in the mean speed of the vehicle on the highway. At present the service road is provided but these are only using for the parking of the vehicle since the city is very congested and there is no place for parking.

The city has a hilly terrain and it is in the peak so considering the topography, problems and solution for those problems providing an underpass will be the best solution.

2 Objectives

At Katapady junction, many accidents are observed due to improper connections, the congestion at the junction is observed due improper movement of vehicles as a cause of this the traveling speed of the vehicle decreases, the crossing or any movement of pedestrians at junction is unsafe, there is a problem in parking vehicles as there is lack of space. So, the main objectives are:

- To reduce accidents
- Hassle free movement of vehicles
- Safety for pedestrians
- Providing space for parking of vehicles
- Maintain design speed in highway
- Complete utility of service roads.

3 Methodology

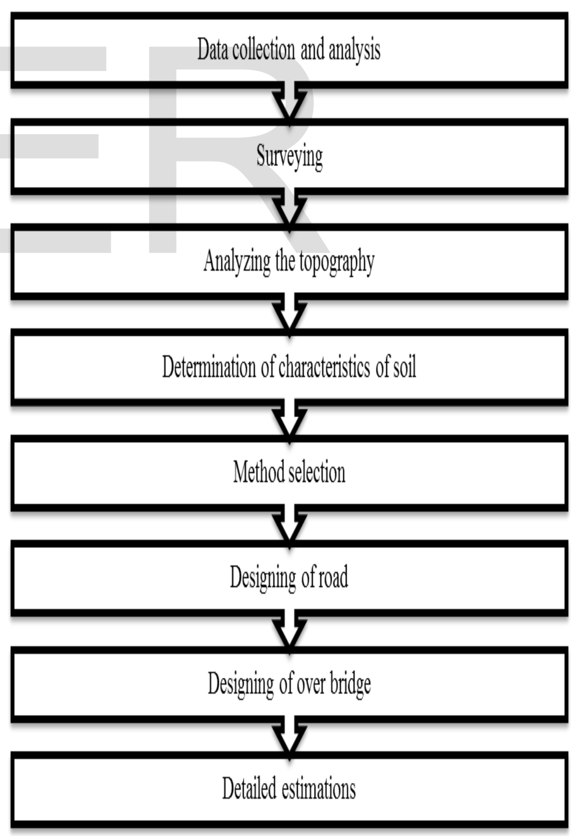

FIG. 3.1 Flow diagram of the proposed work

3.1 Data collection and analysis:

We have collected data about topography, land features, accident, traffic count and traffic details. The analysis of accident data prevents formidable problem due interdependent of several causative factors. The qualitative methods of

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analysis of accidents can provide inside into the cause that contribute to the accident and can often help to identify the black spots on the road systems. But however, the application of statistical techniques establishes the relationship between the accident and its causes, which aids in planning and analyzing the measures for accident prevention. A number of statistical data is vogue in accidental research and one such popular method is regression method. The one variable and the multivariable and regression analysis have been carried out between the number of accidents as dependent variable and the factors such as Traffic volume, spot speed, road width, gradients, skid resistance, day time accident, night time accident, heavy vehicle, light vehicle, effect of traffic volume minor to major road, effect of speed minor to major road and effect of sight distance minor to major road as independent vehicle.

3.2 Surveying:

The reconnaissance survey of the area is conducted. The surveying of the area near the junction is done using the total station. Some of the features of the road the junction:

