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– Ribbanpally section of SH-10

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1 Introduction

1.1 Project Background

GVRMP, a special purpose company was awarded the contract for improvement of two-lane road from Whagdhari to Ribbanpally section of State Highway 10 (hereinafter referred to as Project Road) from Karnataka Road Development Corporation Limited (KRDCL) on a 30 year concession period to be executed on BOT-VGF (Toll) basis. The project road starts from Maharashtra border and ends at Andhra Pradesh border via Alanda- Gulbarga- Malked-Sedam in Gulbarga district for a length of 135.85 km excluding Gulbarga ring road.

State Bank of India (**SBI**) (herein after referred to as **Client**) intends to appraise the vehicular traffic on Project Stretch and has engaged the services of L&T Infrastructure Engineering Limited (herein after referred to as **Consultant**) to study the potential traffic demand and arrive at realistic traffic forecasts.

In this regard, the Consultant carried out necessary traffic surveys on Project Stretch and prepared a **Draft Traffic Report** to Client which comprises of site appreciation, summary of traffic analysis, growth rates and traffic projections.

The scope of work for the traffic study is given below:

- Undertake the following traffic surveys at the existing toll plaza locations on the Project Road:
 - Classified Traffic Volume Count Surveys (24 hours x 7 days) to arrive ADT & AADT
 - Origin-Destination Surveys (24 hours x 1 day) to assess local and long destination traffic
 - Turning volume count survey (24 hours x1 day) to access the diverted traffic.
- Preliminary road inventory of project road to understand impact of major developments/ junctions
- Collection of secondary data (fuel sales data/ toll data) to arrive at seasonal correction factors (SCFs)
- Analysis of collected primary and secondary data
- Alternate route/ competitive route analysis
- Estimation of tollable traffic for different categories of vehicles paying normal and concessional toll rates
- Collection of socio-economic data pertaining to project influence area and details of major developments that may impact the traffic on the project road
- Traffic projections for project road sections based on elasticity method for the concession period
- Preparation of draft and final traffic validation reports

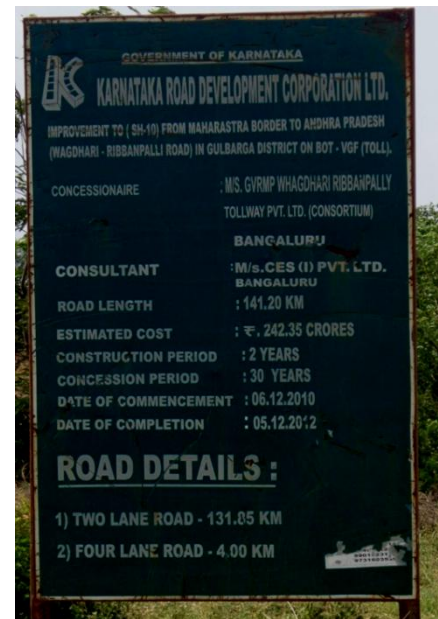
1.2 Project Road Context (SH-10)

The project road is in the state of Karnataka from Maharashtra border to Karnataka border via Aland, Gulbarga (Kalaburagi), Malkhed and Ribbanpally with a total length of 135.85 km (excluding Gulbarga ring road). It is the first State Highway (SH) in Karnataka which is tolled.

The SH-10 passes entirely through the Gulbarga district of Karnataka. The concession agreement for the development of Whagdhari Ribbanpally state highway (SH10) from Maharashtra Border to Andhra Pradesh Border via Aland-Gulbarga-Malked-Sedam in Gulbarga District for a length of 135.85km (excluding Gulbarga ring road) project under PPP-BOT (Toll) was signed between Karnataka Road Development Corporation Ltd and M/s GVRMP Whagdhari Ribbanpally Tollway Pvt Ltd.

The concession period is for a period of 30 years commencing from 2010(from the date of commencement of construction).

The SH10 construction work commenced in 2010 and was completed in 2012. The Toll operations started immediately after the construction was completed.



The location of the project road and its regional context is shown in **Figure 1-1** and the location of the project road in relation to other features of the road is shown in **Figure 1-2**.



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Figure 1-1: Project road in Regional context

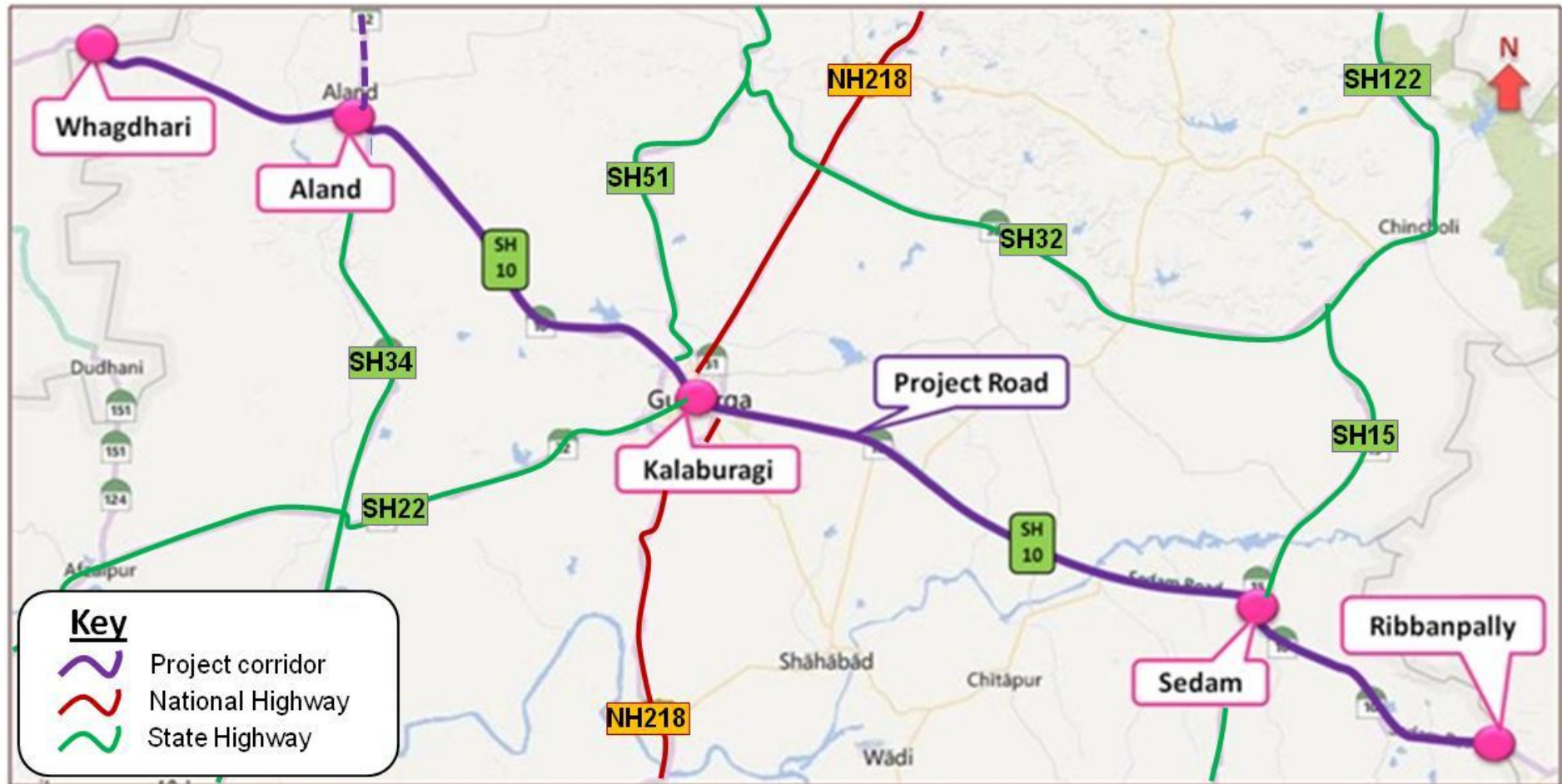


Figure 1-2 Project road with other features of the road

1.3 Site Appreciation

A brief description on the inventory detail of the project stretch is discussed in this section.

1.4 Right of Way (ROW)

The existing right of way varies from 18 to 20 m along the project road.



1.5 Land use

Majority of the project stretch is characterised by agricultural activity on either sides with cultivable lands. Although industries exist along the project stretch, their extent of is relatively low. A small portion of land use is occupied with built up areas, minor commercial establishments and educational institutions.



1.6 Terrain

The terrain along the project stretch consists of both the plain and rolling terrain.



1.7 Carriageway

The project road is a **two lane undivided carriageway** with paved / earthen shoulders on either sides. However, four lane divided carriageway is observed at some major settlements.



1.8 Pavement Condition

The condition of pavement is observed to be in good condition throughout the project road.



1.9 Major/Minor Bridges

Many major and minor bridges are located on the project road. The details of major and minor bridges observed are presented in **Table 1-1**.



Table 1-1 List of Major/Minor Bridges

S.No.	Chainage (Km)	Type of Bridge
1	1+400	Minor
2	18+400	Major
3	24+250	Minor
4	31+600	Minor
5	72+100	Minor
6	80+200	Minor
7	84+800	Minor
8	91+000	Minor
9	101+600	Major
10	109+100	Minor
11	113+600	Minor
12	114+100	Minor
13	117+950	Minor
14	118+550	Major

1.10 ROB/Level crossings

There are two ROB's located along the project stretch. The details of the same are presented in **Table 2-2**.



Table 1-2 List of ROB's

S.No.	Chainage (Km)
1	59+250
2	114+500

1.11 Settlements

The project stretch passes through various villages and towns which vary both in size and population. The details of settlements observed along the project road are presented in **Table 1-3**.



Table 1-3 List of Few Important Settlements/Towns

S.No.	Chainage (Km)	Settlement
1	23+100	R.T.O. Check Post, Aland
2	40+100	Kadaganchi
3	59+900	Gulbarga
4	79+500	Sannoor
5	84+400	Madbool Cross

S.No.	Chainage (Km)	Settlement
6	101+900	Malkhed
7	108+600	Neellolli
8	114+300	Sedam (Chincholli Cross)
9	115+500	Sedam
10	119+100	Battagera
11	123+800	Huda
12	127+600	Adaki

1.12 Industries

One major industry located along the project stretch is **Vasawadatta Cement Plant** located near Sedam town, which has a production capacity of 18,000 tonnes per day and has daily truck movement of 400 per day from the plant. The raw materials for the cement manufacturing in the plant are obtained majorly from Hyderabad and Belgaum and the manufactured product is supplied to places like Pune, Hyderabad, Gulbarga and Bijapur. The plant has a significant influence on the project stretch. There are also some small scale industries located along the project corridor. The list of industries is presented in the **Table 2-4**.



Table 1-4 List of Industries

S.No.	Chainage (Km)	Industry
1	24+800	Stone Crusher Industry
2	57+400	Ware House
3	58+100	S.K. Industries (Agriculture)
4	58+300	Logistic Ware House
5	70+800	N.S. Mulge Earth Industry
6	71+400	Stone Crusher Industry
7	74+050	Southern Oxygen Co. Pvt. Ltd.
8	74+900	RMC Aggregates Industry
9	88+000	Sri Sai Baba Stone Crusher Industry
10	97+150	Canara Bank Depot
11	116+800	Vasawadatta Cement Plant
12	122+500	Stone Quarry

1.13 Intersections

Many minor and major intersections are located along the project road. The details of important intersections are presented in **Table 1-5**



Table 1-5 List of Major / Minor Intersections

S.No.	Chainage (Km)	Road leads to	Type
1	0+350	Hirolli Village (R.H.S)	Minor 3-leg Intersection
2	5+700	Nagalgai Village (R.H.S)	Minor 3-leg Intersection
3	6+700	Sarasamba (R.H.S), Khairat Border (L.H.S)	Minor 4-leg Intersection
4	10+200	Savaleshwar (R.H.S), Padasavali (L.H.S)	Minor 4-leg Intersection
5	14+100	Khanapur (L.H.S)	Minor 3-leg Intersection
6	16+970	Jidaga Village (R.H.S)	Major 3-leg Intersection
7	18+100	Shekapur (L.H.S)	Minor 3-leg Intersection
8	21+150	Gullolli (R.H.S)	Minor 3-leg Intersection
9	23+100	Aland Checkpost (L.H.S), Project road- SH 10 (R.H.S)	Major 3-leg Intersection
10	25+100	Bhusnoor (R.H.S)	Minor 3-leg Intersection
11	26+150	S. F. Tanda (L.H.S)	Minor 3-leg Intersection
12	28+050	Kodal Hangarga (L.H.S)	Minor 3-leg Intersection
13	28+700	Yelenawadgi (L.H.S)	Minor 3-leg Intersection
14	34+900	Lad Chincholi, Madan Hipparaga (R.H.S)	Minor 3-leg Intersection
15	35+200	Dannoor (L.H.S)	Minor 3-leg Intersection
16	40+100	Narona (L.H.S), Kadaganchi (R.H.S)	Major 4-leg Intersection
17	44+000	Santanoor (R.H.S)	Minor 3-leg Intersection
18	47+100	Chowdapur (R.H.S)	Minor 3-leg Intersection
19	48+400	Pattana (L.H.S), Ujjalli (R.H.S)	Major 4-leg Intersection

S.No.	Chainage (Km)	Road leads to	Type
20	51+700	Bheemalli (L.H.S), Savalgi (R.H.S)	Minor 4-leg Intersection
21	56+250	Keribhosga (L.H.S), Project Road - SH 10 (R.H.S)	Minor 3-leg Intersection
22	60+610	Humanabad (L.H.S), Afzalpur (R.H.S), Gulbarga City (Straight)	Major 4-leg Intersection
23	65+800	Humanabad (L.H.S), Shahbad (R.H.S), Project Road (Straight)	Major 4-leg Intersection
24	72+020	Srinivasnarayan Gurulkul School (L.H.S)	Minor 3-leg Intersection
25	72+350	Kalnoor Tanda (R.H.S)	Minor 3-leg Intersection
26	74+550	Daryanayak Tanda (R.H.S)	Minor 3-leg Intersection
27	75+500	Pala (R.H.S)	Minor 3-leg Intersection
28	75+600	Srinivasa Saradagi (L.H.S)	Minor 3-leg Intersection
29	78+900	Madihalla Tanda (R.H.S)	Minor 3-leg Intersection
30	79+500	Shahbad (R.H.S)	Major 3-leg Intersection
31	80+400	Sannoor (R.H.S)	Minor 3-leg Intersection
32	80+700	Bolewada village and Hudanoor (L.H.S)	Minor 3-leg Intersection
33	84+400	Chincholi (L.H.S), Bennur (R.H.S)	Major 4-leg Intersection
34	87+000	Mukuta (L.H.S)	Minor 3-leg Intersection
35	90+550	Gundugurthi (L.H.S), Bagodi (R.H.S)	Minor 4-leg Intersection
36	93+300	Evani (R.H.S)	Minor 3-leg Intersection
37	96+600	Tengli (L.H.S), Chittapur (R.H.S)	Major 4-leg Intersection
38	98+600	Malkood (L.H.S)	Minor 3-leg Intersection
39	101+500	Samkhed Tanda (L.H.S)	Minor 3-leg Intersection
40	101+900	Sanghvi (L.H.S)	Major 3-leg Intersection
41	102+000	Chittapur (R.H.S)	Major 3-leg Intersection
42	105+700	Huda (k) (R.H.S)	Minor 3-leg Intersection
43	107+600	Beernahalli (L.H.S)	Minor 3-leg Intersection
44	109+250	Konkanahalli (L.H.S), Hosalli (R.H.S)	Minor 4-leg Intersection
45	111+450	Bommanahalli (L.H.S)	Minor 3-leg Intersection
46	114+300	Sedam, Chincholli (Straight), Project Road - SH 10 (R.H.S)	Major 3-leg Intersection
47	115+400	Sedam (L.H.S), Project Road - SH 10 (R.H.S)	Major 3-leg Intersection

S.No.	Chainage (Km)	Road leads to	Type
48	116+400	Yadgir (R.H.S)	Minor 3-leg Intersection
49	118+550	Battagera, Bamanalli, Dugannur (R.H.S)	Minor 3-leg Intersection
50	119+100	Battagera (R.H.S)	Minor 3-leg Intersection
51	119+550	Kurugunta (L.H.S)	Minor 3-leg Intersection
52	120+600	Ranjol (R.H.S)	Minor 3-leg Intersection
53	123+100	Immadapur, Madhira (R.H.S)	Minor 3-leg Intersection
54	125+250	Kontanpalli (L.H.S)	Minor 3-leg Intersection
55	127+800	Eeranpalli (L.H.S)	Minor 3-leg Intersection
56	132+100	Madhol, Madana, Handarki (R.H.S)	Major 3-leg Intersection
57	132+200	Gundepalli (L.H.S)	Minor 3-leg Intersection
58	133+750	Lingampalli (L.H.S)	Minor 3-leg Intersection
59	135+500	Bannur (L.H.S)	Minor 3-leg Intersection
60	135+800	Kadalpur (R.H.S)	Minor 3-leg Intersection
61	136+600	Gopanapalli (L.H.S)	Minor 3-leg Intersection
62	138+000	Nadepalli, Yanagondi (R.H.S)	Minor 3-leg Intersection
63	138+500	Mallabad (L.H.S)	Minor 3-leg Intersection
64	141+500	Anathpur (L.H.S)	Minor 3-leg Intersection
65	141+600	Ribbanapalli (R.H.S)	Minor 3-leg Intersection

1.14 Toll Plazas & Location

Four Toll plazas are located at Km 7/300, Km 47/400, Km 82/000 and Km 124/500. The location of the existing Toll Plazas is shown in **Figure 2-1**



Figure 2-1 Map Showing Toll Plaza Locations along the Project Corridor

1.15 Petrol Bunk Locations

The project stretch passes through many petrol bunks along its way. The details of petrol bunks observed along the project road are presented in **Table 1-6**.



