



DHTL: Traffic and Revenue Forecast

Report
October 2017

L&T Infrastructure Development
Projects Ltd.

Our ref: 23138401
Client ref:

Prepared by:

Steer Davies Gleave India
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road, Gurgaon,
Haryana, 122002
+91 124 441 8650
www.steerdaviesgleave.com

Prepared for:

L&T Infrastructure Development
Projects Ltd.
Mount Poonamallee Road,
Manapakkam, Chennai, India

Steer Davies Gleave has prepared this material for L&T Infrastructure Development Projects Ltd. . This material may only be used within the context and scope for which Steer Davies Gleave has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer Davies Gleave shall be deemed to confirm their agreement to indemnify Steer Davies Gleave for all loss or damage resulting therefrom. Steer Davies Gleave has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

Contents

Disclaimer.....	8
1 Introduction	1
The Assignment	1
Our Approach	1
Contents of this Report.....	1
2 The Asset	3
Introduction	3
3 Traffic and Revenue History	8
Introduction	8
FY2018 and FY2017.....	9
Historic evolution of traffic.....	10
Seasonality	12
Specific Events in 2017	12
Key findings from the origin-destination survey	13
4 Socio-economic Context	18
Introduction	18
Population Growth	18
Changes in employment and income distribution	21
Changes in car ownership/registrations.....	25
Evolution of Road Kilometres and Road-Rail Competition.....	29
Economic growth	30
Summary.....	32
5 Traffic Growth	33
Introduction	33
Our approach	33
6 Traffic and Revenue Forecasts.....	42
Introduction	42
FY2018 Base and Forecast Years	42
Future Year Traffic Forecasts	43

Traffic and Revenue forecasts	46
-------------------------------------	----

Figures

Figure 2.1: Location of the DHTL asset on the national map with respect to the Golden Quadrilateral.....	3
Figure 2.2: DHTL asset alignment with existing toll plazas.....	4
Figure 2.3: DHTL typical cross-section	6
Figure 2.4: Km 119.1 Kadabahalli Toll Plaza Figure 2.5: Km 169.5 Shantigramma Toll Plaza	7
Figure 3.1: Vehicle Split at DHTL (Total of Kadabahalli and Shantigramma Toll Plaza Traffic) in FY 2017	10
Figure 3.2: Change in AADT between FY 14-17 by plaza and vehicle type.....	11
Figure 3.3: Change in AADT between FY 14-17 by plaza and vehicle type.....	11
Figure 3.4: Seasonality profile of total traffic (TP01), indexed against the AADT	12
Figure 3.5: Key drivers of traffic - CJV	15
Figure 3.6: Key drivers of traffic - LCV	15
Figure 3.7: Key drivers of traffic - MAV.....	16
Figure 3.8: Split of Trip Purpose (Combined for two toll plazas).....	16
Figure 3.9: Split of transported commodities by toll plazas.....	17
Figure 4.1: Historic and Projected Population: Rural vs. Urban	19
Figure 4.2: Distribution of Rural and Urban Population in 2001, Karnataka and India	20
Figure 4.3: Distribution of Rural and Urban Population in 2011, by Karnataka and India	20
Figure 4.4: Employment participation per 1000 persons, by gender.....	22
Figure 4.5: Proportion of employment in Rural areas on usual status basis.....	23
Figure 4.6: Proportion of employment in Urban areas on usual status basis	23
Figure 4.7: Regional Comparison of Income Inequality in 2013, in Gini Points.....	24
Figure 4.8: Gini Coefficient of Distribution of Consumption, 2009 – 10	25
Figure 4.9: Registered Motor Vehicles in India by type (m), 1960 – 2013	26
Figure 4.10: Proportional Share of Registered Motor Vehicles in India by type, 1960 – 2013 ..	26
Figure 4.11: Proportional Share of Registered Motor Vehicles, 2011 – 12	27
Figure 4.12: Index of growth in registered motor vehicles per 1000 population and per 100 km	27
Figure 4.13: Index of growth in registered motor vehicles (Karnataka vs. India)	28
Figure 4.14: Proportional distribution of roads by type (million km) in India, 2001 – 13	29

