



TRAFFIC STUDIES & FORECAST

Consultancy services for preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under Bharatmala Pariyojana (lot-4/Package-4) (Development of Delhi Vadodara Highway NH-148N) in Rajasthan State

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for National Highways Authority of India
Feedback Infra Private Limited



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TRAFFIC STUDIES & FORECAST

1.1 Traffic Surveys and Analysis

1.1.1 Introduction

This section presents the traffic studies and analysis carried out for addressing various objectives and issues pertaining to development of Project Highway. The results of this analysis will form inputs for assessing the traffic diversion to the proposed corridor, generated and development traffic. The forecast of the traffic helps in planning and designing of the pavement, developing capacity augmentation proposals, designing the toll plaza and design of intersections / interchanges along the project road.

Since it is a Greenfield highway, a thorough knowledge of the travel characteristics of the traffic on the existing alternate routes is essential for future diverted traffic estimation on the project road. Hence, detailed traffic surveys are carried out to assess the baseline traffic characteristics on various alternative routes from Delhi to Vadodara.

1.1.2 Project Details

The proposed Project Highway (Rajasthan section of Delhi - Vadodara) starts at Haryana/Rajasthan Border traverses through / about Bedha, Laxmangarh, Bandikui, Dausa, Lalsot, Sawai Madhopur, Kota and ends at Rajasthan / Gujarat Border. On the way, it crosses SH 25A, NH 11, NH 11A, SH 33, NH 76, SH 51, NH 9A.

The Project Highway has been divided into homogeneous sections based on the interchanges provided and for calculating the diverted traffic between 2 points following nomenclature has been used: The homogeneous sections are indicated in **Table 0-1** and shown in **Figure 3.1**.

Table 0-1: Homogeneous Sections

Homogeneous Section	From (Km)	To (Km)	Length (Km)
Section 1	78.800	102.000	23.200
Section 2	102.000	129.017	27.017
Section 3	129.017	181.452	52.435
Section 4	181.452	210.954	29.502
Section 5	210.954	228.740	17.786
Section 6	228.740	291.974	63.234
Section 7	291.974	337.170	45.196
Section 8	337.170	385.796	48.626
Section 9	385.796	398.240	12.444
Section 10	398.240	417.809	19.569
Section 11	417.600	434.825	17.016
Section 12	434.820	452.425	17.600
Total			373.631

1.1.3 Competing alternate routes

As this is a Greenfield alignment, the various existing alternative routes have been identified. These routes are those which carry the potential divertible traffic.

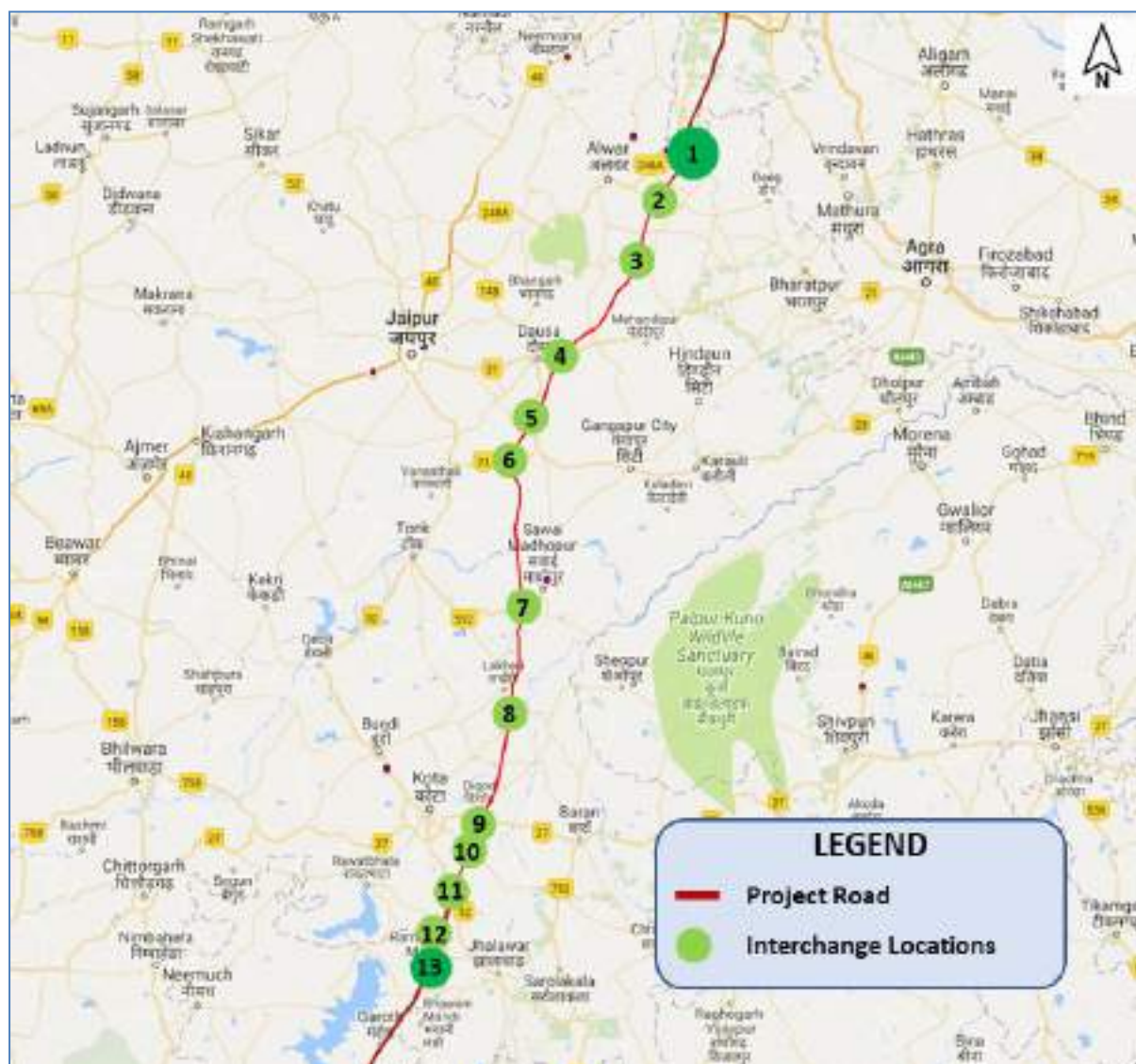


Figure 0-1: Project Road Sections and Interchange Locations

The existing alternative routes are described in the below section.

Alternative route for the Traffic Moving between Point 1 and Point 2:

There are three existing alternative routes for the traffic moving between Points 1-2 other than Project Road. These routes are either via NH-48 & SH-14 or via NH-48 & SH-25, NH-248A as is pictorially shown in Figure 4.8 and explained in detail in subsequent sections.

Alternative Route between Point 1 and 4:

There is an existing alternative route for the traffic moving between Point 1-4 other than Project Road via NH-48 as pictorially shown in Figure 4.9 and explained in detail in subsequent sections.

Alternative route for the Traffic Moving between Point 1 and Point 7:

There are two existing alternative routes for the traffic moving between Points 1-7 other than Project Road. These routes are either via NH-48, NH-52 and NH-552 or via NH-19 & SH-01 which is pictorially shown in Figure 4.10 and explained in detail in subsequent sections.

Alternative route for the Traffic Moving between Point 1 and Point 9:

There are two existing alternative routes for the traffic moving between Points 1-9 other than Project Road. These routes are either via NH-48 & NH-52 or via NH-19, SH-01 and SH-33 which is pictorially shown in Figure 4.11 and explained in detail in subsequent sections.

Alternative route for the Traffic Moving between Points 4 (Dausa) and Vadodara:

There is an existing alternative route for the traffic moving between Point 4 (near Dausa) and Vadodara other than Project Road via NH-48 which is pictorially shown in Figure 4.12 and explained in detail in subsequent sections.

Alternative route for the Traffic Moving between Point 10 (Kota) and Vadodara:

There is an existing alternative route for the traffic moving between Point 10 (near Kota) and Vadodara other than Project Road, via a combination of NH-27 and NH-56 which is pictorially shown in Figure 4.13 and explained in detail in subsequent sections.

Alternative route for the Traffic Moving between Delhi and Mumbai (Through Traffic):

There are two existing alternative routes for the traffic moving between Delhi and Mumbai other than Project Road, via NH-46 (Agra Mumbai Highway) or NH-48 which is pictorially shown in Figure 4.14 and explained in detail in subsequent sections.

Alternative route for the Traffic Moving between Delhi and Vadodara (Through Traffic):

There is an existing alternative route for the traffic moving between Delhi and Vadodara other than Project Road, via NH-48 which is pictorially shown in Figure 4.14 and explained in detail in subsequent sections.

In addition to the above described routes, other smaller divertible traffic components are also there, though their influence is marginal. However, the origin – destination surveys have captured all of them and the diversion analysis is carried out to find diverted traffic from each of them.

1.1.4 Survey Methodology

1.1.5 Primary surveys and considerations

To capture traffic flow characteristics, travel pattern, speed characteristics, users' preference regarding toll imposition on traffic passing through the existing routes from Delhi to Vadodara and other characteristics related to miscellaneous requirements on the project road, following primary traffic surveys were conducted.

- *Classified traffic volume count (CTVC) using ATCC method*
- *Origin – destination survey (OD)*

Traffic survey stations for carrying out CTVC, OD and axle load surveys were selected after a site reconnaissance considering the following parameters.

- The station should represent homogeneous traffic section
- The station should be free from urban and local traffic influence
- The station should be located in a reasonably level terrain with good visibility

The summary of primary surveys conducted on the project corridor is illustrated below in Figure 0-2

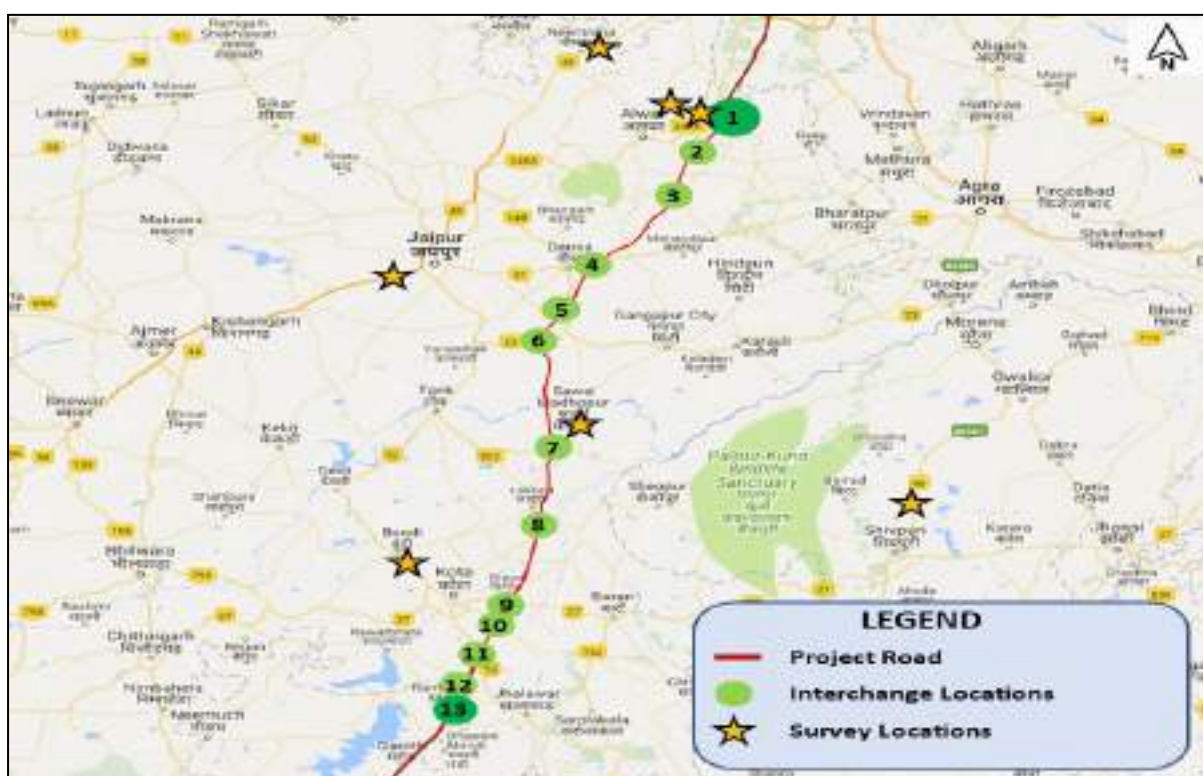


Figure 0-2: Traffic surveys location map

1.1.6 Classified traffic volume count

The classified volume count surveys were carried out at five locations, all of which from where the possibility of diversion of traffic on to the proposed alignment of the project road was observed. These locations are characterized by centres of heavy economic activities, population and are away from the influence of city areas in order to avoid the local traffic. Also, these locations were selected on the basis of possible divertible traffic on Project road so as to capture the entire relevant traffic movement. The surveys were conducted continuously for seven consecutive days for 24 hours on each day through Automatic Traffic Counter and Classifier (ATCC) method. For carrying out the counts, the vehicles were grouped under different categories as indicated in **Table 0-2**.

Automatic Traffic Counter and Classifier (ATCC) is capable of counting vehicles according to their class with help of different non-intrusive technologies such as infrared sensors, Pneumatic tubes etc. Pneumatic Tube Technology was used for the present traffic study.

Table 0-2: Vehicle classification system

Motorised traffic	
2 wheelers: Scooters, bikes, motor cycles and mopeds etc	
3 wheelers including auto rickshaw	
Passenger Car	Car, jeep, taxi & van
Bus	Mini bus
	Govt. bus
	Private bus
Truck	Light commercial vehicles (LCV)
	2 Axle truck
	3 Axle truck
	4 to 6 Axle Truck
	Truck with more than 6 Axle
Other Vehicles	Agriculture Tractor, Tractor & Trailer
Slow moving vehicles	
Bicycle	
Cycle rickshaw	
Animal drawn	
Hand cart	

This traffic data is used for working out traffic characteristics analysis and forecast, capacity augmentation and toll analysis. The schedule of survey is given in **Table 0-3**.

Table 0-3: Schedule of traffic volume count survey

Location	Start Date	End Date	Duration (days)
Bhiwadi – Alwar section (SH-25 near Chikani)	17-04-2018	24-04-2018	7
Firozpur Jhirka – Alwar (NH-248 near Naugaon)	17-04-2018	24-04-2018	7
Gangapur - Sawai Madhopur section (SH-1 near Karmoda)	22-04-2018	29-04-2018	7
Jaipur – Kishangarh section (NH-48 near Tikariya)	15-04-2018	22-04-2018	7
Bundi – Kota section (NH-52 near Ramganj)	23-04-2018	30-04-2018	7
Delhi – Jaipur section (NH-48 near Shahjahanpur)*			-
Gwalior – Shivpuri section (NH-46 near Mudkheda)*			-

**CVC surveys at two locations along NH-48 and NH-46 (Shahjahanpur and Mudkheda) were not carried out as IHMCL data was available. For the purpose of OD analysis, the CVC data from the surveys carried out earlier has been used to determine the volume count according to the vehicular classification used for the present study.*

1.1.7 Origin-Destination survey

The origin-destination surveys were carried out with the primary objective of studying the travel pattern of goods and passenger traffic along the existing routes in the network. The results have also been useful for identifying the influence area of the proposed corridor, estimating the growth rates of traffic and planning tolling strategies. The tonnage analysis will form valuable inputs for pavement design.

The survey was conducted at seven locations for a day (24 hours) as stated in **Table 0-4**. Roadside interview method was adopted for the survey, in accordance with guidelines given

by IRC: SP 19 – 2001. The road users were interviewed by trained enumerators to obtain the required data under the guidance of traffic engineer and supervisors.

For this purpose, cars and buses were considered as passenger vehicles. Similarly, LMVs, LCVs, 2-axle trucks, 3- axle trucks and multi axle trucks were considered as goods vehicles. The information collected contained trip origin and destination. In addition, type of commodity and tonnage for goods vehicles and purpose and occupancy for passenger vehicles were also collected. Further, trip length, trip frequency are also elicited during O-D surveys.

Table 0-4: Schedule of origin – destination survey

Location	Start Date	End Date	Duration (days)
Delhi – Jaipur section (NH-48 near Shahjahanpur)	23-04-2018	24-04-2018	1
Gwalior – Shivpuri section (NH-46 near Mudkheda)	20-04-2018	21-04-2018	1
Bhiwadi – Alwar section (SH-25 near Chikani)	17-04-2018	18-04-2018	1
Firozpur Jhirka – Alwar (NH-248 near Naugaon)	19-04-2018	20-04-2018	1
Gangapur - Sawai Madhopur section (SH-1 near Karmoda)	25-04-2018	26-04-2018	1
Jaipur – Kishangarh section (NH-48 near Tikariya)	17-04-2018	18-04-2018	1
Bundi – Kota section (NH-52 near Ramganj)	27-04-2018	28-04-2018	1

1.1.8 Data Analysis

1.1.9 Traffic volume count

The classified traffic volume count survey data for five locations was analysed in order to obtain the following traffic characteristics:

- Average hourly variation of traffic volume
- Daily variation of traffic volume
- Average Composition of traffic
- Directional distribution of traffic
- Average Daily Traffic (ADT) volume

Daily and hourly variation of classified traffic flow is recorded by conducting traffic count at strategically selected traffic count stations. Recorded traffic data is converted into Passenger Car Unit using PCU factors as shown in **Table 0-5**. These equivalency factors are extracted from IRC: 64 – 1990, Guidelines for Capacity of Roads in Rural Areas.

Table 0-5: Passenger car equivalency factors

Sl. No	Vehicle Type	PCU Factors
1	Two Wheeler	0.5
2	Auto–rickshaw	1
3	Car / Jeep / Van	1
4	Mini Bus	1.5
5	Standard Bus	3
6	Light Commercial Vehicle (LCV), Agricultural Tractor	1.5
7	Two Axle Truck	3
8	Three Axle Truck	3
9	Truck Trailer/Multi Axle Vehicle	4.5

Sl. No	Vehicle Type	PCU Factors
10	Agriculture Tractor-trailer	4.5
11	Animal Drawn	8
12	Cycle	0.5
13	Hand Cart	3
14	Cycle Rickshaw	2

1.1.10 Average daily traffic (ADT)

Traffic volume count data for 7 days at five count locations were averaged to determine Average Daily Traffic (ADT). Traffic volume count summary sheets for survey locations along with ADT tables are presented in **Annexure 4.1a to 4.1e** to this report. The survey location ADT by vehicle type is presented in **Table 0-6**.