Table 1-6 List of Petrol Bunks

S.No.	Chainage (Km)	Industry
1	0+300	Essar Petroleum
2	39+300	Indian Oil Petroleum
3	47+100	Hindustan Petroleum
4	65+800	Bharat Petroleum
5	80+900	Bharat Petroleum
6	99+100	Hindustan Petroleum
7	101+600	Indian Oil Petroleum

2 Alternative Routes for the Toll Plazas

Based on reconnaissance survey, Consultants have identified various alternative routes available to avoid or bypass the Toll Plazas. The details are presented in this section.

2.1 Alternative Route – I (Jidga – Maindargi - Madbul)

The road is an alternative for the proposed toll plaza at Km 7.500. The alternative route starts at Jidga cross (Km 16.970) of the project stretch and passes through villages like Mogha, Ikkalki, and Maindargi. This alternative road is a combination of MDR, PMGSY and State Highway. Details of the alternative route are given in **Table 2-1** and it is shown in **Figure 2-1**.

Table 2-1 Comparison of Alternative Route – I with Project Road

Details	Alternative Route - I			Project Road	
	Jidga to Bhosgi	Bhosgi to Maindargi	Maindargi to Akkalkot	Jidga to Border	Border to Akkalkot
Road Classification	MDR	PMGSY	SH	SH	SH
Distance	27.4	1.2	13.4	17.3	22
Carriageway Width	3.75	3.75	7	7	7
Travel Time	44	3	20	20	65
Condition	Fair	Poor	Fair to Poor	Good	Very Poor

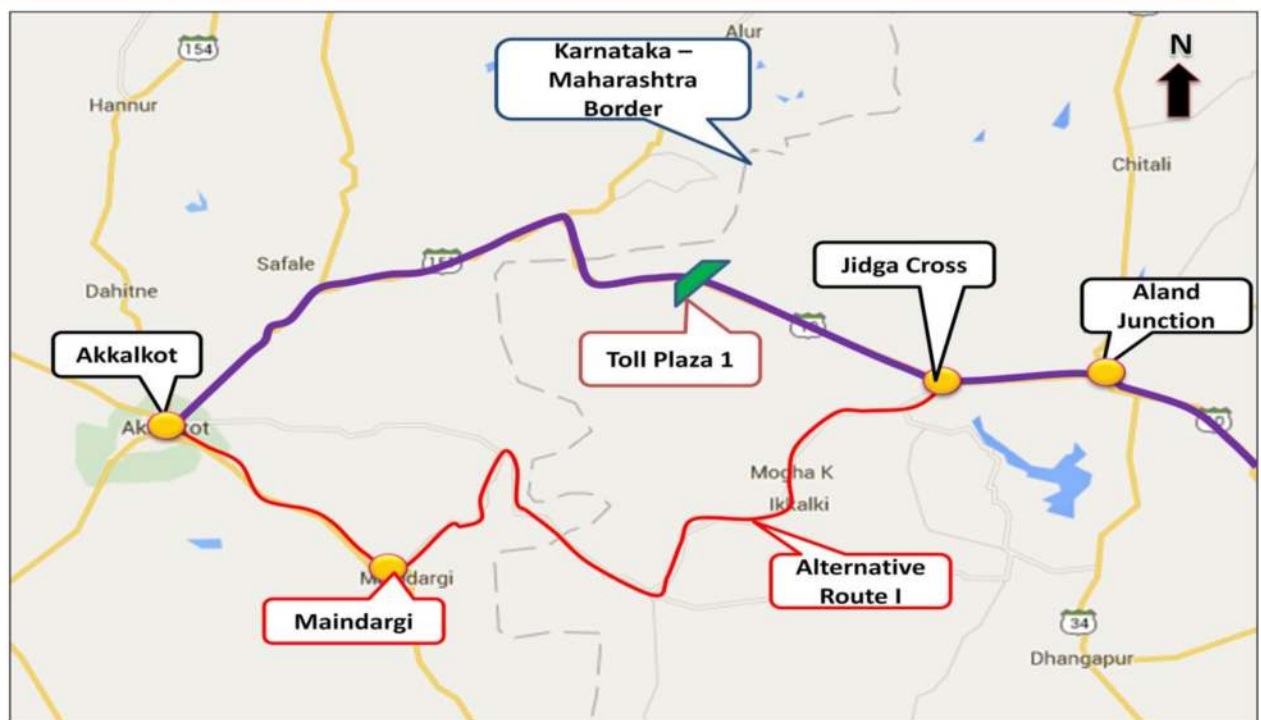


Figure 2-1 Map showing Alternative Route – I



Inference- Alternative Route 1:

The length of the alternative road is **42.0 km** whereas the length along the project road is **39.3 km**. The length on alternative road is **2.7 km** more than project stretch. The travel time on alternative road is **65 minutes** whereas along project corridor it is **67 minutes**.

As the difference in length and travel time of alternative route and project stretch is “**negligible**” considerable diversion of cars is taking place at present from project road to alternative road.

The road from Karnataka/Maharashtra border to Akkalkot is under construction. This shows that most of the cars destined to Akkalkot and Sholapur are using this alternative route. However once the construction is completed the passenger traffic will start using the project road.

2.2 Alternative Route – II (Sannur – Hampapur – Madbool)

The road is an alternative for the proposed toll plaza at Km 82.0. The alternative route starts at Km 80.7 of the project stretch, passes through Hampapur village and ends at Km 84.4 on the project stretch. Details of the alternative route are given in **Table 2-2** and it is shown in

Figure 2-2.

Table 2-2 Comparison of Alternative Route – II with Project Road.

Details	Alternative Route - II		Project Road
	Sannur - Hampapur	Hampapur - Madbool	
Road Classification	MDR	SH 125	SH
Distance	3.9	1.7	3.6
Carriageway Width	3.75	5.5	7
Travel Time	6	2	5
Condition	Good	Good	Good



Figure 2-2 Map showing Alternative Route – II





Inference- Alternative Route 2:

The length of the alternative road is **5.6 km** where as the length along the project road is **3.6 km**. The length on alternative road is **2 km** more than project stretch. The travel time on alternative road is **8 minutes** whereas along project corridor is **5 minutes**.

As the difference in length and travel time of alternative route and project stretch is “negligible” considerable diversion of cars, minibus and LCV’s is possible from project road to alternative road.

However, to control the diversion of cars, minibus and LCV’s GVRMP Toll way Pvt. Ltd has placed a check toll plaza at Km. 80.7 (Toll Plaza 3) on the project road.

2.3 Alternative Route – III (Aland – Umarga – Solapur)

The road is an alternative for the proposed toll plaza at Km 7.500. The alternative route starts at Aland Checkpost (Km 23.400) of the project stretch and passes through settlements like Chitali, Khajuri, Dalimb and Boramni. This alternative road is a combination of SH 32 and NH 9. Details of the alternative route are given in **Table 2-1** and it is shown in **Figure 2-1**.

Table 2-3 Comparison of Alternative Route – III with Project Road.

Details	Alternative Route - III		Project Road	
	Aland Checpost - Umarga	Umarga - Solapur	Aland - Border	Border-Solapur
Road Classification	SH	NH	SH	SH
Distance	34.3	81.5	23.4	60
Carriageway Width		7	7	7
Travel Time	55	95	30	130
Condition	Fair	Good	Good	Poor

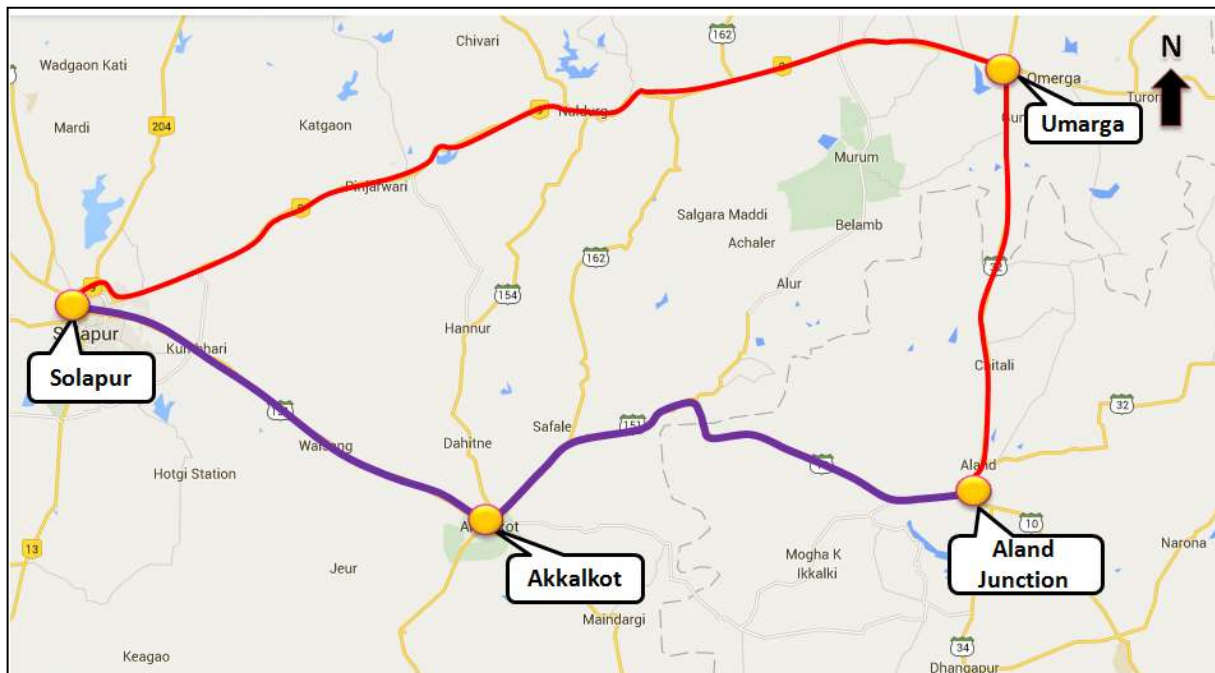


Figure 2-3 Map showing Alternative Route – III



Inference- Alternative Route 3:

The length of the alternative road is **115.8 km** where as the length along the project road is **83.4 km**. The length on alternative road is 32.4 km more than project stretch.

The travel time on alternative road is **150 minutes** whereas along project corridor it is **160 minutes**.

The travel time on the project stretch is more as the road section between Karnataka – Maharashtra Border and Akkalkot is under construction. Even though the travel distance on project road is less compared to the alternative route, passenger vehicles especially cars bound to Solapur and Pune are using the alternative route instead of the Project Road.

However once the construction is completed the passenger traffic will start using the project road.

Based on the Origin and Destination survey analysis, the traffic bound to Pune and Solapur is found out and presented in **Table 2-4** below.

Table 2-4 Comparison of Toll Plaza 1 and Toll Plaza 2

Location	Toll Plaza 1			Toll Plaza 2		
	Car	LCV	Trucks	Car	LCV	Trucks
Solapur	34	15	100	191	82	106
Pune	4	11	226	12	61	257

From the **Table 2-4** it is envisaged that there is considerable reduction in passenger cars (82%) and LCV's (79%) in Toll Plaza 1 when compared to that of Toll Plaza 2.

The commercial vehicle traffic at Toll Plaza 1 is almost aligned with the Toll Plaza 2.

This is mainly due to the fact that, the road section immediately after the Karnataka – Maharashtra Border up to Akkalkot is under construction. So the passenger vehicles are taking the diversion from Aland junction and heading to Solapur via Umarga. Therefore, the traffic could not be captured at the Toll Plaza 1. Though the road condition after the Karnataka border is bad, the commercial vehicles are using the project road, in order to minimize the travel cost.

Salient points about the condition of Road after Karnataka/Maharashtra Border

- ✓ The road condition after the Karnataka border is bad; the commercial vehicles are using the project road, in order to minimize the travel cost.
- ✓ The road falling after Toll Plaza 1 is a part of State Highway 10 and State Highway 151. Precisely the part of road is falling in Gulbarga district of Karnataka and rest in Sholapur district of Maharashtra.
- ✓ The condition of the road after the Karnataka/Maharashtra border is shown in adjacent figure. It was observed from the figure that the road is not laid properly.
- ✓ The road portion from Whagdhari along SH151 is motorable only in fair weather.
- ✓ There is no specific information available regarding the improvement proposal suggested for this section of road.
- ✓ For the traffic forecasting, It is assumed that the condition of the road will be improved after 2015, so the passenger vehicles and LCV's will start using this section of road from 2016 onwards.



3 Traffic Surveys and Analysis

Based on the reconnaissance survey, traffic surveys such as mid block classified volume counts (CVC), origin – destination (OD) surveys are conducted at the existing toll plaza locations and turning movement counts (TMC) was carried out at one identified junction to understand the existing traffic pattern.

3.1 Traffic Survey Locations and Schedule

Traffic survey schedule is presented in **Table 3-1** and the map of survey locations are shown in **Figure 3-1**.

Table 3-1 Traffic Survey Schedule

S. No.	Type of Survey	Chainage	Location	Schedule
Classified Traffic Volume Count (CVC)				
1	7 Day CVC	Km 7.300	Sarsamba Toll Plaza	09/07/2015 to 15/07/2015
2		Km 47.400	Pattan Toll Plaza	09/07/2015 to 15/07/2015
3		Km 82.000	Madbool Toll Plaza	09/07/2015 to 15/07/2015
4		Km 124.500	Jawahar Nagar Toll Plaza	09/07/2015 to 15/07/2015
Origin-Destination Survey (OD)				
1	1 Day OD (24 hrs)	Km 7.300	Sarsamba Toll Plaza	14/07/2015
2		Km 47.400	Pattan Toll Plaza	13/07/2015
3		Km 82.000	Madbool Toll Plaza	10/07/2015
4		Km 124.500	Jawahar Nagar Toll Plaza	9/07/2015
Turning Movement Count (TMC)				
1	1 Day TMC (24 hrs)	Km 32/000	Aland Junction	15/07/2015



Figure 3-1 Map of Traffic Survey Locations



3.2 Passenger Car Units (PCUs)

Different type of vehicles with wide range of physical and traffic characteristics ply on Indian roads. A way of accounting the interaction of various kinds of vehicles is to express the capacity of roads in terms of a common unit, generally identified as the 'Passenger Car Unit (PCU)'. Tentative equivalent factors for conversion of different types of vehicles into equivalent PCU based on their relative interference value are given in **Table 3-2**.

Table 3-2 Recommended PCU Factors for Various Types of Vehicles on Rural Roads

Sl. No.	Vehicle Type	Equivalency Factor
1	Motor Cycle or Scooter	0.50
2	Passenger Car, Pick-up Van or Auto-rickshaw	1.00
3	Agricultural Tractor, Light Commercial Vehicles	1.50
4	Truck or Bus	3.00
5	Truck-trailer, Agriculture Tractor-trailer	4.50
6	Cycle	0.50

7	Cycle-rickshaw	2.00
8	Hand cart	3.00
9	Horse-drawn Vehicle	4.00
10	Bullock cart	8.00
<i>Source: Guidelines for Capacity of Roads in Rural Areas (IRC:64-1990)</i>		

3.3 Average Daily Traffic (ADT)

Based on the 7-day classified volume count surveys carried out at existing toll plaza locations on project road at Km 7/300, Km 47/400, Km 82.000 and Km 60.610. Based on the surveys, Average Daily Traffic is arrived and presented in **Table 3-3** and **Figure 3-2**. Summary of classified volume count is given in **Annexure-I**.

