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TRAFFIC ASSESSMENT STUDIES BASED ON SOCIO ECONOMIC STUDIES

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ABSTRACT: *Traffic growth on a road facility is generally estimated on the basis of historical trends. Demand changes are usually because of shifts in the pattern of economic activities in the surrounding regions. Hence, future traffic estimation necessitates a preview, however imprecise, of the probable pattern of future growth of the economy.*

The exercise of normal traffic growth rate estimation has been carried out by using the elasticity approach. The total traffic that is likely to patronize and improves road facility will comprise three distinct streams vizi) normal traffic, ii) generated (or induced) traffic and iii) diverted traffic.

The elasticity approach has variables comprising of

- *Elasticity Values (published by GoI)*
- *Socio Economic Profile of the region*
- *Industrial Development plans and strategy*
- *Economic Indicators*

1. INTRODUCTION:

TRANSPORTATION ENGINEERING

Pavement Engineering	Traffic Engineering	Transportation Engineering
• Material • Construction • Analysis & Design • Evaluation • Management	• Traffic Flow • Traffic Simulation • Traffic Control • Traffic Study & Analysis	• Urban Transportation & Planning • Mass transit • Transportation Network • Transportation Economics

Transportation engineering or transport engineering is the application of technology and scientific principles to the planning, functional design, operation and management of facilities for any mode of transportation in order to provide for the safe, efficient, rapid, comfortable, convenient, economical, and environmentally compatible movement of people and goods (transport). It is a sub-discipline of civil engineering. The importance of transportation engineering within the civil engineering profession can be judged by the number of divisions in ASCE (American Society of Civil Engineers) that are directly related to transportation.

Modes of transport:

- Road transportation.
- Railway transportation.
- Airport transportation.
- Waterway transportation.

The planning aspects of transportation engineering relate to elements of urban planning, and involve technical forecasting decisions and political factors. technical forecasting of passenger travel usually involves an urban transportation planning model, requiring the estimation of trip generation (how many trips for what purpose), trip distribution (destination choice,

where is the traveler going), mode choice (what models being taken), and route assignment (which streets or routes are being used). passenger trips are the focus of transportation engineering because they often represent the peak of demand on any transportation system.

1.2.STUDY LOCATION

The Project location is situated in state of Gujarat and the end points of the project are Budhel and Vartej .The location is shown through below Index map

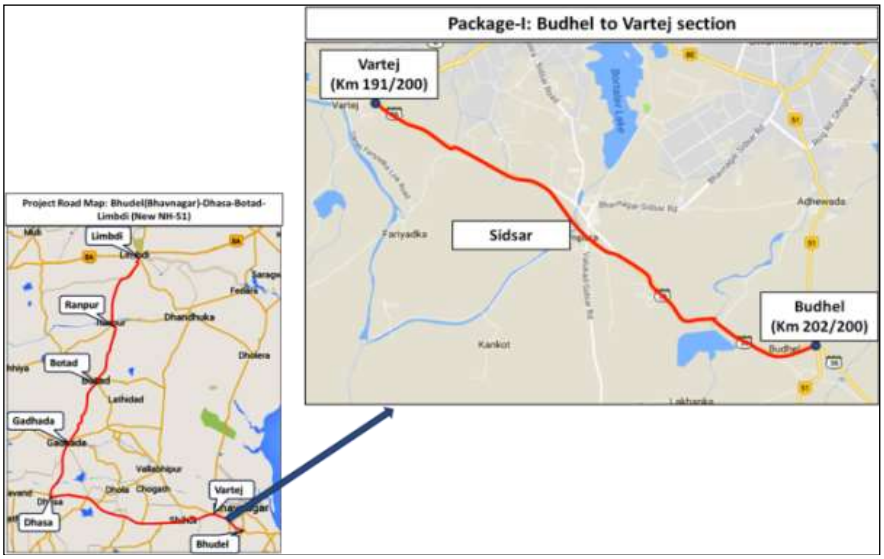

Figure-1: Package-I: Budhel to Vartej section with Project Road Map

2 HOMOGENEOUS SECTION

The project section from Budhel to Vartej is considered as single homogenous section as the traffic intensity at any point within this section is uniform. The homogeneous section and its details given below:

Table -1: Traffic Survey locations and Durations

Survey Description	No.	Location	Duration
1. Classified Traffic Volume Counts	1	Near Sidsar Village at KM 198/500	7 Days
2. Origin & Destination Surveys	1	Near Sidsar village at KM 196/200	24 hours
3. Axle Load Surveys	1	Near Sidsar village at KM 196/200	48 hours
4. Turning Moment Counts	1	At km 191/200 (Vartej Junction)	8 hours
	2	At km 202/200 (Budhel Junction)	8 hours
5. Pedestrian Counts	1	Sidsar – Valukad Jn (197/300)	12 hours
6. Speed and Delay Survey		Complete Project Road Section	
7. Animal Counts		Along the Project Road Section	12 hours

The locations for the above traffic surveys are shown in **Figure 2** below:

Figure-3.2: Traffic Survey Location

3. TRAFFIC SURVEYS AND ANALYSIS

3.1 Classified Traffic Volume Count.

3.1.1 Daily Variation of Traffic Volume

The day wise traffic volume at this location has been analysed and observed that the traffic is high on Monday at Km 198/500. The observed daily traffic ranges in between 2,983 to 3,864 vehicles and 5391 to 6395 PCU. The daily variations of traffic are shown graphically in Figure 3.(Both Directions)

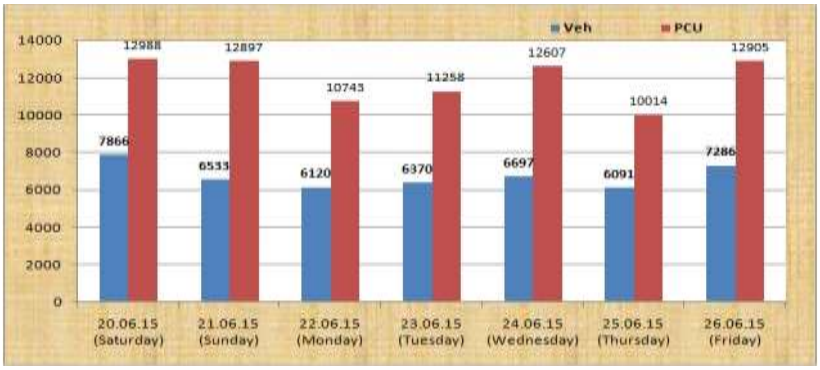

Figure-3: Daily Variation at 198/500 (Near Sidsar Village)-(HS-1)

3.1.2 Average Hourly Variation of Traffic

The hourly flow pattern of vehicles and PCU on the project corridor (during 7 days) is depicted in charts shown in **Figure 4.1.** The minimum and maximum vehicles per hour observed in the order 91 and 1143 and the minimum and maximum PCU per hour observed are in the order of 177 and 1183 respectively. Hourly variation for this homogenous section is shown graphically in below figure.

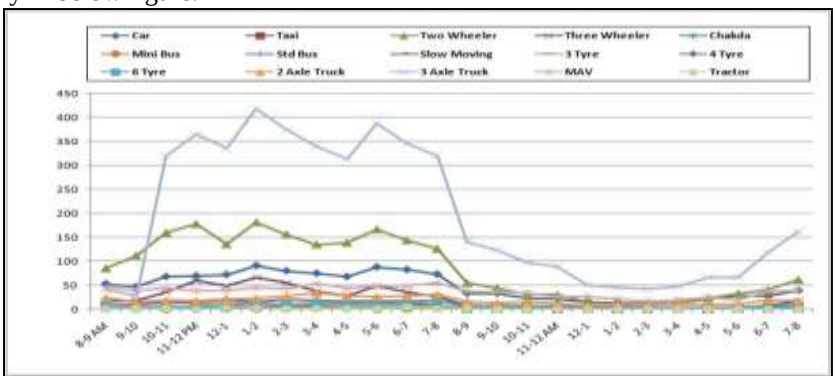

Figure-4: Average Hourly Variation at Km 198/500

Peak hour traffic flows recorded for the project corridor is between 11:00 to 12:00 Noon and evening in between 5:00 to 6:00 PM. The peak hour percentage varies from 6.58% to 8.31% in morning to evening peak hours respectively.