Figure 4.15: Proportional distribution of roads by type Karnataka vs. India (million km), 2013	30
Figure 4.16: Karnataka: Composition and Total Volume of GDP	30
Figure 4.17: Comparison of evolution of State GDP and National GDP	31
Figure 5.1: India GDP and Karnataka GSDP: Historic and Forecast	35
Figure 5.2: Relationship between CJV traffic growth and Karnataka GSDP by toll plaza	36
Figure 5.3: Relationship between LCV traffic growth and Karnataka GSDP by toll plaza.....	37
Figure 5.4: Relationship between MAV traffic growth and Karnataka GSDP by toll plaza.....	38
Figure 5.5: Impact of Shiradi Ghat Closure at TP02 Shantigrama on truck traffic.....	39
Figure 6.1: Historic and forecast traffic	47
Figure 6.2: DHTL total revenues (INR nominal) by vehicle type for FY2014-2024	48
Figure 6.3: DHTL CJV historic and forecast traffic growth rates for FY2016-2040	49
Figure 6.4: DHTL LCV transactions historic and forecast growth rates for FY2016-2040.....	49
Figure 6.5: DHTL MAV historic and forecast traffic growth rates for FY2016-2040	50
Figure 6.6: DHTL revenue (nominal) historic and forecast and growth rates for FY2014-2040.	51

Tables

Table 2.1: Km 119.100 Kadabahalli Toll Plaza - Current toll rates (in INR).....	6
Table 2.2: Km 169.500 Shantigrama Toll Plaza - Current toll rates (in INR)	7
Table 3.1: Reconciliation of average daily toll collection (Kadabahalli and Shanthigrama Toll Plaza) INR (lakhs)	9
Table 3.2: Average Daily Toll Transactions by Toll Plaza and total PCUs, FY 2017, reported.....	9
Table 3.3: AADT between FY 14-17 by plaza and vehicle type.....	10
Table 3.4: Gross Revenue for DHTL toll plazas (INR Crore)	12
Table 3.5: Gross revenue comparison for DHTL, Nov-2016	13
Table 3.6: OD survey sample rate.....	13
Table 3.7: Vehicle wise OD survey sample rate at TP01-Kadabahalli.....	13
Table 3.8: Vehicle wise OD sample survey rate for TP02-Shanthigrama	14
Table 4.1: CAGR of Population in India.....	18
Table 4.2: Population growth Karnataka and India (2001 – 11)	19
Table 4.3: Employment and Unemployment Scenario in India	21
Table 4.4: Poverty Ratio: percentage of persons below the Poverty Line	24
Table 4.5: CAGR of Registered Motor Vehicles in India.....	25

Table 4.6: Passenger Cars in use per 1000 inhabitants	28
Table 5.1: Key Socio-Economic Drivers Growth Assumptions (CAGR)	35
Table 5.2: DHTL vehicle type elasticities at each toll plaza by individual influencing factor.....	38
Table 5.3: Shiradi Ghat closure impact on forecast traffic	40
Table 5.4: Post Shiradi Ghat Jump in traffic assumptions for different vehicle types.....	40
Table 6.1: AADT by Toll Plaza and total PCUs, FY 2018, adjusted for actual traffic in FY2018...	43
Table 6.2: WPI forecast assumptions	45
Table 6.3: Proportion of ticket types used in the forecasts	45
Table 6.4: Vehicle type return trip factors for TP01 and TP02	46
Table 6.5: Local trip factor for CJV vehicles for TP01 and TP02	46
Table 6.6: Total Traffic (AADT): Forecasts of Total Traffic at DHTL	47
Table 6.7: Revenue INR (Nominal): Forecasts of Total Revenue at DHTL	48
Table 6.8: Concession agreement: target traffic estimation	52
Table 6.9: Total traffic (PCU) growth rates (%) for both toll plazas.....	53
Table 6.10: Vehicle wise forecasted growth rates (%)	54
Table 6.11: Forecasted annual total revenue (INR crore)	54

Disclaimer

This report has been produced for the sole benefit of L&T IDPL. The report may only be relied upon by Approved Addressees in accordance with the terms of our engagement letter.