Table 3-3 Average Daily Traffic (ADT)

Vehicle Type	Location			
	Km 7.300	Km 47.400	Km 82.000	Km 124.500
Car/ Van/ Jeep (Private)	104	1132	1,455	749
Car/ Van/ Jeep (Taxi)	13	115	252	49
Auto/ 3 Wheeler	10	97	78	314
Two Wheeler	707	2,887	1,752	1,297
Bus (Government)	52	290	357	113
Bus (Private)	-	6	5	4
Institutional Bus	-	2	9	0
Mini Bus	36	18	50	2
2-Axle Truck	32	201	118	74
3-Axle Truck	38	347	421	381
MAV (4-6 axles)	341	540	527	445
MAV (>6 axles)	-	1	1	0
HCM / EME	1	2	1	0
LCV (4-tyre)	7	37	29	12
LCV (6-tyre)	12	115	94	86
Light Motor Vehicle (Tata Ace, etc)	20	167	147	96
Goods Auto	3	93	95	34
Agricultural Tractor Trailer	11	29	39	102
Army/Govt vehicle	8	55	56	20
Cycle	36	8	1	2
Animal Drawn (Bullock Cart)	8	1	1	1
Total Vehicles	1,438	6,141	5,487	3,783
Total PCUs	2,643	8,612	8,633	6,322

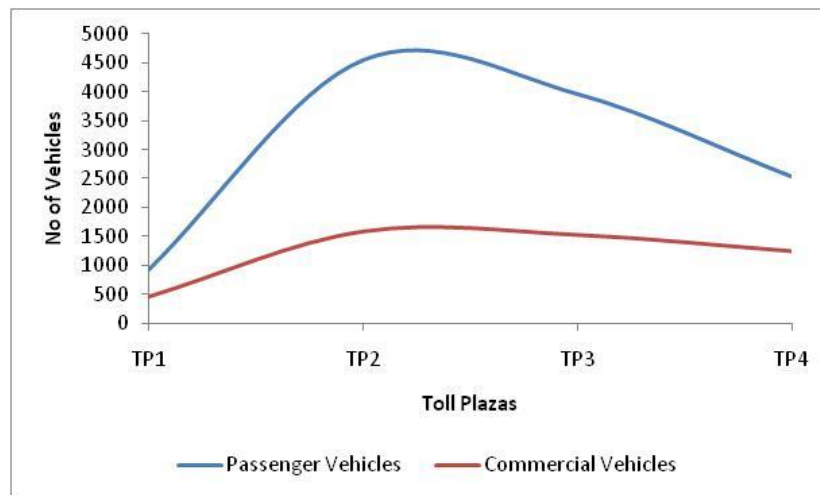


Figure 3-2 ADT Trend at Toll Plaza locations

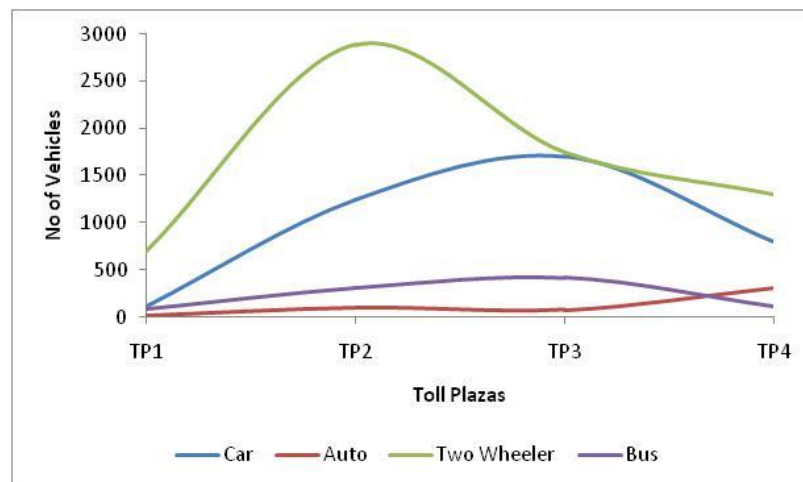


Figure 3-3 Passenger vehicle trend at Toll Plaza locations

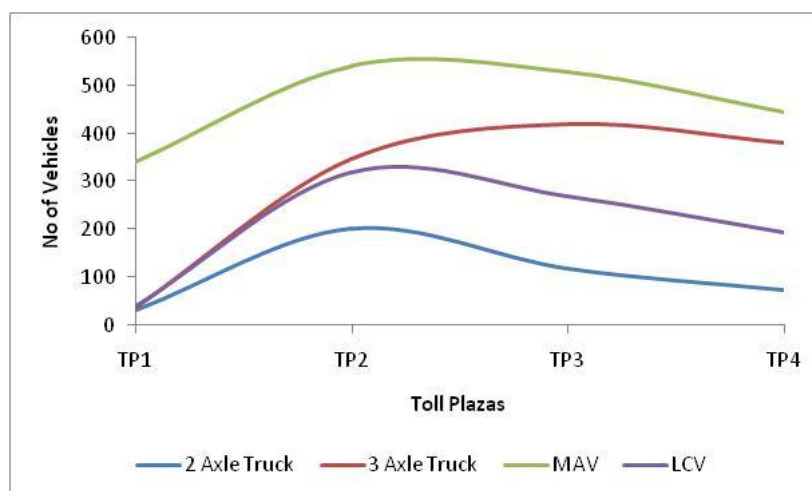


Figure 3-4 Commercial vehicle trend at Toll Plaza locations

Observations:

The key points regarding changes in Average Daily Traffic (ADT) along the project section and at each toll plaza locations observed from **Table 3-3** and **Figure 3-2** are:

- Overall along the project section, it can be seen that the passenger vehicles are predominantly more than the commercial vehicles. This is mainly due to the local traffic from the nearby settlements around the toll plaza locations.
- Along the project section, the traffic levels at Toll plaza 1 and Toll Plaza 4 are comparatively less as compared to Toll Plazas 2 and 3.
- The reduction in traffic observed at TP1 is mainly due to the traffic diversion happening at the Alternative Route – I (Jidga – Maindargi - Madbul) presented in the **Section 2.1** of the report.
- The traffic level at TP4 has decreased primarily due to the cement factory located in between Toll plaza 3 and 4. The traffic from factory is predominantly going towards the direction of Gulbarga and it is captured at TP3 and the trips coming from the direction of Gulbarga is attracted in the factory, this in turn reduced the traffic level on the TP4.

3.4 Tollable Traffic on the Project Stretch

Discounts and Tollable traffic components:

The concession agreement toll policy was issued by the "Public works, ports and inland water transport" secretariat for the development of Whagdhari-Ribbanpally SH10 for the concession period of 30years commencing from 2010. Based on that the tollable traffic will have various components based on number of trips and trip distances.

- Commercial vehicles using the toll within 20km radius is considered to be local user
- Passenger vehicles using the toll within 10 km radius is considered to be a local user.
- Vehicles of those who prefer monthly pass and returning on same day.
- Vehicles that are returning within 24 hours and take a daily ticket.
- Separate rate for the single trip and return trip.
- Vehicles crossing the single toll plaza and both toll plazas (TP1 & TP2, TP3 & TP4) will have separate rates.

Based on the above, the tollable traffic on the project stretch based on the ADT is shown in the **Table 3-4**.

Table 3-4 Tollable Traffic on the Project Stretch

Type of Vehicle	Km 7.300	Km 47.400	Km 82.000	Km 124.500
Car/Van/Jeep/ LMV	140	1,507	1,949	927
LCV /LGV /MiniBus	55	170	173	101
Bus / 2- Axle Truck	84	499	490	192
MAV (3-6 axles) / HCM & EME	380	888	949	827

Type of Vehicle	Km 7.300	Km 47.400	Km 82.000	Km 124.500
Over Sized Vehicles (>6 Axles)	0	1	1	0
Total Tollable Traffic	659	3,065	3,561	2,047
% Tollable Traffic	46%	50%	65%	54%

Observations:

- The percentage of tollable traffic observed at each toll plazas are 46%, 50%, 65% and 54% to the total Average Daily Traffic (ADT) at each toll plazas.
- The commercial traffic is more at Km 82 and Km 47.4 with 950 vehicles and 889 vehicles is mainly due to the presence of cement factories at Sedam and Malkhed which has more production and attraction.
- The major destinations for the cement produced at these factories are Pune, Hyderabad, Gulbarga and Bijapur.
- The passenger traffic is more at Km 82 due to the local traffic from Gulbarga, Sedam, and Malkhed and Km 47.4 from the influence of Gulbarga and Aland.
- Overall the passenger vehicles at Km 47.4 and Km 82 are influenced majorly by Gulbarga followed by Sedam and Malkhed.
- The reduction in passenger vehicles at the Km 7.3 is mainly due to the bad road condition after the Karnataka/Maharashtra border and also at diversion happening at the Jidga – Maindargi – Madbul.

3.4.1 Traffic Composition on the Project Road

The traffic composition of vehicles at all the survey locations are worked out and presented in **Table 3-5** and **Figure 3-5**.

Table 3-5 Traffic Composition along the Project road

Vehicle Type	% Composition			
	Km 7.300	Km 47.400	Km 82.000	Km 124.500
Car/ Van/ Jeep	8.11%	20.31%	31.12%	21.09%
3 Wheeler	0.69%	1.58%	1.42%	8.29%
2 Wheeler	49.14%	47.01%	31.93%	34.29%
Bus	3.61%	4.83%	6.59%	3.11%
Mini Bus	2.50%	0.29%	0.91%	0.06%
2-Axle Truck	2.22%	3.27%	2.16%	1.97%
3-Axle Truck	2.65%	5.65%	7.67%	10.08%
MAV	23.81%	8.83%	9.63%	11.78%
LCV	1.33%	2.48%	2.25%	2.60%
LMV	1.37%	2.72%	2.68%	2.53%
Goods Auto	0.23%	1.51%	1.72%	0.89%
Others	4.35%	1.54%	1.92%	3.32%

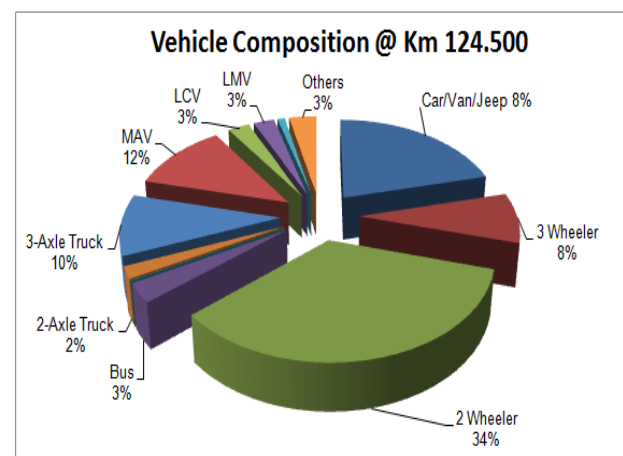
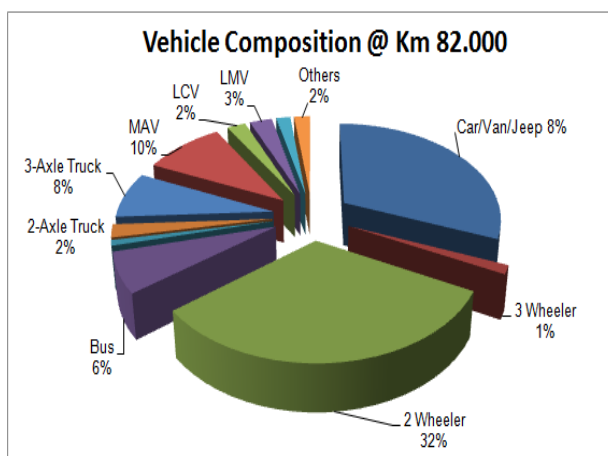
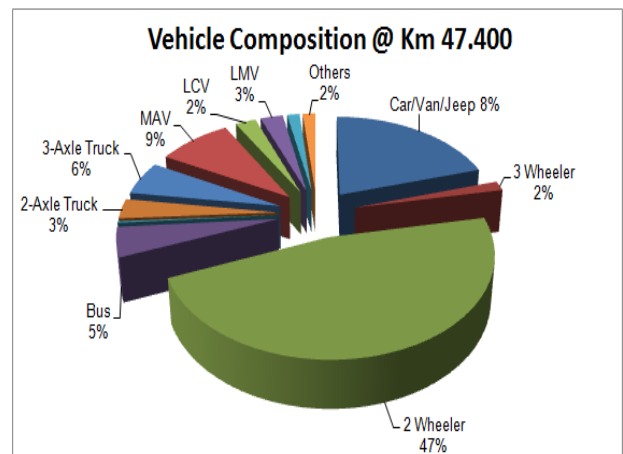
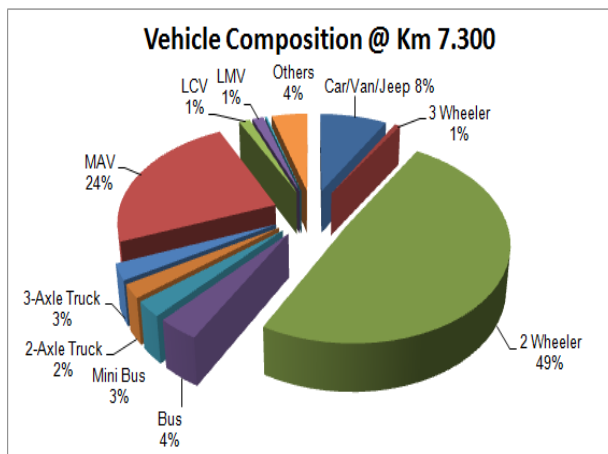


Figure 3-5 Traffic Composition along the Project road

3.5 Seasonal Correction Factor (SCF)

AADT is the product of Average Daily Traffic (ADT) and Seasonal Correction Factor (SCF). Seasonal variation factor can be derived using various methods. Vehicle data from toll booths check posts etc. or sale details of petrol and diesel fuels along the corridor are the commonly used sets of data. For this study, the Consultant has collected traffic data for the toll plazas from M/s GVRMP Whagdhari Ribbanpally Toll way private limited and fuel data from the petrol stations along the project corridor.

Based on toll traffic data collected Seasonal Correction Factor (SCF) is worked out and presented in **Table 3-6** and based on fuel sales data collected Seasonal Correction Factor (SCF) is worked out and presented in **Table 3-7**. The SCF of July month is adopted as per the survey schedule.

Table 3-6 Seasonal Correction Factor for Toll Plaza – I to IV Based on Toll Traffic Data

Location	Toll Plaza I (Km 7/300)		Toll Plaza II (Km 47/400)		Toll Plaza III (Km 82/000)		Toll Plaza IV (Km 124/500)	
Month	No. of Vehicles	SCF	No. of Vehicles	SCF	No. of Vehicles	SCF	No. of Vehicles	SCF
Apr-14	11553	0.88	62100	0.94	53479	1.00	23938	1.12
May-14	11887	0.86	66448	0.88	58689	0.91	26726	1.01
Jun-14	10196	1.00	55545	1.05	53352	1.00	25329	1.06
Jul-14	8321	1.22	50531	1.16	48710	1.10	24721	1.09
Aug-14	8232	1.24	52431	1.12	51074	1.05	25757	1.04
Sep-14	8039	1.27	51267	1.14	49140	1.09	24125	1.11
Oct-14	9664	1.05	53847	1.09	51669	1.03	25584	1.05
Nov-14	10344	0.98	55403	1.06	52094	1.03	27359	0.98
Dec-14	11538	0.88	64166	0.91	55888	0.96	29269	0.92
Jan-15	11505	0.88	60975	0.96	55480	0.96	29884	0.90
Feb-15	10470	0.97	63121	0.93	53935	0.99	29102	0.92
Mar-15	10402	0.98	65852	0.89	57629	0.93	30867	0.87

Table 3-7 Seasonal Correction Factor for Toll Plaza – I to IV Based on Fuel Sales Data

Month	SCF for Toll Plaza I & II	SCF for Toll Plaza I & II	Overall SCF
Jan-14	1.26	0.83	1.09
Feb-14	1.35	0.82	1.11
Mar-14	1.22	0.73	1.00
Apr-14	0.91	0.67	0.84
May-14	0.70	0.73	0.78
Jun-14	0.82	0.84	0.91
Jul-14	0.94	0.94	1.03
Aug-14	1.09	1.01	1.15
Sep-14	1.06	0.95	1.09
Oct-14	1.22	0.92	1.14
Nov-14	0.93	0.99	1.05
Dec-14	0.92	0.88	0.98

As the toll traffic collected from the M/s GVRMP Whagdhari Ribbanpally Toll way private limited is reliable source of information and the seasonal factor of **1.22, 1.16, 1.09, 1.10** obtained for each toll plaza is in line with the fuel sales data, the same was taken for the further analysis.

3.6 Annual Average Daily Traffic (AADT)

AADT is derived by applying seasonal correction factors to ADT and presented in **Table 3-8**. The seasonal factor of **1.16** was arrived based on the toll traffic data is presented in the **Table 3-6**.

Table 3-8 Annual Average Daily Traffic (AADT)

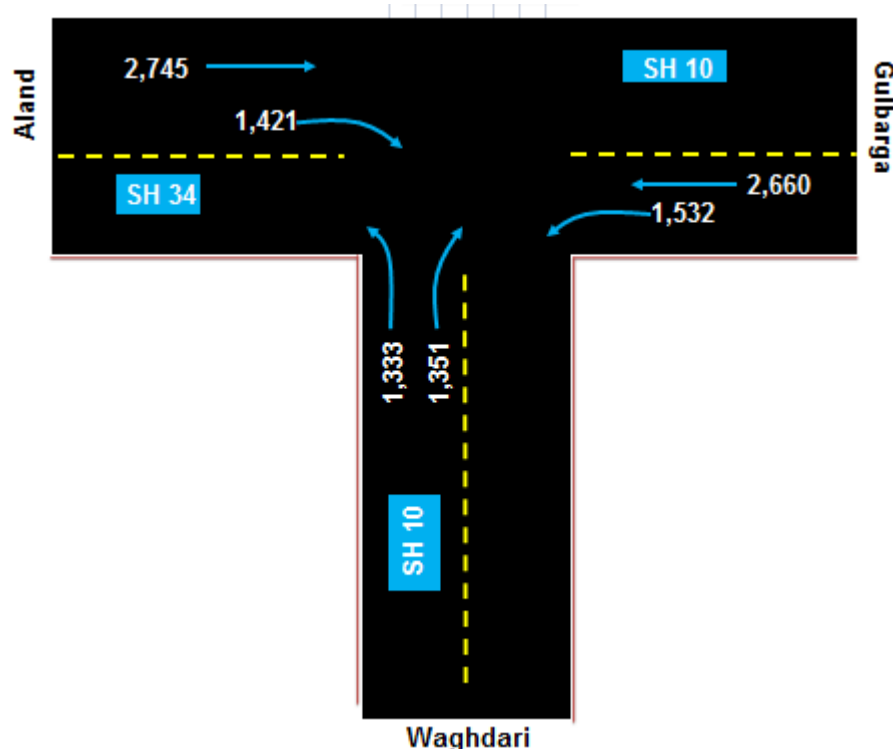
Vehicle Type	Location			
	Km 7/300	Km 47/400	Km 82/000	Km 124/500
Car/ Van/ Jeep (Private)	127	1,310	1,596	815
Car/ Van/ Jeep (Taxi)	16	133	277	53
Auto/ 3 Wheeler	12	112	85	341
Two Wheeler	864	3,341	1,922	1,411
Bus (Government)	63	336	392	123
Bus (Private)	-	7	5	5
Institutional Bus	-	2	10	0
Mini Bus	44	20	55	3
2-Axle Truck	39	233	130	81
3-Axle Truck	47	401	462	415
MAV (4-6 axles)	418	625	578	484
MAV (> 6 axles)	-	1	1	-
HCM/ EME	1	2	1	0
LCV Type 1 (4-tyre)	8	43	32	13
LCV Type 2 (6-tyre)	15	133	103	94
Light Motor Vehicle (Tata Ace, etc)	24	193	161	104
Goods Auto	4	107	104	37
Agricultural Tractor Trailer	14	33	42	111
Army/ Govt. Vehicle	9	64	62	21
Cycle	44	9	1	2
Animal Drawn (Bullock Cart)	9	1	1	1
Total Vehicles	1,759	7,106	6,019	4,114
Total PCUs	3,234	9,966	9,469	6,876

3.7 Turning Movement Survey

To assess the impact of major cross roads, turning movement survey is carried out at identified important junction. Detailed Direction-wise traffic data is presented in **Annexure-II**.