Average Composition of Traffic

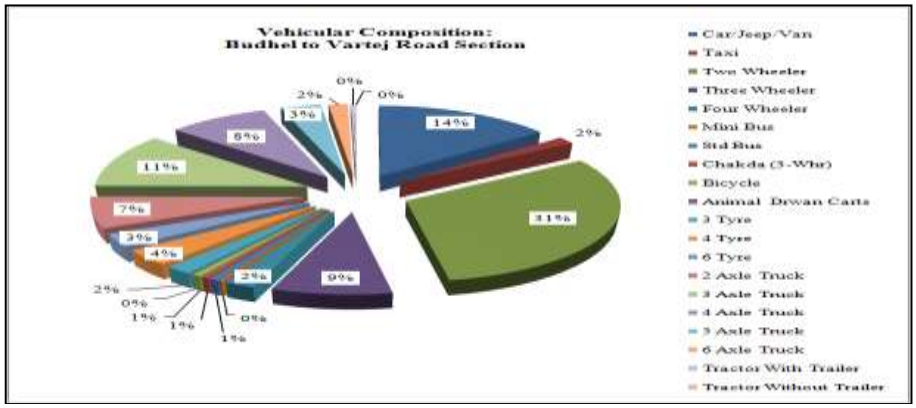

Figure -5 Composition of Vehicles (Percentage) at Km 198/500

- Passenger Car Units (PCU) values for the project study have been adopted as given in IRC 64-1990 .

Average Daily Traffic (ADT) & Annual Average Daily Traffic (AADT)

To arrive at ADT Arithmetic mean, seven days count was considered and the ADT & AADT arrived values for this homogeneous section is given in **Tables**

Table- 2: Average Daily Traffic (ADT)

S.No	Vehicle Type	Budhel to Vartej Section	
		ADT	AADT
1	Car/Jeep/Van	1020	979
2	Taxi	101	96
3	2- Wheeler	2083	2000
4	3- Wheeler & Chakda	574	552
5	Four Wheeler	130	125
6	Mini Bus	23	22
7	Std Bus	45	43
8	Ambulance & Military Vehicle	5	4
9	Cycle	46	44
10	Animal Driven Carts	1	1
11	Light commercial Vehicle 3- Tyre	128	123
12	Light commercial Vehicle 4 –Tyre	236	226
13	Light commercial Vehicle 6-Tyre	196	188
14	2-Axle	449	431
15	3-Axle	763	732
16	Multi Axle Vehicle	875	839

17	Trailers	17	17
18	Tractor	11	11
19	Other slow moving vehicle	6	7
Grand Total Vehicles		6709	6440
Grand Total PCU's		11912	11438

Traffic Volume Count At Km 198/500

Figure-6: Photograph during Traffic Survey under progress

3.2 AXLE LOAD SURVEY

Axle load surveys were carried out at one selected locations on the project corridor at Km 196/200 of Budhel – Vartej section for two normal days (48 hours) to get the axle load spectrum for further computations of Vehicle Damage Factor. The locations with survey details are given in the **Table-3,4**

Table-3: Locations of Axle load surveys

S. no	Homogeneous section	Remarks
1	Budhel Jn. to Vartej Jn.	Axle Load survey conducted at km 196/200 near Sidsar Village

Table-4: Percentage of Commercial Vehicles at km 196/200

Direction wise % of sample collected w.r.to One-day TVC						
Vehicle Type	Direction: Vartej – Budhel			Direction: Budhel - Vartej		
	No. of Vehicles (1-day TVC)	No of vehicles Surveyed	%	No. of Vehicles (1-day TVC)	No of vehicles Surveyed	%
LCV	96	59	61.46%	97	59	60.82%
2-Axle	200	53	26.50%	257	54	21.01%

3-Axle	255	94	36.86%	301	88	29.24%
MAV	532	133	25.00%	548	110	20.07%
Bus	4	8	200.00%	15	6	40.00%
Total	1087	347	**31.92%**	1218	317	**26.03%**

The distribution of lead and load obtained from the O-D surveys has been compared to that of sample collected during the axle load surveys. The output of the same is presented in tabulated and graphical formats below.