The projections of traffic contained within this document represent Steer Davies Gleave's best estimates. While they are not precise forecasts, they do represent, in our view, a reasonable expectation for the future, based on the most credible information available as of the date of this report.

The estimates contained within this document rely on numerous assumptions and judgements and are influenced by external circumstances that can change quickly and that can affect the outcome. In addition, it has been necessary to base most of this analysis on data collected by third parties. This has been independently checked whenever possible. However, Steer Davies Gleave does not guarantee the accuracy of this data.

Finally, it is important to note that the traffic forecasts presented represent long term growth profiles. In reality, there will be a degree of year-on-year oscillation of actual traffic levels around these growth rates in line with macroeconomic cycles. We do not believe it is feasible to include such oscillations within our concession life forecast, and would recommend that such uncertainties are addressed through "stress tests" within the financial model.

1 Introduction

The Assignment

- 1.1 L&T Infrastructure Development Projects Limited (Client) has appointed Steer Davies Gleave (SDG) to prepare traffic and revenue forecasts for a 78.83 km section of NH75 (previously NH48) in the state of Karnataka.
- 1.2 Devihalli Hassan Tollway Ltd (DHTL) - the asset, has been upgraded from 2 to 4 lanes and belongs to the Client's portfolio of assets. Canada Pension Plan Investment Board (CPPIB) is a co-investor along with L&T IDPL in this portfolio. As per the terms of the Investment Agreement (IA) between CPPIB and L&T IDPL, a Fair Market Valuation (FMV) exercise of the assets is to be carried out as per the schedule and methodologies prescribed in the IA. This exercise is being jointly run by CPPIB and L&T IDPL to update and further develop the long-term views on their assets in order to inform the strategy for the asset portfolio. This study forms part of the FMV process.

Our Approach

- 1.3 The approach employed by Steer Davies Gleave (SDG) in the preparation of the traffic and revenue forecasts was developed to take advantage of the existing knowledge of the asset and of the available data. It follows normal practices well established in addressing the issue of forecasting on-going traffic growth on a brownfield project.
- 1.4 The analysis focus on the following key issues:
 - understanding and verifying the traffic which is at present using the asset; and
 - identifying how and why that traffic will change in the future.
- 1.5 In order to understand the current traffic on the asset, independent primary data collection was commissioned and then compared against the vendor supplied traffic and revenue datasets.
- 1.6 Future change in traffic is driven by two key factors:
 - Growth of 'background' traffic: this depends to a certain extent on the on-going socio-economic and demographic development of the catchment area served by the asset; and
 - Changes in the competitive position of the asset: this reflects changes in highway capacity of competing roads and the relative changes in service levels (time, congestion, price, etc.) for the asset, and its competitors.

Contents of this Report

- 1.7 The report has been divided into 6 chapters, including this introduction:
 - Chapter 2 describes the key features of the asset;
 - Chapter 3 reports the current traffic and revenue of the asset;