Table 0-6: Average Daily Traffic at survey locations

Vehicle Type	Delhi – Jaipur section (NH-48)	Gwalior – Shivpuri section (NH-46)	Bhiwadi – Alwar section (SH-25)	Firozpur Jhirka – Alwar (NH-248A)	Gangapur - Sawai Madhopur section (SH-01)	Jaipur – Kishangarh section (NH-48)	Bundi – Kota section (NH-52)
Tollable Traffic (nos)							
Car / Jeep / Van (Private)	17348	1570	4262	1541	2642	10117	5577
Car / Jeep (Taxi)			552	182	572	1892	1047
Shared Jeep			42	54	92	20	27
Mini Bus	0	0	83	32	136	162	47
School. Bus			35	2	5	83	3
Govt. Bus			315	104	87	455	338
Pvt. Bus			65	11	135	711	231
Maxx/Pick-Up	1532	258	1043	466	515	1219	976
LCV (4 tyre)	0	0	88	35	45	107	61
LCV (6 tyre)			454	248	164	1515	497
2 Axle	2904	926	286	150	208	1646	633
3 Axle	4384	1364	246	399	255	2922	1043
MAV (4 to 6 Axles)	9923	958	450	476	245	9245	1295
MAV (> 6 Axles)	4	0	0	0	0	2	1
Others	7	0	6	4	5	6	8
Total vehicles	39882	5698	7927	3704	5106	30102	11784
Total PCUs	91117	13942	11730	6874	7534	75014	21147
Non – Tollable Traffic (nos)							
3 Wheeler	222	14	81	141	34	324	145
2 Wheeler	5221	643	5792	5484	8764	10148	11372
Agriculture Tractor	25	14	39	58	20	17	21
Agriculture Tractor with Trailer	554	62	415	355	208	142	463
Cycle	9	18	17	53	44	21	19

Vehicle Type	Delhi – Jaipur section (NH-48)	Gwalior – Shivpuri section (NH-46)	Bhiwadi – Alwar section (SH-25)	Firozpur Jhirka – Alwar (NH-248A)	Gangapur - Sawai Madhopur section (SH-01)	Jaipur – Kishangarh section (NH-48)	Bundi – Kota section (NH-52)
Cycle Rickshaw	1	0	4	16	3	10	1
Animal Drawn Cart	0	0	2	14	13	2	2
Toll Exempted Car	0	0	3	3	4	6	2
Toll Exempted Bus	0	0	7	1	12	12	0
Toll Exempted LCV	0	0	2	0	1	6	7
Toll Exempted Truck	0	0	2	0	0	14	1
Total Non-Tollable (Nos.)	6032	751	6364	6125	9103	10702	12033
Total Non-Tollable (PCUs)	5370	645	4965	4716	5530	6198	7985
Grand Total (Nos.)	45914	6449	14291	9829	14209	40804	23817
Grand Total (PCUs)	96487	14587	16695	11590	13064	81212	29132

Maximum traffic has been observed at Delhi – Jaipur section of NH 48 near Shahjahanpur Toll Plaza, followed by Jaipur - Kishangarh section of NH-48.

0.1.1 Annual average daily traffic (AADT)

Seasonal variation factors by vehicle types are required to account for variations in the pattern of traffic volume on the project road sections over different seasons of the year. These factors are worked out based on the month wise fuel sales data collected along the roads where the survey was carried out. The seasonal correction factors adopted for petrol and diesel driven vehicles are presented in **Table 0-7**.

Table 0-7: Seasonal Correctional Factors

Month	SCF	
	Petrol	Diesel
April	1.01	0.98
May	0.94	0.96
June	1.02	0.99
July	1.03	1.07
August	0.96	1.04
September	1.01	0.96
October	0.99	0.92
November	0.99	0.92
December	1.05	1.01
January	1.07	1.09
February	0.99	1.1
March	0.95	1.02
Average	1	1.01

The traffic volume survey along the project road is carried out in the month of April 2018 and seasonal factor for this month is considered for converting ADT to AADT. Vehicle class wise AADT at survey locations along the project road is shown in **Table 3-8**.

Table 0-8 The AADT value of base year (FY-19) is used for the traffic volume projection up to horizon year and projected traffic volume is used in design of pavement and for projecting the tollable traffic. Summary of ADT & AADT are shown in **Figure 3.3**.

Table 0-8: Annual Average Daily Traffic at survey locations

Vehicle Type	Delhi – Jaipur section (NH-48)	Gwalior – Shivpuri section (NH-46)	Bhiwadi – Alwar section (SH-25)	Firozpur Jhirka – Alwar (NH-248A)	Bangapur – Sawai Madhopur section (SH-01)	Jaipur – Kishangarh section (NH-48)	Bundi – Kota section (NH-52)
Tollable Traffic (nos)							
Car / Jeep / Van (Private)	17348	1570	4262	1541	2642	10117	5577
Car / Jeep (Taxi)			552	182	572	1892	1047
Shared Jeep			42	54	92	20	27
Mini Bus	0	0	83	32	136	162	47
School. Bus	0	0	35	2	5	83	3
Govt. Bus	0	0	315	104	87	455	338
Pvt. Bus	0	0	65	11	135	711	231
Maxx/Pick-Up	1501	253	1043	466	515	1219	976
LCV (4 tyre)	3704	610	86	34	44	105	60
LCV (6 tyre)			445	243	161	1485	487
2 Axle	2846	907	280	147	204	1613	620
3 Axle	4296	1337	241	391	250	2864	1022
MAV (4 to 6 Axles)	9725	939	441	466	240	9060	1269
MAV (> 6 Axles)	4	0	0	0	0	2	1
Others	7	0	6	4	5	6	8
Total vehicles	39431	5616	7896	3677	5088	29794	11713
Total PCUs	89643	13696	11640	6787	7478	73860	20911
Non – Tollable Traffic (nos)							
3 Wheeler	222	14	81	141	34	324	145
2 Wheeler	5221	643	5792	5484	8764	10148	11372
Agriculture Tractor	25	14	39	58	20	17	21
Agriculture Tractor with Trailer	543	61	415	355	208	142	463
Cycle	9	18	17	53	44	21	19
Cycle Rickshaw	1	0	4	16	3	10	1
Animal Drawn Cart	0	0	2	14	13	2	2
Toll Exempted Car	0	0	3	3	4	6	2
Toll Exempted Bus	0	0	7	1	12	12	0
Toll Exempted LCV	0	0	2	0	1	6	7
Toll Exempted Truck	0	0	2	0	0	14	1
Total Non-Tollable (Nos.)	6021	750	6364	6125	9103	10702	12033
Total Non-Tollable (PCUs)	5320	640	4965	4716	5530	6198	7985
Grand Total (Nos.)	45452	6366	14260	9802	14191	40496	23746
Grand Total (PCUs)	94963	14336	16604	11503	13008	80058	28896

Table 0-9: Summary of ADT and AADT at survey locations

Sl. No.	Location	ADT		AADT	
		Nos.	PCUs	Nos.	PCUs
1	Delhi - Jaipur section (NH-48)	45914	96487	45452	94963
2	Gwalior - Shivpuri section (NH-46)	6449	14587	6366	14336
3	Bhiwadi - Alwar section (SH-25)	14291	16695	14260	16604
4	Firozpur Jhirka - Alwar (NH-248A)	9829	11590	9802	11503
5	Gangapur - Sawai Madhopur section (SH-01)	14209	13064	14191	13008
6	Jaipur - Kishangarh section (NH-48)	40804	81212	40496	80058
7	Bundi - Kota section (NH-52)	23817	29132	23746	28896

1.1.11 Composition of traffic

The composition of tollable and total traffic at count locations is presented in Table 0-10 and **Figure 3-3**. The share of cars/jeeps varies between 18% and 34% while 3-wheelers vary from 0% to 1%, whereas trucks composition varies from 10% to 41% of traffic. The buses constitute 2% to 4% of total traffic.

Table 0-10: Total Traffic Composition at Survey Locations

Location	Passenger Vehicles				Goods Vehicles		Slow Moving Vehicle
	Car	2 W	3 W	Buses	Truck	Tractor	
Bhiwadi – Alwar section (SH-25)	34%	41%	1%	4%	18%	3%	0%
Firozpur Jhirka – Alwar (NH-248A)	18%	56%	1%	2%	18%	4%	1%
Gangapur - Sawai Madhopur section (SH-01)	23%	62%	0%	3%	10%	2%	0%
Jaipur – Kishangarh section (NH-48)	29%	25%	1%	3%	41%	0%	0%
Bundi – Kota section (NH-52)	28%	48%	1%	3%	19%	2%	0%

Table 0-11: Tollable Traffic Composition at Survey Locations

Location	Passenger Vehicles			Goods Vehicles				
	Cars	Taxi	Buses	Goods Vehicles	LCV	2 Axle	3 Axle	4-6 Axle
Bhiwadi – Alwar section (SH-25)	54%	7%	6%	13%	7%	4%	3%	6%
Firozpur Jhirka – Alwar (NH-248A)	43%	5%	4%	13%	8%	4%	11%	13%
Gangapur - Sawai Madhopur section (SH-01)	54%	11%	7%	10%	4%	4%	5%	5%
Jaipur – Kishangarh section (NH-48)	34%	6%	5%	4%	5%	5%	10%	31%
Bundi – Kota section (NH-52)	48%	9%	5%	8%	5%	5%	9%	11%

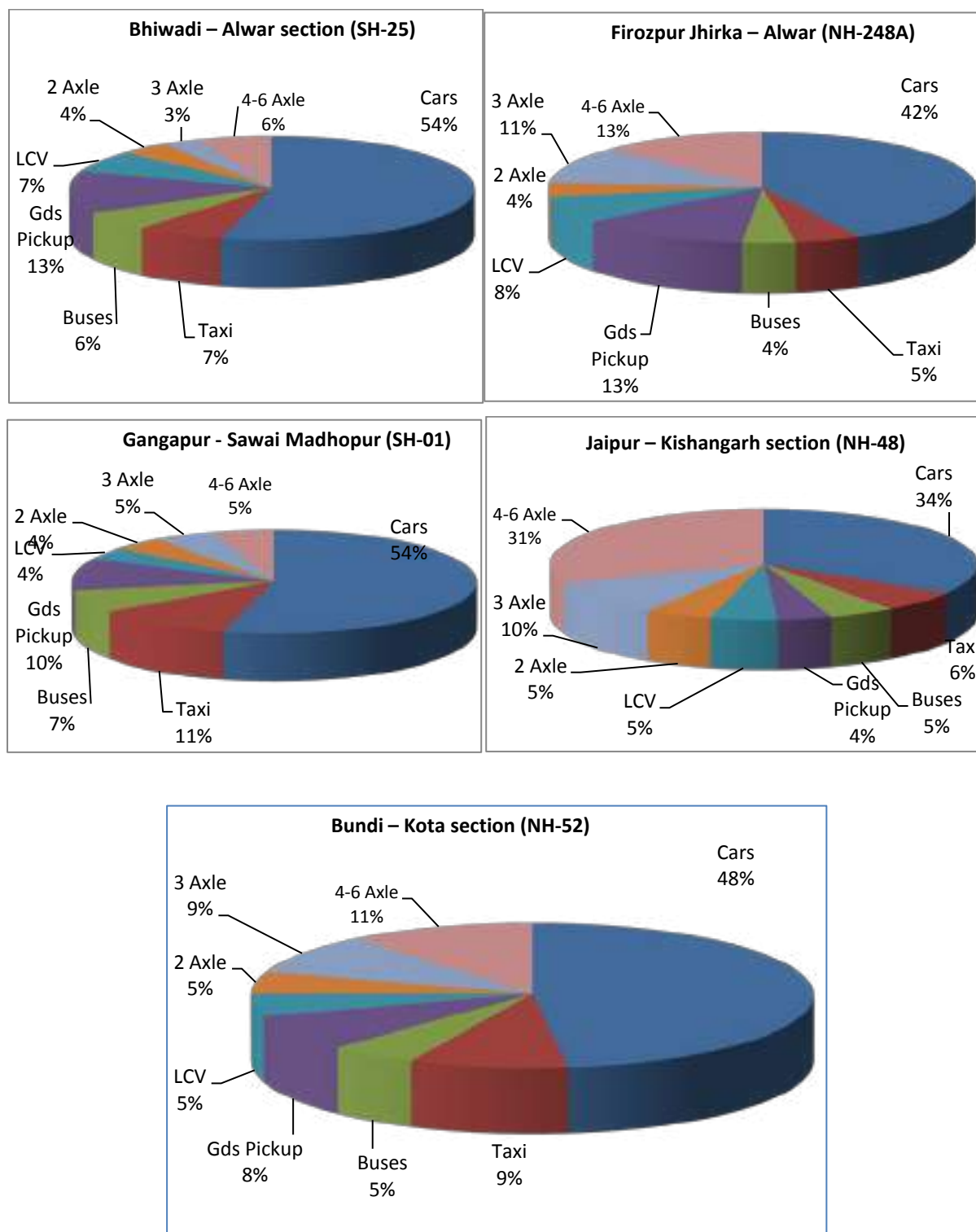


Figure 0-3: Tollable Traffic Composition

1.1.12 Hourly variation of traffic

Average hourly variation of traffic at survey locations is shown in **Figure 0-4**. At all locations the morning peak is observed between 8.00AM to 10.00PM and evening peak hour between 5.00PM to 7.00PM.

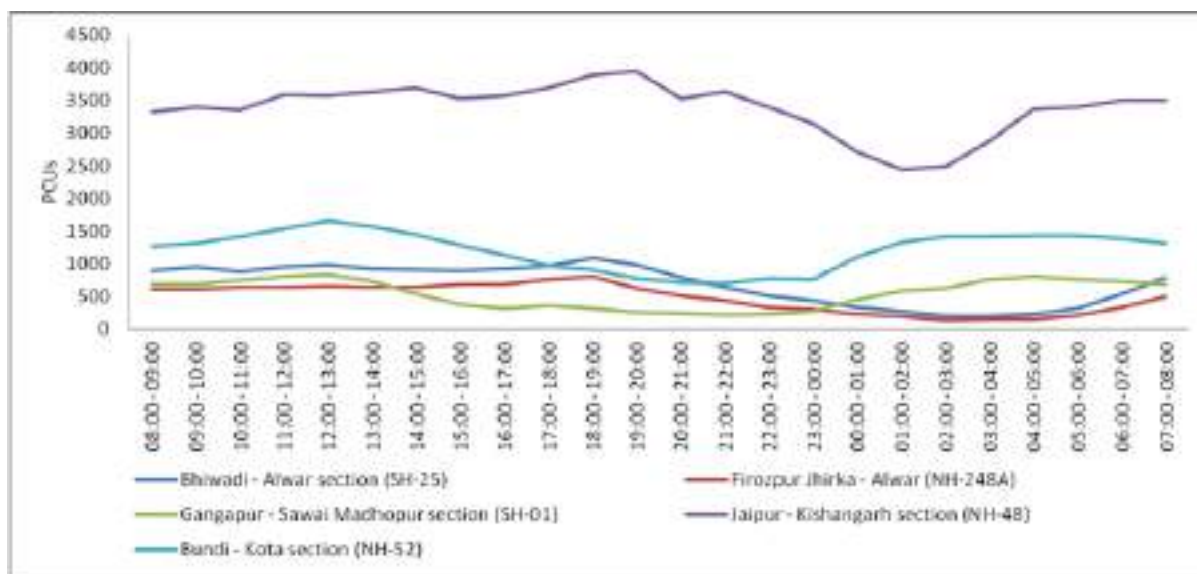


Figure 0-4: Hourly traffic variation at survey locations

0.1.2 Daily variation of traffic volume

Daily variation of tollable traffic for survey locations is shown in **Figure 0-5**. The variation of daily tollable traffic PCU is presented in

Table 0-12 along with maximum and minimum variations from average volume in percentages.

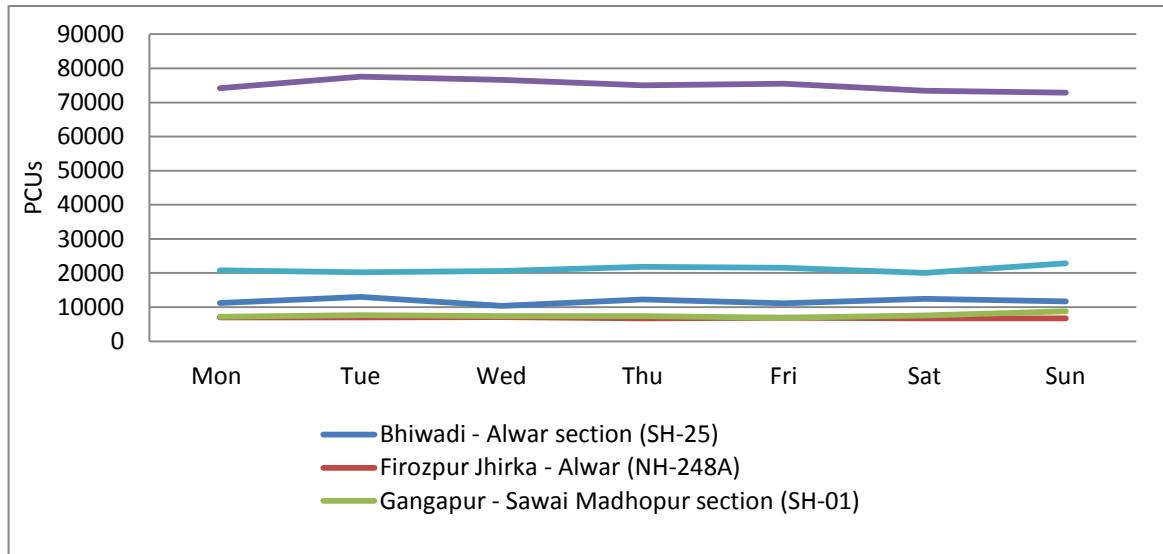


Figure 0-5: Daily variation of tollable traffic at survey locations

Table 0-12: Daily Variation of Tollable Traffic Volume (PCUs)

Location	Mon	Tue	Wed	Thu	Fri	Sat	Sun	ADT	Maximum variation	
									Ve (%)	- Ve (%)
Bhiwadi - Alwar section (SH-25)	11232	13031	10383	12206	11111	12421	11719	11730	11.1	-11.5
Firozpur Jhirka - Alwar (NH-248A)	6963	6989	7065	6697	6941	6732	6748	6874	2.8	-2.6
Gangapur - Sawai Madhopur section (SH-01)	7159	7611	7388	7410	6872	7518	8791	7534	16.7	-8.8
Jaipur - Kishangarh section (NH-48)	74186	77537	76585	75059	75457	73426	72839	75014	3.4	-2.9
Bundi - Kota section (NH-52)	20812	20262	20640	21806	21568	20060	22841	21147	8.0	-5.1

Day wise variations are observed at survey locations. It is observed that variations in traffic across the week is varying from location to location and is attributed to local factors along with other reasons like market days, weekly holidays etc.

1.1.13 Directional distribution of traffic

Directional split at survey locations is shown in **Table 0-13**. This is a useful input for capacity analysis and pavement design. As seen, the directional split for up and down traffic is almost equal along the survey locations.

Table 0-13: Directional split

Location	UP Direction (%)	Down Directionf (%)
Bhiwadi – Alwar section (SH-25)	50.1	49.9
Firozpur Jhirka – Alwar (NH-248A)	48.1	51.9
Gangapur - Sawai Madhopur section (SH-01)	50.5	49.5
Jaipur – Kishangarh section (NH-48)	48.6	51.4
Bundi – Kota section (NH-52)	49.1	50.9

1.1.14 Origin – Destination Survey

The origin –destination survey locations was carried out at the locations provided in previous section.

The analysis of daily flow of classified volume counts has been the basis for fixing the sample size of vehicles by type and direction.

The expansion factors have been worked out based on the average daily volumes to the sample size at each location separately. Percentage of OD sample size at each location is shown in table 3.14.

Table 0-14

Table 0-14: Sample Size for O – D Survey (%)

Sl. No.	Vehicle type	NH-48 near Shahjahanpur	NH-46 near Mudkheda	SH-25 near Chikani	NH-248 near Naugaon	SH-1 near Karmoda	NH-48 near Tikariya	NH-52 near Ramganj
1	Car	10.3	30.2	30.5	27.4	29.1	22	29.8
2	Taxi / Jeep	10.6	29.5	30	69.4	33.7	28.8	43.3
3	Mini Bus	46.7	56.7	59.8	78.1	82.4	22.8	70.2
4	Govt Bus	34.5	62.5	46.3	67.6	35.6	56.5	49.4
5	Pvt Bus	51.1	43.7	47.5	61.5	33.6	50.1	74.4
6	Mini LCV	34.1	16.9	35.6	30.3	32.2	29.1	15.4
7	LCV	52.6	24.1	85.8	33.7	61.8	36.7	49.6
8	2A	57.4	48.4	89.3	51.7	58.3	35.8	68.4
9	3A	27.7	33	96.3	57.5	52.8	29.1	62.5
10	4-6 A	41.3	37	60.5	54.6	29.2	25.6	72.6

The collected data were entered into the computer and checked manually. Incorrect entries were corrected by cross-checking it with original field data sheets. The data was also checked for inconsistencies. The checking included:

- Trips from zones to zones which cannot possibly ply through the survey location
- Vehicle type with their corresponding lead / load / occupancy for any inconsistencies

The checked and corrected data were used for final analysis.