The Summary of the junction traffic is given below:

- Total junction traffic – 11,041 PCU
- Total Turning Traffic – 5,636 PCU
- % of Turning Traffic – 51%



Observations:

The turning volume count was conducted at the Aland junction (SH10/SH34) in order to capture the diverted traffic from the project road. It is observed from the above analysis that:

- The significant amount of traffic from Gulbarga is bound to Umerga using SH34.
- Certain percentage of through traffic destined to Solapur and Pune from Gulbarga are using SH34 rather than the project road.

3.8 Origin-Destination Survey

In order to understand the base year travel characteristics and future year traffic diversions of goods and passenger trips using the project road, Origin - destination (O-D) surveys are conducted. The O-D surveys are conducted at the existing 4 toll plaza locations for 24hours period.

Information like origin, destination and commodity carried, frequency of trips etc., are collected during the survey.

The data collected from OD survey are entered and incorrect entries were corrected by cross-checking it with original field data sheets. The data was also checked for inconsistencies.

3.8.1 Zoning

In order to assess the traffic pattern on the project influence area, zoning system is developed keeping in view the major generation and attraction points.

Zones should be smallest in the Area of Detailed Modelling, becoming larger for the Rest of the Fully Modelled Area and progressively much larger for the External Area. At the boundary between the classifications of area type, it is important to avoid sudden changes in average zone size and a graduated approach is desirable.

The primary building block for the zoning system adopted was based on ward and district boundaries, in particular the zones are delineated as

- All-important towns located along the proposed project stretch
- Immediate influence areas of project road and nearby areas/towns
- All nearby districts were grouped as zones
- States beyond the influence area were aggregated broadly in terms of direction of project road.

The entire project influence area is divided into 57 zones and the same presented in **Figure 3-6 and Table 3-9.**

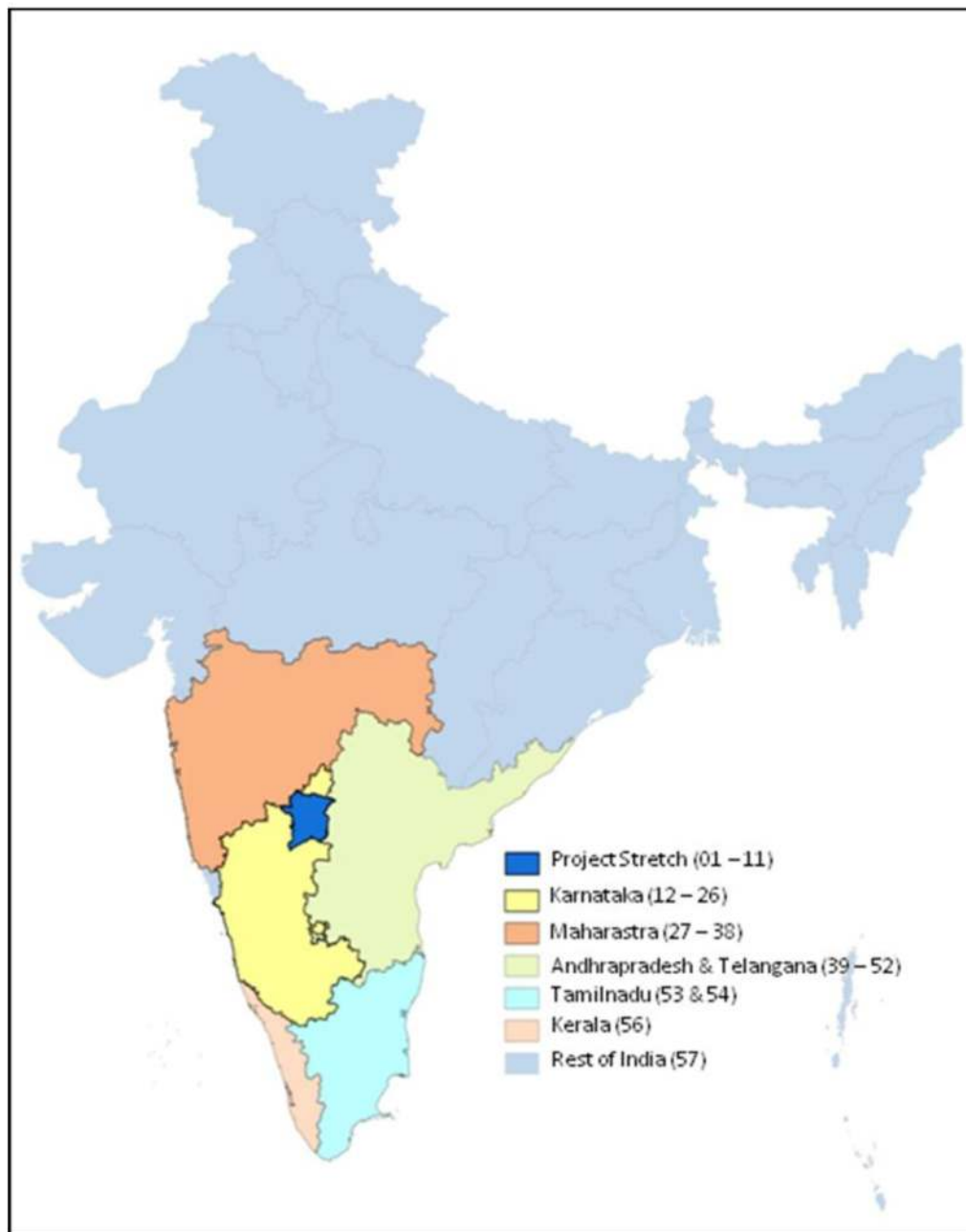


Figure 3-6 Zoning

Table 3-9 OD Zoning System

S.No.	Zone Name	S.No.	Zone Name
1	Sarasamba	30	Umarga
2	Aland	31	Solapur
3	Kadaganchi	32	Latur
4	Nimbarga	33	Gangapur
5	Gulbarga	34	Aurangabad
6	Madbol	35	Pune
7	Malkhed	36	Mumbai
8	Sedam	37	Nasik
9	Adki	38	Rest of Maharastra
10	Mudhol	39	Tandur
11	Ripponpalli	40	Kodangal
12	Basavakalyan	41	Pargi
13	Kamalapur	42	Gurmitkal
14	Shahbad	43	Mahububnagar
15	Wadi	44	Kandarpalli
16	Chittapur	45	Zaheerabad
17	Chincholi	46	Hyderabad
18	Vijayapura	47	Rest of Telangana
19	Bidar	48	Kadapa
20	Yadgir	49	Kurnool
21	Jevargi	50	Nellore
22	Raichur	51	Thirupati
23	Afzalpur	52	Rest of Andhra Pradesh
24	Belgaum	53	Chennai
25	Bangalore	54	Rest of TamilNadu
26	Rest of Karnataka	55	Gujarat
27	Wagdari	56	Kerala
28	Akkalkot	57	Rest of India
29	Tuljapur		

The collected data is coded, processed and expanded to total traffic using the expansion factors for each vehicle type. The percentage samples collected for various categories of vehicles for the O-D survey are given in **Table 3-10**.

Table 3-10 Sample Size of O-D Survey

Vehicle Type		Km 7/300	Km 47/400	Km 82/000	Km 124/500
Bus		92%	62%	68%	75%
Car		78%	58%	62%	65%
Trucks	LCV	67%	44%	45%	73%
	2 Axle	82%	78%	68%	88%
	3 Axle	67%	78%	68%	93%
	MAV	91%	91%	76%	73%

3.8.2 Zone-wise Influence Factors

The O-D survey results provide a clear indication of the region, which contribute to the traffic on the existing roads in the project influence area. Number of trips originating from and destined to any zone represents the influence of that zone on the traffic. Sum of trips originating from and destined to any zone divided by twice the total number of observed trips in percentage terms gives the influence factor (I.F of that particular zone. The formula for estimation of influence factor is presented below (equation 1):

$$I.F. = \frac{\sum O_i + \sum D_j}{\sum (O_i + D_j)} \dots\dots\dots (1)$$

The O-D matrices developed from O-D survey data is used to estimate the influence factors. Thus estimated zone-wise influence factors are presented in **Table 3-11**. Expanded matrices are given in **Annexure III** (Based on O-D Survey data for Km 7.3, Km 47.4, Km 82.0 and Km 124.5).

Table 3-11 Zone-wise Influence Factors at Km 7/300 and Km 47/400

Zone No.	Zone	Bus	Car	LCV	2A Truck	3A Truck	MAV	Bus	Car	LCV	2A Truck	3A Truck	MAV
		Km 7/300						Km 47/400					
1	Sarasamba	2.3%	14.9%	7.6%	4.2%	-	0.5%	-	0.2%	-	-	-	-
2	Aland	26.8%	24.9%	7.3%	6.7%	-	2.3%	23.6%	24.4%	8.5%	16.4%	8.1%	4.5%
3	Kadaganchi	-	-	-	-	-	-	1.4%	5.1%	4.3%	6.5%	2.5%	2.1%
4	Nimbarga	0.6%	-	-	-	-	-	1.7%	3.0%	1.7%	0.6%	0.5%	0.1%
5	Gulbarga	22.1%	20.6%	12.6%	12.9%	7.4%	7.7%	44.3%	48.5%	33.8%	34.3%	21.6%	15.4%
6	Madbol	-	-	-	-	-	-	0.8%	-	-	-	-	-
7	Malkhed	-	-	-	-	-	0.8%	-	0.1%	-	-	1.0%	1.2%
8	Sedam	0.6%	1.3%	22.5%	10.8%	39.3%	33.4%	0.4%	0.1%	4.8%	3.6%	9.4%	18.2%
9	Adki	-	-	-	-	-	-	-	-	-	-	-	-
10	Mudhol	-	-	-	-	-	-	-	-	-	-	-	-
11	Ripponpalli	-	-	-	-	-	-	-	-	-	-	-	-
12	Basavakalyan	-	-	-	-	-	-	0.6%	0.2%	-	-	-	-
13	Kamalapur	-	-	-	-	-	-	0.2%	-	-	-	-	-
14	Shahbad	-	-	1.9%	-	-	0.2%	-	-	-	1.3%	1.8%	1.1%
15	Wadi	-	0.6%	1.8%	4.2%	-	1.2%	-	0.1%	1.1%	3.3%	2.8%	3.0%
16	Chittapur	-	-	-	-	-	-	0.2%	-	-	-	-	0.1%
17	Chincholi	-	-	-	-	-	-	-	-	-	-	-	-
18	Vijayapura	-	-	-	-	-	-	0.6%	0.5%	-	-	-	0.1%
19	Bidar	-	-	-	-	-	-	0.8%	0.1%	1.2%	3.0%	0.9%	0.1%
20	Yadgir	-	-	-	-	-	-	-	-	-	-	-	-
21	Jevargi	-	-	-	-	-	-	0.7%	-	-	-	-	0.1%
22	Raichur	-	-	-	-	-	0.8%	-	-	1.2%	1.2%	1.6%	1.1%
23	Afzalpur	-	-	-	-	-	-	-	1.0%	0.3%	0.3%	0.2%	-

24	Belgaum	-	-	-	-	-	-	-	-	-	-	0.2%	-
25	Bangalore	-	-	-	-	-	-	0.8%	-	0.4%	-	-	0.4%
26	Rest of Karnataka	-	-	-	-	-	-	0.4%	0.2%	1.4%	0.3%	0.4%	0.1%
27	Wagdari	21.8%	2.5%	1.8%	-	-	-	0.2%	0.4%	0.3%	-	0.7%	0.4%
28	Akkalkot	1.8%	8.2%	-	2.1%	1.6%	1.4%	0.4%	0.3%	0.3%	-	0.2%	0.8%
29	Tuljapur	-	0.6%	-	-	-	-	1.9%	0.8%	-	0.3%	0.4%	0.5%
30	Umarga	-	-	-	-	-	-	3.6%	3.3%	5.2%	1.6%	3.6%	3.8%
31	Solapur	21.3%	19.8%	18.3%	10.8%	13.1%	12.2%	9.6%	6.5%	12.1%	4.0%	4.3%	7.2%
32	Latur	-	-	1.8%	-	-	-	2.9%	1.9%	3.9%	2.2%	3.8%	1.3%
33	Gangapur	-	-	-	-	-	-	0.2%	1.5%	0.3%	0.6%	-	-
34	Aurangabad	-	0.7%	-	-	-	-	1.1%	-	0.4%	2.3%	2.2%	0.6%
35	Pune	2.3%	2.6%	12.9%	20.4%	26.2%	28.2%	1.3%	0.4%	9.1%	8.2%	12.1%	17.1%
36	Mumbai	0.6%	-	7.7%	15.0%	9.0%	7.9%	0.7%	0.4%	1.6%	3.5%	5.7%	4.6%
37	Nasik	-	-	-	-	-	0.1%	-	-	-	-	1.1%	0.7%
38	Rest of Maharastra	-	1.3%	-	-	-	0.5%	0.6%	0.4%	0.3%	0.9%	1.1%	0.9%
39	Tandur	-	-	-	-	1.6%	-	-	-	0.8%	-	0.5%	0.4%
40	Kodangal	-	-	-	-	-	-	-	-	-	-	-	-
41	Pargi	-	-	-	8.3%	1.6%	0.7%	-	-	-	-	-	-
42	Gurmitkal	-	-	-	-	-	-	-	-	-	-	-	-
43	Mahububnagar	-	-	-	-	-	-	-	0.1%	-	-	-	-
44	Kandarpalli	-	-	-	-	-	-	-	-	-	-	-	-
45	Zaheerabad	-	-	-	-	-	-	-	-	-	-	-	-
46	Hyderabad	-	1.9%	1.9%	2.1%	-	0.3%	1.3%	-	1.8%	0.9%	1.5%	1.2%
47	Rest of Telangana	-	-	-	-	-	0.1%	-	-	-	-	0.4%	0.1%
48	Kadapa	-	-	-	-	-	0.3%	-	-	-	-	0.2%	-
49	Kurnool	-	-	1.9%	-	-	0.3%	-	0.2%	0.4%	0.3%	0.5%	1.4%
50	Nellore	-	-	-	-	-	-	-	-	-	-	0.7%	0.3%

51	Thirupati	-	-	-	-	-	0.1%	-	-	0.3%	0.7%	1.2%	0.1%
52	Rest of Andhra Pradesh	-	-	-	-	-	-	-	0.1%	0.4%	0.3%	0.5%	0.6%
53	Chennai	-	-	-	2.5%	-	0.5%	-	-	3.7%	2.4%	5.0%	5.1%
54	Rest of TamilNadu	-	-	-	-	-	0.1%	-	-	-	-	-	0.3%
55	Gujarat	-	-	-	-	-	0.3%	-	0.1%	0.6%	0.6%	2.0%	4.3%
56	Kerala	-	-	-	-	-	-	-	-	-	0.3%	-	-
57	Rest of India	-	-	-	-	-	-	-	-	-	-	1.1%	0.8%
Total		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 3-12 Zone-wise Influence Factors at Km 82/000 and Km 124/500

Zone No.	Zone	Bus	Car	LCV	2A Truck	3A Truck	MAV	Bus	Car	LCV	2A Truck	3A Truck	MAV
		Km 82/000						Km 124/500					
1	Sarasamba	-	0.1%	-	-	-	-	-	-	-	-	-	-
2	Aland	-	0.8%	0.5%	1.0%	1.6%	0.5%	-	0.6%	-	-	0.2%	0.3%
3	Kadaganchi	-	-	-	-	0.1%	-	-	-	-	-	-	-
4	Nimbarga	-	0.1%	-	-	-	-	-	-	-	-	-	-
5	Gulbarga	46.7%	46.2%	32.9%	29.2%	19.1%	11.5%	14.7%	31.8%	2-	20.5%	9.7%	11.2%
6	Madbol	5.9%	1.2%	-	-	0.3%	0.2%	-	0.2%	-	-	-	-
7	Malkhed	0.4%	4.4%	7.8%	3.4%	5.0%	3.6%	0.5%	1.9%	2.5%	5.3%	7.4%	3.8%
8	Sedam	18.0%	19.8%	23.8%	22.6%	25.8%	30.2%	33.3%	10.4%	19.7%	16.9%	22.4%	23.3%
9	Adki	-	-	-	-	-	-	-	0.7%	1.5%	0.6%	0.3%	0.2%
10	Mudhol	0.1%	0.8%	-	0.5%	0.1%	-	5.7%	4.3%	3.3%	0.6%	0.4%	0.8%
11	Ripponpalli	-	0.2%	-	0.5%	0.2%	-	-	0.6%	-	0.6%	-	0.5%
12	Basavakalyan	-	0.2%	-	-	0.3%	0.1%	-	-	-	-	-	-
13	Kamalapur	-	0.1%	-	-	-	-	-	-	-	-	-	0.1%
14	Shahbad	-	0.7%	-	-	-	-	-	0.1%	-	-	0.3%	0.3%

