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Re-design of Geometrics for Hubli-Dharwad Bypass km 417-419 (Bangalore-Pune) Accident zone

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ABSTRACT: The aim of this project is to conduct a study of the geometrics of the Study Zone and also a study on vehicular behavior /road user (driver) behavior and work out a solution to reduce the number of accidents and thus save lives and property of the nation.

This particular study zone is located at 15 degree 21' latitude and 75 degree 15' longitude near Micro finish (Hubli) along Pune Bangalore Highway NH4

The study zone lies in the centre of Tarihal toll and Kalghatgi toll, it starts from Itigatti bridge at a milestone (Belgaum-86, Pune-487) and ends at milestone (Belgaun-88,Pune-489). This study zone happens to be the central two kilometers of the bypass between the above mentioned toll gates

This particular stretch has a sharp horizontal curve along with a valley curve formed by two steep slopes. Accidents which have taken place in this stretch have been regularly reported in newspaper, many of them involving loss of human life

I.INTRODUCTION

The geometrics of the road can be easily altered and number of accidents can be reduced, as geometrics are well within the control of human effort. Loss of life and property because of wrong or erroneous geometric design of a road can be directly blamed on road engineers and hence must be strictly avoided. Wrong geometrics include improper provision of width/extra widening at curves, improper provision of camber, improper provision of grades, improper provision of super elevation, improper provision of sight distances, improper provision of road humps/speed breakers, improper design of intersections, non provision of sign boards/warning signals, non provision of guard stones at horizontal curves, non provision of zebra crossings for pedestrians, etc

Relevance to current Research

In this paper, studies are made to find the major causes of traffic congestion including inadequate road capacity, poor planning rules in cities and towns, careless driving and road accidents among many others.at study zone cause of traffic congestion may be because, many vehicles reduces their speeds at the valley point and further when they start rising on the grade towards microfinish factory they lose speed further. this loss of speed of vehicles leads to greater congestion and further leads to accident many a times .Also due to cattle disturbances also many vehicles tends to loose their speed resulting in traffic congestion.



III.METHODOLOGY OF PROPOSED SURVEY

Various causes of accidents are analysed out to find out the reasons and hence be listed as given below:

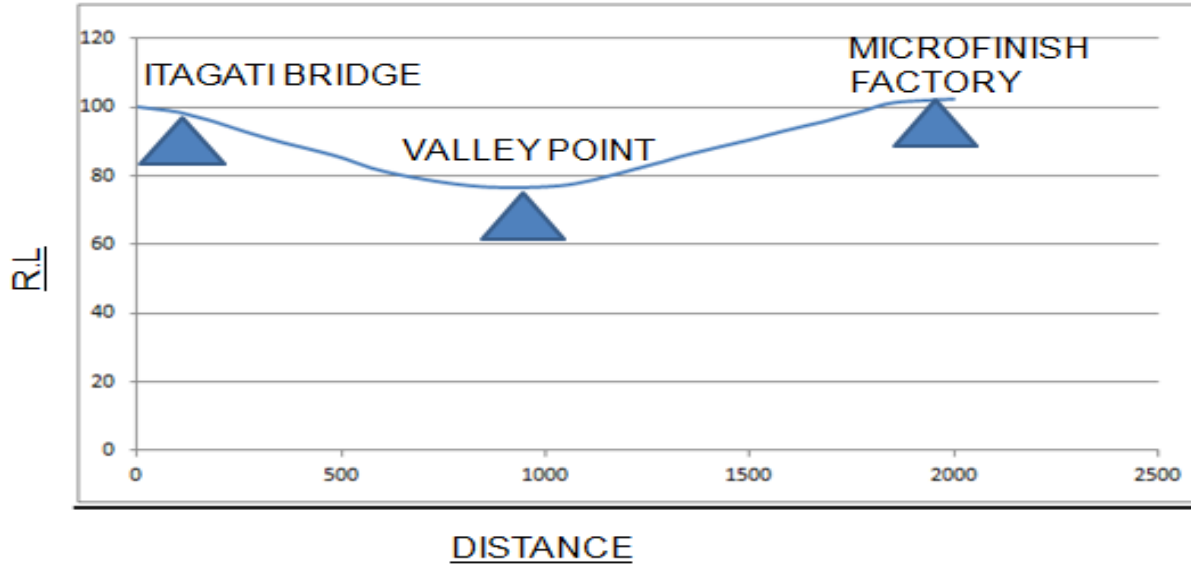
- 1) Drivers: Excessive speed and rash driving , carelessness, violation of rules and regulation, failure to see or understand the traffic condition , sign or signals , temporary effects due to fatigue, sleep or alcohol.
- 2) Pedestrians:Violating regulations , carelessness in using the carriageway meant for vehicular traffic .
- 3) Passengers : Alighting from or getting into moving vehicle.
- 4) Vehicle defects: Failure of brakes steering system and lighting system , tyre burst and any other defects in the vehicle.
- 5) Road condition: Slippery or skidding road surface, pot holes, ruts and other damaged condition of road surface.
- 6) Road design : Defective geometric design like inadequate site distance, inadequate width of shoulders, improper curve design.
- 7) Weather: Unfavorable weather condition like mist , fog, snow , dust, smoke , heavy rainfall.