Zoning system

For analysis of O-D data collected from the field, it is required to code the origin and destination of trip. The zoning was done at four levels. In first level, all-important towns located along the proposed project stretch were assigned a zone code. Secondly, immediate influence areas of project road were considered and nearby areas/towns were defined as zones. In the next level, all nearby districts were grouped in zones. Finally, states beyond the influence area were aggregated broadly in terms of direction of project road. In all, total 99 traffic zones were considered for the project road. The list of traffic zones is presented in **table 3-15**.

Table 0-15: Adopted zoning system for the study

Zone No.	Zone Name	District	State
1	Naugaon	Project Road	Rajasthan
2	Ramgarh, Milkpur, Barodameo		
3	Laxmangarh		
4	Mehandipur, Bamanpura, Mandawar		
5	Dausa , Mitrapura		
6	Nangal Rajawatan		
7	Lalsot		
8	Sawai Madhopur		

Zone No.	Zone Name	District	State
9	Lakheri, Indargarh		
10	Kota , Digod		
11	Mandana, Dara		
12	Ramganj Mandi (Kota District)		
13	Alwar	Alwar District	
14	Bhiwadi		
15	Tijara		
16	Behror, Neemrana		
17	Kishangarh(Alwar District)		
18	Rajgarh		
19	Rest of Alwar District		
20	Mahwa	Dausa District	
21	Rest of Dausa		
22	Bharatpur	Bharatpur District	
23	Nagar, Deeg		
24	Rest of Bharatpur District		
25	Dhaulpur/Dholpur	Dhaulpur District	
26	Bari		
27	Rest of Dhaulpur District		
28	Karauli	Karauli District	
29	Hindaun		
30	Rest of Karauli		
31	Gangapur City	Sawai Madhopur District	
32	Rest of Sawai Madhopur		
33	Baran	Baran District	
34	Chhabra		
35	Shahbad		
36	Rest of Baran District		
37	Jhalawar	Jhalawar District	
38	Aklera		
39	Rest of Jhalawar District		
40	Bundi City	Bundi District	
41	Rest of Bundi		
42	Sangod	Kota District	
43	Rest of Kota		
44	Tonk City	Tonk District	
45	Unniara		
46	Rest of Tonk		

Zone No.	Zone Name	District	State	
47	Jaipur District	Jaipur District		
48	Ajmer District	Ajmer District		
49	Bhilwara District	Bhilwara District		
50	Chittorgarh, Rajsamand, Udaipur, Dungarpur, Banswara, Pratapgarh	Southern Rajasthan		
51	Jaisalmer, Barmer, Jalor, Sirohi, Pali, Jodhpur	Western Rajasthan		
52	Nagaur, Sikar, Jhunjhunun	Central Rajasthan		
53	Bikaner, Ganganagar, Hanumangarh, Churu	Northern Rajasthan		
54	Gurugram District	Gurugram District		Haryana State
55	Badshapur, Bhundsi, Alipur, Sohna			
56	Manesar, IMT			
57	Bilaspur, Kakrola, Bahora, Pataudi	Other district of Haryana		
58	Rewari District			
59	Mewat District, Nuh, Firozpur Zhirka			
60	Palwal District, Hodal			
61	Faridabad District			
62	Mahendragarh District, Narnaul			
63	Rest of Haryana			
64	New Delhi	Delhi	Uttar Pradesh	
65	Dwarka ,Janakpuri, UttamNatar (South West)			
66	Rajouri Garden (West Delhi), Khanjhwala (North West), Narela (North Delhi)			
67	Seelampur (North East), Daryaganj (Central delhi), Shahdara, Preet Vihar, Anand Vihar (East Delhi)			
68	Defence Colony (South East), Saket (South Delhi)			
69	Noida, Ghaziabad			
70	Meerut, Hapur, Bulandshahr, Bhagpat			
71	Muzaffarnagar, Saharanpur, Shamli, Bijnor, Amroha, Moradabad, Rampur, Sambhal			
72	Lucknow, Bareilly, Aligarh and Kanpur Divisions, Jalaun District (Central UP)			
73	Agra, Firozabad, Mainpuri, Mathura			
74	Jhansi, Latipur			
75	Rest of Uttar Pradesh (Eastern UP)			

Zone No.	Zone Name	District	State
76	Gwalior, Morena, Bhind, Datia	Madhya Pradesh	
77	Sheopur		
78	Shivpuri		
79	Guna, Ashok Nagar		
80	Neemuch, Mandsaur		
81	Ratlam, Ujjain		
82	Indore		
83	Bhopal		
84	Rest of Madhya Pradesh		
85	Aravalli, Mahisagar, Sabarkantha, Banaskantha, Mehsana, Patan	Gujarat	
86	Dahod, Panchmahal, Chhota Udaipur		
87	Baroda/Vadodara		
88	Gandhinagar, Ahmedabad		
89	Kutch		
90	Surendranagar, Morbi, Rajkot, Botad		
91	Jamnagar, Dhevbhoomi Dwarka, Porbandar, Junagadh, GirSomanath, Amreli, Bhavnagar		
92	Kheda Anand		
93	Bharuch, Narmada, Surat, Tapi, Dangs, Valsad, Navsari		
94	Mumbai	Maharashtra	
95	Rest of Maharashtra		
96	Jammu & Kashmir, Himachal Pradesh, Punjab, Uttarakhand	Rest of India	
97	Goa, Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Telangana		
98	Bihar, Jharkhand, Orissa, Chhattisgarh, West Bengal		
99	Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Assam, Meghalaya		

Expansion factors and development of O – D matrices

The origin – destination details were collected from the trip makers during the survey on sample basis. Sampling varied with the changes in traffic flow across the day. Care has been taken to eliminate any element of bias in sampling. Since data was collected on sample basis, expansion factors are required to replicate the pattern as reflected in the sample to the total number of vehicular trips made during the day. These expansion factors are calculated separately for each class of vehicle. For example, if x_c is number of cars interviewed and X_c is the total number of cars counted during the day, then X_c/x_c would be the expansion factor for the matrix of cars.

O – D matrices are developed to assess the traffic movement pattern. These matrices actually speak about distribution of trips for each zone as intra zonal and inter zonal movements. The vehicle wise O – D matrices are developed by multiplying the sample O – D matrix obtained from survey data with expansion factors. Accordingly, 8 matrices, for different modes were developed for each survey location. O – D matrices for different vehicle types for all seven survey locations are presented in **Annexure 4.2a to 4.2g** to this report.

Travel Pattern

The share of trips from major areas within the project road is presented in **Table 0-16**.

Table 0-16: Distribution of Trip in the Project Influence Area

State/ Vehicle Type	Car	Mini Bus	Bus	Mini LCV	LCV	2-Axle Trucks	3- Axle Trucks	MAV (4 to 6 Axle)
Rajasthan	73%	82%	71%	71%	47%	43%	37%	43%
Haryana	8%	6%	3%	9%	15%	12%	13%	15%
Delhi	10%	4%	12%	9%	14%	15%	17%	15%
Gujarat	1%	0%	2%	1%	4%	6%	7%	8%
Maharashtra	1%	2%	0%	1%	5%	6%	7%	5%
Rest of India	6%	7%	11%	9%	16%	19%	18%	14%
Total	100%	100%	100%	100%	100%	100%	100%	100%

From the above tables, it is observed that most of the trips originating or destined are from Rajasthan followed by Haryana and Delhi.

Lead Distribution

The O-D survey data has been analyzed to obtain lead ranges for various categories of vehicles. Different categories of freight vehicles viz. LCV, 2/3 axle trucks and multi axle trucks are distributed on the basis of spectrum developed using various load and lead ranges. The lead distribution in terms of percentage is also presented in **Table 0-17** and **Table 3.18**.

Table 0-17: Lead Distribution of Passenger Vehicle

Vehicle type	Trip Length Range (km)							Total
	0-20	20-50	50-100	100-200	200-500	500-1000	>1000	
Delhi – Jaipur section (NH-48)								
Car	0	0.5	20.5	16.2	51.1	9.1	2.6	100
Mini Bus	0	0	28.3	11.7	50	10	0	100
Std. Bus	0	0	8	7.9	66.8	12.4	4.9	100
Gwalior – Shivpuri section (NH-46)								
Car	16.5	0.2	0	66.1	8.4	7.4	1.5	100
Mini Bus	34.5	0	0	37.9	24.1	3.4	0	100
Std. Bus	32.9	0	0	45.5	11.3	8.2	2.2	100
Bhiwadi – Alwar section (SH-25)								
Car	0	20.2	42.7	22.3	11.7	2.7	0.4	100
Mini Bus	0	62.2	32.9	2.4	2.4	0	0	100

Vehicle type	Trip Length Range (km)							Total
	0-20	20-50	50-100	100-200	200-500	500-1000	>1000	
Std. Bus	0.5	7.5	50.1	23.6	16.4	1.4	0.5	100
Firozpur Jhirka – Alwar (NH-248A)								
Car	0.3	13.6	48.9	23.5	11.2	2.3	0.3	100
Mini Bus	0	37.5	50	3.1	9.4	0	0	100
Std. Bus	0	11.1	32.5	27.4	27.4	1.7	0	100
Gangapur - Sawai Madhopur section (SH-01)								
Car	0.4	17.9	57.6	5.7	16.2	2.1	0.2	100
Mini Bus	0	11.1	79.3	3.7	5.9	0	0	100
Std. Bus	0	9.2	61.6	12.2	14	3.1	0	100
Jaipur – Kishangarh section (NH-48)								
Car	0	0	2.4	60.6	14.9	14.7	7.4	100
Mini Bus	0	0	0	71.6	4.3	9.9	14.2	100
Std. Bus	0	0	1	44.2	17.7	34	3	100
Bundi – Kota section (NH-52)								
Car	3	30.4	4.6	22.5	31.9	6.4	1.3	100
Mini Bus	0	31.9	8.5	23.4	29.8	6.4	0	100
Std. Bus	0.5	17	1.6	25.9	38.3	14.7	2.1	100

Table 0-18: Lead Distribution of Passenger Vehicle

Vehicle type	Trip Length Range (km)						Total
	0-20	20-100	100-200	200-500	500-1000	>1000	
Delhi – Jaipur section (NH-48)							
Mini LCV	0	22.9	26.9	26.8	18	5.5	100
LCV	0	14.4	14.9	30.2	26.1	14.4	100
2A	0	7.7	12.9	29.7	26.6	23.1	100
3A	0.5	7.3	17.1	27.5	24.4	23.2	100
MAV	0.5	6.4	22.7	29.9	23.5	17	100
Gwalior – Shivpuri section (NH-46)							
Mini LCV	38.8	0	48.8	5	2.5	5	100
LCV	4.3	0	8.6	17.1	34.1	35.9	100
2A	6.4	0	11.7	15.5	30	36.4	100
3A	3.3	0	10.5	11.1	37.5	37.5	100
MAV	3.7	0.9	8.2	10.4	37.1	39.7	100
Bhiwadi – Alwar section (SH-25)							
Mini LCV	27.1	27.9	19.7	21.5	3.8	0	100
LCV	16.8	25.5	26.4	21.3	8.1	1.9	100
2A	6.8	41.3	23.5	18.9	6.8	2.8	100
3A	7	30.2	26.4	17.4	12.8	6.2	100
MAV	7.9	33.8	23.1	14.7	10.9	9.5	100
Firozpur Jhirka – Alwar (NH-248A)							
Mini LCV	22.1	38.8	26.3	10.7	1.5	0.6	100

Vehicle type	Trip Length Range (km)						Total
	0-20	20-100	100-200	200-500	500-1000	>1000	
LCV	6.1	45.9	19.4	14.7	10.4	3.6	100
2A	1.4	10.3	45.2	18.5	13	11.6	100
3A	2.8	27.4	31.5	14.1	12.3	11.8	100
MAV	1.5	25.1	38	21.7	6.2	7.5	100
Gangapur - Sawai Madhopur section (SH-01)							
Mini LCV	29	46.9	6.8	9.1	4.7	3.5	100
LCV	9.8	37.7	6.9	20.6	18.1	6.9	100
2A	6.9	30.9	10.8	14.2	18.1	19.1	100
3A	4.4	19	4.4	31.9	18.1	22.2	100
MAV	2.9	12.9	8.8	27.1	28.3	20	100
Jaipur – Kishangarh section (NH-48)							
Mini LCV	0.5	0.6	51.7	16	23.3	8	100
LCV	0	0.3	31.1	14.3	32.1	22.2	100
2A	0.2	0.3	19.8	16.9	36.2	26.7	100
3A	0.1	0.7	13.6	16.8	32.6	36.1	100
MAV	0.1	0.4	15.3	22.5	34.5	27.1	100
Bundi – Kota section (NH-52)							
Mini LCV	63.3	4	18	12	2	0.6	100
LCV	8.2	2.9	12.5	44.7	16.8	14.8	100
2A	23.4	5.2	18.1	31	10.5	11.8	100
3A	22.9	3.1	15.6	27.6	14.7	16.1	100
MAV	13.1	2.8	15.3	33.5	16.3	19	100

The major trip attraction and generation centres are Delhi, Alwar, Jaipur, Kota, Ahmadabad and Mumbai.

Commodity Group and Analysis

The different commodities recorded during the O – D survey have been classified in to 17 categories as presented in **Table 0-19**.

Due consideration has been given to include all possible commodities and to categorize them into homogeneous groups.

Table 0-19: Classification of commodities

Code	Commodity type
1	Food grains and other agricultural products (Rice, wheat, pulses, maize, chilly, coconut, sugarcane, sugar, cotton, coffee, tea, eggs etc.)
2	Fruits, vegetables – perishables
3	Wood and Forest Products
4	Petroleum, oil, Gas and lubricants product
5	Minerals, chemicals, fertilizer
6	Iron, Metal and steel

Code	Commodity type
7	Finished and manufactured products (Vehicles, Products of machinery, rubber, electric & electronics, textile, automobile, glass, plastic etc.)
8	Parcel Service & Containers
9	Medicines
10	Building materials (Brick, Tiles, Mud and Blocks)
11	Mining (Sand, Bajri and Coarse Aggregate)
12	Cement
13	Marble stone
14	Textiles &Fibre
15	Coal
16	Miscellaneous goods (Livestock, Waste, paper etc)
17	Empty vehicles

The commodity movement pattern along the network under study is analysed and presented in **Table 0-20**.

Table 0-20: Distribution of goods carried by commercial vehicles

Vehicle type	Commodities in %																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Delhi – Jaipur section (NH-48)																	
LMV	4.8	27.1	1.2	0.8	0.3	2.4	9.9	7.1	0.3	1.9	0.5	0.5	0.8	2.2	0.4	2.7	37.1
LCV	5.5	6.3	1.1	2.8	0.8	2.9	15.9	17.7	0.5	2.7	0.5	0.7	2.6	2.5	0.7	10.5	26.4
2A Truck	6.6	4.8	1.9	3.7	0.8	4.7	17.2	13.9	0.3	2	0.6	0.8	4.1	1.7	0.2	8.8	27.5
3A Truck	6.9	4	0.7	3.3	0.9	7.6	10.2	9.3	0.5	1.8	1	1.7	4.7	2.4	0.7	17.1	27.3
MAV	4.6	2.7	1.4	4.4	0.9	8.5	13	5	0.2	4.3	0.5	4.3	5.9	2.1	2.8	9.6	29.8
Gwalior – Shivpuri section (NH-46)																	
LMV	9.9	16.9	0	16.9	0	2.5	9.9	7.4	0	0	0	7.4	0	0	0	9.5	19.4
LCV	5	14.6	1.4	2.1	0	3.6	26.5	8.7	2.8	2.1	1.4	0.7	0	1.4	0	16.3	13.5
2A Truck	9.9	10.4	2.1	7.4	0.5	3.9	28.6	7.9	0	1	0	0.8	0	3	0	11.2	13.3
3A Truck	11.8	25.4	2.4	5.5	0.7	2.1	9.6	8.1	1.6	1.2	0.5	0	0.2	1.7	0.2	14.4	14.5
MAV	12.2	23.3	0.9	8.8	0	3.4	13.8	6.4	0.6	0.9	0.9	0.9	0.7	2.7	0	7.1	17.6
Bhiwadi – Alwar section (SH-25)																	
LMV	7.1	30.5	1.6	2.1	0	0.7	5	1	0.5	2.4	0.2	0.2	0.8	0.2	0	6.9	40.9
LCV	6.3	30.7	1.7	3.4	0.4	0.8	8.1	1.3	0	5.3	0.6	0	0.9	0.6	0.2	15	24.8
2A Truck	7.9	10.4	2.9	6.8	1.1	2.9	8.2	2.9	0.4	12.9	1.1	0.4	2.2	1.1	0	7.9	31.2
3A Truck	8.3	12	1.2	7.4	1.2	4.1	12.4	3.3	0	6.6	0.8	2.1	5.4	0.4	0	9.9	24.8
MAV	9.8	6.8	1.4	4.3	2.5	2	6.6	2.3	0.2	17.2	2	2	6.1	1.4	0	3.2	32.2
Firozpur Jhirka – Alwar (NH-248A)																	
LMV	9.2	21.7	1.5	0.6	0	1.5	2.1	1.5	0	1.5	0	0	0.6	1.5	0	11.6	46.6
LCV	9.3	9.6	2.1	2.9	0	5.7	11.1	0.7	0	3.9	0	0	0	0.7	0	6.8	47.1
2A Truck	6.8	5.4	2.7	1.4	0	6.8	16.9	1.4	0	16.2	0	0	2.7	0	0	7.4	32.4
3A Truck	4.6	6.2	0.8	0.5	0.8	11	11.8	5.4	0.3	7.2	1	0.5	6.7	0.3	0	8.5	34.6
MAV	10.3	1.5	0	0	0.9	6.4	6.9	0	0	11.6	1.3	1.5	8.2	0	0.2	2.8	48.5
Gangapur - Sawai Madhopur section (SH-01)																	
LMV	4.8	11.4	0.8	2.3	0	1.5	13	6	0	3.3	1.4	0	2.3	0.6	0.6	10.4	41.6
LCV	15.8	17.2	0.5	4.4	1	2.5	5.9	7.4	0	3	2	2.5	0.5	0	0.5	12.3	24.6
2A Truck	13.2	14.1	2.4	5.9	0	0	15.6	3.4	0	4.9	5.4	1.5	1	0	1.5	14.6	16.6

Vehicle type	Commodities in %																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
3A Truck	11.5	19.8	1.6	4.4	0	2.4	9.1	6	0	2.4	3.2	1.6	1.6	0	2.4	16.3	17.9
MAV	17.2	14.2	0	8.8	1.3	1.3	4.2	5.9	0	2.9	8.8	2.9	1.3	2.9	1.3	15.9	11.3
Jaipur – Kishangarh section (NH-48)																	
LMV	8.9	9.7	0.2	3.2	3	1.7	6.6	4.7	0	1	1.1	1.7	0.4	0.6	0	8.9	48.4
LCV	4.2	2.8	0.9	5.9	1.6	2.6	10.7	12.6	0.4	1.3	0.1	1	0.9	1	0.3	11.1	42.6
2A Truck	4.5	2.8	0.7	10.8	0.5	2	9.2	13.9	0.3	2.2	0.4	2	1.3	0.7	1.5	14.7	32.4
3A Truck	4.9	5.5	1.4	9.6	2.3	2.8	9.1	11.8	0.5	2.3	0	4.9	1.8	3.3	1.1	14.1	24.6
MAV	4.3	1.8	1.7	5.9	2.1	3.4	10.1	7	0.1	2.6	0.5	9.4	2.1	1.7	3.7	10.7	32.9
Bundi – Kota section (NH-52)																	
LMV	11.4	5.3	0	7.4	4.7	1.9	4.7	2.7	0	1.3	4	4	4	0.6	0	15.4	32.7
LCV	13	6.4	2.2	7.3	2.6	3.7	4.2	2.2	1.1	4	0	2.2	5.1	1.6	1.6	17	25.6
2A Truck	10.9	3.7	1.4	7.9	2.7	5.3	3.7	7.1	0.5	3.1	1.4	2.1	4.7	1.9	1.6	15.8	26.2
3A Truck	9.6	4.5	1	6.1	1.9	5.7	3.2	4.1	0.2	3.6	2.1	2.5	4.7	2.5	2.9	14.2	31.3
MAV	11.4	4	0.8	5.2	1.8	5.8	5.5	4.8	0.3	5.2	1.5	4.4	7	1.7	2	9.8	28.7

Generally, the food grains, fruits, vegetables and other perishable goods have the maximum share close to around 20% on an average, among the commodities transported on the corridors under study, followed by finished and manufactured products (10%), parcel services and containers (6.0 %) and miscellaneous products like livestock, waste, paper, etc (11 % on average). Petroleum, oil, Gas and lubricants products have share of around 5 % on average and building materials have about 4% share. Empty vehicles have a higher share, close to 30 % as many trips have trip-ends as either pickup or drop.