Zone No.	Zone	Bus	Car	LCV	2A Truck	3A Truck	MAV	Bus	Car	LCV	2A Truck	3A Truck	MAV
15	Wadi	-	0.4%	-	-	-	-	-	0.1%	-	0.6%	0.7%	0.7%
16	Chittapur	11.0%	11.0%	2.1%	0.5%	1.5%	1.4%	-	0.3%	0.3%	-	0.4%	0.1%
17	Chincholi	9.0%	0.2%	0.8%	-	0.1%	0.4%	1.0%	0.1%	0.9%	2.3%	0.2%	-
18	Vijayapura	0.8%	0.3%	2.3%	3.0%	2.6%	1.6%	-	1.3%	1.9%	0.6%	1.4%	1.4%
19	Bidar	-	0.2%	3.1%	1.5%	0.8%	0.6%	-	0.1%	-	-	0.1%	-
20	Yadgir	-	-	-	-	-	-	-	-	-	-	-	-
21	Jevargi	-	0.2%	-	-	-	-	-	-	-	-	-	-
22	Raichur	-	-	-	-	0.2%	0.2%	-	-	-	-	0.3%	0.6%
23	Afzalpur	-	0.2%	-	-	0.2%	0.1%	-	-	-	-	-	-
24	Belgaum	-	-	0.3%	-	1.8%	0.9%	-	0.1%	0.3%	-	-	-
25	Bangalore	0.2%	0.1%	-	-	-	-	-	0.4%	1.0%	-	1.3%	1.5%
26	Rest of Karnataka	1.3%	0.1%	0.5%	-	0.4%	0.2%	-	-	-	0.6%	-	0.1%
27	Wagdari	-	-	-	-	-	-	-	-	-	-	-	-
28	Akkalkot	-	0.1%	-	-	-	0.1%	-	-	-	-	-	-
29	Tuljapur	-	0.1%	-	-	-	-	-	-	-	-	-	-
30	Umarga	-	-	1.0%	-	0.5%	0.1%	-	0.2%	0.3%	-	-	-
31	Solapur	0.2%	0.4%	1.3%	2.5%	4.4%	8.0%	-	0.5%	0.7%	1.8%	0.4%	0.2%
32	Latur	-	-	0.3%	-	-	1.4%	-	-	-	-	0.4%	-
33	Gangapur	-	-	-	-	-	-	-	0.7%	-	-	-	0.2%
34	Aurangabad	-	-	-	-	0.5%	0.2%	-	0.2%	0.5%	0.6%	0.3%	0.9%
35	Pune	-	0.2%	4.9%	7.9%	12.2%	17.5%	-	0.5%	0.9%	0.6%	1.5%	1.4%
36	Mumbai	-	0.3%	1.5%	2.0%	2.4%	3.7%	1.1%	0.5%	1.9%	0.6%	1.7%	2.0%
37	Nasik	-	-	-	-	0.3%	0.4%	-	-	-	-	0.1%	-
38	Rest of Maharastra	-	0.2%	1.3%	0.5%	1.2%	1.1%	-	0.1%	0.5%	1.2%	1.0%	1.4%
39	Tandur	-	0.4%	-	3.5%	3.1%	3.0%	5.3%	3.4%	3.1%	6.0%	6.9%	7.5%
40	Kodangal	0.7%	0.8%	0.3%	0.5%	0.9%	0.5%	10.4%	2.8%	2.0%	1.1%	2.4%	2.8%

Zone No.	Zone	Bus	Car	LCV	2A Truck	3A Truck	MAV	Bus	Car	LCV	2A Truck	3A Truck	MAV
41	Pargi	-	0.2%	-	-	-	-	-	0.8%	-	0.6%	1.8%	1.0%
42	Gurmitkal	2.6%	0.8%	-	-	-	-	19.4%	2.8%	0.9%	-	0.3%	-
43	Mahububnagar	-	0.3%	0.8%	0.5%	1.0%	1.5%	0.5%	1.0%	2.7%	5.4%	1.4%	1.4%
44	Kandarpalli	-	-	-	-	-	-	-	0.1%	2.6%	1.2%	1.1%	0.2%
45	Zaheerabad	-	0.4%	-	-	-	-	-	-	-	-	0.1%	-
46	Hyderabad	2.0%	8.0%	9.1%	14.6%	7.9%	5.3%	6.2%	30.1%	26.7%	20.9%	24.2%	21.8%
47	Rest of Telangana	0.8%	0.1%	-	-	0.3%	0.1%	1.5%	0.8%	-	1.7%	0.6%	0.6%
48	Kadapa	-	-	-	1.0%	0.3%	0.1%	-	-	0.5%	0.6%	0.8%	1.2%
49	Kurnool	0.3%	0.5%	0.3%	-	-	0.1%	0.5%	1.5%	0.5%	1.8%	2.7%	1.9%
50	Nellore	-	-	-	-	-	0.1%	-	-	-	0.6%	0.1%	-
51	Thirupati	-	0.2%	0.5%	-	-	0.2%	-	-	-	1.2%	0.5%	0.2%
52	Rest of Andhra Pradesh	-	-	3.9%	1.0%	0.6%	1.0%	-	0.5%	1.2%	-	1.0%	1.1%
53	Chennai	-	-	-	1.0%	2.1%	1.9%	-	-	1.2%	4.2%	2.5%	3.0%
54	Rest of TamilNadu	-	0.1%	-	0.5%	0.6%	0.1%	-	0.4%	1.6%	1.2%	0.9%	3.2%
55	Gujarat	-	-	0.8%	1.5%	1.2%	1.3%	-	-	-	-	1.4%	1.9%
56	Kerala	-	-	-	-	-	-	-	-	0.5%	-	0.4%	0.7%
57	Rest of India	-	-	-	1.0%	0.3%	0.6%	-	0.1%	-	-	0.2%	0.5%
Total		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Observations

It is observed from the **Table 3-11** that

- Gulbarga, Solapur and Pune have major influence on the project corridor which is observed at toll plaza 1 and 2 locations.
- Other major influencing zones are Aland, Sedam and Whagdhari.

It is observed from the **Table 3-12** that

- Gulbarga, Sedam and Hyderabad have major influence on the project corridor which is observed at toll plaza 3 and 4 locations.
- Other major influencing zones are Pune and Chitapur.

3.8.3 State-wise Influence Factors

State-wise influence factors based on OD survey is estimated and presented in **Table 3-13**

Table 3-13 State-wise Influence factors

State	Car	Bus	LCV	2 Axle	3 Axle	MAV
Km 7/300						
Karnataka	52%	62%	54%	39%	47%	47%
Maharashtra	48%	36%	42%	48%	50%	50%
Andhra Pradesh	0%	2%	4%	10%	3%	2%
Tamil Nadu	0%	0%	0%	3%	0%	1%
Kerala	0%	0%	0%	0%	0%	0%
Rest of India	0%	0%	0%	0%	0%	0%
Km 47/400						
Karnataka	76%	83%	59%	71%	51%	48%
Maharashtra	22%	16%	34%	24%	35%	38%
Andhra Pradesh	1%	0%	4%	2%	5%	4%
Tamil Nadu	0%	0%	4%	2%	5%	5%
Kerala	0%	0%	0%	0%	0%	0%
Rest of India	0%	0%	1%	1%	3%	5%
Km 82/000						
Karnataka	94%	87%	74%	62%	60%	52%
Maharashtra	0%	1%	10%	13%	21%	33%
Andhra Pradesh	6%	12%	15%	21%	14%	12%
Tamil Nadu	0%	0%	0%	1%	3%	2%
Kerala	0%	0%	0%	0%	0%	0%
Rest of India	0%	0%	1%	2%	1%	2%
Km 124/500						
Karnataka	55%	53%	51%	49%	45%	45%
Maharashtra	1%	3%	5%	5%	5%	6%
Andhra Pradesh	44%	44%	40%	41%	44%	40%
Tamil Nadu	0%	0%	3%	5%	3%	6%
Kerala	0%	0%	1%	0%	0%	1%
Rest of India	0%	0%	0%	0%	2%	2%

Observations:

- The Passenger and commercial vehicle traffic at Toll Plaza 1 and 2 have predominantly influenced by the states Karnataka and Maharashtra.
- The Passenger and commercial vehicle traffic at Toll Plaza 3 and 4 have predominantly influenced by the states Karnataka and Andhra Pradesh.
- The other major states having considerable influence are Tamil Nadu and Kerala

3.8.4 Frequency Distribution

Frequency distribution based on OD survey is estimated and presented in **Table 3-14**.

Table 3-14 Frequency Distribution

Frequency	Car	L C V	2-Axle	3 Axle	MAV
Km 7/300					
Daily Once (One-Way)	39%	22%	17%	13%	24%
Daily Twice (Up & Down)	28%	19%	4%	9%	19%
Daily Thrice or More	3%	0%	0%	4%	0%
Others	30%	59%	78%	74%	57%
Grand Total	100.00%	100%	100%	100%	100%
Km 47/400					
Daily Once (One-Way)	52%	40%	39%	31%	23%
Daily Twice (Up & Down)	34%	21%	15%	11%	14%
Daily Thrice or More	6%	13%	9%	9%	9%
Others	7%	26%	37%	48%	54%
Grand Total	100.00%	100%	100%	100%	100%
Km 82/000					
Daily Once (One-Way)	28%	19%	35%	36%	42%
Daily Twice (Up & Down)	32%	50%	33%	28%	22%
Daily Thrice or More	17%	11%	10%	9%	3%
Others	23%	20%	22%	27%	33%
Grand Total	100.00%	100%	100%	100%	100%
Km 124/500					
Daily Once (One-Way)	32%	37%	31%	29%	33%
Daily Twice (Up & Down)	26%	24%	29%	32%	25%
Daily Thrice or More	9%	18%	22%	26%	26%
Others	33%	21%	18%	13%	16%
Grand Total	100.00%	100%	100%	100%	100%

Observations:

- For Car, multiple trips at Km 82/000 is observed to be comparatively high which is due to the major influence of local areas such as Gulbarga and Sedam
- In general, multiple trips are observed to be low for the commercial traffic. This may be due to the long distance trips of commercial vehicles

3.8.5 Commodity Distribution

Location-wise, mode-wise and direction-wise Commodity distribution is derived from O-D data and presented in **Table 3-15**, **Table 3-16**, **Table 3-17**.

Table 3-15 Mode Wise Commodity Distribution at Km 7/300

Commodity Type	LCV	2A Truck	3A Truck	MAV	LCV	2A Truck	3A Truck	MAV
	Wagdhari to Aland				Aland to Wagdhari			
Empty	53.8%	100.0%	80%	83.5%	35.7%	5.6%	5.6%	3.9%
Vegetables & Fruits	7.7%	-	-	1.7%	7.1%	11.1%	22.2%	8.7%
Food Grains (Rice/ Wheat/ etc.)	-	-	-	-	-	-	-	0.5%
Perishable Products (Milks / Sweets / Food Items)	-	-	20.0%	1.7%	28.6%	-	5.6%	5.3%
Textile Products (Cotton / Wool / Clothes)	-	-	-	0.9%	-	-	5.6%	-
Leather	-	-	-	-	-	-	-	-
Sand/Cement/Aggregate/Steel/ Brick/Tiles/ Glass	-	-	-	2.6%	21.4%	61.1%	50.0%	71.4%
Petroleum Products	-	-	-	-	-	5.6%	-	1.0%
Chemical products	7.7%	-	-	3.5%	7.1%	5.6%	11.1%	2.4%
Machines or Machine Parts	-	-	-	0.9%	-	5.6%	-	1.0%
Mines, Minerals & Ores	-	-	-	-	-	-	-	-
Iron, Steel & Metal Products, Wires	7.7%	-	-	1.7%	-	5.6%	-	2.4%
Containers	-	-	-	-	-	-	-	-
Wood & Forest Products	7.7%	-	-	1.7%	-	-	-	-
Rubber Products	-	-	-	-	-	-	-	-
Consumer Products (Daily Used Items)	-	-	-	0.9%	-	-	-	-
Plastic Products	-	-	-	-	-	-	-	-
Parcel & Paper Products	-	-	-	0.9%	-	-	-	3.4%
Animals	15.4%	-	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	-	-	-
Grand Total	100%	100%	100%	100%	100%	100%	100%	100%

Table 3-16 Mode Wise Commodity Distribution at Km 47/400

Commodity Type	LCV	2A Truck	3A Truck	MAV	LCV	2A Truck	3A Truck	MAV
	Aland to Gulbarga				Gulbarga to Aland			
Empty	54.4%	53.7%	47.0%	56.8%	10%	13.8%	12.1%	11.1%
Vegetables & Fruits	8.9%	3.2%	7.7%	3.0%	10%	1.5%	6.9%	3.8%
Food Grains (Rice/ Wheat/ etc.)	5.6%	6.3%	7.7%	10.7%	6.7%	4.6%	5.2%	3.8%

Commodity Type	LCV	2A Truck	3A Truck	MAV	LCV	2A Truck	3A Truck	MAV
Perishable Products (Milks / Sweets / Food Items)	11.1%	6.3%	6.0%	6.5%	5.0%	3.1%	0.9%	3.0%
Textile Products (Cotton / Wool / Clothes)	-	1.1%	4.3%	-	1.7%	-	0.9%	0.4%
Leather	-	-	-	1.2%	-	-	-	-
Sand/Cement/Aggregate/Steel/ Brick/Tiles/ Glass	-	3.2%	8.5%	9.5%	36.7%	44.6%	49.1%	56.8%
Petroleum Products	2.2%	4.2%	2.6%	0.6%	1.7%	12.3%	1.7%	2.6%
Chemical products	3.3%	1.1%	2.6%	3.6%	5.0%	4.6%	4.3%	5.1%
Machines or Machine Parts	3.3%	4.2%	4.3%	3.6%	5.0%	4.6%	5.2%	4.3%
Mines, Minerals & Ores	-	-	-	-	-	-	0.9%	0.4%
Iron, Steel & Metal Products, Wires	-	1.1%	-	-	8.3%	6.2%	3.4%	2.6%
Containers	-	-	-	0.6%	-	-	0.9%	-
Wood & Forest Products	3.3%	2.1%	0.9%	0.6%	3.3%	3.1%	2.6%	3.0%
Rubber Products	-	2.1%	0.9%	0.6%	-	-	-	-
Consumer Products (Daily Used Items)	3.3%	3.2%	1.7%	-	1.7%	-	-	1.7%
Plastic Products	1.1%	4.2%	0.9%	-	5.0%	1.5%	4.3%	-
Parcel & Paper Products	2.2%	2.1%	5.1%	1.8%	-	-	0.9%	0.4%
Animals	-	1.1%	-	0.6%	-	-	-	-
Miscellaneous	1.1%	1.1%	-	0.6%	-	-	0.9%	0.9%
Grand Total	100%	100%	100%	100%	100%	100%	100%	100%

Table 3-17 Mode Wise Commodity Distribution at Km 82/000

Commodity Type	LCV	2A Truck	3A Truck	MAV	LCV	2A Truck	3A Truck	MAV
	Sedam to Gulbarga				Gulbarga to Sedam			
Empty	42.9%	15.7%	13.2%	9.7%	64.8%	64.0%	60.2%	71.2%
Vegetables & Fruits	-	-	2.0%	0.9%	1.1%	-	4.0%	3.8%
Food Grains (Rice/ Wheat/ etc.)	-	2.0%	-	0.4%	1.1%	2.0%	1.7%	-
Perishable Products (Milks / Sweets / Food Items)	5.7%	-	0.7%	0.4%	9.1%	8.0%	13.1%	6.7%
Textile Products (Cotton / Wool / Clothes)	-	-	-	-	-	-	1.1%	-
Leather	-	-	-	-	-	-	-	-
Sand/Cement/Aggregate/Steel/ Brick/Tiles/ Glass	42.9%	62.7%	73.0%	74.8%	4.5%	8.0%	4.5%	7.2%
Petroleum Products	2.9%	3.9%	2.6%	2.7%	3.4%	4.0%	1.7%	1.4%
Chemical products	-	2.0%	2.0%	0.9%	2.3%	4.0%	2.3%	0.5%
Machines or Machine Parts	-	3.9%	2.6%	2.7%	2.3%	-	2.8%	0.5%

Commodity Type	LCV	2A Truck	3A Truck	MAV	LCV	2A Truck	3A Truck	MAV
	Sedam to Gulbarga				Gulbarga to Sedam			
Mines, Minerals & Ores	-	-	1.3%	2.7%	-	-	-	-
Iron, Steel & Metal Products, Wires	-	2.0%	0.7%	-	1.1%	-	2.3%	1.0%
Containers	-	5.9%	-	-	-	-	-	1.0%
Wood & Forest Products	5.7%	-	-	2.2%	3.4%	-	1.1%	1.4%
Rubber Products	-	-	-	0.4%	3.4%	-	-	2.4%
Consumer Products (Daily Used Items)	-	-	-	-	1.1%	-	1.1%	-
Plastic Products	-	-	-	-	-	2.0%	1.1%	1.4%
Parcel & Paper Products	-	2.0%	2.0%	1.3%	1.1%	4.0%	1.1%	1.0%
Animals	-	-	-	-	-	2.0%	0.6%	0.5%
Miscellaneous	-	-	-	0.9%	1.1%	2.0%	1.1%	-
Grand Total	100%	100%	100%	100%	100%	100%	100%	100%

Table 3-16 Mode Wise Commodity Distribution at Km 124/500

Commodity Type	LCV	2A Truck	3A Truck	MAV	LCV	2A Truck	3A Truck	MAV
	Sedam to Ribbanpalli				Ribbanpalli to Sedam			
Empty	37.0%	25.0%	25.4%	18.2%	16.3%	18.2%	21.9%	22.5%
Vegetables & Fruits	6.2%	-	1.7%	0.5%	4.7%	4.5%	6.8%	10.1%
Food Grains (Rice/ Wheat/ etc.)	2.5%	2.5%	1.7%	1.1%	-	-	1.6%	2.4%
Perishable Products (Milks / Sweets / Food Items)	11.1%	7.5%	9.9%	7.0%	20.9%	18.2%	13.9%	16.6%
Textile Products (Cotton / Wool / Clothes)	-	2.5%	1.1%	0.5%	-	-	-	-
Leather	-	-	0.6%	-	-	-	-	-
Sand/Cement/Aggregate/Steel/ Brick/Tiles/ Glass	24.7%	55.0%	49.7%	58.8%	37.2%	36.4%	36.3%	32.5%
Petroleum Products	-	2.5%	1.1%	1.6%	-	2.3%	1.2%	0.6%
Chemical products	1.2%	-	1.1%	-	-	-	0.8%	1.2%
Machines or Machine Parts	1.2%	-	-	-	-	2.3%	0.4%	-
Mines, Minerals & Ores	-	-	-	-	7.0%	-	8.4%	2.4%
Iron, Steel & Metal Products, Wires	7.4%	-	2.2%	3.2%	4.7%	-	0.8%	3.6%
Containers	-	-	-	-	-	-	-	-
Wood & Forest Products	-	-	-	-	2.3%	4.5%	1.2%	0.6%
Rubber Products	-	-	-	0.5%	-	-	-	-
Consumer Products (Daily Used Items)	-	-	-	-	-	-	-	-

Commodity Type	LCV	2A Truck	3A Truck	MAV	LCV	2A Truck	3A Truck	MAV
	Sedam to Ribbonpalli				Ribbonpalli to Sedam			
Plastic Products	-	5.0%	1.7%	1.1%	2.3%	-	0.8%	1.8%
Parcel & Paper Products	3.7%	-	2.8%	4.3%	4.7%	13.6%	6.0%	5.9%
Animals	3.7%	-	0.6%	1.1%	-	-	-	-
Miscellaneous	1.2%	-	0.6%	2.1%	-	-	-	-
Grand Total	100%	100%	100%	100%	100%	100%	100%	100%

Observations:

- Major commodity carried along the project corridor are observed to be Cement, Perishable products and Petroleum products
- Cement is one of the major commodities carried along the project road. This is due to the presence of Vasavadatta Cement factory and Ultratech Cement factory at Sedam and Malkhed respectively.
- Empty Vehicles are observed to high at both all the toll plaza location due to the return trips of loaded vehicles

4 Socio Economic Profile of Influencing States

A study of the socio-economic profiles of the regions comprising the project influence area (PIA) provides an overview of the factors likely to influence the pattern of economic development, and hence the flows and volumes of traffic on the proposed highway. The details include population, per-capita income, NSDP and targeted growth rates of the economy. The profiles help to generate basic inputs for the estimation of future growth in transport demand on the basis of past scenarios, prospective changes in transport demand elasticity and economic growth rates.