3.3 Vehicle Damage Factor (VDF)

The objective of analysis is to estimate the Vehicle Damage Factor (mode wise) in each direction. The equivalency factor derived from the "4^{th} power rule" to achieve the Equivalent Standard Axle Load for the respective vehicle type.Vehicle Damage Factor (VDF) for each type of vehicle is given in **Table- 4.11**.

Table-5: Vehicle Damage Factor (VDF) at Km 196/200

Type of Vehicles	Budhel to Vartej	Vartej to Budhel	Average VDF
LCV 4 tyre	0.27	0.30	0.28
LCV 6 tyre	1.73	0.49	1.11
2Axle	3.29	1.73	2.51
3Axle	8.60	2.81	5.70
Avg for MAV	13.13	3.82	8.48
Standard Bus	1.88	1.90	1.89

Note: *Weighted average VDF for MAV is in the order of 8.70*

The VDF values for 4-Axle/MAV vehicles in Budhel to Vartej direction are high due to transportation of cement from kodinar/Rajula to Bhavnagar/Ahmedabad/Rajkot areas. Axle load survey photos are set out in **Figure- 5**

Photos_1: Axle Load Survey at Km 196/200 of SH-36

Figure-7: Axle Load Survey Photographs

3.4 Commodity Distribution

Based on the OD analysis the commodity distribution has been studied and the summary is given in **Table-6**

Table-:6 Commodity Distribution at Km 196/200

S. No	Commodity Vehicle Type	LCV	2 Axle	3 Axle	MAV
1	Food Material	20.34	11.21	10.81	4.20
2	Container	0.00	1.87	2.16	20.17
3	Oil & Gas	0.00	0.00	0.00	2.52
4	Wood	22.03	12.15	1.08	0.00
5	Cement	5.08	0.00	4.32	21.85
6	Sand	0.00	1.87	4.86	1.26
7	Stone	8.47	16.82	8.11	3.78
8	Steel & Machinery	2.54	25.23	4.86	5.88
9	Fly ash	0.00	0.00	9.19	2.94
10	Coal	0.00	0.00	23.78	1.26
11	Chemical	0.00	2.80	7.57	11.76
12	Empty	13.56	23.36	21.08	23.53
13	Others	27.97	4.67	2.16	0.84
Total		**100**	**100**	**100**	**100**

Photograph during Origin Destination Survey at Km 196/200

Figure-8: Origin and Destination Survey Photograph

3.5 Speed and Delay Survey

Speed and Delay survey was carried out on the project stretch starting from Budhel to Vartej from Km 202/200 to Km 191/200 of SH-36 considering as a single section.

There are no major delays observed on the project stretch except at built-up areas. The details of average journey speeds are given in below **Table-**

Table - 7: Journey Speeds Observed Direction from Budhel to Vartej & Vartej to Budhel (KMPH)

S. No	Homogenous Section	Km	Journey Time (Sec)	Delay (Sec)	Journey Speed (km/h)	Running Speed (km/h)
1	Section: Budhel to Vartej	11.00	632	0	63.1	63.1
2	Section : Vartej to Budhel	11.00	651	0	61.7	61.7

From the above two tables it was observed that the average running speed varying from 62 kmph to 63 kmph.

4. Traffic Projections & Socio Economic Profile

4.1 Elasticity Values

The elasticity values published by the Road Development Plan – Vision 2021 are considered to compute the growth rate for each type of vehicle and the values published is given below in **Table 8**.

Table 8: Elasticity Values

Type of Vehicle	2006-2011	2011-2016	2016-2021	2021-2026	2026-2031	2031-2036
Car/Van/Jeep	1.7	1.6	1.5	1.4	1.3	1.25
Bus	1.4	1.3	1.2	1.1	1.05	1.0
All Trucks (LCV, 2 Axle Truck, 3 Axle truck, 3-6 Axle truck & HME)	1.5	1.4	1.2	1.1	1.05	1.0

4.2 Elasity Values:

Table 9: Elasticity Values along with Projected Economic Indicators

Type of Vehicle	2015-2018	2019-2023	2024-2028	2029-2033	2034-2038	> 2038
Car/Van/Jeep	0.98	0.83	0.71	0.60	0.51	0.43
Bus	7.28	6.18	5.26	4.47	3.80	3.23
All Trucks	0.79	0.67	0.57	0.48	0.41	0.35
PCI	6.88%	5.85%	4.97%	4.23%	3.59%	3.05%
NSDP	8.32%	7.07%	6.01%	5.11%	4.34%	3.69%
Agriculture	4.77%	4.77%	4.77%	4.77%	4.77%	4.77%
Population Growth	6.88%	5.85%	4.97%	4.23%	3.59%	3.05%