0.1.3 Location of Ramp Plaza

0.1.4 Toll Plaza

Since the project road is a part of access-controlled Greenfield Economic Corridor from Delhi to Vadodara in Rajasthan state, there are 11 ramp plazas on the interchange locations proposed along the project corridor. Interchange points have been provided at intersection of all National Highways and some important state highways which have important towns in the vicinity to/from there is likely of traffic diversion to the project road. The details of the toll plaza are given in **Table 0-21**.

Table 0-21: Location of Toll Plaza

Sl. No	Ramp Plaza	Location of Toll Plaza (Chainage)
1	Ramp Plaza (TB 1)	km 102000
2	Ramp Plaza (TB 2)	km 129017
3	Ramp Plaza (TB 3)	km 181452
4	Ramp Plaza (TB 4)	km 210954
5	Ramp Plaza (TB 5)	km 228740
6	Ramp Plaza (TB 6)	km 291974
7	Ramp Plaza (TB 7)	km 337170
8	Ramp Plaza (TB 8)	km 385796
9	Ramp Plaza (TB 9)	km 398240
10	Ramp Plaza (TB 10)	km 417600
11	Ramp Plaza (TB 11)	km 434820

0.1.5 Methodology Adopted for Study

As the project road has a closed system of tolling, the vehicles entering the project road from one point will have to pay toll at the exit ramp of the interchange of that point. Thus, in order

to access the revenue generated at a particular toll plaza / toll booth, the traffic entering from different interchange points and exiting at that toll plaza / toll booth has to be worked out from the OD surveys.

0.1.6 Potential Diverted Traffic

The potentially divertible traffic at the exit of interchanges for each category of vehicle has been assessed using this methodology and is as given in **Table 0-22**.

Table 0-22: Potential Diverted Traffic at Exit of Corridor in Year 2018-19

Vehicle Type	Start point	TB 1	TB 2	TB 3	TB 4	TB 5	TB 6	TB 7	TB 8	TB 9	TB 10	TB 11	End Point
Cars	5056	1122	207	3486	10	1615	472	248	1118	90	268	32	723
Taxi/Shared Jeep	669	128	18	502	0	326	115	69	270	17	38	6	122
Mini Bus	29	8	1	19	0	41	34	3	2	1	2	1	11
Govt Bus	261	70	19	174	0	131	29	13	89	1	43	2	13
Pvt Bus	142	20	2	99	0	140	22	9	96	3	23	0	80
Mini LCV	621	214	109	203	9	206	100	39	115	8	30	3	185
LCV	1309	170	57	599	15	302	39	21	184	15	108	1	611
2 axle Truck	899	107	27	372	2	231	34	30	138	25	102	2	571
3 axle Truck	1643	140	33	719	8	360	46	37	235	29	206	3	1198
MAV	3236	287	102	1523	13	868	39	47	412	56	152	10	2256
Total Vehicles	13866	2266	574	7697	57	4221	929	515	2660	245	973	60	5770
Total PCUs	31751	4035	1122	16066	130	9155	1362	868	5313	565	2309	110	17701

*TB – Toll Booth

1.2 Traffic forecast and demand estimates

0.1.7 Traffic Forecasting

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 is 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 – 2015. 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 the absence of historical traffic census data on the project road, the future traffic has been forecasted using transport demand elasticity approach by regression of registered vehicles of the influencing states of Rajasthan, Haryana, Delhi, Maharashtra and Gujarat with respect to socio-economic parameters viz., population, PCI, NSDP and GDP as explained below.

The exercise of traffic growth rate estimation has been carried out using the elasticity approach. The elasticity method relates traffic growth to changes in the related economic parameters. According to IRC: 108 – 2015, elasticity based econometric model for highway projects could be derived in the following form:

$$\text{Log } e(P) = A_0 + A_1 \text{Log } e(EI)$$

Where,

- P = Traffic volume (of any vehicle type)
- EI = Economic Indicator (GDP/NSDP/Population/PCI)
- A0 = Regression constant;
- A1 = Regression co-efficient (Elasticity Index)

The main steps followed are:

- Defining the Project Influence Area from OD analysis of travel pattern
- Estimating the past elasticity of traffic growth from time series of registered vehicles of influencing states
- Assessment of future elasticity values for major vehicle groups, namely, cars, buses and trucks
- Study of past performance and assessment of prospective growth rates of state economies of influence area

The elasticity values are obtained by fitting log-log regression between the registered vehicle types (car, bus and goods vehicles) and NSDP, population and per-capita income of influencing states and GDP of India. The regression analysis is carried out using various combinations of economic indicators and population of registered vehicles and the elasticity values resulted from the best fit equations are used in estimating growth rates.

0.1.8 Past Vehicle registered details

In order to analyse the vehicle growth in the Project Influence Area (PIA), the vehicle registration data of Rajasthan, Haryana, Delhi, Gujarat, Maharashtra and India have been collected. The Compounded Average Growth Rate (%) of different vehicle types is shown in **Table 0-23**,

Table 0-24, **Table 0-25**, **Table 0-26**, **Table 0-27** and Table 0-28.

Table 0-23: Growth of Vehicle Registration of Rajasthan

Year	TW	Car	Bus	Trucks
2004-05	3016763	409442	58092	208881
2005-06	3393916	460380	60979	229347
2006-07	3833746	515376	63320	269084
2007-08	4261695	579044	65605	297423
2008-09	4715835	646102	69298	318118
2009-10	5230454	727158	73257	346981
2010-11	5859719	824612	77980	385796
2011-12	6629743	934962	83345	431537
2012-13	7465863	1051288	88616	478379
2013-14	8331142	1168101	93892	467758
2014-15	9272233	1294542	97650	564152
CAGR	11.88%	12.20%	5.33%	10.45%

Source: MORT&H

Table 0-24: Growth of Vehicle Registration of Haryana

Year	TW	Car	Bus	Trucks
2004-05	1729236	419879	11297	166437
2005-06	1881174	485453	19986	176046
2006-07	2172669	568758	22101	200977
2007-08	2463672	664134	26906	220470
2008-09	2768197	745335	29516	230858
2009-10	2975418	851374	33520	249991
2010-11	3370426	988958	35646	275162
2011-12	3755349	1134514	39153	292735
2012-13	4146906	1293065	43456	307509
2013-14	4541932	1454182	46558	327882
2014-15	4988518	1609544	52640	348732
CAGR	11.18%	14.38%	16.64%	7.68%

Source: MORT&H

Table 0-25: Growth of Vehicle Registration of Gujarat

Year	TW	Car	Bus	Trucks
2004-05	5744353	787385	56660	191159
2005-06	6352109	865848	61387	204362
2006-07	7003860	953747	66637	223022
2007-08	7579457	1047356	72092	239404
2008-09	8087416	1138284	76849	247772
2009-10	8716981	1256468	81663	259231
2010-11	9507556	1427954	87774	276290
2011-12	10512304	1632745	97758	301533
2012-13	11500292	1832103	104087	286207
2013-14	12502698	2007923	110285	334021
2014-15	13704879	2255057	116455	367303
CAGR	9.08%	11.10%	7.47%	6.75%

Source: MORT&H

Table 0-26: Growth of Vehicle Registration of Maharashtra

Year	TW	Car	Bus	Trucks
2004-05	6926576	1448809	63405	266004
2005-06	7691856	1602266	66754	287230
2006-07	8573679	1781688	71187	316502
2007-08	9394869	1971984	77042	344267
2008-09	10212360	2137107	79073	366642
2009-10	11181762	2351276	83816	374705
2010-11	12429011	2608900	89861	389941
2011-12	13921763	2925964	100097	411418

Year	TW	Car	Bus	Trucks
2012-13	15457173	3249425	110121	440866
2013-14	16910395	3514630	120886	470128
2014-15	18603835	3822770	120750	491582
2015-16	20355825	4180361	131183	513086
2016-17	22102376	4568266	146708	553930
CAGR	10.15%	10.04%	7.24%	6.30%

Source: MORT&H

Table 0-27: Growth of Vehicle Registration of Delhi

Year	TW	Car	Bus	Truck
2004-05	2874673	1400675	36801	157959
2005-06	3118986	1516771	37519	164293
2006-07	3377073	1649785	38500	174223
2007-08	3616417	1791478	39622	189101
2008-09	3846721	1931486	41142	208294
2009-10	4107912	2091522	43250	226256
2010-11	4395086	2258434	45757	242331
2011-12	4702712	2442527	46937	261412
2012-13	5014037	2619495	47987	276346
2013-14	5358535	2784732	49239	289881
2014-15	5737610	2965863	50296	306080
CAGR	7.16%	7.79%	3.17%	6.84%

Source: www.delhi.gov.in

Table 0-28: Growth of Vehicle Registration of Trucks (All India)

Year	Trucks (All India)
2004-05	3877622
2005-06	4274984
2006-07	5118880
2007-08	5600938
2008-09	6040924
2009-10	6431926
2010-11	7064495
2011-12	7658391
2012-13	8306834
2013-14	8697541
2014-15	9344464
CAGR	9.19%

0.1.9 Past Growth of Economy

The past performance of the economic indicators for the project influence area (PIA) was also collected for the same period (2004-05 to 2014-15), 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 and Net National Domestic Product
- Per Capita Income (PCI)
- Population

Table 0-29, Table 0-30,

Table 0-31, Table 0-32 and Table 0-34 give the growth of Economic indicators for Rajasthan, Haryana, Delhi, Maharashtra, Gujarat and India.

Table 0-29: Growth in Economic Indices of Rajasthan State (at 2004-05 Prices)

Year	NSDP (Million)	PCI	Population
2004-05	11263572	18565	60670000
2005-06	12020228	19445	61818000
2006-07	13434991	21342	62951000
2007-08	14047148	21922	64077000
2008-09	15228354	23356	65200000
2009-10	16115948	24304	66310000
2010-11	18536565	27502	67401000
2011-12	20274905	29612	68468000
2012-13	21439120	30839	69519000
2013-14	22463210	31836	70559000
2014-15	23752978	33186	71576000
CAGR	7.75%	5.98%	1.67%

Table 0-30: Growth in Economic Indices of Haryana State (at 2004-05 Prices)

Year	NSDP (Million)	PCI	Population
2004-05	8622228	37972	22707000
2005-06	9401146	40627	23140000
2006-07	10470049	44423	23569000
2007-08	11289592	47046	23997000
2008-09	12158839	49780	24425000
2009-10	13677999	55044	24849000
2010-11	14605347	57797	25270000
2011-12	15852299	61716	25686000
2012-13	16716882	64052	26099000
2013-14	17830719	67260	26510000
2014-15	19243700	71493	26917000
CAGR	8.36%	6.53%	1.72%

Table 0-31: Growth in Economic Indices of Gujarat State (at 2004-05 Prices)

Year	NSDP (Million)	PCI
2004-05	1722650	32021
2005-06	1972700	36102
2006-07	2139540	38568

Year	NSDP (Million)	PCI
2007-08	2392530	42498
2008-09	2494800	43685
2009-10	2847320	49168
2010-11	3158920	53813
2011-12	3368862	56634
2012-13	3564768	59157
2013-14	3854719	63168
2014-15	4246926	68653
CAGR	9.43%	7.92%

Table 0-32: Growth in Economic Indices of Maharashtra State (at 2004-05 Prices)

Year	NSDP (Million)	PCI
2004-05	3700228	36077
2005-06	4236322	40671
2006-07	4819832	45582
2007-08	5380810	50138
2008-09	5465329	50183
2009-10	5993384	54246
2010-11	6676254	59587
2011-12	6959044	61276
2012-13	7491370	65095
2013-14	8055929	69097
2014-15	8524513	72200
2015-16	9112635	76386
2016-17	9951473	82436
CAGR	8.54%	7.18%

Table 0-33: Growth in Economic Indices of Delhi State (at 2004-05 Prices)

Year	NSDP (Rs lacs)	PCI
2004-05	947169	63877
2005-06	1044734	69128
2006-07	1174441	76243
2007-08	1306830	83243
2008-09	1469612	91845
2009-10	1590435	97525
2010-11	1722352	103619
2011-12	1807222	106677
2012-13	1941403	112441
2013-14	2083682	118411
2014-15	2256296	125809
CAGR	8.83%	6.78%

Table 0-34: Growth in Economic Indices of All India (at 2004-05 Prices)

Year	GDP (Billion Rs.)
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Year	GDP (Billion Rs.)
2004-05	29,71,464
2005-06	32,53,073
2006-07	35,64,364
2007-08	38,96,636
2008-09	41,58,676
2009-10	45,16,071
2010-11	49,18,533
2011-12	52,47,530
2012-13	54,82,111
2013-14	57,41,791
CAGR	7.59%

The trend in economy in the influence region had fluctuations in last decade. The same for various time periods along with national trend is depicted in **Table 0-35**. The growth of PIA factored with regional influence mentioned earlier also is given.

Table 0-35: Past Growth Trend of Economy (CAGR %)

Year	Rajasthan	Haryana	Delhi	Gujarat	Maharashtra	AI (New)	AI (Old)	PIA growth
2005-2016	7.75	8.36	9.07	9.43	8.54		7.59	8.15
2009-2016	8.07	7.96	7.41	9.28	7.58		6.66	7.77
2012-2016	5.42	6.06	7.68	8.36	6.97	6.01	4.6	5.98

0.1.10 Transport demand elasticity

The regression analysis tool performs linear regression analysis by using the "least squares" method to fit a line through a set of observations. We can analyze how a single dependent variable is affected by the values of one or more independent variables. In the present case, registered vehicles by type are dependent variables whereas the economic parameters are independent variables.

T-statistic

The t-statistic is a measure of how strongly a particular independent variable explains variations in the dependent variable. The larger the t-statistic, the better the independent variable's explanatory power. Next to each t-stat is a P-value. The P-value is used to interpret the t-stat. In short, the P-value is the probability that the independent variable in question has nothing to do with the dependent variable. Generally, we look for a P-value of less than .05, which means there is a 5% chance that the dependent variable is unrelated to the dependent variable. If the P-value is higher than .10, a strong argument can be made for eliminating this particular independent variable from a model because it "isn't statistically significant."

R Square

R Square is another measure of the explanatory power of the model. In theory, R square compares the amount of the error explained by the model as compared to the amount of error explained by averages. The higher the R-Square, the better it is.

Regression analysis has been carried out by creating econometric models as suggested in IRC: 108 – 1996, using past vehicle registration data, and economic indicators such as population and PCI for passenger vehicles and NSDP for freight vehicles. All India registered trucks are also regressed with GDP to estimate national level elasticity value for trucks and

its growth rate. The elasticity values obtained for each class of vehicle are given in **Table: 4.36/37/38/39/40.**

Table 0-36: Elasticity Values Derived based on Regression Analysis for Rajasthan

Vehicle Type	Indicator	Elasticity	GR (%)	R-square	t-stat
Two Wheeler	PCI	0.187	11.285	0.997	0.669
	Population	6.06			5.818
	Population	6.752	11.258	0.997	57.625
	NSDP	1.424	11.532	0.991	31.65
	PCI	1.8	11.382	0.987	25.75
Car	PCI	0.324	11.78	0.998	1.452
	Population	5.836			7.011
	NSDP	1.485	12.027	0.993	36.649
	PCI	1.877	11.873	0.989	28.76
	Population	7.037	11.733	0.998	68.685
Bus	PCI	0.369	5.464	0.989	1.321
	Population	1.879			1.804
	Population	3.245	5.411	0.987	25.79
	PCI	0.869	5.495	0.985	23.973
	NSDP	0.687	5.562	0.987	26.389
Trucks	NSDP	1.218	9.859	0.986	24.805

Table 0-37: Elasticity Values Derived based on Regression Analysis for Haryana

Vehicle Type	Indicator	Elasticity	GR (%)	R-square	t-stat
Two Wheeler	PCI	-0.117	10.807	0.999	0.737
	Population	6.748			0.001
	Population	6.312	10.824	0.999	0
	NSDP	1.33	11.13	0.996	0
	PCI	1.684	11.013	0.994	0
Car	PCI	0.026	13.69	0.999	0.925
	Population	7.883			0
	NSDP	1.682	14.078	0.997	0
	PCI	2.13	13.931	0.995	0
	Population	7.982	13.686	0.999	0
Bus	PCI	2.918	13.381	0.926	0.376
	Population	-3.329			0.782
	Population	7.563	12.968	0.918	0
	PCI	2.03	13.28	0.926	0
	NSDP	1.602	13.403	0.925	0
Trucks	NSDP	0.928	7.769	0.996	0
LCV / LMV	NSDP	1.084	9.071	0.985	0

Table 0-38: Elasticity Values Derived based on Regression Analysis for Gujarat

Vehicle Type	Indicator	Elasticity	GR (%)	R-square	t-stat
Two Wheeler	PCI	1.142	8.693	0.988	27.044
	NSDP	0.963	8.772	0.99	29.884
Car	PCI	1.424	10.843	0.982	22.108
	NSDP	1.201	10.942	0.984	23.798
Bus	PCI	0.98	7.463	0.989	28.775
	NSDP	0.827	7.53	0.991	32.09
Trucks	NSDP	0.676	6.16	0.969	16.81
LCV/LMV	NSDP	1.127	10.265	0.973	18.126

Table 0-39: Elasticity Values Derived based on Regression Analysis for Maharashtra

Vehicle Type	Indicator	Elasticity	GR (%)	R-square	t-stat
Two Wheeler	PCI	1.507	9.877	0.982	24.34
	NSDP	1.246	9.995	0.986	28.344
Car	PCI	1.491	9.773	0.984	25.839
	NSDP	1.233	9.888	0.988	30.5
Bus	PCI	1.075	7.047	0.962	16.795
	NSDP	0.89	7.133	0.968	18.196
Trucks	NSDP	0.741	5.944	0.992	37.032
LCV/LMV	NSDP	1.31	10.507	0.981	23.685

Table 0-40: Elasticity Values Derived based on Regression Analysis for Delhi

Vehicle Type	Indicator	Elasticity	GR (%)	R-square	t-stat
Two Wheeler	PCI	1.003	6.908	0.982	22.398
	NSDP	0.787	7.035	0.99	29.874
Car	PCI	1.273	8.766	0.987	26.044
	NSDP	0.993	8.877	0.984	23.218
Bus	PCI	-0.277	-1.905	0.043	-0.638
	NSDP	0.489	4.371	0.925	8.619
Trucks	NSDP	0.213	1.902	0.062	0.768

The elasticity of commercial vehicles in PIA for various time periods was computed and are presented in **Error! Reference source not found.**. The commercial vehicle registration and NSDP of the states are used to arrive at the elasticity.