The project stretch is predominantly influenced by Karnataka, Maharashtra and Andhra Pradesh. Among the three states, Karnataka influenced the most with 50% as the project stretch is falling on the same followed by Maharashtra with 35% and by Andhra Pradesh with 10%. The rest of the neighbouring states viz. Tamil Nadu and Kerala was less influenced by the project stretch.

Some salient features of the states are listed below.

Demographic Details of Influencing states		
Karnataka	Maharashtra	Andhra Pradesh
<p>Karnataka, India's eighth largest State in terms of geographical size (1, 91,791 square km) is home to 6.11 crore people as per 2011 Provisional Population Census table, accounting for 5.05% of India's population (decadal Growth 15.67%).</p> <p>The State has 30 Districts and 176 Taluks. Based on physiographic features, the State is divided into four regions viz., coastal region, Malanad (hilly) region, northern plateau region and the southern plateau region.</p>	<p>Maharashtra is a state in the western region of India. According to the provisional results of the 2011 national census, Maharashtra is the second most populous state in India with a population of 112,374,333 (9.28% of India's population).</p> <p>The total population growth in 2011 was 15.99 percent while in the previous decade it was 22.57 percent. The 2011 census for the state found 55% of the population to be rural with 45% being urban based.</p>	<p>Based on the Census of India (2011), the state has a population of 49,386,799. Spread over an area of 160,205 km², the state has a population density of 308 as against 277 in 2001 Census, which is below the national average.</p> <p>Registered growth rate of the population is 11.10 as against 14.59 recorded in the 2001 census. The decadal growth rate has come down by 3.49 during the 2001-2011.</p>

4.1 Economic Indicators of Influencing States

The past performance of the economic indicators of Karnataka, Maharashtra, Andhra Pradesh and Tamil Nadu was collected with the objective of establishing elasticity of travel demand to the different economic indicators. The economic indicators considered for the analysis include:

- ➔ Net State Domestic Product
- ➔ Per Capita Income (PCI)
- ➔ Population

The tables for the NSDP, PCI and Population is presented in **Table 4-1 to Table 4-4**

Table 4-1 Economic Indicators NSDP of Influencing States

Year	Karnataka	Maharastra	Andhra Pradesh	Tamil Nadu	Rest of India
2008-09	218309	546532	292258	286742	4158675
2009-10	218362	599338	303668	316760	4516071
2010-11	240816	667626	338163	359959	4918531
2011-12	248040	698086	362809	386508	5247529
2012-13	259501	739040	382633	397471	5482110
2013-14	274531	811268	405482	427184	5741790
CAGR	4.74%	8.25%	6.80%	8.36%	6.68%

**NSDP in Rupees Crores; Source: RBI statistics, 2014*

Table 4-2 Per- Capita Income of Influencing States

Year	Karnataka	Maharastra	Andhra Pradesh	Tamil Nadu	Rest of India
2008-09	37687	50183	35272	43193	31754
2009-10	37294	54246	36303	47394	33901
2010-11	40699	59587	40054	53507	36202
2011-12	41492	61468	42589	57093	38048
2012-13	42976	64218	44526	58360	38856
2013-14	45024	69584	46788	62361	39904
CAGR	3.68%	6.79%	5.84%	7.68%	4.69%

**Per - Capita Income in Rupees; Source: RBI statistics, 2014*

Table 4-3 Population of Influencing States

Year	Karnataka	Maharastra	Andhra Pradesh	Tamil Nadu	Rest of India
1951	19402	32003	31115	30119	361088
1961	23587	39554	35983	33687	439235
1971	29299	50412	43503	41199	548160
1981	37136	62783	53551	48408	683329

1991	44977	78937	66508	55859	846421
2001	52851	96879	76210	62406	1028737
2011	61131	112373	84666	72139	1210193
CAGR	1.93 %	2.12 %	1.68 %	1.47 %	2.04 %

**Population in Thousands; Source: census of India, 2011*

4.2 Estimation of Traffic Growth Rate by Elasticity Method

Investment priorities are governed by traffic demand, assessed benefits and cost of the project. Demand plays the important role, which governs which type of facility / infrastructure to be created. This in turn determines likely benefits and costs to develop the same. A highway project of this nature calls for significant investment. Prediction of traffic demand becomes an important task and has to be carried out as accurately as possible. Accurate estimation of traffic has direct bearing on the viability of the project. Recognizing this, efforts need to be made to carefully assess all the parameters that help in predicting the traffic demand in future, which necessitates realistic estimation of traffic growth rates. Traffic growth on a road facility is generally estimated on the basis of historical trends. In the present case, traffic growth rates are estimated using elasticity method as per **IRC-108:1996**. 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.

In order to arrive at the growth rate of goods vehicles, the influence of each zone in terms of goods traffic is considered. The relative impact of each sector was estimated on the basis of commodities being carried by vehicles.

Goods Vehicles

Traffic Growth in Goods Vehicles = $((\sum \text{Influence of region X Combined Sector Growth of region}) \times \text{Elasticity})$

Combined sector growth of Agriculture and Industrial sectors are considered for estimating growth of commercial vehicles. Service sector is not considered as the impact of service sector is minimal on commercial traffic growth.

Growth rates derived based on Elasticity Method gives growth that is only linked with economy (NSDP, Population, Per-capita income). But past traffic growth trends on the project road also needs to be considered because it throws insight to the reality past growth rate taken from the past studies. The weightages given for past growth and growth based on NSDP for LCV (70%, 30%).

Elasticity of 1.1 for commercial truck traffic is considered as recommended by ADB for Traffic projection in India. Based on the above discussion, the location wise goods traffic growth rates for base year (2015) are estimated separately for LCV, 3A Truck and MAV traffic.

Passenger Vehicles

For estimation of growth rates for Passenger traffic (Car & Bus), the population and per capita income (PCI) are taken as indicators that influence the growth instead of considering NSDP. To estimate Car growth rates 70% weightage is given to per capita income and 30% weightage is given to population and to estimate Bus growth rates, 70% weightage is given to Population growth trends and 30% weightage is given to Per Capita Income growth trends because the travel demand for public transportation is more influenced by Population.

As described above, the base year growth rates were estimated for all the Toll Plazas separately and presented in **Table 4-4**.

Table 4-4 Base Year Traffic Growth Rate

	Toll Plaza 1	Toll Plaza 2	Toll Plaza 3	Toll Plaza 4
Car	6.37%	5.63%	5.36%	6.17%
Bus	3.55%	3.24%	2.98%	3.21%
LCV	8.97%	8.95%	8.71%	8.98%
2 Axle	-1.00%	-1.00%	-1.00%	-1.00%
3 Axle	3.37%	3.16%	2.61%	3.28%
MAV	8.74%	8.14%	7.86%	8.69%

Observations:

- The growth rates arrived based on Elasticity method all the other category of vehicles has recorded a reasonable good growth rate except in 2-axle truck.
- 2-axle trucks have recorded a negative growth whereas LCV and MAV category has recorded a consistently high growth high growth rate on road network in the state as well as rest of India.
- 2 Axle Trucks showing negative trend implies that the distribution of load from 2 Axle Trucks to LCV, 3 Axle Truck and MAV modes.
- Therefore, the reduced growth rate in 2 Axle Truck was distributed to other truck modes in order to retain the overall growth rate and also not to lose any trips.
- The assumption for distribution of 2 Axle Truck growth rate to MAV growth rates is 50% and LCV growth rate to MAV is 40% respectively.
- The concept of Load factor considered for distribution of growth rates is (2A Truck = $0.5 \times \text{LCV}$, $\text{LCV} = 0.4 \times \text{MAV}$).
- The Car and Bus growth rate is reasonably more as the per capita income and population growth of Karnataka (4% and 2%) and Maharashtra (7% and 2%) is at par with the overall india growth rate.

4.3 Assessment of Growth Rates

In view of the above discussions, it is felt that the future growth rates should neither be under nor over targeted. The complexities involved and sensitive dimensions of economy are many, so it is important that its larger issues are to be addressed by constructing different scenarios. Thus an effort has been made to develop three different scenarios of varying growth rates of economic indicators as under:

- **Optimistic Scenario**
- **Most likely Scenario**
- **Pessimistic Scenario**

Considering all the above discussed points, the growth rates were conceived using method discussed earlier and are modified accordingly. The basic growth factors are considered to be realistic rates. In the calculation, the growth rate of economic indicators was treated with $\pm 10\%$ sensitivity and the pessimistic and optimistic values were arrived at. The final recommended growth rates for the Optimistic, Most Likely and Pessimistic scenarios for the base year are given in **Table 4-5** and for the forecast years in **Table 4-6**.

Table 4-5 Estimated Base Year traffic growth rates for Optimistic, Most Likely and Pessimistic Scenario

Vehicle Mode	Most Likely	Optimistic	Pessimistic
Toll Plaza 1			
Car	6.37%	7.00%	5.73%
Bus	3.55%	3.91%	3.20%
LCV	8.97%	9.06%	8.88%
2 Axle	-1.00%	-1.00%	-1.00%
3 Axle	3.37%	3.71%	3.03%
MAV	8.74%	9.24%	8.55%
Toll Plaza 2			
Car	5.63%	6.19%	5.06%
Bus	3.24%	3.56%	2.92%
LCV	8.95%	9.04%	8.87%
2 Axle	-1.00%	-1.00%	-1.00%
3 Axle	3.16%	3.48%	2.84%
MAV	8.14%	8.58%	8.03%
Toll Plaza 3			
Car	5.36%	5.89%	4.82%
Bus	2.98%	3.28%	2.69%
LCV	8.71%	8.77%	8.64%
2 Axle	-1.00%	-1.00%	-1.00%
3 Axle	2.61%	2.87%	2.35%
MAV	7.86%	8.27%	7.74%
Toll Plaza 4			
Car	6.17%	6.78%	5.55%
Bus	3.21%	3.53%	2.89%
LCV	8.98%	9.07%	8.90%
2 Axle	-1.00%	-1.00%	-1.00%
3 Axle	3.28%	3.61%	2.95%
MAV	8.69%	9.18%	8.53%

Table 4-6 Estimated Forecast Year traffic growth rates for Optimistic, Most Likely and Pessimistic Scenario

Type of Vehicle	Optimistic Scenario						Most Likely Scenario						Pessimistic Scenario					
	Car	Bus	LCV	2 Axle	3 Axle	MAV	Car	Bus	LCV	2 Axle	3 Axle	MAV	Car	Bus	LCV	2 Axle	3 Axle	MAV
TOLL PLAZA 1																		
2014-2015	7.00%	3.91%	9.06%	-1.00%	3.71%	9.24%	6.37%	3.55%	8.97%	-1.00%	3.37%	8.74%	5.73%	3.20%	8.88%	-1.00%	3.03%	8.55%
2016-2020	7.00%	3.91%	9.06%	-1.00%	3.71%	9.24%	6.37%	3.55%	8.97%	-1.00%	3.37%	8.74%	5.73%	3.20%	8.88%	-1.00%	3.03%	8.55%
2021-2025	6.30%	3.52%	8.15%	-0.90%	3.34%	8.32%	5.73%	3.20%	8.07%	-0.90%	3.03%	7.86%	5.16%	2.88%	8.00%	-0.90%	2.73%	7.70%
2026-2030	6.30%	3.52%	8.15%	-0.90%	3.34%	8.32%	5.73%	3.20%	8.07%	-0.90%	3.03%	7.86%	5.16%	2.88%	8.00%	-0.90%	2.73%	7.70%
> 2030	6.30%	3.52%	8.15%	-0.90%	3.34%	8.32%	5.73%	3.20%	8.07%	-0.90%	3.03%	7.86%	5.16%	2.88%	8.00%	-0.90%	2.73%	7.70%
TOLL PLAZA 2																		
2014-2015	6.19%	3.56%	9.04%	-1.00%	3.48%	8.58%	5.63%	3.55%	8.95%	-1.00%	3.16%	8.14%	5.06%	3.20%	8.87%	-1.00%	2.84%	8.03%
2016-2020	6.19%	3.56%	9.04%	-1.00%	3.48%	8.58%	5.63%	3.55%	8.95%	-1.00%	3.16%	8.14%	5.06%	3.20%	8.87%	-1.00%	2.84%	8.03%
2021-2025	5.57%	3.21%	8.14%	-0.90%	3.13%	7.72%	5.06%	3.20%	8.06%	-0.90%	2.84%	7.32%	4.56%	2.88%	7.98%	-0.90%	2.56%	7.23%
2026-2030	5.57%	3.21%	8.14%	-0.90%	3.13%	7.72%	5.06%	3.20%	8.06%	-0.90%	2.84%	7.32%	4.56%	2.88%	7.98%	-0.90%	2.56%	7.23%
> 2030	5.57%	3.21%	8.14%	-0.90%	3.13%	7.72%	5.06%	3.20%	8.06%	-0.90%	2.84%	7.32%	4.56%	2.88%	7.98%	-0.90%	2.56%	7.23%
TOLL PLAZA 3																		
2014-2015	5.89%	3.28%	8.77%	-1.00%	2.87%	7.86%	5.36%	2.98%	8.71%	-1.00%	2.61%	7.86%	4.82%	2.69%	8.64%	-1.00%	2.35%	7.74%
2016-2020	5.89%	3.28%	8.77%	-1.00%	2.87%	7.86%	5.36%	2.98%	8.71%	-1.00%	2.61%	7.86%	4.82%	2.69%	8.64%	-1.00%	2.35%	7.74%
2021-2025	5.30%	2.95%	7.89%	-0.90%	2.59%	7.07%	4.82%	2.69%	7.83%	-0.90%	2.35%	7.07%	4.34%	2.42%	7.78%	-0.90%	2.12%	6.96%
2026-2030	5.30%	2.95%	7.89%	-0.90%	2.59%	7.07%	4.82%	2.69%	7.83%	-0.90%	2.35%	7.07%	4.34%	2.42%	7.78%	-0.90%	2.12%	6.96%
> 2030	5.30%	2.95%	7.89%	-0.90%	2.59%	7.07%	4.82%	2.69%	7.83%	-0.90%	2.35%	7.07%	4.34%	2.42%	7.78%	-0.90%	2.12%	6.96%
TOLL PLAZA 4																		
2014-2015	6.78%	3.53%	9.07%	-1.00%	3.61%	9.18%	6.17%	3.21%	8.98%	-1.00%	3.28%	8.69%	5.55%	2.89%	8.90%	-1.00%	2.95%	8.53%
2016-2020	6.78%	3.53%	9.07%	-1.00%	3.61%	9.18%	6.17%	3.21%	8.98%	-1.00%	3.28%	8.69%	5.55%	2.89%	8.90%	-1.00%	2.95%	8.53%
2021-2025	6.11%	3.18%	8.17%	-0.90%	3.25%	8.27%	5.55%	2.89%	8.09%	-0.90%	2.95%	7.82%	5.00%	2.60%	8.01%	-0.90%	2.66%	7.67%
2026-2030	6.11%	3.18%	8.17%	-0.90%	3.25%	8.27%	5.55%	2.89%	8.09%	-0.90%	2.95%	7.82%	5.00%	2.60%	8.01%	-0.90%	2.66%	7.67%
> 2030	6.11%	3.18%	8.17%	-0.90%	3.25%	8.27%	5.55%	2.89%	8.09%	-0.90%	2.95%	7.82%	5.00%	2.60%	8.01%	-0.90%	2.66%	7.67%
Average	6.08%	3.36%	8.45%	-0.94%	3.21%	8.19%	5.53%	3.13%	8.37%	-0.94%	2.92%	7.85%	4.97%	2.81%	8.29%	-0.94%	2.63%	7.72%

4.4 Estimation of Development traffic

Based on the secondary data review and discussions with officials of cement factories, it was noted that several plants are expanding their capacity. There are proposals for few new plants as well. The above development will generate additional traffic on the project road.