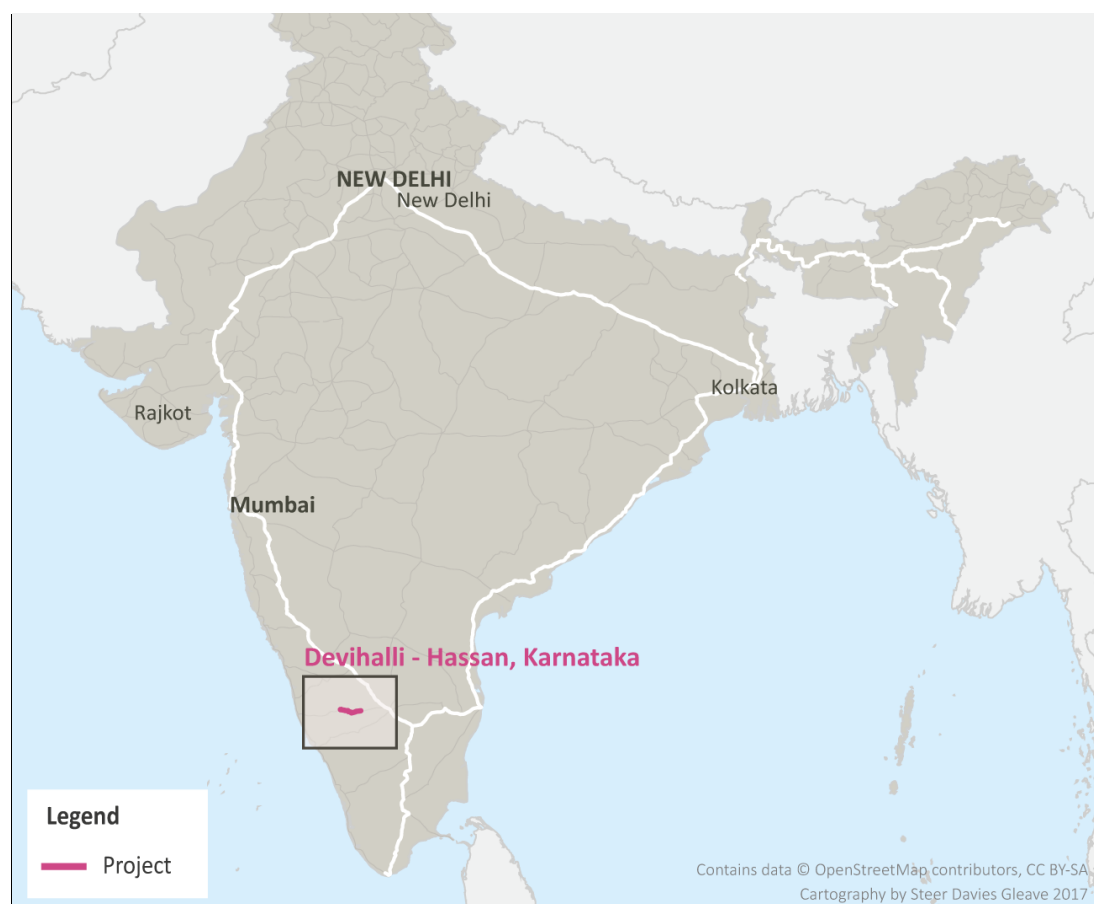
- Chapter 4 discusses the socio-economic context of India and the corridor of the asset;
- Chapter 5 reports our approach to forecasting traffic demand growth on the asset; and
- Chapter 6 presents our forecasting assumptions and the traffic and revenue forecasts for the asset.

2 The Asset

Introduction

- 2.1 This chapter provides a description of the asset, prepared using available information/information provided by the Client, and our own analysis, based on site visits and our understanding of the local areas around the asset.
- 2.2 It further covers a brief history of the asset, the alternative routes (if any), the relative competitive advantage between the asset and the alternatives, and places of interest which could be the possible source of traffic or travel demand along the corridor. The location of the asset on the national network is shown in the figure below.

Figure 2.1: Location of the DHTL asset on the national map with respect to the Golden Quadrilateral