Table 0-41: Elasticity of commercial vehicles in PIA

Period	Rajasthan	Haryana	Delhi	Gujarat	Maharashtra	All India
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Period	Rajasthan	Haryana	Delhi	Gujarat	Maharashtra	All India
LCV						
2005-2015	1.35	1.08	0.21	1.13	1.31	1.78
2009-2015	1.27	1.13	-0.67	1.16	1.41	1.56
2012-2015	1.72	1.48	-1.55	1.45	1.72	1.56
Trucks						
2005-2015	1.35	0.93	0.21	0.68	0.74	0.69
2009-2015	1.27	1.04	-0.67	0.73	0.7	0.74
2012-2015	1.72	1.36	-1.55	0.96	0.96	0.74

Projected transport demand elasticity

In order to arrive at realistic future elasticity for the project road, various factors relating to vehicle technology changes besides character of traffic and travel pattern on the project road have been considered. The basic projection for elasticity of each mode with respect to the relevant parameter is presented in **Table 0-42**.

Table 0-42: Projected Basic Elasticity

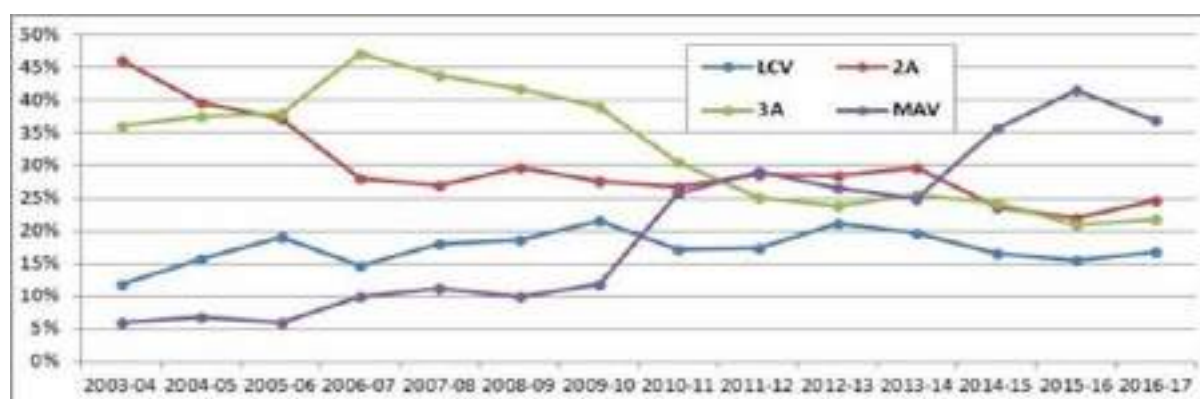
Period	Car	Bus	LCV	2A	3A	MAV
2020-24	1.09	0.62	0.88	0.89	0.86	0.86
2025-29	0.93	0.53	0.84	0.85	0.82	0.82
2030-34	0.8	0.45	0.8	0.81	0.78	0.78
2035-39	0.69	0.39	0.76	0.77	0.74	0.74
2040-44	0.62	0.35	0.72	0.73	0.7	0.7
> 2044	0.56	0.32	0.68	0.69	0.67	0.67

The high elasticity of cars witnessed at present is due to the large demand facilitated by financing schemes and loans. Factors like growth of household incomes (particularly in urban areas), reduction in the prices of entry-level cars, growth of the used car market, changes in life style, growing personal incomes, desire to own a vehicle facilitated by availability of loans/financing schemes on easy terms, etc. have all contributed to the rapid growth in ownership of cars. However, such trend could slow down and elasticity could decline in future, which the assumption is made in this report. However, given India's current low level of motorisation it could also be a possible scenario where the levels of elasticity could be maintained at current levels into the future.

Over the years there is a change in passenger movement with more and more people shifting towards personalised modes. Moreover, the buses are usually plying on fixed pre-decided routes and thus elasticity values for buses have been considered accordingly.

With the changing freight vehicle mix in favour of LCV for short distance traffic and MAVs for long-distance traffic, higher elasticity values for these have been considered as compared to 2-axle and 3 axle trucks. Considering the on-going technical advancements in automobile industry, some of the standard two axle trucks were getting replaced by three axle truck and MAVs over last few years, further the three axle trucks also started replaced by MAVs in last few years leading to reduction in number of trucks. But presently, production of new technology 2 and 3 axle trucks has been observed and the same is expected to grow over a period of next few years. This shift has already been observed in various areas of the country. The production trends of commercial vehicles in the country also depict the increase in share of 2A and 3A trucks in last 2 years.

The **Figure 0-6** shows the percentage changes in commercial vehicles, category-wise, in India from FY04 to FY17. The introduction of rigid body MAVs and 6-wheel LCVs have resulted in increased use of these modes. These days the LCVs are used for even long-haul trips, contrary to their conventional usage. The changes in vehicle technology, improved safety standards etc. have contributed to these shifts, but it is clear from the chart below that the shift may have achieved equilibrium and plateaued over the recent few years. However, for the purposes of our report, we have assumed that the shift continues.



Source: from various volumes published by SIAM

Figure 0-6: Trend of production of commercial vehicles in India

It would be easier to relate the PIA growth and vehicular growth projections. Thus, the final elasticities are calculated with respect to PIA growth and are presented in **Table 0-43**, which depict the direct relation of projection of vehicular growth to PIA growth.

Table 0-43: Projected transport demand elasticity values

Period	LCV	2A	3A	MAV
2020-24	0.94	0.49	0.52	0.98
2025-29	0.88	0.49	0.54	0.91
2030-34	0.83	0.55	0.58	0.84
2035-39	0.77	0.63	0.62	0.77
2040-44	0.73	0.69	0.66	0.71
> 2044	0.69	0.73	0.7	0.68

0.1.11 Perspective growth: state and national economies

Against this background, any agenda for future growth of the state economies has to take into account past trends, future prospects, and the emerging challenges. The growth prospects for the subject state has been developed taking into consideration the past performance of the state economy and the economic growth envisaged for the future. The pace with which the regional economies grow with the envisaged growth of the state is a major contributing factor in growth of traffic.

Various studies by economic houses, researchers and other observers like World Bank, CID¹ of Harvard University, EIU², OECD³ etc. have published the forecast for GDP, from time to time. Observing the trend and relation of NSDP to GDP in the past (Section 2.6) the

¹ CID: Centre for International Development, Harvard University

² EIU: Economic Intelligent Unit

³ OECD: Organisation for Economic Co-operation and Development

forecast for future is framed carefully. The past 10 years witnessed a lot of changes in economic front of the country. Considering that entire block as a guiding factor may skew the values, and thus a short period of recent past (2012-15) has been taken as guiding block duly considering the trend in various periods. This helps in framing the future GDP values for smaller periods initially, like blocks of two and three years and subsequently for five years till 2059-60. **Table 0-44** depicts the projection of GDP for horizon years.

Among the various GDP projections, OECD projection covers long term and is in line with recent trends in growth. Thus, that series is adopted in the present study. The GDP suggested is considered for factoring NSDP and the projections. The regions which outperformed the GDP in the past will continue to do so, while others will follow the trends which are marked by their present trend as well as likely changes in longer term.

As mentioned earlier, the government of India introduced a new series for GDP growth recently which has changed the datum from FY05 to FY15 and the methodology of calculating the GDP also has been changed. This made the historic values in the new series and projection of the old series difficult to calculate, and moreover there is no data available for linking both. Thus the elasticities of different modes are moderated considering the growth of both series in the overlapping period.

Table 0-44: Projected growth rates of indicators in percentage

Period	Rajasthan	Haryana	Delhi	Gujarat	Maharashtra	All India
2020-24	6.9	7.8	9.8	10.7	8.9	5.9
2025-29	6.9	7.8	9.8	10.7	8.9	5.9
2030-34	6.9	7.8	9.8	10.7	8.9	5.9
2035-39	6.8	7.6	9.7	10.5	8.8	5.8
2040-44	6.5	7.2	9.2	10	8.3	5.5
> 2044	6.1	6.8	8.7	9.4	7.9	5.2

0.1.12 Projected traffic growth rates

In view of the above, 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. It is therefore, important that its larger issues are addressed by constructing different scenarios. Thus, an effort is 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 points, the growth rates were conceived using methods discussed earlier and are modified accordingly. Based on the present composition of goods vehicles, overall growth of goods vehicles and average load carried by each vehicle type, tonnage is calculated for present and future composition of traffic. On this basis growth rates of goods vehicles are appropriated keeping the overall growth of trucks constant.

The basic growth factors are considered to be realistic rates. In the calculation, the growth rate of economic indicators was treated with ± 0.5 sensitivity to arrive at pessimistic and optimistic values. The final recommended growth rates are given in

Table 0-45

Table 0-45: Estimated and recommended traffic growth rates

Mode	2020-24	2025-29	2030-34	2035-39	2040-44	> 2044
Most likely						
Car	8.33	7.12	6.09	5.21	4.45	3.81
Bus	4.73	4.04	3.46	2.96	2.53	2.16
LCV	7.2	6.75	6.32	5.83	5.19	4.65
2 Axle Truck	3.75	3.71	4.2	4.76	4.94	4.94
3 Axle Truck	3.96	4.14	4.47	4.64	4.71	4.71
MAVs	7.46	6.93	6.4	5.82	5.12	4.59
Optimistic						
Car	8.83	7.62	6.59	5.71	4.95	4.31
Bus	5.23	4.54	3.96	3.46	3.03	2.66
LCV	7.7	7.25	6.82	6.33	5.69	5.15
2 Axle Truck	4.25	4.21	4.7	5.26	5.44	5.44
3 Axle Truck	4.46	4.64	4.97	5.14	5.21	5.21
MAVs	7.96	7.43	6.9	6.32	5.62	5.09
Pessimistic						
Car	7.83	6.62	5.59	4.71	3.95	3.31
Bus	4.23	3.54	2.96	2.46	2.03	1.66
LCV	6.7	6.25	5.82	5.33	4.69	4.15
2 Axle Truck	3.25	3.21	3.7	4.26	4.44	4.44
3 Axle Truck	3.46	3.64	3.97	4.14	4.21	4.21
MAVs	6.96	6.43	5.9	5.32	4.62	4.09

0.1.13 Traffic forecast for non-motorised traffic

The slow-moving vehicles essentially cater to short haul traffic, meeting localised demand for transportation of individual passenger and goods to market centres and urban centres. Non-motorised traffic, especially pedal cycles, cycle rickshaws and animal drawn vehicles will be gradually replaced by motorised vehicles. Therefore, it is assumed that volume of animal drawn vehicles and pedal cycles are expected to decline by a negative growth of 2% per annum because of economic improvement. The growth rates of tractors are however considered as 2% per annum.

1.3 Travel Demand Estimates

0.1.14 Traffic demand estimation for proposed project road

This section presents the assessment of traffic on the proposed Delhi – Vadodara Greenfield alignment. The results of this analysis will form inputs for forecasting toll traffic and revenue, deciding tolling strategy, planning and designing the pavement, developing capacity augmentation proposals and designing the toll plaza.

The corridor traffic would consist of three components:

- **Diverted Traffic:** This is traffic based on trips that are already being made between various origin and destination pairs and likely to be diverted to the proposed project corridor.
- **Development Traffic:** This is the traffic based on new trips that would be generated due to the development of new nodes along the project highway.
- **Generated / Induced Traffic:** This is traffic that is based on trips that were not taken earlier due to lack of desired infrastructure.

Thus, the total traffic on project corridor is sum of diverted traffic, developmental traffic and generated traffic.

0.1.15 Traffic Diversion Methodology

Cost ratio diversion curves have been used for estimating the diverted traffic from/to the project road. In this approach, traffic likely to be diverted from project road to alternate route is estimated using diversion curves, which computes the ratio of perceived costs on the competitive/alternative facilities.

According to the model, the vehicle will shift if the perceived cost on the project road is lower in comparison to alternate road. The rate of diversion is calculated using the diversion curve/equations, which is similar to the Logit curve. These equations are presented in Table 0-46.

Table 0-46: Diversion Curve Equation

Vehicle	Cost Ratio Interval	Relationship
Car	<0.634	% Div = 98.75 – ((CR/0.634)* 8.125)
	0.64 = CR <1.465	% Div= 90.625-((CR-0.634)/0.831)*84.375
	1.465 <=CR <= 2.00	%Div = 6.25-((CR-1.465)/0.535))*5.25
Truck & Buses	<= 0.75	% Div=100-(CR/0.75)*5
	0.75 <= CR <=1.25	% Div= 95-((CR-0.75)/.5)*90
	1.25<=CR <=2.00	% Div= ((2-CR)/0.75)*5

Where,

CR = (Total Cost of Project Route) / (Total Cost of Alternate Route)

Total Cost (INR) = Vehicle Operating Cost (INR) Toll Charges (INR) Value of time (INR).

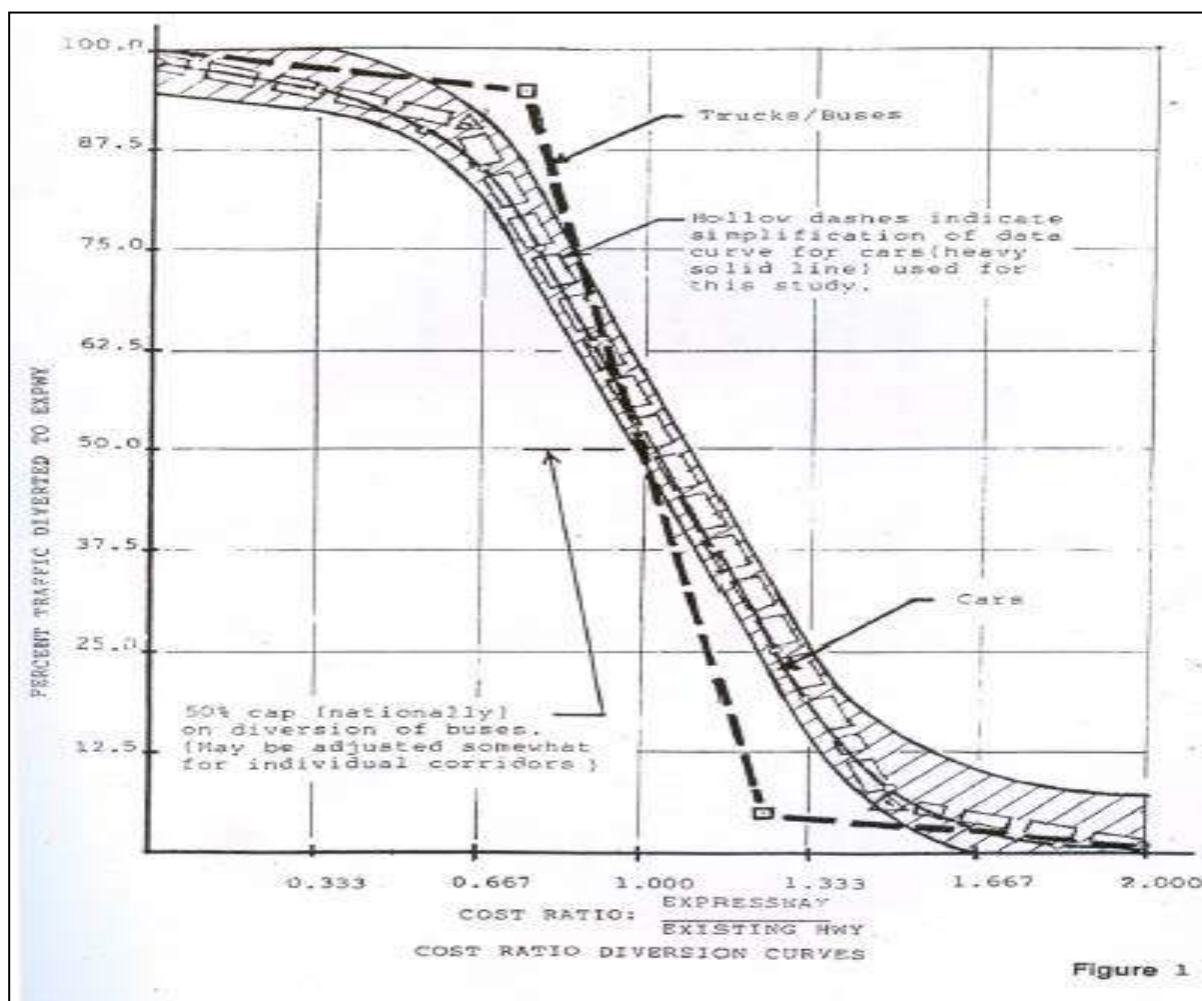


Figure 0-7: Diversion Curves

For calculating the cost ratio, the generalized cost is considered on the project road and alternative road. The generalized cost consists of three components vehicle operating cost (VOC), value of time (VOT) and toll cost. The percentage diversion is estimated based on the Cost ratio as given in above table and is applied on the potential divertible traffic obtained from OD Matrix to get the total traffic that will get diverted from the alternate route to the project road.

Vehicle operating cost

The VOC for various vehicle types are suggested in IRC: SP: 30 – 2009. Vehicle operating cost comprises of fixed and variable costs, like, fuel, tyres, maintenance, lubricants etc. which vary with the distance travelled forming the variable cost component and insurance, taxes and depreciation forming the fixed component. The IRC: SP: 30 – 2009 suggests VOCs based on lane configuration, rise and fall and roughness. The revised VOCs for present year is considered for alternate routes mentioned above based on the lane configuration and pavement conditions.

Value of time

The values of time costs for different modes are adopted from IRC: SP: 30 – 2009. It is revised for present year and the adopted values given below.

Nature of Journey by Passenger	Value of Time (INR per hour) (2009)		Value of Time (INR per hour) (2018)	
	Primary Route	Secondary Route	Primary Route	Secondary Route
Cars	63	53	89	75
Ordinary Bus Passenger	40	15	57	21
Deluxe Bus Passenger	44	-	62	-

Types of Route	Commodity Holding Cost (INR/day)	Commodity Holding Cost (INR/hr) (2009)	Commodity Holding Cost (INR/hr) (2018)
Primary Route	58	2	4
	178	7	11
	333	14	20
Secondary Route	54	2	3
	148	6	9

Travel Time: Travel time is derived from the length of alternative routes and average speed.
Toll: Toll estimation for each route is done using the prevailing toll policies and actual toll on various routes, wherever necessary. The toll on project highway is considered as suggested by NHA toll notification.

The Generalized Cost for cost ratio calculation for vehicles has the following form:

$$GC = VOC * TL * VOT * TT * TR$$

Where,

- VOC = Vehicle Operating Cost
- VOT = Value of Travel Time
- TT = Travel Time
- TR = Toll Rates
- TL = Trip Length

0.1.16 Diversion Analysis

A) Alternative route for the Traffic Moving Between Point 1 and Point 2:

There are three existing alternative routes for the traffic moving between Points 1-2 other than Project Road. These routes are either via NH-48 & SH-14 or via NH-48 & SH-25, NH-248A as is pictorially shown in Figure 0-8 and explained in detail below:



Figure 0-8: Alternate Route from 1- 2

Alternative Route-1: Via NH-48 & SH-14: For the traffic coming from Gurugram or north of Gurugram and destined to Alwar, the combination of NH-48 and SH-14 acts as one alternative road against the proposed Greenfield Economic Corridor.