The list of existing and proposed cement industry along the PIA with rail connectivity is shown in **Figure 4-1**

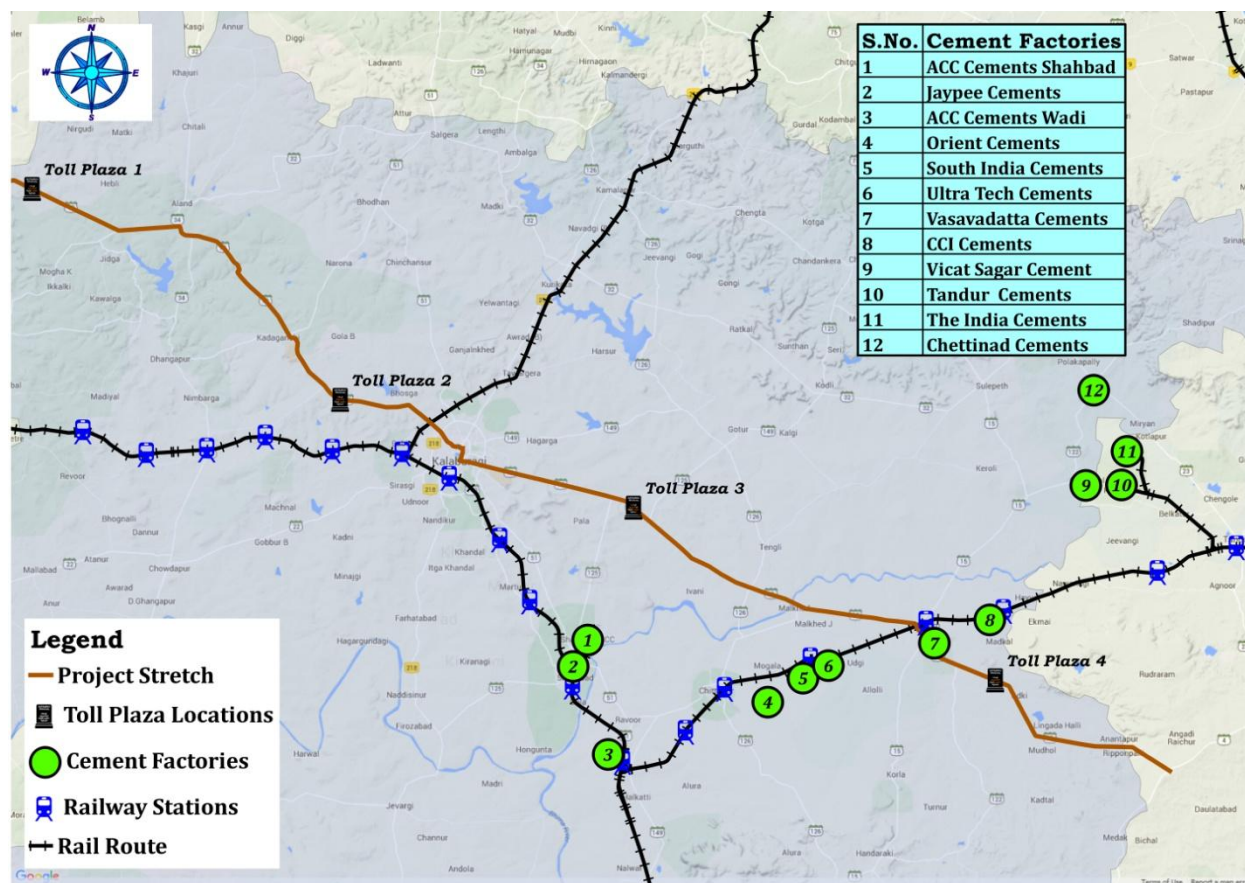


Figure 4-1 Location of Cement industries along the PIA

It can be inferred from the **Figure 4-1** that, the cement industries along the PIA has very good rail connectivity and few of the industries have dedicated railway siding connecting to the main line. Appropriate assumptions have been made based on secondary information and desk research on the likely share of road and rail for transportation of cement. The **Table 4-7** and **Table 4-8** gives the details of expansion of existing and proposed cement plants in project influence area. The share of tonnage likely to be evacuated by rail is also indicated.

Table 4-7 Details of Existing Cement Plants in PIA

S. No.	Cement Industry	Assumption		Increase in Cement Production (MTPA)	Expected year of Operation
		Share of Traffic by Rail	Share of Traffic by Road		
1	Ultra Tech cements*	80	20	4.5	2016
2	South India Cement Factory	70	30	0.94	2017
3	Sri Sakthi Cement Factory	30	70	4	2017
4	Dalmia Cement factory	70	30	4	2017
5	Orient Cement factory	70	30	3	2017
6	M/S Vicat Sagar cements and Chettinad cements	70	30	10	2017

Table 4-8 Details of Proposed Cement Plants in PIA

Sl.No	Cement Industry	Share of Traffic by Rail	Share of Traffic by Road	Expected Cement Production in MTPA	Expected year of Operation
1	M/S Zuari Cements, Lafarge Cements, Surya vinayagar Cement, Mexicos Comex and JK cements	30%	70%	18	2020

From the **Table 4-7** and further the following assumptions have been made to broadly project the traffic for the future:

- M/S Ultra Tech Cements is expected to increase their production capacity from 4.2 to 8.7 Million tons per annum at Nrupathanga village which is 7.7 Km away from our project stretch. The site has a dedicated railway siding connecting to the Gulbarga – Hyderabad rail route section. It was obtained from the factory source that 80% of the raw materials/products will be transported through rail and remaining 20% through the road network.
- The South India cement factory is located near Ultra tech cement factory which is 7.7 Km away from our project stretch has planned to increase their production capacity from 0.066 MTPA to 1 MTPA. The factory is 3.2 km away from the Malkhed railway station. Hence 70% and 30% split is assumed for rail and road.
- M/S Shree Cements is expected to set up a new factory with a production capacity of 4.0 Million tons per annum at Benkanhalli village which is 19 Km away from our project stretch. The site selected for the above establishment is 22km away from the Sedam railway station. Hence it is assumed that 30% of the raw materials/products will be transported through rail and remaining 70% through the road network.
- M/S Dalmia Cements is expected to set up a new factory with a production capacity of 4.0 Million Tons Per Annum at Konkanhalli village which is 8km away from the Sedam railway station. Hence 70% and 30% split is assumed for rail and road.
- M/S Orient Cements is expected to set up a new factory with a production capacity of 3.0 Million Tons Per Annum at Itgi village which is 18Km away from the project stretch

and 5km from the Chitapur railway station. Hence 70% and 30% split is assumed for rail and road.

- M/S Vicat Sagar cements and Chettinad cements are expected to increase their production by 10MTPA at Karkunda village which is located 6.3km away from the project road. The Chettinad cement factory has its own rail siding connecting to the main line.
- From the secondary source it is obtained that few industries viz., M/S Zuari Cements, Lafarge Cements, Surya vinayagar Cement, Mexicos Comex and JK cements are likely to setup a new factories around Gulbarga district with the total production capacity of 18 MTPA.
- It is assumed that,
 - All the proposed cement industries will start their operation only after 2020
 - Among the total capacity of 18 MPTA, only 25% of that is assumed for the pessimistic scenario, 50% for the most likely scenario and 80% for the optimistic scenario.
 - In all the scenarios, 70% of the tonnes will transfer by Rail and remaining 30% by Road.

Scenario	Tonnage assumed	Rail Share in MTPA	Road Share in MTPA
Optimistic	80% of 18MTPA = 14.4	10	4.4
Realistic	50% of 18MTPA= 9.0	6.3	2.7
Pessimistic	25% of 18MTPA= 4.5	3.15	1.35

The total tonnage from the each cement industries are converted in to number of trucks by assuming 20 tonnes per vehicle for 3axle truck and 25 tonnes per vehicle for MAV. The number of trucks and MAV's are again distributed to the each toll plazas based on the existing OD pattern. Also it was assumed that 30% of the empty trucks will also add to the existing truck traffic generated. Based on the above calculations, the number of 3-Axle and MAV vehicles assumed for each toll plazas is given in **Table 4-9**.

Table 4-9 Generated Traffic at each Toll plazas

Scenario	Year	TP1		TP2		TP3		TP4	
		3- Axle	MAV	3- Axle	MAV	3- Axle	MAV	3- Axle	MAV
Optimistic	2016	0	5	3	9	25	33	36	31
	2017	14	96	37	78	189	194	193	152
	2018	14	96	37	78	189	194	193	152
	2019	14	96	37	78	189	194	193	152
	2020	27	179	78	148	323	321	319	247
Realistic	2016	0	5	3	9	25	33	36	31
	2017	14	96	37	78	189	194	193	152
	2018	14	96	37	78	189	194	193	152
	2019	14	96	37	78	189	194	193	152
	2020	22	147	62	121	271	272	270	211
Pessimistic	2016	0	5	3	9	25	33	36	31
	2017	14	96	37	78	189	194	193	152
	2018	14	96	37	78	189	194	193	152
	2019	14	96	37	78	189	194	193	152
	2020	18	121	50	100	230	233	231	181

The forecast traffic numbers are presented in **Table 4-10** to **Table 4-13** for Optimistic, Most Likely and Pessimistic scenarios for each toll plaza.

Table 4-10 Traffic forecast numbers for all scenarios of Toll Plaza - 1

Toll Plaza - 1																								
Year	Optimistic Scenario								Most Likely Scenario								Pessimistic Scenario							
	Car	Bus	LCV	2 Axle	3 Axle	MAV	Total Vehicles	Total PCUs	Car	Bus	LCV	2 Axle	3 Axle	MAV	Total Vehicles	Total PCUs	Car	Bus	LCV	2 Axle	3 Axle	MAV	Total Vehicles	Total PCUs
2015	143	107	48	39	47	418	801	2673	143	107	48	39	47	418	801	2673	143	107	48	39	47	418	801	2673
2016	953	112	252	39	48	461	1864	4002	952	111	252	39	48	459	1861	3990	951	111	252	39	48	458	1858	3983
2017	963	116	257	38	64	594	2033	4678	961	115	256	38	64	590	2025	4652	959	114	256	38	64	588	2020	4639
2018	975	121	262	38	66	640	2101	4922	972	119	262	38	66	633	2089	4880	969	118	261	38	65	630	2081	4859
2019	987	125	267	37	68	691	2176	5188	983	124	267	37	68	680	2158	5127	978	122	267	37	67	618	2089	4836
2020	1000	130	273	37	83	828	2352	5889	994	128	273	37	77	782	2291	5648	988	126	273	37	72	673	2169	5132
2021	1006	132	276	37	84	853	2388	6019	999	130	276	37	78	804	2324	5767	993	127	275	37	73	773	2278	5596
2022	1019	137	282	37	86	909	2470	6312	1011	134	282	37	80	856	2399	6037	1003	131	281	37	75	715	2241	5369
2023	1033	142	289	36	88	970	2557	6629	1023	138	288	36	81	912	2479	6327	1013	135	288	36	76	746	2294	5542
2024	1047	147	296	36	90	1036	2652	6971	1035	143	296	36	83	972	2565	6639	1024	139	295	36	78	778	2349	5724
2025	1063	152	304	36	92	1107	2754	7340	1049	147	303	36	85	1037	2657	6975	1036	143	303	36	79	812	2408	5915
2026	1079	157	313	35	94	1185	2863	7738	1063	152	312	35	87	1107	2756	7335	1048	147	311	35	81	1065	2687	7097
2027	1097	163	322	35	96	1268	2981	8169	1078	157	321	35	89	1183	2862	7724	1061	151	320	35	83	1138	2787	7467
2028	1116	168	332	35	99	1359	3108	8633	1094	162	330	35	91	1264	2976	8141	1074	155	329	35	84	1216	2894	7864
2029	1136	174	342	34	101	1457	3245	9135	1111	167	341	34	93	1352	3099	8590	1088	160	340	34	86	1300	3009	8291
2030	1157	181	354	34	104	1563	3392	9677	1129	172	352	34	95	1447	3230	9073	1103	165	351	34	88	1391	3132	8749
2031	1179	187	367	34	106	1679	3551	10262	1148	178	365	34	97	1549	3371	9593	1119	169	363	34	90	1489	3263	9242
2032	1203	193	380	33	109	1803	3722	10895	1168	184	378	33	100	1659	3522	10152	1135	174	376	33	92	1594	3405	9771
2033	1228	200	395	33	111	1938	3907	11578	1189	189	392	33	102	1778	3684	10754	1152	179	390	33	94	1707	3556	10339
2034	1255	207	411	33	114	2085	4105	12316	1211	195	408	33	105	1907	3858	11402	1171	184	405	33	96	1829	3718	10950
2035	1284	215	428	33	117	2243	4320	13114	1235	202	425	33	107	2045	4046	12099	1190	190	421	33	98	1961	3892	11607

Note: The section of project road between the Karnataka/ Maharashtra border and Akkalkote is assumed to be completed by the end of 2015. After completion of the road, it is assumed that traffic from alternative route i.e. Aland-Umarga-Solapur will be diverted to the project road. The quantum of diversion is assumed as 80% in Cars and LCVs. Other category of vehicles are already using the project road.

Table 4-11 Traffic forecast numbers for all scenarios of Toll Plaza - 2

Toll Plaza - 2																								
Year	Optimistic Scenario								Most Likely Scenario								Pessimistic Scenario							
	Car	Bus	LCV	2 Axle	3 Axle	MAV	Total Vehicles	Total PCUs	Car	Bus	LCV	2 Axle	3 Axle	MAV	Total Vehicles	Total PCUs	Car	Bus	LCV	2 Axle	3 Axle	MAV	Total Vehicles	Total PCUs
2015	1443	365	369	233	401	625	3437	7809	1443	365	369	233	401	625	3437	7809	1443	365	369	233	401	625	3437	7809
2016	1544	380	403	230	420	692	3668	8350	1535	378	402	230	418	689	3653	8318	1526	377	402	230	417	688	3640	8295
2017	1652	394	439	228	469	824	4008	9296	1633	392	439	228	466	818	3975	9228	1613	389	438	228	463	815	3947	9179
2018	1768	410	479	226	485	893	4261	9869	1737	406	478	226	481	882	4209	9760	1706	402	477	226	476	878	4164	9683
2019	1892	426	522	223	502	969	4534	10488	1847	420	521	223	496	952	4460	10332	1803	414	519	223	490	946	4396	10224
2020	2024	443	570	221	560	1121	4939	11594	1965	435	568	221	536	1072	4797	11216	1907	428	565	221	516	1042	4679	10939
2021	2082	450	591	220	567	1158	5068	11891	2016	441	588	220	543	1106	4915	11489	1951	433	586	220	522	1075	4788	11195
2022	2214	465	639	218	583	1242	5362	12563	2131	455	636	218	557	1183	5182	12104	2052	446	633	218	535	1150	5034	11773
2023	2353	482	691	216	600	1333	5676	13284	2254	470	687	216	572	1267	5467	12762	2158	458	683	216	548	1231	5295	12391
2024	2501	499	748	214	618	1432	6012	14058	2383	485	743	214	588	1357	5770	13466	2269	472	738	214	561	1318	5573	13051
2025	2659	516	809	212	636	1539	6371	14888	2519	501	803	212	604	1454	6093	14218	2386	485	797	212	575	1412	5868	13755
2026	2827	534	875	211	654	1654	6755	15780	2664	517	868	211	620	1559	6438	15023	2509	499	861	211	590	1513	6182	14508
2027	3005	553	946	209	673	1779	7166	16737	2816	533	938	209	637	1672	6805	15885	2638	514	930	209	604	1622	6517	15312
2028	3194	573	1023	207	693	1915	7605	17765	2977	550	1013	207	654	1794	7197	16806	2774	528	1004	207	620	1739	6872	16170
2029	3395	593	1107	205	714	2062	8076	18870	3148	568	1095	205	672	1926	7614	17793	2917	544	1084	205	635	1865	7251	17088
2030	3609	614	1197	203	735	2221	8579	20056	3328	586	1184	203	691	2068	8060	18849	3068	559	1171	203	651	2001	7653	18070
2031	3837	635	1294	201	757	2394	9119	21331	3519	605	1279	201	710	2221	8535	19980	3226	575	1265	201	668	2147	8082	19119
2032	4079	658	1400	199	780	2581	9696	22702	3721	624	1383	199	730	2386	9043	21192	3392	592	1366	199	684	2305	8539	20241
2033	4336	681	1514	198	803	2783	10314	24175	3934	644	1494	198	750	2564	9584	22489	3567	609	1475	198	702	2475	9025	21441
2034	4609	705	1637	196	827	3002	10976	25758	4159	664	1615	196	771	2757	10162	23879	3751	626	1593	196	720	2658	9543	22725
2035	4899	730	1771	194	852	3240	11686	27462	4397	686	1745	194	792	2964	10779	25369	3945	644	1720	194	738	2854	10096	24099