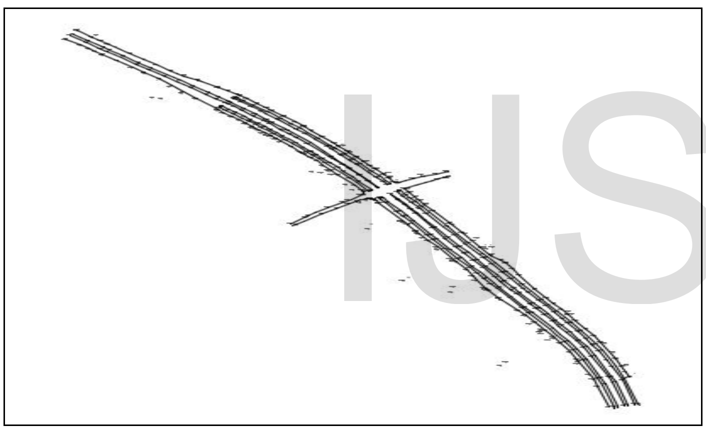


FIG 2.1: Plan of existing road at Katapady

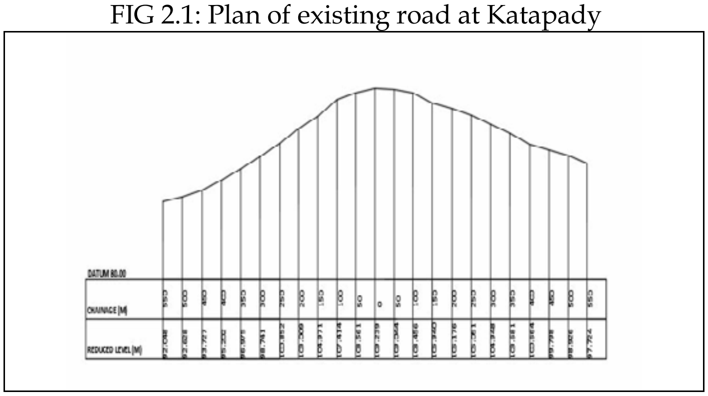


FIG 2.2: Longitudinal section of Katapady

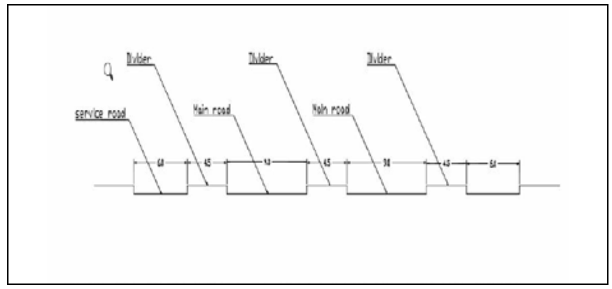


FIG 2.3: Cross section of Existing Road

3.3 Determination of characteristics of soil:

The soil sample from 5 different places nearby the Katapady junction are extracted. The analysis of soil samples is observed below:

3.3.1 Specific gravity test:

Sample No.		1			2			3			4			5		
Empty weight of Pycnometer(W1)	kg	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
Weight of Pycnometer+ soil sample (W2)	kg	0.85	0.91	0.96	0.87	0.93	0.99	0.88	0.92	0.97	0.78	0.83	0.87	0.78	0.82	0.85
Weight of Pycnometer + sample + water (W3)	kg	1.63	1.67	1.69	1.64	1.68	1.71	1.65	1.67	1.70	1.59	1.62	1.64	1.59	1.61	1.63
Weight of Pycnometer + water (W4)	kg	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51
Specific gravity (G)		2.26	2.28	2.26	2.27	2.23	2.23	2.25	2.25	2.30	2.27	2.24	2.24	2.27	2.26	2.29
Average specific gravity (G)		2.27			2.24			2.26			2.25			2.27		

Table 4.1. Specific gravity test

3.3.2 Core cutter method:

Sample		1	2	3	4	5
Weight of empty core (W1)	g	984	957	945	968	975
Weight of core+soil (W2)	g	2805	2656	2685	2712	2640
Weight of soil (W3)	g	1821	1699	1740	1744	1665
Volume of core cutter (V)	cc	1021.018	1021.018	1021.01761	1021.018	1021.018
Bulk density (γ_b)	g/cc	1.783515	1.664026	1.70418216	1.7081	1.630726
Water content (w)	%	8	7.2	6.2	6.4	5
Dry density (γ_d)	g/cc	1.651403	1.552263	1.6046913	1.605357	1.553072
Void ratio		0.374589	0.462381	0.4146023	0.414016	0.461619
Degree of saturation (Sr)	%	57.66318	42.04326	40.3760425	41.73755	29.2449

Table 4.2. Core cutter method

3.3.3 Determination of consistency limits:

3.3.3.1 Liquid limit:

Water content (%)	PENETRATION (mm)														
	Sample-1			Sample-2			Sample-3			Sample-4			Sample-5		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
15	54	53	55	57	53	51	45	47	50	42	44	40	50	53	57
18	98	86	90	89	94	90	76	79	77	73	78	71	72	76	81
21	134	120	125	134	145	131	143	140	143	132	146	141	115	109	110
24	184	173	180	192	200	190	189	174	186	194	191	193	148	156	159
27	248	245	245	251	268	253	248	251	243	256	232	240	185	190	181
30		-			-			-			-		240	238	231
LL (from graph) (%)	25	28	26	25	24	26	24	24	25	24	25	25	27	27	27

Table 4.3. Cone penetration test

3.3.3.2 Plastic limit:

DESCRIPTION		Sample 1			Sample 2			Sample 3			Sample 4			Sample 5		
		Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3
Plastic limit	%	25	25	24	23	24	25	24	24	24	25	25	24	24	23	24
Average	%	24.67			24.00			24.00			24.67			23.67		

Table 4.4. Plastic limit test

3.3.3.3 Shrinkage limit:

Description		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Weight of shrinkage dish (W_1)	g	62.9	62.9	62.9	62.9	62.9
Weight of shrinkage dish + wet soil pat (W_2)	g	108	112	105	109	113
Weight of shrinkage dish + dry soil pat (W_3)	g	95.1	98.9	92.3	95.1	98
Weight of wet soil pat (W_4)	g	45.1	49.1	42.1	46.1	50.1
Weight of dry soil pat (W_5)	g	32.2	36	29.4	32.2	35.1
Water content of wet soil pat(w)	%	40.06	36.39	43.20	43.17	42.74
Volume of wet soil pat(V)	ml	25	25	25	25	25
Volume of dry soil pat(Vo)	ml	18	18.6	18	17.5	17.9
Shrinkage limit (W_S)	%	18.32	18.61	19.39	19.88	22.51
Shrinkage ratio (R)		1.79	1.94	1.63	1.84	1.96
Volumetric shrinkage (V_S)	ml	38.89	34.41	38.89	42.86	39.66