Table 0-47: Details of Alternate Road via NH-48 & SH-14 and Project Road (Greenfield Economic Corridor)

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Alternative Route-1					
Gurugram (Rajeev Chowk) - Behror	102	6 lane	Good	NH-48	2
Behror- Alwar	60	4 lane	Good	SH-14	1
Total	162	-	-	-	3
Project Route					
Gurugram (Rajeev Chowk) - km 0.000	20	6 lane	Very Good	NH-248A	1
Km 0.000 - km 102.000	102	6 lane	Very Good	Project Road	2
km 102.000 – Alwar	23	4 lane	Good	SH-14	1
Total	145	-	-	-	4

Table 0-48 gives the generalized cost of alternate route and project road.

Table 0-48: Generalized cost of Alternate road and Project road

Vehicle Type	Generalised Cost	
	Alternate Road	Project Road
Car	2097	1757
Pvt Bus	8743	7646
LCV	3268	2849
2Axle	4124	3836
3Axle	4854	3981
MAV	7440	6634

Percentage of Traffic Diversion from Alternate Road is as shown in **Table 0-49**.

Table 0-49: Percentage of Traffic Diversion from Alternate Road to Proposed Project Road

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Cars	69.90
Taxi/Shared Jeep	69.90
Mini Bus	73.06
Govt Bus	72.58
Pvt Bus	72.58
Mini LCV	69.90
LCV	73.06
2 axle T	62.59
3 axle T	82.39
MAV	69.48

Alternate Route-2: Via NH-48 SH-25: For the traffic coming from Gurugram and North of Gurugram and destined towards Alwar, the combination of NH-48 & SH-25 as acts as another alternative against the proposed Economic Corridor.

Table 0-50: Details of Alternative Route via NH-48 and SH-25

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Alternative Route-2					
Gurugram (Rajeev Chowk) - Bhiwadi	37	6-lane	Good	NH-48	1
Bhiwadi - Alwar	89	2 lane	Good	SH-25	2
Total	126	-	-	-	3
Project Route					

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Gurugram (Rajeev Chowk) - km 0.000	20	6 lane	Very Good	NH-248A	1
Km 0.000 - km 102.000	102	6 lane	Very Good	Project Road	2
km 102.000 - Alwar	23	4 lane	Good	SH-14	1
Total	145	-	-	-	4

Table 0-51 gives the generalized cost of alternate route and project road.

Table 0-51: Generalized cost of Alternate road and Project road

Vehicle Type	Generalised Cost	
	Alternate Road	Project Road
Car	1718	1757
Pvt Bus	7668	7646
LCV	2571	2849
2Axle	3387	3836
3Axle	3732	3981
MAV	5877	6634

Percentage of Traffic Diversion from Alternate Road is as shown in Table 0-52.

Table 0-52: Percentage of Traffic Diversion from Alternate Road to Proposed Project Road

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Cars	51.14
Taxi/Shared Jeep	51.14
Mini Bus	30.52
Govt Bus	50.50
Pvt Bus	50.50
Mini LCV	51.14
LCV	30.52
2 axle T	26.18
3 axle T	38.03
MAV	26.79

B) Alternative Route Between Point 1 and 4:

There is an existing alternative route for the traffic moving between Points 1-4 other than Project Road via NH-48 as pictorially shown in Figure 0-9 and explained in detail below:



Figure 0-9: Alternate Route from 1- 4

Alternative Route Via NH-48: For the traffic coming from Gurugram and North of Gurugram and destined to Jaipur / Ajmer / Dausa, the existing NH-48 acts as the alternative road against the combination of proposed alignment and NH-21.

Table 0-53: Details of Alternate Road via NH-48 and Project Road

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Alternative Route					
Gurugram (Rajeev Chowk) - Jaipur	228	6 lane	Good	NH-48	3
Project Route					
Gurugram (Rajeev Chowk) - km 0.000	20	6 lane	Very Good	NH-248A	1
km 0.000 - km 181.452	181	6 lane	Very Good	Project Road	2
km 181.452 - Jaipur	61	4 lane	Good	NH-21	1
Total	262	-	-	-	4

Table 0-54 gives the generalized cost of alternate route and project road.

Table 0-54: Generalized cost of Alternate road and Project road

Vehicle Type	Generalised Cost	
	Alternate Road	Project Road
Car	2870	3142
Pvt Bus	12135	13695
LCV	4358	4997
2Axle	5562	6714
3Axle	6270	6924
MAV	9909	11628

Percentage of Traffic Diversion from Alternate Road is as shown in **Table 0-55**.

Table 0-55: Percentage of Traffic Diversion from Alternate Road to Proposed Project Road

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Cars	43.85
Taxi/Shared Jeep	43.85
Mini Bus	23.58
Govt Bus	26.85
Pvt Bus	26.85
Mini LCV	43.85
LCV	23.58
2 axle T	12.73
3 axle T	31.24
MAV	18.78

C) Alternative route for the Traffic Moving Between Point 1 and Point 7:

There are two existing alternative routes for the traffic moving between Points 1-7 other than Project Road. These routes are either via NH-48, NH-52 and NH-552 or via NH-19 & SH-01 which is pictorially shown in Figure 0-10 and explained in detail below:

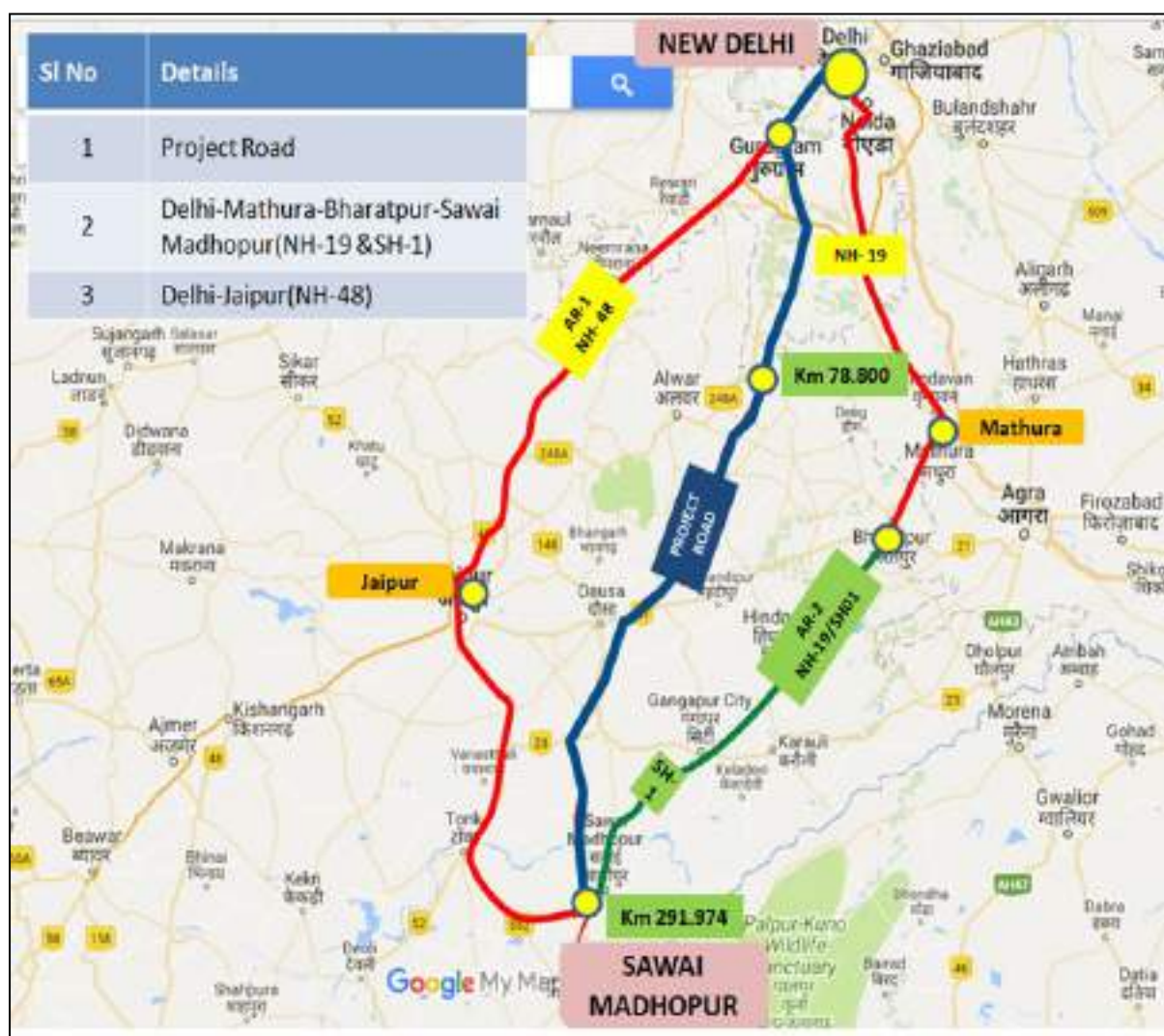


Figure 0-10: Alternate Route from 1- 7

Alternative Route-1: Via NH-48 NH-52 SH-552: For the traffic coming from Gurugram or beyond Gurugram and destined to Sawai Madhopur, the combination of NH-48, NH-52 and NH-552 acts as one alternative road against the proposed Greenfield Economic Corridor.

Table 0-56: Details of Alternate Road via NH-48 & NH-52/552 and Project Road

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Alternative Route-1					
Gurugram (Rajeev Chowk) - Jaipur	228	6 lane	Good	NH-48	3
Jaipur - Sawai Madhopur	182	4 lane	Good	NH-52/552	1
Total	410	-	-	-	4
Project Route					

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Gurugram (Rajeev Chowk) - km 0.000	20	6 lane	Very Good	NH-248A	1
km 0.000 - km 291.974	292	6 lane	Very Good	Project Road	2
km 291.974 - Sawai Madhopur	12	2 lane	Good	SH-1/NH-552	0
Total	324	-	-	-	3

Table 0-57 gives the generalized cost of alternate route and project road.

Table 0-57: Generalized cost of Alternate road and Project road

Vehicle Type	Generalised Cost	
	Alternate Road	Project Road
Car	5052	3860
Pvt Bus	21528	17016
LCV	7646	6202
2Axle	9884	8324
3Axle	10757	8449
MAV	17300	14487

Percentage of Traffic Diversion from Alternate Road is as shown in Table 0-58.

Table 0-58: Percentage of Traffic Diversion from Alternate Road to Proposed Project Road

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Cars	77.41
Taxi/Shared Jeep	77.41
Mini Bus	84.00
Govt Bus	87.73
Pvt Bus	87.73
Mini LCV	77.41
LCV	84.00
2 axle T	78.41
3 axle T	88.62
MAV	79.27

Alternate Route-2: Via NH-19 SH-01: For the traffic coming from Delhi side and destined towards Sawai Madhopur, the combination of NH-19 & SH-01 acts as another alternative against the proposed Economic Corridor.

Table 0-59: Details of Alternative Route via NH-19 & SH-01

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Alternative Route-1					
Delhi – Bharatpur	184	6 lane	Good	NH-2	2
Bharatpur - Sawai Madhopur	185	2 lane	Good	SH-1	0
Total	369	-	-	-	2
Project Route					
Delhi - Gurugram (Rajeev Chowk)	40	6 lane	Very Good	NH-48	1
Gurugram (Rajeev Chowk) - km 0.000	20	6 lane	Very Good	NH-248A	1
km 0.000 - km 291.974	292	6 lane	Very Good	Project Road	2
km 291.974 - Sawai Madhopur	12	2 lane	Good	SH-1	0
Total	364	-	-	-	4

Table 0-60 gives the generalized cost of alternate route and project road.

Table 0-60: Generalized cost of Alternate road and Project road

Vehicle Type	Generalised Cost	
	Alternate Road	Project Road
Car	4644	4381
Pvt Bus	21033	19255
LCV	6692	7044
2Axle	8854	9510
3Axle	9049	9665
MAV	15223	16526

Percentage of Traffic Diversion from Alternate Road is as shown in Table 0-61.

Table 0-61: Percentage of Traffic Diversion from Alternate Road to Proposed Project Road

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Cars	59.20
Taxi/Shared Jeep	59.20
Mini Bus	40.54
Govt Bus	65.22
Pvt Bus	65.22
Mini LCV	59.20

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
LCV	40.54
2 axle T	36.67
3 axle T	37.75
MAV	34.60

D) Alternative route for the Traffic Moving Between Point 1 and Point 9:

There are two existing alternative routes for the traffic moving between Points 1-9 other than Project Road. These routes are either via NH-48 & NH-52 or via NH-19, SH-01 and SH-33 which is pictorially shown in Figure 0-11 and explained in detail below:



Figure 0-11: Alternate Route from 1-9

Alternative Route-1: Via NH-48, NH-52&SH-552: For the traffic coming from Gurugram or beyond Gurugram and destined to Kota, the combination of NH-48 and NH-52 acts as one alternative road against the proposed Project Road.

Table 0-62: Details of Alternate Road via NH-48 & NH-52/552 and Project Road

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Alternative Route-1					
Gurugram (Rajeev Chowk) - Jaipur	228	6 lane	Good	NH-48	3
Jaipur – Kota	250	4 lane	Good	NH-52	2

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Total	487	-	-	-	5
Project Route					
Gurugram (Rajeev Chowk) - km 0.000	20	6 lane	Very Good	NH	1
km 0.000 - km 385.796	386	6 lane	Very Good	Project Road	2
km 385.796 - Kota	25	2 lane	Good	SH-1	0
Total	431	-	-	-	3

Table 3.63 Gives the generalized cost of alternate route and project road

Table 0-63: Generalized cost of Alternate road and Project road

Vehicle Type	Generalised Cost	
	Alternate Road	Project Road
Car	5914	5126
Pvt Bus	25191	22638
LCV	8946	8228
2Axle	11652	11040
3Axle	12675	11205
MAV	20303	19223

Percentage of Traffic Diversion from Alternate Road is as shown in **Table 0-64**.

Table 0-64: Percentage of Traffic Diversion from Alternate Road to Proposed Project Road

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Cars	66.98
Taxi/Shared Jeep	66.98
Mini Bus	64.45
Govt Bus	68.24
Pvt Bus	68.24
Mini LCV	66.98
LCV	64.45
2 axle T	59.45
3 axle T	70.87
MAV	59.58

Alternate Route-2: Via NH-19SH-01SH-33: For the traffic coming from Delhi side and destined towards Kota, the combination of NH-19, SH-01 and SH-33 acts as another alternative against the proposed Greenfield Economic Corridor.

Table 0-65: Details of Alternative Route via NH-19, SH-01& SH-33

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Alternative Route-2					
Delhi - Bharatpur	184	6 lane	Good	NH-2	2
Bharatpur - Kota	394	2 lane	Good	SH-1, SH-33	0
Total	578	-	-	-	2
Project Route					
Delhi - Gurugram (Rajeev Chowk)	40	6 lane	Very Good	NH-48	1
Gurugram (Rajeev Chowk) - km 0.000	20	6 lane	Very Good	NH-248A	1
km 0.000 - km 385.796	386	6 lane	Very Good	Project Road	2
km 385.796 - Kota	25	2 lane	Good	NH-27	0
Total	471	-	-	-	4

Table 0-66 gives the generalized cost of alternate route and project road.

Table 0-66: Generalized cost of Alternate road and Project road

Vehicle Type	Generalised Cost	
	Alternate Road	Project Road
Car	7390	5647
Pvt Bus	34199	24877
LCV	10440	9069
2Axle	13802	12226
3Axle	13997	12421
MAV	23847	21262

Percentage of Traffic Diversion from Alternate Road is as shown in Table 0-67.

Table 0-67: Percentage of Traffic Diversion from Alternate Road to Proposed Project Road

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Cars	77.41
Taxi/Shared Jeep	77.41
Mini Bus	73.63

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Govt Bus	95.15
Pvt Bus	95.15
Mini LCV	77.41
LCV	73.63
2 axle T	70.55
3 axle T	70.26
MAV	69.52

E) Alternative route for the Traffic Moving Between Point 4 (Dausa) and Vadodara:

There is an existing alternative route for the traffic moving between Point 4 (near Dausa) and Vadodara other than Project Road via NH-48 which is pictorially shown in Figure 0-12 and explained in detail below.

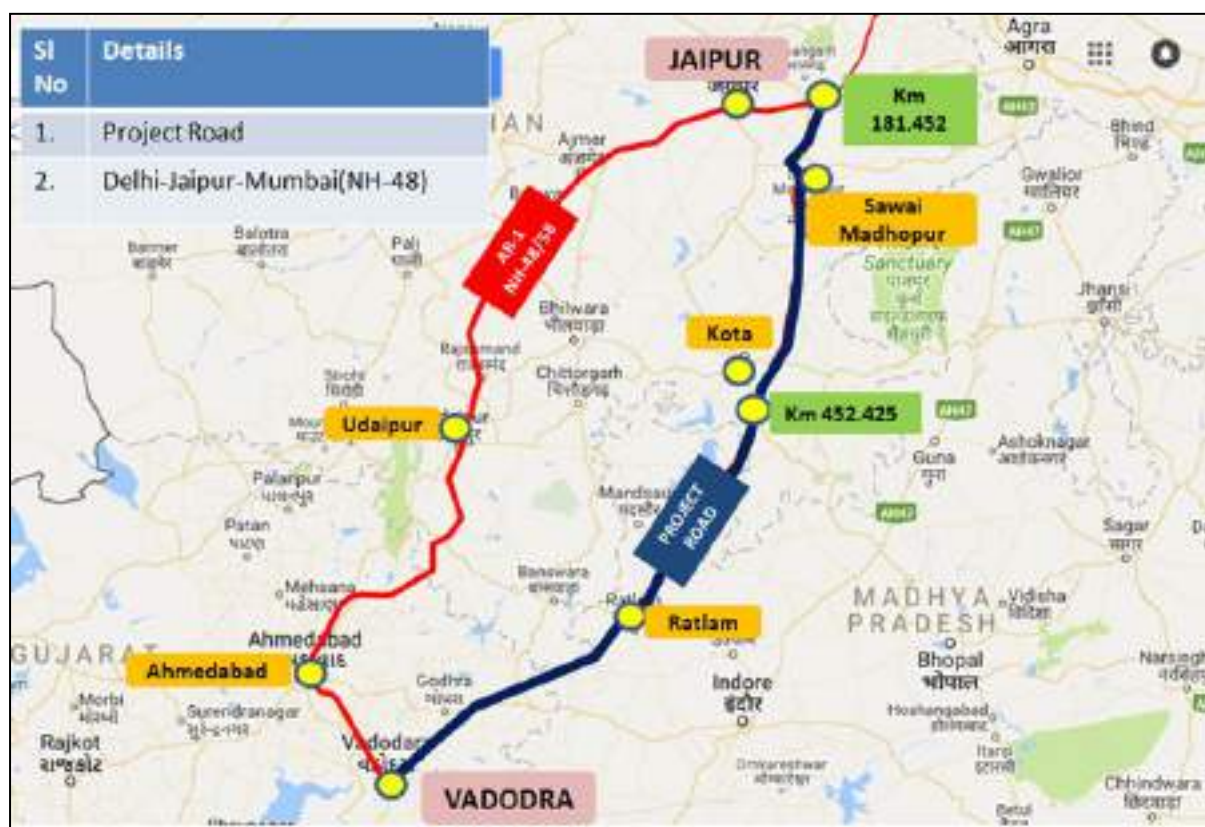


Figure 0-12: Alternate Routes for Point 4 – Vadodara

Alternative Route: Via NH-48: For the traffic coming from Dausa/Jaipur and beyond Agra and destined to Vadodara and other parts of Gujarat, Maharashtra, the combination of NH-21 and NH-48 is the alternative road against the proposed Greenfield Economic Corridor

Table 0-68: Details of Alternate Road via NH-48 and NH-21 and Project Road

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Alternative Route					
km 181.450 – Jaipur	81	4 lane	Good	NH-21	1
Jaipur – Vadodara	726	4 lane	Good	NH-48	14
Total	807	-	-	-	15
Project Route					
km 181.452 - km 452.425	271	6 lane	Very Good	Project Road	1
km 452.425 - Vadodara	400	6 lane	Good	SH-1	1
Total	671	-	-	-	2

Table 4-69 gives the generalized cost of alternate route and project road.