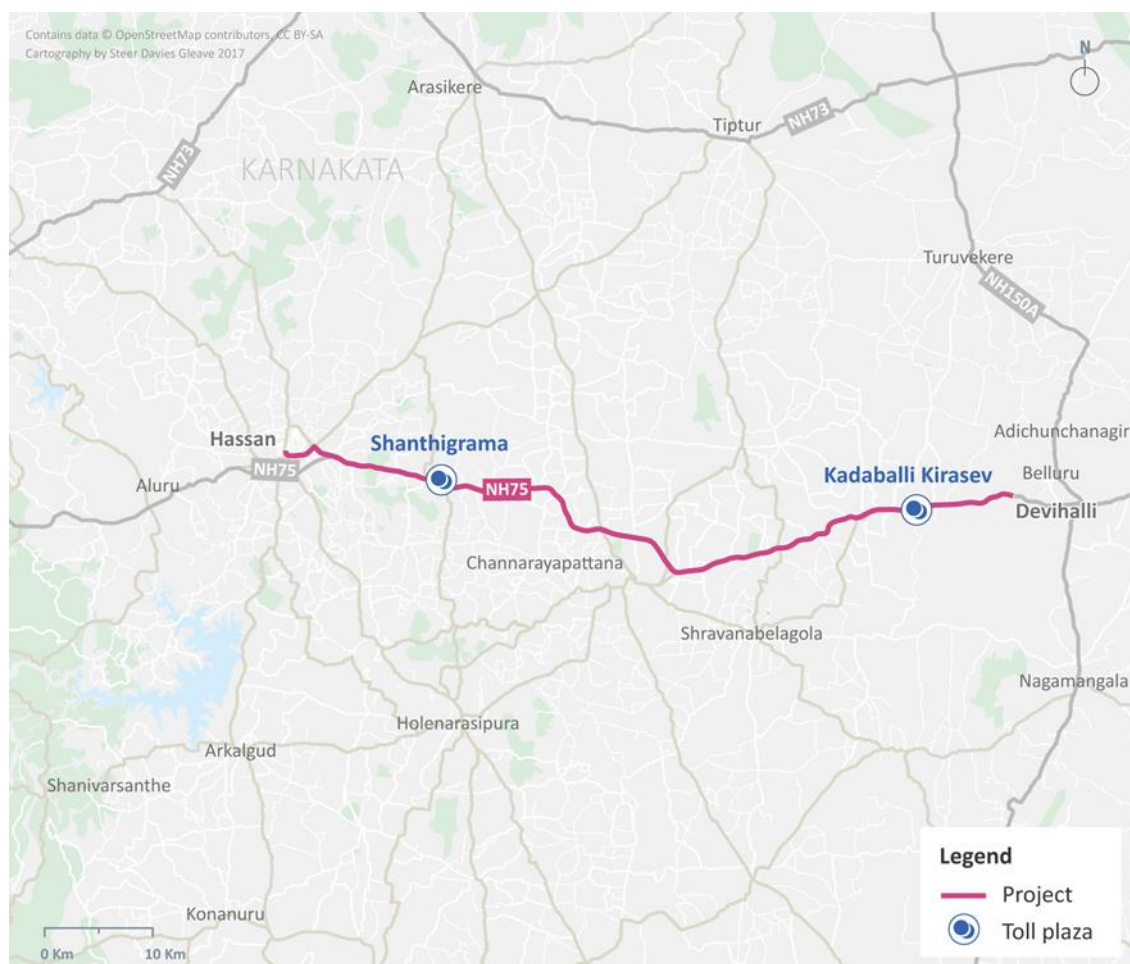
Source: Steer Davies Gleave cartography

Key characteristics

- 2.3 The Client was awarded the 4 laning project of the road between Devihalli and Hassan (Km 110.00 – 189.500) and the concession agreement was signed in May 2010. The project was awarded to develop, operate and maintain the project road for a 30 year concession period.

- 2.4 Toll collection on the project road commenced in October 2014, and at present, toll is charged at two locations:
- Kadabahalli at km 119.100; and
 - Shanthigrama at km 169.500.
- 2.5 NH75 (previously known as NH48), is on the Bengaluru to Mangalore Highway, which connects Mangaluru (on the Southwest Coast of the country) to Vellore in the state of Tamil Nadu (west of Chennai), passing through Bengaluru (in the state of Karnataka). This is an important East – West connection for the four southern states and connects various major cities and towns, such as Vellore, Bengaluru and Mangaluru.
- 2.6 The road comprises of two bypasses for Channarayapatna and Hassan, which have a two lane configuration. NHAI is currently undertaking the four laning of both bypasses, under the EPC mode of procurement. The alignment of the asset and toll plaza locations are shown in the figure below.

Figure 2.2: DHTL asset alignment with existing toll plazas



Source: Steer Davies Gleave cartography

Key economic activity along the asset corridor

- 2.7 Primary land use along the corridor is agricultural with some industrial units towards the North East of the project road and some industries along the corridor. HPCL has a bottling plant at Yediur, south west of the project road.