Causes of accident at study zone -

- 1) At the start of the bridge, vehicles gain speed and momentum which is used by the vehicles to climb up the rising gradient. but due to over congestion at times, drivers are forced to apply sudden brakes.
- 2) At the start of rising gradient, the initial speed is expected to be equal to the design speed. however, this may not be true always because vehicles have to apply sudden brakes at the valley point due to cattle movement and the vehicles may start with lesser speeds leading to loss of speed. when loaded lorries lose excessive speeds, the faster moving following vehicles try to overtake these lorries and many a times this has become the cause for major accidents.
- 3) According to irc 37, the loss of speed should not exceed 25 kmph due to rising gradients, however, due to long stretch of the gradient, the loss of speed may exceed the recommended speed reduction. this may lead to congestion and accidents



LONGITUDINAL PROFILE OF STUDY ZONE



- i) RL AT ITAGATI BRIDGE IS 97.84 M
- ii) RL AT VALLEY POINT IS 76.56 M
- iii) RL AT MICROFINISH FACTORY IS 101.27 M

Spot Speed studies are used primarily to determine the distribution of traffic speeds, or vehicle speed/class percentiles, at specific location

Spot speed is defined as the average speed of vehicles passing a point. It is mostly used by traffic engineers to measure the speed that drivers freely select, in free flow condition.

Stop watch is adopted for spot speed study at study zone. In this method, markings are made on pavement at a distance of 50 mts. Observer start and stops the watch as vehicle passes the markings.

Minimum two observers are required to collect the data, of which one stands at the starting point to start and stop the stop watch and other one stands at end point to give indication to stop the watch when vehicle passes marking. Time taken by vehicle to pass the marked section is recorded and used for calculating speed.

CALCULATION OF REVISED GRADIENT

Dist. (m)	Obs speed (kmph)	Obs speed (m/s)	Obs speed (kmph)	Obs speed (m/s)	Desired speed (m/s)	Obs decel ⁿ . (m/s ²)	Desired decel ⁿ . for reduction of 25 kmph (m/s ²)	Diff in decel ⁿ .	Required reduction in (sinθ)	Required reduction in (θ)	Raising of valley point m
600	56.7823	15.7728	19.8019	5.50055	8.82842	0.18210	0.142369	0.039738	0.00405	0.23209	2.43043
600	47.1204	13.0890	24.6238	6.83994	6.14456	0.10378	0.111305	-0.00752	-0.00077	-0.04395	-0.46021
600	39.8230	11.0619	14.8392	4.12201	4.11750	0.08781	0.087844	-3.1E-05	-3.2E-06	-0.00018	-0.00189