Table 0-69: Generalized cost of Alternate road and Project road

Vehicle Type	Generalised Cost	
	Alternate Road	Project Road
Car	10242	8050
Pvt Bus	43570	35252
LCV	15512	13024
2Axle	21137	17586
3Axle	21953	17876
MAV	35777	30557

Percentage of Traffic Diversion from Alternate Road is as shown in Table 0-70.

Table 0-70: Percentage of Traffic Diversion from Alternate Road to Proposed Project Road

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Cars	75.19
Taxi/Shared Jeep	75.19
Mini Bus	78.87
Govt Bus	84.36
Pvt Bus	84.36
Mini LCV	75.19
LCV	78.87
2 axle T	80.24
3 axle T	83.43
MAV	76.26

F) Alternative route for the Traffic Moving Between Point 10 (Kota) and Vadodara:

There is an existing alternative route for the traffic moving between Point 10 (near Kota) and Vadodara other than Project Road, via a combination of NH-27 and NH-56 which is pictorially shown in **Figure 3.13** and explained in detail below:



Figure 0-13: Alternate Routes for Point 10 - Vadodara

Alternative Route: Via NH-48: For the traffic coming from Kota and destined to Vadodara and other parts of Gujarat, the combination of NH-27 and NH-56 is the alternative road against the proposed Greenfield Economic Corridor.

Table 0-71: Details of Alternate Road via Banswara and Project Road

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Alternative Route-1					
Kota - Banswara - Godhra	500	4 lane	Good	NH	4
Godhra - Vadodara	80	4 lane	Good	SH	2
Total	580	-	-	-	6
Project Route					
Kota - km 417.600	35	4 lane	Very Good	NH	0
km 417.600 - km 452.425	35	6 lane	Good	Project Road	1

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
km 452.425 - Vadodara	400	6 lane	Good	Economic Corridor	1
Total	470	-	-	-	2

Table 0-72 gives the generalized cost of alternate route and project road.

Table 0-72: Generalized cost of Alternate road and Project road

Vehicle Type	Generalised Cost	
	Alternate Road	Project Road
Car	7125	5661
Pvt Bus	30464	24719
LCV	10747	9117
2Axle	14305	12338
3Axle	15165	12538
MAV	24534	21376

Percentage of Traffic Diversion from Alternate Road is as shown in **Table 0-73**.

Table 0-73: Percentage of Traffic Diversion from Alternate Road to Proposed Project Road

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Cars	74.32
Taxi/Shared Jeep	74.32
Mini Bus	77.31
Govt Bus	83.95
Pvt Bus	83.95
Mini LCV	74.32
LCV	77.31
2 axle T	74.75
3 axle T	81.18
MAV	73.17

G) Alternative route for the Traffic Moving Between Delhi and Mumbai (Through Traffic):

There are two existing alternative route for the traffic moving between Delhi and Mumbai other than Project Road, via NH-46 (Agra Mumbai Highway) or NH-48 which is pictorially shown in

Figure 0-14 and explained in detail below.

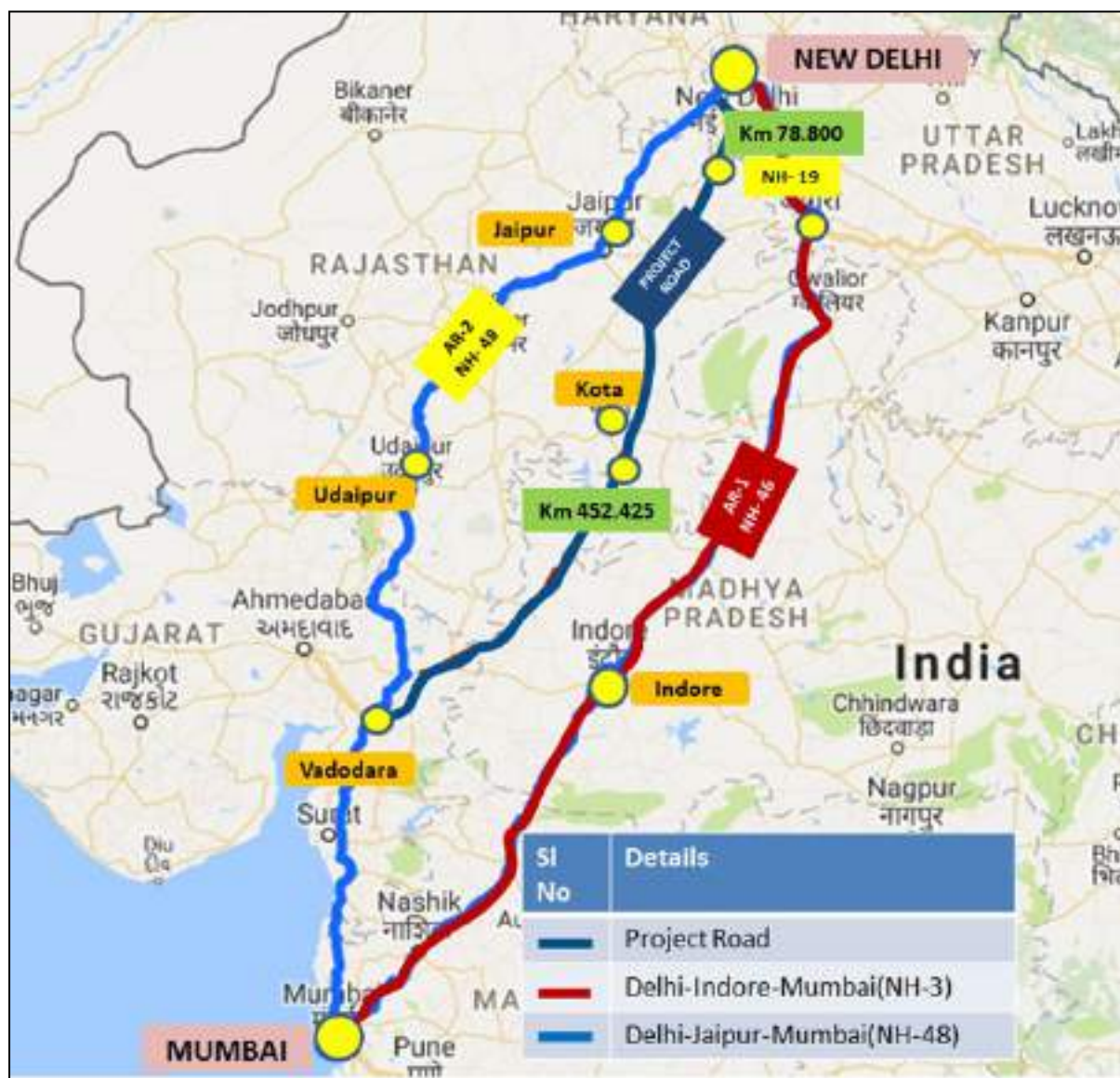


Figure 0-14: Alternative Routes for Through Traffic

Alternative Route 1: Via NH-46(Agra Mumbai Highway): For the traffic coming from Delhi and beyond Delhi and destined to Mumbai, the existing NH-46 is the alternative road against the proposed Greenfield Economic Corridor.

Table 0-74: Details of Alternate Road via NH-46 and Project Road

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Alternative Route-1					
Delhi - Agra	237	6 lane	Good	NH-2	4
Agra - Gwalior	97	4 lane	Good	NH-46	2
Gwalior - Mumbai	1100	4 lane	Good	NH-46	16

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Total	1434	-	-	-	22
Project Route					
Delhi - Gurugram (Rajeev Chowk)	40	6 lane	Very Good	Expressway	1
Gurugram (Rajeev Chowk) - km 0.000	20	6 lane	Very Good	NH	1
km 0.000 - km 452.425	452	6 lane	Very Good	Project Road	2
km 452.425 - Vadodara	400	6 lane	Good	Economic Corridor	1
Vadodara - Mumbai	425	4 lane	Good	NH-48	6
Total	1337	-	-	-	11

Table 0-75 gives the generalized cost of alternate route and project road.

Table 0-75: Generalized cost of Alternate road and Project road

Vehicle Type	Generalised Cost	
	Alternate Road	Project Road
Car	18328	16209
Pvt Bus	77938	70565
LCV	27818	25756
2Axle	37977	34731
3Axle	40194	36006
MAV	64534	60046

Percentage of Traffic Diversion from Alternate Road is as shown in Table 0-76.

Table 0-76: Percentage of Traffic Diversion from Alternate Road to Proposed Project Road

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Cars	65.20
Taxi/Shared Jeep	65.20
Mini Bus	63.35
Govt Bus	67.03
Pvt Bus	67.03
Mini LCV	65.20
LCV	63.35
2 axle T	65.39
3 axle T	68.76
MAV	62.52

Alternative Route 2: Via NH-48: For the traffic coming from Delhi and beyond Delhi and destined to Mumbai, the existing NH-48 is the other alternative road against the proposed Greenfield Economic Corridor.

Table 0-77: Details of Alternate Road via NH-48 and Project Road

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Alternative Route-2					
Gurugram (Rajeev Chowk) - Jaipur	234	6 lane	Good	NH-48	3
Jaipur - Vadodara	726	4 lane	Good	NH-48	2
Vadodara - Mumbai	425	4 lane	Good	NH-48	2
Total	1385	-	-	-	5
Project Route					
Gurugram (Rajeev Chowk) - km 0.000	20	6 lane	Very Good	NH	1
km 0.000 - km 452.425	452	6 lane	Very Good	Project Road	2
km 452.425 - Vadodara	400	6 lane	Good	SH-1	1
Vadodara - Mumbai	425	4 lane	Good	NH-48	2
Total	1297	-	-	-	6

Table 0-78 gives the generalized cost of alternate route and project road.

Table 0-78: Generalized cost of Alternate road and Project road

Vehicle Type	Generalised Cost	
	Alternate Road	Project Road
Car	17535	15688
Pvt Bus	74595	68326
LCV	26619	24914
2Axle	35943	33545
3Axle	38212	34790
MAV	61259	58007

Percentage of Traffic Diversion from Alternate Road is as shown in Table 0-79.

Table 0-79: Percentage of Traffic Diversion from Alternate Road to Proposed Project Road

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Cars	64.15
Taxi/Shared Jeep	64.15
Mini Bus	61.53
Govt Bus	65.13

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Pvt Bus	65.13
Mini LCV	64.15
LCV	61.53
2 axle T	62.01
3 axle T	66.12
MAV	59.56

H) Alternative route for the Traffic Moving Between Delhi and Vadodara (Through Traffic):

There is an existing alternative route for the traffic moving between Delhi and Vadodara other than Project Road, via NH-48 which is pictorially shown in **Figure 4.14** and explained in detail below.

Alternative Route: Via NH-48: For the traffic coming from Delhi and beyond Delhi and destined to Vadodara, the existing NH-48 is the alternative road against the proposed Greenfield Economic Corridor.

Table 0-80: Details of Alternate Road via NH-48 and Project Road

Existing Route	Length (km)	Lane Configuration	Condition	Type of Road	No of Toll Plaza
Alternative Route-1					
Gurugram (Rajeev Chowk) - Jaipur	234	6 lane	Good	NH-48	3
Jaipur - Vadodara	726	4 lane	Good	NH-48	14
Total	960	-	-	-	17
Project Route					
Gurugram (Rajeev Chowk) - km 0.000	20	6 lane	Very Good	NH	1
km 0.000 - km 452.425	452	6 lane	Very Good	Project Road	2
km 452.425 - Vadodara	400	6 lane	Good	Economic Corridor	1
Total	872	-	-	-	4

Table 0-81 gives the generalized cost of alternate route and project road.

Table 0-81: Generalized cost of Alternate road and Project road

Vehicle Type	Generalised Cost	
	Alternate Road	Project Road
Car	12240	10431
Pvt Bus	51930	45700
LCV	18557	16858
2Axle	25121	22750

Vehicle Type	Generalised Cost	
	Alternate Road	Project Road
3Axle	26520	23125
MAV	42785	39533

Percentage of Traffic Diversion from Alternate Road is as shown in **Table 0-82**.

Table 0-82: Percentage of Traffic Diversion from Alternate Road to Proposed Project Road

Vehicle Type	% Diversion to Project Road in the Base Year (2018-19)
Cars	68.47
Taxi/Shared Jeep	68.47
Mini Bus	66.48
Govt Bus	71.59
Pvt Bus	71.59
Mini LCV	68.47
LCV	66.48
2 axle T	66.99
3 axle T	73.04
MAV	63.68

Table 0-83: Final Diverted Traffic at Each Toll Booth in base year (2018-19)

Vehicle Type	Start point	TB 1	TB 2	TB 3	TB 4	TB 5	TB 6	TB 7	TB 8	TB 9	TB 10	TB 11	End Point
Cars	2424	569	101	1535	4	574	125	63	466	33	107	11	355
Taxi/Shared Jeep	321	67	8	221	0	112	30	17	108	6	15	1	57
Mini Bus	8	2	0	4	0	9	7	0	0	0	0	0	4
Govt Bus	97	37	9	47	0	48	8	2	35	0	18	0	7
Pvt Bus	62	9	1	31	0	53	5	1	44	1	10	0	39
Mini LCV	321	108	53	90	3	68	28	9	43	3	13	1	100
LCV	548	55	18	167	6	116	10	6	85	8	59	0	344
2 axle Truck	384	31	8	93	1	89	10	10	61	13	52	1	324
3 axle Truck	891	59	12	305	3	141	17	10	113	17	107	2	711
MAV	1342	88	32	426	5	345	15	14	200	34	80	4	1217
Total vehicles	6398	1025	242	2919	22	1555	255	132	1155	115	461	20	3158
Total PCUs	14241	1634	423	5448	51	3487	396	230	2404	300	1145	40	9754

Section-wise Traffic

Project road has been divided into 12 homogeneous sections based on interchange points provided. The section wise traffic has been provided in

Table 0-84.

Table 0-84: Section-wise Normal Traffic in Year 2018-19

Vehicle Type	Sections												Average
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
	Km 78.800 to km 102.000	Km 102.000 to km 129.017	Km 129.017 to km 181.452	Km 181.452 to km 210.954	Km 210.954 to km 228.740	Km 228.740 to km 291.974	Km 291.974 to km 337.170	Km 337.170 to km 385.796	Km 385.796 to km 398.240	Km 398.240 to km 417.600	Km 417.600 to km 434.820	Km 434.820 to km 452.425	
Cars	4848	3841	3664	911	903	1956	1762	1836	918	912	740	715	1917
Taxi/Shared Jeep	642	548	536	137	137	361	317	350	141	139	118	115	295
Mini Bus	16	12	12	4	4	22	8	8	8	8	8	8	10
Govt. Bus	194	146	128	38	38	134	120	122	54	50	15	14	88
Pvt. Bus	124	110	108	84	84	190	181	182	94	96	80	80	118
Mini LCV	642	437	340	202	196	327	291	304	218	224	202	198	298
LCV	1096	1012	989	797	785	997	983	991	822	812	699	696	890
2 axle T	768	728	721	737	735	897	879	890	769	760	669	665	768
3 axle T	1782	1719	1710	1672	1666	1911	1892	1907	1683	1673	1480	1470	1714
MAV	2684	2594	2599	2425	2415	3012	2993	2999	2604	2601	2508	2478	2659
Total vehicles	12796	11147	10807	7007	6963	9807	9426	9589	7311	7275	6519	6439	8757
Total PCUs	28482	26144	25738	20957	20856	27123	26541	26787	22040	21947	20139	19922	23890

0.1.17 Development Traffic

The Delhi–Mumbai Industrial Corridor Project (DMICDC) is a planned industrial development project between India's capital, Delhi and its financial hub, Mumbai. The Delhi–Mumbai Industrial Corridor Project (DMICDC) is a planned industrial development project between India's capital, Delhi and its financial hub, Mumbai.

The eight investment regions proposed to be developed in Phase I of DMIC are Dadri-Noida-Ghaziabad (in UP), Manesar-Bawal (in Haryana), Khushkhera-Bhiwadi-Neemrana and Jodhpur-Pali-Marwar (in Rajasthan), Pithampur-Dhar-Mhow (in MP), Ahmedabad-Dholera Special Investment Region (SIR) in Gujarat, the Shendra-Bidkin Industrial Park, and Dighi Port Industrial Area in Maharashtra.

One of the main goals of this mega project would be the development of numerous new cities to create new centers of economic activity in the country.

Some major developments that are likely to take place in the next few years are as under:

- Ahmedabad-Dholera Special Investment Region, Gujarat
- Dadri-Noida-Ghaziabad Investment Region, Uttar Pradesh
- Manesar-Bawal Investment Region, Haryana
- Shendra-Bidkin Industrial Area, Maharashtra
- Dighi Port Industrial Area, Maharashtra

These developments will generate passenger and commercial traffic which demand the need of an additional facility as the existing facility of NH-48 has already reached its capacity. Also, the new alignment will promote the region's economic development by improving the investment environment, promoting exchange and circulation of commodities, providing convenient transportation for tourists, and promoting development in small towns and urbanization (Table: 84/86/87)



Table 0-85: Section-wise Development Traffic in Year 2022-23

Vehicle Type	Sections												Average
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
	Km 78.800 to km 102.000	Km 102.000 to km 129.017	Km 129.017 to km 181.452	Km 181.452 to km 210.954	Km 210.954 to km 228.740	Km 228.740 to km 291.974	Km 291.974 to km 337.170	Km 337.170 to km 385.796	Km 385.796 to km 398.240	Km 398.240 to km 417.600	Km 417.600 to km 434.820	Km 434.820 to km 452.425	
Cars	64	70	74	78	78	78	40	40	40	40	40	35	56
Pvt Bus	2	3	3	3	3	3	1	1	1	1	1	1	2
LCV	140	227	241	250	250	250	121	121	121	121	121	109	173
2 axle T	176	347	358	368	368	368	162	162	162	162	162	152	246
3 axle T	276	393	408	419	419	419	186	186	186	186	186	172	286
MAV	332	615	631	641	641	641	281	281	281	281	281	268	431
Total veh	990	1655	1715	1759	1759	1759	791	791	791	791	791	737	1194
Total PCUs	3130	5407	5582	5708	5708	5708	2533	2533	2533	2533	2533	2380	3857

Table 0-86: Section-wise Development Traffic in Year 2025-26

Vehicle Type	Sections												Average
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
	Km 78.800 to km 102.000	Km 102.000 to km 129.017	Km 129.017 to km 181.452	Km 181.452 to km 210.954	Km 210.954 to km 228.740	Km 228.740 to km 291.974	Km 291.974 to km 337.170	Km 337.170 to km 385.796	Km 385.796 to km 398.240	Km 398.240 to km 417.600	Km 417.600 to km 434.820	Km 434.820 to km 452.425	
Cars	86	95	101	105	105	105	54	54	54	54	54	47	76
Pvt Bus	4	5	5	5	5	5	2	2	2	2	2	2	3
LCV	184	301	319	333	333	333	163	163	163	163	163	147	230

Vehicle Type	Sections												Average
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
	Km 78.800 to km 102.000	Km 102.000 to km 129.017	Km 129.017 to km 181.452	Km 181.452 to km 210.954	Km 210.954 to km 228.740	Km 228.740 to km 291.974	Km 291.974 to km 337.170	Km 337.170 to km 385.796	Km 385.796 to km 398.240	Km 398.240 to km 417.600	Km 417.600 to km 434.820	Km 434.820 to km 452.425	
2 axle T	234	461	478	491	491	491	218	218	218	218	218	204	328
3 axle T	372	528	545	560	560	560	246	246	246	246	246	228	382
MAV	442	819	839	855	855	855	375	375	375	375	375	358	575
Total veh	1322	2209	2287	2349	2349	2349	1058	1058	1058	1058	1058	986	1595
Total PCUs	4181	7214	7439	7620	7620	7620	3384	3384	3384	3384	3384	3181	5150

Table 0-87: Section-wise Development Traffic in Year 2029-30

Vehicle Type	Sections												Average
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
	Km 78.800 to km 102.000	Km 102.000 to km 129.017	Km 129.017 to km 181.452	Km 181.452 to km 210.954	Km 210.954 to km 228.740	Km 228.740 to km 291.974	Km 291.974 to km 337.170	Km 337.170 to km 385.796	Km 385.796 to km 398.240	Km 398.240 to km 417.600	Km 417.600 to km 434.820	Km 434.820 to km 452.425	
Cars	64	72	76	80	80	80	41	41	41	41	41	36	58
Pvt Bus	4	3	3	3	3	3	1	1	1	1	1	1	2
LCV	142	229	241	251	251	251	122	122	122	122	122	110	174
2 axle T	176	347	358	368	368	368	162	162	162	162	162	152	246
3 axle T	278	395	410	419	419	419	186	186	186	186	186	172	287
MAV	332	615	631	641	641	641	281	281	281	281	281	268	431
Total veh	996	1661	1719	1762	1762	1762	793	793	793	793	793	739	1197
Total PCUs	3145	5418	5590	5711	5711	5711	2536	2536	2536	2536	2536	2382	3862

0.1.18 Projected Traffic

The total projected traffic at the exit of each location / toll booth is presented in Table 0-88 and the mode wise projected traffic is presented in **Annexure 4.3**.