***The growth rates are achieved by **Regression analysis**.

The computed growth rates for passenger as well as commercial vehicles for three scenarios for Most likely scenarios are given in **Table 9.**

- **Recommended Growth Rates:**

The growth rates are restricted to 5% for the values less than 5%; the table given below shows the recommended growth rates for three scenarios i.e., Most likely.

Table 10: Recommended Growth Rates for Most Likely Scenarios

Type of Vehicle	2015-18	2019-2023	2024-2028	2029-2033	2034-2038	> 2038
Car/Van/Jeep	8.09	6.87	5.84	5.00	5.00	5.00
Two Wheeler	8.59	7.30	6.21	5.28	5.00	5.00
Three Wheeler	8.32	7.07	6.01	5.11	5.00	5.00
Bus	9.84	8.36	7.11	6.04	5.14	5.00
LCV	8.67	7.37	6.27	5.33	5.00	5.00
All Trucks	6.52	5.55	5.00	5.00	5.00	5.00
Tractor & Tractor Trailer	6.62	5.63	5.00	5.00	5.00	5.00

5.1 ANALYSIS OF CAPACITY AND LEVEL OF SERVICE

The projected traffic is compared with the Design Service Volume (DSV) at Level of Service (LOS) -B (for rural roads, IRC: 64- 1990) to examine whether the facility would be able to carry the anticipated traffic or capacity augmentation would be needed. The design service volumes and capacities based on IRC 64-1990 are shown in **Table 11**

Table 11: Design Service Volume (PCU/day)

, Level of service was studied and the warrants for are given in Tables below:

Homogeneous Sections	Two lane with Earthen shoulder		Two Lane with Paved Shoulder		Four Lane with Paved Shoulder	
	LOS B	LOS C	LOS B	LOS C	LOS B	LOS C
Budhel – Vartej Km 202/200 to Km 191/200	AA	2017	AA	2018	2026	2034

-AA: Already Achieved

Based on the capacity assessment the following lane configuration has been recommended based on the LOS B from **Table 11**

From Km 202+200 to Km 191+200 (SH-36) – Two lane with paved shoulders option will get saturated in the year 2017. This section warrants Four lane paved shoulder configurations in the year 2026.

Four lane with Paved Shoulder configuration is recommended as Improvement Proposals for this project section.

6. CONCLUSION & RECOMMENDATIONS:

- The projections for upcoming years are given below.

Year	Grand Total VEH'S	Grand Total PCU's
2016	6362	10928
2017	6998	11931
2018	7699	13030
2019	8472	14232

2020	9324	15551
2021	10123	16776
2022	10991	18101
2023	11935	19533
2024	12961	21079
2025	14076	22748
2026	15108	24286
2027	16218	25930
2028	17410	27687
2029	18690	29563
2030	20064	31566
2031	21323	33392
2032	22662	35326
2033	24086	37374
2034	25600	39543
2035	27210	41841
2036	28668	43913

- The Final VDF after calculations are

Type of Vehicles	**Direction: Budhel to Vartej**	**Direction: Vartej to Budhel**	**Average VDF**
LCV 4 tyre	0.27	0.30	0.28
LCV 6 tyre	1.73	0.49	1.11
2Axle	3.29	1.73	2.51
3Axle	8.60	2.81	5.70
Avg for MAV	13.13	3.82	8.48
Standard Bus	1.88	1.90	1.89

- By the above traffic surveys and obtained CBR values we determine the different pavement layers and through traffic forecast we came to know the upcoming (future) traffic of particular location.

The pavement layers are as recommeneded follows.

Sections	**4-Lane Configuration**			
	PQC	**DLC**	**GSB**	**Sub-grade**
Budhel - Vartej	300	150	200	500

PQC - Pavement Quality concrete.

DLC - Dry lean Concrete

GSB - Granular Sub-Base.

- Through Accident data proper Geometric improvements have been planned at particular locations and sign boards to reduce propability of accidents.

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