Table 4.5. Shrinkage limit

3.3.4 Standard proctor test:

Description		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Avg. Wet density (γ_b)	g/cc	1.93	1.91	1.93	2.02	2.016
Avg. Moisture content	%	10.8	12.6	12.6	12	10.4
Avg. Dry density (γ_d)	g/cc	1.63	1.58	1.62	1.708	1.76
Maximum dry density ($\gamma_{d\ max}$)	g/cc	1.71	1.685	1.74	1.8	1.805
Optimum moisture content (O.M.C.)	%	18.34	19.05	18.3	17.1	13.8

Table 4.6. Standard proctor test

3.3.5 Triaxial compression test:

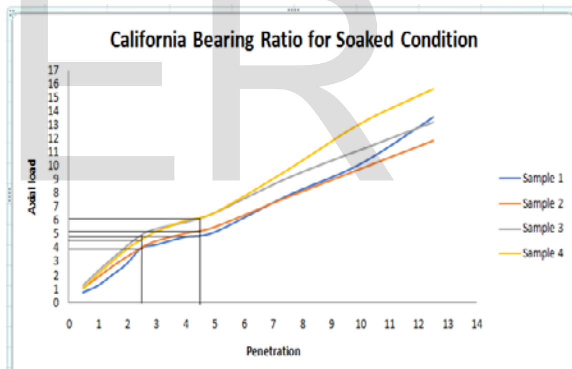
Description	Sample 1	Sample 2	Sample 3	Sample 4
Max. Dry Density, $\gamma_{d\ max}$ (gm/cc)	2.006	2.058	2.108	2.054
Cohesion, c	0.25	0.2	0.35	0.35
Angle of internal friction, ϕ	24'26'	23'18'	23' 30'	22'53'
S.B.C.(kN/m^2)	225.83	215.64	161	201.79

Table 4.7. Triaxial compression calculated values

3.3.6 California Bearing Ratio Test:

Penetration (mm)	Sample 1	Sample 2	Sample 3	Sample 4
	Axial load in kg/cm2	Axial load in kg/cm2	Axial load in kg/cm2	Axial load in kg/cm2
0.5	0.81	1.04	1.27	1.04
1	1.274	1.85	2.31	2.08
1.5	2.085	2.66	3.24	3.01
2	2.895	3.36	4.17	3.94
2.5	4.053	4.05	4.98	4.63
3	4.285	4.52	5.44	5.21
4	4.864	5.096	5.91	6.02
5	5.211	5.56	6.6	6.6
7.5	7.875	7.76	9.15	9.73
10	10.191	9.84	11.23	13.15
12.5	13.617	11.93	13.27	15.69

Table 4.7.CBR test calculated values



Graph 4.1. CBR Penetration (mm) v/s Axial load(kg/cm²)

4 Proposed Plan

According to our plan highway will go down around 8m and an over-bridge is designed across highway to connect the two halves of city in order to keep connection between city. Considering future development of highway, we are designing the width of each road up to 12m over the existing road width is 9m. We are reducing the width of divider to 2m from 4.5m in order to get some extra space for development. We are designing a bridge of 25m width and 45 m length in order to provide 6 lanes two-way road upon the bridge considering future development which also helps in easy movement of traffic. We also provide a divider of 1 m width to channelize the section and to reduce the conflict points. Turning radius, weaving length also designed as per IRC at the connection of service road so that there will be enough space at junction which ensures safety.

5 Expected Outcome

- Accident reduction in junction
- Speed of vehicles is maintained in highway
- Risk free connections in between state highway and national highway
- Simplified movement of intercity traffic
- Safety of pedestrians in crossing
- Parking problems will be eliminated

6 Advantages

- Conflict points at Katapady junction is reduced hence there will be reduction in accident probability.
- Traffic flow will be easier, there will not be any disturbance to the traffic in national Highway. Hence there will be increase in the mean speed of the vehicle which also results in the saving fuel and money. So, it is economical.
- We can provide some parking spaces in the side of roads which also helps in solving parking issues also.

7 Conclusion

As per the topographical area the construction of underpass would be suitable. The analysis of soil properties and its ability to handle load are carried out. The traffic volume count has been done and the PCU values have been calculated.
We have planned to propose following features:

1. Hassle free movement of vehicles
2. Safety for pedestrians
3. Reduced accident condition
4. Parking facility
5. Maintenance of design speed in highway
6. Complete utility of service roads.

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