Table 0-88: Projected Total Traffic for Start Point to TB-5

FY	Start Point (Km 78.800)		TB-1 (Km 102.000)		TB-2 (Km 129.017)		TB-3 (Km 181.452)		TB-4 (Km 210.954)		TB-5 (Km 228.740)	
	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs
2018-19	6398	14241	1025	1634	242	423	2919	5448	22	51	1555	3487
2019-20	6847	15174	1102	1746	260	452	3135	5819	23	54	1665	3718
2020-21	7329	16173	1185	1868	279	483	3367	6217	25	57	1784	3966
2021-22	7847	17241	1275	1998	300	516	3618	6644	27	61	1911	4232
2022-23	8898	19949	2774	6716	360	660	3936	7236	28	65	2048	4518
2023-24	9496	21175	2877	6865	384	699	4227	7729	30	69	2195	4823
2024-25	10073	22385	2976	7010	407	736	4503	8208	32	73	2336	5122
2025-26	11350	25762	4952	13273	482	920	4863	8898	34	77	2487	5441
2026-27	12007	27133	5064	13436	508	962	5179	9443	37	82	2647	5779
2027-28	12708	28592	5184	13610	535	1006	5515	10022	39	88	2819	6139
2028-29	13455	30147	5311	13795	564	1054	5876	10640	42	93	3002	6524
2029-30	14675	33258	6837	18556	632	1210	6266	11379	44	99	3177	6902
2030-31	15441	34890	6965	18746	662	1259	6627	12017	47	104	3363	7301
2031-32	16252	36618	7101	18946	693	1310	7010	12693	49	110	3560	7725
2032-33	17112	38449	7244	19158	727	1365	7417	13408	52	117	3768	8173
2033-34	18023	40389	7397	19384	763	1425	7848	14169	55	124	3989	8648
2034-35	18893	42283	7540	19600	797	1482	8253	14899	58	130	4199	9109
2035-36	19810	44279	7690	19827	833	1542	8678	15669	61	137	4420	9594
2036-37	20776	46386	7848	20066	870	1606	9127	16481	65	145	4653	10107

FY	Start Point (Km 78.800)		TB-1 (Km 102.000)		TB-2 (Km 129.017)		TB-3 (Km 181.452)		TB-4 (Km 210.954)		TB-5 (Km 228.740)	
	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs
2037-38	21793	48605	8015	20317	910	1673	9599	17336	68	153	4899	10647
2038-39	22865	50946	8190	20582	952	1743	10096	18237	72	161	5157	11216
2039-40	23867	53166	8351	20829	991	1809	10555	19082	76	169	5397	11752
2040-41	24917	55495	8520	21088	1032	1878	11035	19968	79	178	5648	12313
2041-42	26016	57936	8696	21358	1074	1949	11537	20896	83	186	5911	12902
2042-43	27169	60499	8881	21641	1118	2025	12062	21869	87	196	6186	13518
2043-44	28375	63185	9074	21938	1165	2105	12612	22889	92	205	6475	14166
2044-45	29505	65744	9251	22214	1208	2178	13120	23850	96	215	6743	14778
2045-46	30681	68415	9435	22502	1253	2255	13647	24850	100	224	7022	15416
2046-47	31909	71207	9627	22802	1299	2335	14197	25896	104	234	7313	16082
2047-48	33190	74125	9827	23116	1348	2420	14770	26987	109	245	7617	16778
2048-49	34525	77172	10035	23443	1399	2508	15367	28125	114	256	7934	17505
2049-50	35918	80356	10252	23785	1453	2600	15988	29314	119	268	8264	18265
2050-51	37371	83682	10477	24141	1509	2697	16635	30554	124	280	8608	19058
2051-52	38886	87158	10712	24512	1567	2798	17308	31849	130	292	8967	19887
2052-53	40466	90788	10957	24898	1627	2902	18010	33199	136	305	9340	20750
2053-54	42114	94581	11211	25301	1690	3011	18740	34608	142	319	9729	21652
2054-55	43832	98545	11476	25720	1755	3125	19501	36078	148	333	10136	22595
2055-56	45625	102684	11751	26157	1823	3243	20293	37612	154	348	10559	23579
2056-57	47495	107011	12039	26615	1894	3368	21118	39214	161	364	11000	24608
2057-58	49445	111530	12338	27092	1969	3498	21977	40886	168	380	11461	25682
2058-59	51480	116254	12649	27590	2046	3634	22872	42632	176	398	11940	26804
2059-60	53602	121189	12974	28108	2127	3775	23805	44454	184	416	12440	27974

Table 0-89: Projected Total Traffic for TB-6 to End Point

FY	TB-6 (Km 291.974)		TB-7 (Km 337.170)		TB-8 (Km 385.796)		TB-9 (Km 398.240)		TB-10 (Km 417.600)		TB-11 (Km 434.820)		End Point of Rajasthan Section (Km 452.425)	
	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs
2018-19	255	396	132	230	1155	2404	115	300	461	1145	20	40	3158	9754
2019-20	274	422	142	244	1237	2561	123	320	490	1211	22	43	3358	10369
2020-21	294	450	152	261	1326	2731	132	341	521	1282	23	46	3572	11025
2021-22	316	481	163	278	1421	2912	141	363	554	1358	25	49	3800	11727
2022-23	391	661	175	297	1523	3107	150	386	589	1439	27	53	4743	14750
2023-24	416	694	188	316	1634	3316	160	411	626	1524	29	56	5003	15549
2024-25	439	727	200	335	1739	3518	170	436	663	1610	31	60	5262	16352
2025-26	534	958	212	354	1851	3735	180	462	702	1699	32	63	6475	20245
2026-27	560	995	226	375	1971	3966	191	490	743	1794	34	67	6768	21153
2027-28	589	1033	240	397	2098	4210	203	519	786	1895	37	71	7080	22119
2028-29	619	1074	256	421	2235	4471	216	550	833	2003	39	75	7412	23147
2029-30	699	1262	271	445	2365	4726	228	582	879	2112	41	79	8447	26464
2030-31	729	1304	286	470	2503	4996	241	616	928	2227	44	83	8799	27564
2031-32	761	1347	303	496	2649	5283	255	651	979	2347	46	88	9173	28731
2032-33	795	1394	320	523	2803	5585	269	688	1033	2475	48	92	9568	29966
2033-34	831	1445	339	553	2967	5906	285	729	1091	2611	51	98	9987	31276
2034-35	865	1493	356	582	3123	6218	301	769	1148	2747	54	104	10401	32575
2035-36	901	1544	375	611	3286	6545	317	811	1208	2889	57	109	10838	33946
2036-37	938	1598	394	644	3458	6890	334	856	1271	3040	60	116	11298	35395
2037-38	978	1655	415	678	3638	7253	352	902	1337	3198	63	122	11784	36922
2038-39	1020	1714	437	713	3829	7635	371	952	1407	3365	67	129	12297	38535
2039-40	1058	1769	457	747	4005	7995	388	999	1473	3526	70	135	12787	40078
2040-41	1098	1828	477	781	4190	8373	407	1047	1542	3694	73	141	13301	41699

FY	TB-6 (Km 291.974)		TB-7 (Km 337.170)		TB-8 (Km 385.796)		TB-9 (Km 398.240)		TB-10 (Km 417.600)		TB-11 (Km 434.820)		End Point of Rajasthan Section (Km 452.425)	
	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs	Nos	PCUs
2041-42	1139	1887	499	817	4383	8767	426	1099	1615	3871	76	148	13840	43400
2042-43	1183	1950	521	854	4585	9181	447	1153	1691	4057	80	154	14407	45188
2043-44	1228	2015	546	895	4797	9616	468	1210	1771	4252	83	162	15001	47064
2044-45	1270	2077	567	932	4994	10026	488	1264	1847	4440	87	169	15571	48872
2045-46	1313	2140	589	969	5198	10454	509	1320	1926	4636	90	175	16167	50762
2046-47	1358	2206	613	1010	5412	10901	531	1379	2010	4841	94	183	16791	52739
2047-48	1405	2275	638	1052	5634	11368	553	1441	2096	5056	97	190	17443	54807
2048-49	1454	2348	664	1097	5865	11854	578	1506	2188	5282	101	198	18125	56971
2049-50	1505	2424	691	1143	6107	12362	603	1574	2282	5518	105	206	18837	59236
2050-51	1559	2503	720	1192	6358	12894	629	1646	2382	5764	110	216	19582	61603
2051-52	1614	2586	749	1243	6620	13448	657	1721	2485	6022	114	225	20361	64080
2052-53	1672	2671	780	1295	6893	14026	685	1799	2593	6291	119	235	21175	66670
2053-54	1731	2759	811	1349	7177	14628	715	1879	2705	6571	124	245	22026	69378
2054-55	1793	2851	844	1406	7473	15259	745	1964	2823	6865	129	255	22916	72213
2055-56	1857	2947	878	1465	7782	15915	778	2052	2945	7172	134	265	23845	75177
2056-57	1925	3048	914	1527	8104	16603	811	2145	3073	7493	139	277	24818	78279
2057-58	1996	3155	951	1593	8439	17319	847	2242	3207	7830	145	290	25835	81523
2058-59	2069	3265	989	1660	8788	18067	884	2343	3347	8180	151	302	26898	84917
2059-60	2145	3379	1030	1731	9152	18848	922	2449	3493	8547	157	315	28010	88467

Junctions in terms of interchanges are to be decided catering above traffic at least or as per expressway manual guidelines whichever is governing.

0.1.19 Toll Plaza

0.1.20 Location of toll plaza

Since this is an access-controlled highway, toll plazas will be installed at all entry and exit points along the highway.

0.1.21 Capacity Analysis

0.1.22 Capacity augmentation proposals (lane requirement)

Based on the guidelines decided as per the Ministry of Road Transport and Highways (MoRT&H) office memorandum no. NHAI/Planning/EC/DPR/2016 dated 3rd May 2018, the end-lane configuration and the stage development guidelines based on the present traffic including the induced traffic (PCU) and the present lane status of the stretch is given in **Table 0-90**.

Table 0-90: Design service volume standards for LOS-B

Sl. No.	Present traffic including induced traffic (PCU)	Present Lane Status	End Lane Status	Stage Development	ROW
(i)	Upto 20,000 PCUs	Upto 2LPS	8 Lane	4 Lane highway with 4 lane structures	70m
(ii)	20,000 - 30,000 PCUs	Upto 2LPS	8 Lane	6 Lane highway with 8 lane structures	70m
(iii)	30,000 - 40,000 PCUs onwards	Upto 2LPS	8 Lane	8 Lane highway with 8 lane structures	70m
(iv)	40,000 PCUs onwards	Upto 2LPS	12 Lane	8 Lane highway with 8 lane structures Service Roads in urban areas	100m
(v)	40,000 PCUs onwards	4-Lane	6/8-Lane	*Option of a Green-filled alignment or 8 lane with 8 lane structures (where lifecycle cost is lower) * 6 Lane with 6 lane structures, in cases, where portion of the corridor has been 6 laned or 6 lane structures have already been developed on 4 lane highway or Cost of land acquisition for brown-field expansion is prohibitive.	70m

The projected traffic in all homogeneous sections is presented in **Table 0-91**. The mode wise projected traffic is presented in **Annexure 4.4**.

Table 0-91: Section wise Total Traffic Projection

FY	Sections												Average PCUs
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
	Km 78.800 to km 102.000	Km 102.000 to km 129.017	Km 129.017 to km 181.452	Km 181.452 to km 210.954	Km 210.954 to km 228.740	Km 228.740 to km 291.974	Km 291.974 to km 337.170	Km 337.170 to km 385.796	Km 385.796 to km 398.240	Km 398.240 to km 417.600	Km 417.600 to km 434.820	Km 434.820 to km 452.425	
2018-19	28482	26144	25738	20957	20856	27123	26541	26787	22040	21947	20139	19922	23890
2019-20	30349	27845	27410	22258	22151	28833	28213	28475	23415	23317	21407	21176	25404
2020-21	32348	29663	29199	23646	23532	30660	29999	30278	24882	24779	22761	22515	27022
2021-22	34487	31609	31112	25128	25006	32611	31905	32202	26448	26340	24207	23944	28750
2022-23	39907	39099	38742	32417	32287	40403	36474	36791	30652	30539	28285	27850	34454
2023-24	42358	41327	40933	34105	33966	42629	38649	38988	32437	32317	29935	29480	36427
2024-25	44781	43536	43106	35803	35655	44855	40826	41185	34232	34106	31594	31120	38400
2025-26	51540	53101	52858	45228	45071	54842	46525	46905	39524	39391	36743	36044	45648
2026-27	54286	55603	55320	47147	46980	57359	48986	49390	41553	41413	38620	37899	47880
2027-28	57209	58267	57941	49188	49010	60036	51604	52032	43711	43564	40616	39873	50254
2028-29	60322	61104	60731	51357	51168	62883	54389	54844	46005	45850	42740	41972	52780
2029-30	66550	69340	69095	59262	59061	71453	59722	60203	50858	50696	47421	46473	59178
2030-31	69816	72326	72035	61586	61373	74481	62686	63194	53313	53143	49693	48719	61864
2031-32	73277	75490	75149	64048	63822	77688	65826	66362	55914	55735	52101	51100	64709
2032-33	76943	78842	78450	66655	66416	81086	69152	69719	58670	58482	54653	53623	67724
2033-34	80828	82395	81947	69418	69163	84685	72676	73275	61590	61392	57358	56296	70919
2034-35	84619	85870	85371	72162	71893	88238	76157	76788	64488	64280	60040	58948	74071
2035-36	88617	89536	88982	75057	74773	91985	79829	80493	67544	67326	62870	61745	77396
2036-37	92833	93402	92791	78111	77812	95939	83703	84401	70771	70542	65858	64699	80905

FY	Sections												Average PCUs
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
	Km 78.800 to km 102.000	Km 102.000 to km 129.017	Km 129.017 to km 181.452	Km 181.452 to km 210.954	Km 210.954 to km 228.740	Km 228.740 to km 291.974	Km 291.974 to km 337.170	Km 337.170 to km 385.796	Km 385.796 to km 398.240	Km 398.240 to km 417.600	Km 417.600 to km 434.820	Km 434.820 to km 452.425	
2037-38	97278	97480	96808	81334	81018	100110	87791	88525	74175	73934	69011	67816	84607
2038-39	101967	101781	101045	84735	84401	104510	92103	92876	77767	77514	72338	71105	88512
2039-40	106410	105866	105070	87999	87649	108714	96225	97034	81211	80946	75525	74256	92242
2040-41	111071	110151	109293	91427	91059	113127	100552	101398	84827	84550	78871	77565	96158
2041-42	115961	114647	113724	95025	94639	117758	105093	105979	88624	88333	82385	81039	100267
2042-43	121089	119364	118374	98804	98397	122619	109861	110788	92611	92306	86075	84688	104581
2043-44	126469	124313	123252	102771	102344	127722	114865	115835	96797	96478	89950	88519	109110
2044-45	131591	129035	127909	106599	106152	132622	119673	120684	100832	100499	93682	92210	113457
2045-46	136942	133970	132775	110603	110136	137745	124701	125754	105053	104706	97585	96070	118003
2046-47	142532	139126	137860	114791	114303	143102	129958	131056	109468	109105	101668	100108	122756
2047-48	148372	144514	143174	119171	118661	148702	135456	136599	114086	113706	105939	104332	127726
2048-49	154473	150144	148727	123753	123219	154558	141203	142395	118916	118519	110406	108751	132922
2049-50	160847	156027	154530	128545	127987	160680	147213	148456	123968	123553	115080	113373	138355
2050-51	167506	162175	160594	133558	132975	167082	153497	154793	129253	128818	119968	118207	144036
2051-52	174464	168599	166932	138802	138192	173775	160069	161419	134781	134327	125081	123265	149976
2052-53	181733	175312	173554	144286	143649	180773	166940	168348	140562	140088	130430	128555	156186
2053-54	189327	182327	180475	150023	149357	188091	174125	175593	146610	146114	136025	134088	162680
2054-55	197261	189658	187708	156024	155327	195743	181639	183168	152935	152417	141877	139877	169470
2055-56	205551	197319	195267	162302	161573	203743	189495	191090	159552	159010	147999	145931	176569
2056-57	214213	205326	203167	168869	168106	212109	197711	199373	166473	165906	154403	152265	183993
2057-58	223263	213693	211423	175737	174940	220857	206303	208035	173713	173120	161102	158890	191756
2058-59	232720	222437	220052	182922	182088	230003	215287	217094	181286	180666	168110	165821	199874
2059-60	242600	231576	229071	190438	189565	239568	224682	226565	189208	188560	175441	173072	208362

According to **Table 0-90**, the thresholds for 8-lane highway with 8-lane structures with End lane status of 8 lanes and 8 Lane highway with 8 lane structures and Service road in urban areas with End lane status of 12 lanes for the proposed Greenfield economic corridor are given in

Table 0-92: Capacity Augmentation

Requirement of	Year	Sections												Average
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
8-lane highway with 8-lane structures with End lane status of 8 lanes	2022-23	39907	39099	38742	32417	32287	40403	36474	36791	30652	30539	28285	27850	34454
8 Lane highway with 8 lane structures Service road in urban areas with End lane status of 12 lanes	2025-26	51540	53101	52858	45228	45071	54842	46525	46905	39524	39391	36743	36044	45648

In most sections, requirement of 8-lane with 8-lane structures will reach by 2022-23. Hence, there is an immediate requirement to construct 8-lane highway with 8-lane structures considering the construction period of 3-4 years. Further, in many sections threshold for 8-lane with 8-lane structures and service roads in urban areas with end lane status of 12 lanes will reach by 2025-26, within 2-3 years of start of operations. Therefore, it is recommended to go for 8-lane with 8-lane structures and service roads in urban areas with end lane status of 12 lanes immediately.