Table 4-12 Traffic forecast numbers for all Scenarios of Toll Plaza -3

Toll Plaza - 3																								
Year	Optimistic Scenario								Most Likely Scenario								Pessimistic Scenario							
	Car	Bus	LCV	2 Axle	3 Axle	MAV	Total Vehicles	Total PCUs	Car	Bus	LCV	2 Axle	3 Axle	MAV	Total Vehicles	Total PCUs	Car	Bus	LCV	2 Axle	3 Axle	MAV	Total Vehicles	Total PCUs
2015	1873	462	296	130	462	578	3801	8081	1873	462	296	130	462	578	3801	8081	1873	462	296	130	462	578	3801	8081
2016	2004	480	323	129	504	665	4104	8817	1992	478	323	129	503	662	4086	8782	1980	477	323	129	501	660	4069	8755
2017	2144	499	352	127	686	884	4692	10586	2119	495	352	127	682	878	4653	10511	2094	492	351	127	679	875	4619	10455
2018	2294	518	384	126	704	948	4975	11181	2254	513	383	126	699	938	4913	11061	2213	508	383	126	694	934	4857	10972
2019	2455	538	419	125	723	1018	5278	11822	2397	531	418	125	716	1003	5190	11651	2340	524	417	125	709	997	5112	11525
2020	2627	559	457	124	877	1221	5865	13486	2550	550	455	124	816	1151	5646	12882	2474	541	454	124	807	1105	5504	12539
2021	2702	568	474	123	885	1255	6008	13791	2616	558	472	123	824	1183	5776	13160	2532	548	470	123	814	1135	5622	12800
2022	2873	588	513	122	904	1333	6333	14482	2766	576	510	122	840	1254	6069	13790	2663	563	508	122	829	1205	5889	13387
2023	3054	609	555	121	923	1417	6679	15222	2924	594	552	121	858	1332	6380	14462	2800	579	548	121	844	1279	6172	14013
2024	3246	630	600	120	944	1508	7048	16013	3092	613	596	120	876	1415	6711	15179	2944	596	592	120	860	1360	6472	14680
2025	3451	653	649	119	964	1607	7442	16861	3269	633	644	119	894	1505	7063	15943	3096	613	640	119	876	1447	6790	15389
2026	3668	676	702	118	986	1714	7862	17769	3456	653	696	118	913	1602	7438	16759	3256	631	691	118	892	1540	7128	16145
2027	3899	699	759	117	1008	1830	8312	18742	3654	674	752	117	932	1707	7836	17630	3424	649	746	117	909	1641	7485	16951
2028	4145	724	821	115	1031	1955	8791	19785	3864	695	813	115	952	1819	8260	18560	3600	668	806	115	927	1749	7865	17810
2029	4406	749	888	114	1054	2091	9303	20902	4085	718	879	114	973	1941	8710	19553	3786	687	870	114	945	1866	8268	18725
2030	4684	776	960	113	1079	2238	9850	22100	4319	741	950	113	994	2072	9190	20614	3981	707	939	113	963	1991	8695	19702
2031	4979	803	1038	112	1104	2398	10435	23385	4567	764	1026	112	1016	2214	9700	21748	4186	727	1015	112	982	2127	9149	20743
2032	5293	831	1123	111	1130	2571	11059	24763	4828	789	1109	111	1039	2367	10243	22959	4402	748	1096	111	1001	2272	9631	21855
2033	5626	860	1215	110	1157	2758	11727	26242	5105	814	1199	110	1062	2531	10822	24254	4629	770	1183	110	1021	2429	10143	23041
2034	5981	891	1314	109	1185	2960	12440	27829	5397	840	1296	109	1086	2709	11438	25639	4868	792	1278	109	1042	2598	10687	24307
2035	6358	922	1421	108	1214	3180	13203	29532	5707	867	1400	108	1111	2901	12094	27119	5119	815	1380	108	1063	2780	11266	25659

Table 4-13 Traffic forecast numbers for all Scenarios of Toll Plaza – 4

Toll Plaza - 4																								
Year	Optimistic Scenario								Most Likely Scenario								Pessimistic Scenario							
	Car	Bus	LCV	2 Axle	3 Axle	MAV	Total Vehicles	Total PCUs	Car	Bus	LCV	2 Axle	3 Axle	MAV	Total Vehicles	Total PCUs	Car	Bus	LCV	2 Axle	3 Axle	MAV	Total Vehicles	Total PCUs
2015	868	131	211	81	415	484	2189	5241	868	131	211	81	415	484	2189	5241	868	131	211	81	415	484	2189	5241
2016	928	136	230	80	466	559	2400	5837	923	135	230	80	465	557	2390	5814	917	135	230	80	463	556	2381	5799
2017	993	141	251	79	639	730	2833	7232	982	140	250	79	636	724	2812	7184	970	139	250	79	633	722	2794	7151
2018	1063	147	274	79	656	783	3000	7640	1044	145	273	79	651	774	2966	7563	1025	144	272	79	647	771	2938	7511
2019	1137	152	298	78	673	841	3180	8080	1111	150	297	78	667	829	3131	7970	1084	148	296	78	660	824	3091	7897
2020	1217	158	325	77	816	1000	3594	9362	1181	156	324	77	760	946	3444	8903	1146	153	323	77	713	911	3323	8559
2021	1252	161	337	77	824	1029	3680	9573	1212	158	336	77	766	973	3522	9097	1173	155	335	77	719	937	3395	8742
2022	1331	166	365	76	841	1094	3873	10052	1281	163	363	76	781	1033	3698	9535	1234	159	361	76	732	995	3557	9155
2023	1415	172	395	75	858	1165	4080	10565	1355	168	392	75	797	1098	3885	10004	1297	164	390	75	746	1057	3730	9596
2024	1504	178	427	75	876	1241	4301	11116	1432	173	424	75	813	1167	4085	10505	1364	169	421	75	760	1125	3914	10068
2025	1599	185	462	74	895	1324	4537	11707	1515	179	458	74	829	1243	4298	11041	1434	174	455	74	775	1197	4109	10571
2026	1699	191	499	118	914	1413	4835	12478	1601	1227	495	73	846	1324	5567	14741	1508	1186	491	73	789	1275	5324	14130
2027	1806	198	540	117	934	1510	5106	13159	1693	1266	535	73	864	1411	5842	15454	1586	1220	531	73	805	1360	5574	14791
2028	1920	205	584	116	954	1615	5395	13891	1790	1306	579	72	882	1506	6135	16215	1668	1255	573	72	820	1450	5839	15495
2029	2041	212	632	115	976	1729	5705	14677	1893	1348	625	71	901	1608	6446	17025	1754	1291	619	71	836	1548	6120	16244
2030	2170	220	683	114	998	1852	6036	15523	2001	1391	676	71	920	1717	6776	17888	1844	1328	669	71	853	1653	6418	17041
2031	2307	227	739	70	1020	1986	6349	16303	2116	216	730	70	939	1836	5908	15150	1940	206	722	70	870	1766	5574	14408
2032	2452	235	799	69	1044	2130	6730	17281	2237	223	789	69	960	1964	6242	16015	2040	212	780	69	887	1888	5876	15212
2033	2607	244	864	69	1068	2287	7138	18334	2365	230	853	69	981	2102	6600	16941	2145	218	842	69	905	2020	6198	16072
2034	2771	252	935	68	1093	2456	7575	19466	2501	238	922	68	1002	2250	6981	17934	2255	224	909	68	924	2161	6542	16992
2035	2946	261	1011	68	1119	2640	8044	20684	2644	245	996	68	1024	2411	7388	18999	2372	231	982	68	943	2313	6908	17977

5 Toll Revenue Estimation

Based on the toll policy specified in Schedule-R of Concession Agreement, future toll rates have been calculated and the corresponding revenue has been estimated.

5.1 Trip Categorization

The tollable trips are categorized into single, return, local trips and monthly pass category as per the observed OD data. The trip categorization is presented in **Table 5-1**.

Table 5-1 Trip Categorization

5.2 Toll Rate Computation Steps

The toll rates for various categories of trips were derived based on the Schedule-R of Concession Agreement

Step1- Basic toll rate: The basic toll rates for 2009-2010 as per the Memorandum for Empowered Institution submitted by Karnataka Road Development Corporation Limited; Government of Karnataka is given in **Table 5-2**.

Table 5-2 Basic Toll Rate for Project Road

Type of Vehicle	Basic Toll Rate 1 st April 2009 to 31 st March 2010 (Rs. Per km and per trip)
Car/Van/Jeep	0.58
Mini Bus, LCV	0.87
Bus, Truck	1.75
MAV	2.62

Step2- Annual Revision of basic toll rates: The basic toll rates mentioned in **Table 5-2** is increased by **3%** thereof for a period of 15 successive years commencing from April 2008 till April 2022.

Step3- WPI Correction: The basic toll rates after the annual revision is adjusted to reflect the variation in WPI occur between January 2007 and January immediately preceding the date of revision. An annual increase of WPI has been considered as **5%** till end of the concession period.

Step4- Discounts and Tollable traffic components

- Local traffic entitled to ply on the project road and cross the toll plaza on production of a monthly pass issued by the concessionaire on a payment of monthly fee of **RS 100**. The monthly fee has been revised annually to reflect the variation in WPI.
- The private car owned by a person situated within a distance of **10kms** from the toll plaza has been considered as a local traffic. The zones falling on the 10km radius of each toll plaza along the project corridor is shown in **Figure 5-1**.
- The commercial traffic commuting by a car, LCV, bus or truck between the toll plaza and any point within **20kms** on either side of the toll plaza has been considered as a local commercial traffic. The zones falling on the 10km radius of each toll plaza along the project corridor is shown in **Figure 5-1**.

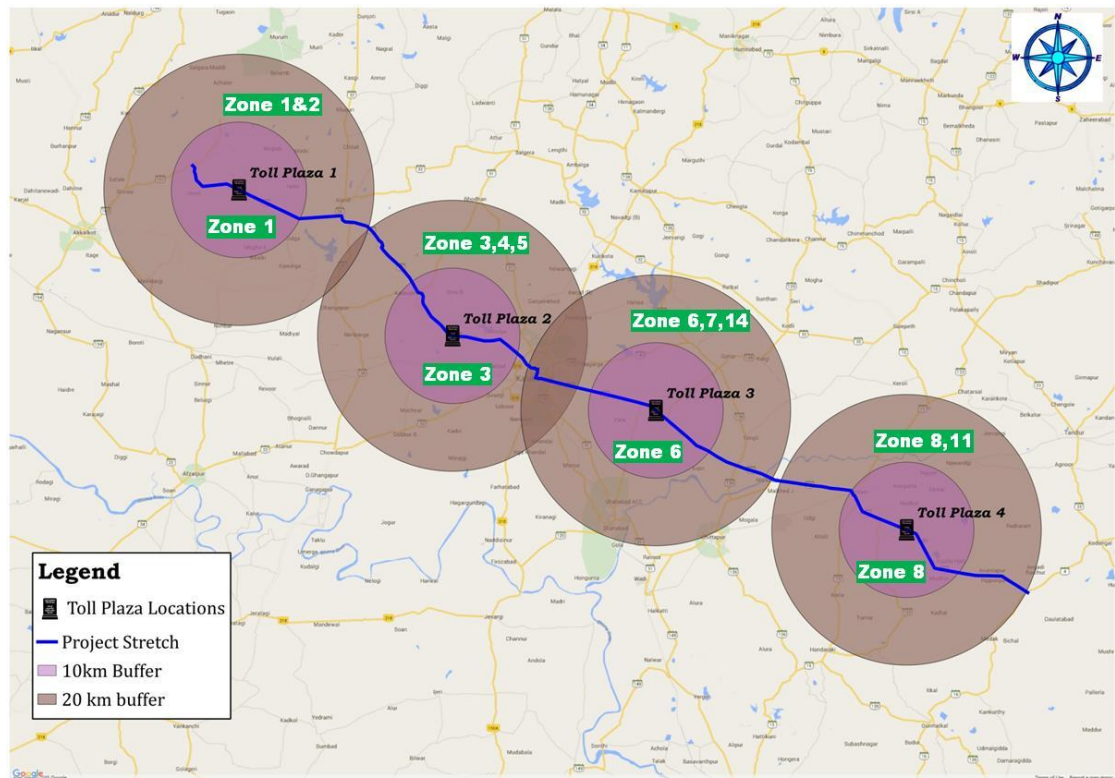


Figure 5-1 Zones considered for the Local traffic

- A frequent user, who have purchased tickets for 50 or more one way trips undertaken by the same vehicle with in the calendar month of the date has entitled for a discount of **33.3%** (one third of the toll charges payable for such vehicle).
- A frequent user, who are returning on the same day as the outward journey by the same vehicle day has been entitled for a return ticket on payment of a sum equal to **150%** of the toll charge.

The **Table 5-3** shows the various discount and tollable components to obtain the toll rates.

Table 5-3 Discounts and Tollable traffic components

Type of Traffic	Vehicle Type	Basic Toll charge as on April 2012
Single Trip	Car/Jeep/Van, LCV, Bus, Mini Bus, Truck, MAV	No discounts
Local Traffic (10km)	Can/Van/Jeep	Rs 100
Local Commercial Traffic (20km)	Mini Bus, LCV, Bus, Truck	Monthly pass for 30 One way trips/Month
Frequent users-Monthly	Car/Jeep/Van, LCV, Bus, Mini Bus, Truck, MAV	33% discount i.e. 1/3 on the toll charges and 50 One way trips/Month
Frequent users- Daily	Car/Jeep/Van, LCV, Bus, Mini Bus, Truck, MAV	150% of the single one way trip rate

Based on the above concessions and discounts, the toll rates were projected for the forecast years. The toll rate for the year 2015 is mentioned in the **Table 5-4** and subsequently the toll revenue is calculated for the base and forecast years and mentioned in the **Table 5-5** for the Daily Traffic and **Error! Reference source not found.** for the Monthly pass category.

Table 5-4 Toll Rates for the Year 2015

Vehicle Categories	Toll Plaza 1 & 2		Toll Plaza 3 & 4	
	Crossing 1 Toll Plaza	Crossing Both Toll Plaza	Crossing 1 Toll Plaza	Crossing Both Toll Plaza
Through Traffic – One Way				
CAR / JEEPS	45	55	55	70
LCV	65	80	85	105
BUS / 2 Axle Vehicle	130	165	165	210
3 Axle Vehicle / MAV	200	250	250	310
Daily Return				
CAR / JEEPS	65	80	85	105
LCV	100	125	125	155
BUS / 2 Axle Vehicle	200	250	250	310
3 Axle Vehicle / MAV	295	370	375	465
Monthly Pass				
CAR / JEEPS	1460	1825	1935	2295
LCV	2190	2740	2750	3440
BUS / 2 Axle Vehicle	4410	5510	5535	6920
3 Axle Vehicle / MAV	6600	8250	8285	10355
Local Commercial Traffic(With in20km radius)				
LCV	1975	2465	2475	3095
BUS / 2 Axle Vehicle	3970	4960	4980	6225
Local Pass (With in10km radius)				
CAR	160	160	160	160

Table 5-5 Projected Daily Toll Revenue (in Rs)

Year	Toll Plaza - 1	Toll Plaza - 2	Toll Plaza - 3	Toll Plaza - 4
2015	50,054	2,45,113	3,38,575	2,25,756
2016	87,180	2,79,642	3,98,235	2,72,582
2017	1,10,671	3,33,642	5,26,763	3,73,930
2018	1,23,558	3,79,872	5,89,290	4,18,302
2019	1,36,745	4,26,593	6,61,048	4,67,746
2020	1,60,960	4,93,390	7,82,896	5,61,094
2021	1,74,518	5,39,155	8,49,941	6,08,540
2022	1,94,735	6,03,654	9,43,072	6,75,940
2023	2,08,106	6,51,885	10,14,653	7,25,451
2024	2,25,405	7,11,317	10,97,217	7,83,808
2025	2,42,697	7,72,916	11,78,722	8,41,738
2026	2,60,489	8,36,225	12,69,873	10,99,483
2027	2,81,994	9,10,923	13,66,404	11,79,461

2028	3,02,862	9,89,317	14,77,461	12,70,329
2029	3,27,921	10,73,037	15,88,345	13,61,486
2030	3,53,337	11,65,454	17,18,841	14,67,669
2031	3,82,426	12,63,060	18,48,028	13,18,843
2032	4,13,052	13,71,989	19,86,002	14,19,408
2033	4,45,493	14,82,481	21,46,758	15,34,973
2034	4,82,383	16,07,317	23,12,433	16,53,878
2035	5,21,004	17,42,736	24,98,598	17,87,472

Observations:

- The Daily revenue obtained for the Toll plazas 1 for the year 2035 is **Rs. 5,17,030**, Toll Plaza 2 is **Rs.17,06,720**, Toll Plaza 3 is **Rs.24,95,457** and Toll Plaza 4 is **Rs. 17,86,265**.
- The revenue obtained through Monthly pass for the Toll plazas 1 is **Rs. 3,975**, Toll Plaza 2 is **Rs.36,015**, Toll Plaza 3 is **Rs.3,141** and Toll Plaza 4 is **Rs. 1,208**.
- The revenue obtained through monthly pass, local traffic and local commercial traffic categories is very minimal as compared to the through traffic and daily return.
- For the forecast years from 2016 onwards the revenue is calculated based on the following assumptions.
 - ♦ *The section of project road between the Karnataka/ Maharashtra border and Akkalkote is assumed to be completed by the end of 2015. After completion of the road, it is assumed that traffic from alternative route i.e. Aland-Umarga-Solapur will be diverted to the project road. The quantum of diversion is assumed as 80% in Cars and LCVs. Other categories of vehicles are already using the project road.*
 - ♦ *As mentioned in the previous section Table 4-9, few cement industries are about to set their plant in the forecast years and few industries are about to increase their production in the coming years, so accordingly the development traffic is considered for the revenue forecasting.*

6 Conclusions and Recommendations

Based on the Traffic Assessment study on the project road, the following conclusions were arrived:

- The observed Average Daily Traffic (ADT) on the project corridor is as follows:
 - Km 7.300- 2,643 PCUs (1,438 Vehicles)
 - Km 47.400- 8,612 PCUs (6,141 Vehicles)
 - Km 82.000-8,633 PCUs (5,487 Vehicles)
 - Km 124.500 – 6,322 PCUs (3,783 Vehicles)
- Traffic intensity at the first Toll Plaza is less as the section of the road after Karnataka/Maharashtra road is under construction.
- It is observed that MAV & 3 Axle trucks predominately carrying cement on project stretch.
- There are two alternate roads available for the Toll Plaza at Km.7.300, Km 82.000 and one alternate road for the Toll Plaza 82.000. Considering the impact of all the alternate roads, only Alternate road 1 & 3 has possible chances of traffic diversion (Car, LCV and 2A trucks) from the project road.
- Vasavadatta Cement plant which is located along the project corridor at Sedam is generating/attracting lot of commercial traffic in the region.
- In the growth rate calculation, the growth rate of economic indicators was treated with +10% sensitivity and the pessimistic, optimistic values were arrived.
- Few cement industries are about to set their plant in the forecast years and few industries are about to increase their production in the coming years, so accordingly the development traffic is added for the traffic forecasting.
- Based on the assumptions and calculations, development traffic is added over to the normal traffic from the year 2016 onwards.
- The Daily revenue obtained for the Toll plazas 1 for the year 2035 is Rs. 5,17,030, Toll Plaza 2 is Rs.17,06,720, Toll Plaza 3 is Rs.24,95,457 and Toll Plaza 4 is Rs. 17,86,265.
- The revenue obtained through monthly pass, local traffic and local commercial traffic categories is very minimal as compared to the through traffic and daily return.