600	42.8571	11.9047	17.9282	4.98008	4.96031	0.09743	0.097599	-0.00016	-1.7E-05	-0.00096	-0.01001
600	52.4781	14.5772	22.7560	6.32111	7.63281	0.14378	0.128531	0.015253	0.00155	0.08908	0.93289
600	53.0973	14.7492	19.1693	5.32481	7.80481	0.15765	0.130521	0.027135	0.00276	0.15848	1.65961
600	45.8015	12.7226	21.8712	6.07533	5.77820	0.10413	0.107065	-0.00294	-0.0003	-0.01714	-0.17951
600	36.7346	10.2040	23.3160	6.47668	3.25963	0.05181	0.077915	-0.0261	-0.00266	-0.15245	-1.59644
600	60	16.6666	18.1086	5.03018	9.72222	0.21039	0.152713	0.057682	0.00588	0.33689	3.52797
600	44.8877	12.4688	18.2370	5.06585	5.52438	0.10817	0.104127	0.004047	0.00041	0.02363	0.24749
600	43.4782	12.0772	20.8092	5.78034	5.13285	0.09370	0.099596	-0.00589	-0.0006	-0.03439	-0.36016
600	52.3255	14.5348	19.1489	5.31914	7.59043	0.15247	0.12804	0.024435	0.00249	0.14271	1.49446
600	61.4334	17.0648	17.6125	4.89236	10.1204	0.22272	0.157322	0.065406	0.00666	0.38201	4.00037
600	47.8723	13.2978	19.8895	5.52486	6.35342	0.12192	0.113723	0.008202	0.00083	0.04790	0.50162
600	62.9370	17.4825	19.6721	5.46448	10.5380	0.22981	0.162156	0.067659	0.00689	0.39516	4.13814
600	52.1739	14.4927	17.6817	4.91159	7.54830	0.15493	0.127552	0.027378	0.00279	0.15990	1.67447
600	43.0622	11.9617	20.1117	5.58659	5.01727	0.09327	0.098258	-0.00503	-0.00051	-0.02938	-0.30769
600	42.5531	11.8203	19.9778	5.54939	4.87588	0.09077	0.096622	-0.00585	-0.0006	-0.03417	-0.35787
600	48	13.3333	17.7514	4.93096	6.38888	0.12788	0.114133	0.013753	0.00140	0.08032	0.84115
600	46.2724	12.8534	22.6986	6.30517	5.90902	0.10454	0.108579	-0.00403	-0.00041	-0.02355	-0.24661
600	48.1283	13.3689	19.3340	5.37056	6.42454	0.12490	0.114546	0.01036	0.00105	0.06050	0.63362
600	62.9370	17.4825	18.9873	5.27426	10.5380	0.23151	0.162156	0.069361	0.00707	0.40510	4.24226
600	62.2837	17.3010	20.0445	5.56792	10.3565	0.22360	0.160056	0.063548	0.00647	0.37115	3.88670
600	57.6923	16.0256	17.7165	4.92126	9.08119	0.19383	0.145294	0.048541	0.00494	0.28350	2.96887
600	45.9183	12.7551	19.0880	5.30222	5.81065	0.11214	0.107441	0.004708	0.00048	0.0275	0.28797
600	60.8108	16.8919	19.5227	5.42299	9.94744	0.2132	0.15532	0.057952	0.00590	0.33847	3.54448
600	52.7859	14.6627	18.5758	5.15995	7.71831	0.1569	0.12952	0.027456	0.00279	0.16035	1.67926
600	48.7804	13.5501	22.5281	6.25782	6.60569	0.1203	0.116643	0.003729	0.00038	0.02177	0.22807
600	51.7241	14.3678	20.2474	5.62429	7.42337	0.1566	0.126106	0.019561	0.00199	0.11425	1.19641
600	48.78049	13.55014	19.43844	5.39956	6.6691	0.1287	0.116643	0.012067	0.00123	0.07047	0.738013

This particular cells shows only the points where the rise of gradient has to be carried out to achieve the desired results. The different colours of cells shows the different category of the rising point in which it belongs to. That category is described in the table provided below. Range of rise of valley point.

TABLE:9

2.430431
0.932895
1.65961
3.527976
0.247498
1.494466
4.000371
0.501628
4.138146
1.674477
0.841156
0.633624
4.24226
3.886707



2.968875
0.287978
3.544488
1.679264
0.228074
1.196418
0.738013

Key:

Red – more than 4 mts

Green – more than 3 mts but less than 4 mts

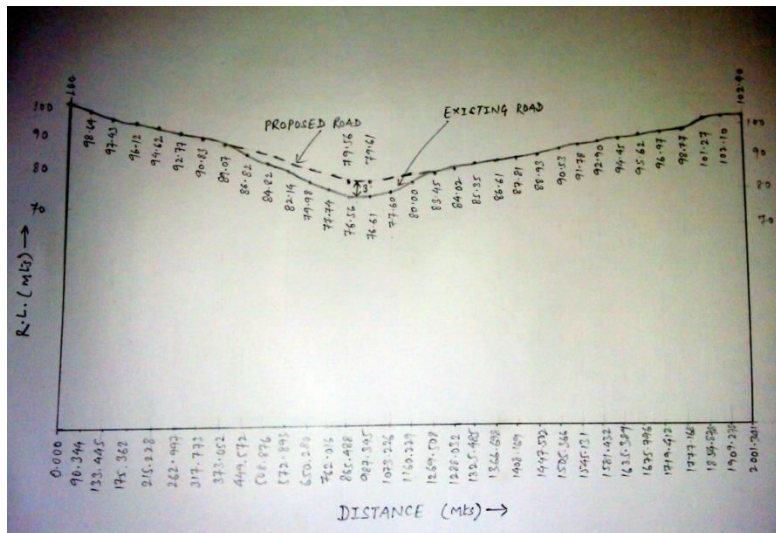
Blue – more than 2 mts but less than 3 mts

Pink – more than 1 mts but less than 2 mts

White – less than 1 mts

Suggested corrective measures:

1. Gradient on the microfinish factory side to be reduced to avoid congestion of traffic.
2. To raise the valley point reduced level by 3.00 mts by constructing a bridge/embankment.



IV.CONCLUSION AND FUTURE WORK

1. The accidents occurring in this “accident zone” are primarily due the congestion caused by the excessive loss of speed of loaded lorries.



2. The spot speed studies clearly indicate that 70 percent of loaded lorries lose speed by more than 25 kmph i.e., more than the value stipulated by the irc 37 code.
3. The congestion and excessive loss of speed can be reduced/avoided by changing the gradient and making it flatter than existing by raising the valley point reduced level. from 76.56 to 79.56
4. An embankment or bridge may be constructed at the valley to raise the reduced level. at the valley point.

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