- 2.8 The commodities transported along this road are mainly agricultural produce such as coconuts, ragi and silk. Trucks carrying petroleum products were also observed during our site visit, however, their volume has decreased due to the development of a pipeline from Mangaluru refinery to carry these products.
- 2.9 Stone aggregate from mines near Shiradi ghat, stone dust from crushers around Nelmangla and sand from Nethravati river is also transported to other parts of the region via this road. Sand mining from Nethravati river is banned these days due to environmental concerns.

Connecting routes and places of interest

- 2.10 The project road provides a connection to Bengaluru (east of the asset). A user continuing to Bengaluru would need to pass through two additional two toll road sections, namely the Devihalli – Nelmangla section (operated by Lanco Infrastructure) and the Bengaluru – Nelmangla section (operated by Navayuga Engineering). Four laning of the road sections towards the west of the asset (between Hassan and Mangaluru) is also under progress.
- 2.11 The asset also connects a number of pilgrim sites in the state of Karnataka for different communities and a significant share of traffic is related to religious tourism, visiting key areas such as Shiradi, Dharmasthala, Kukke Subramanya, Bellur and Udupi. There are also seasonal peaks during festivals, such as at Shravanabelagola (which is a Jain pilgrim centre), which hosts a major festival every 12 years (with the next one in Feb 18) - traffic is expected to increase significantly during such periods.
- 2.12 In addition to pilgrim sites, this road also connects to a number of other tourist destinations in the southern region such as Mangaluru, Coorg (Madikeri), Udupi and few national parks and water falls.

Asset Description

- 2.13 The project road is designed as an open system toll road, allowing users to enter or exit the road without necessarily paying toll, unless they cross the toll plazas. The entire asset is of a 4 lane configuration with service roads in areas, however, the two bypasses, Channarayapatna and

Hassan, are still two lanes. The following images show a typical cross section of the project road, from different locations.

Figure 2.3: DHTL typical cross-section



Source: Steer Davies Gleave photos from the site visit

- 2.14 Tolls are currently charged at two toll plazas locations and the toll rates for FY 2017-18 are presented in the tables below.

Table 2.1: Km 119.100 Kadabahalli Toll Plaza - Current toll rates (in INR)

Category of Vehicle	Fee per vehicle per Single trip	Multiple Trips within 24hrs	Monthly Pass
Car, Passenger Van or Jeep	40	60	1,330
Monthly pass for local car	N/A	N/A	245
Light Commercial Vehicle	65	95	2,145
Bus or Truck	135	200	4,495
MAV, EMV, HCM*(three to six axles)	210	315	7,050
Oversized vehicles (seven or more axles)	255	385	N/A

Source: NHAI Toll Notifications dated 28 March 2017 / * MAV – Multi Axle Vehicle (> 2 Axle), EMV – Earth Moving Vehicle, HCM – Heavy construction Machinery

Table 2.2: Km 169.500 Shantigramma Toll Plaza - Current toll rates (in INR)

Category of Vehicle	Fee per vehicle per Single trip	Multiple Trips within 24hrs	Monthly Pass
Car, Passenger Van or Jeep	35	50	1,140
Monthly pass for local car	N/A	N/A	245
Light Commercial Vehicle	55	85	1,845
Bus or Truck	115	175	3,860
MAV, EMV, HCM*(three to six axles)	180	270	6,055
Oversized vehicles (seven or more axles)	220	330	N/A

Source: NHAI Toll Notifications dated 28 March 2017 / * MAV – Multi Axle Vehicle (> 2 Axle), EMV – Earth Moving Vehicle, HCM – Heavy construction Machinery

- 2.15 The images below show the two toll plazas, which are well maintained, each of them comprising of 8 lanes for normal traffic tolls and 2 lanes for oversized vehicle tolls.

Figure 2.4: Km 119.1 Kadabahalli Toll Plaza



Figure 2.5: Km 169.5 Shantigramma Toll Plaza



Source: Steer Davies Gleave photos from the site visit

Competing routes/modes

- 2.16 Toll collection on the asset commenced in October 2014 and at present there are no viable alternatives. However, some factors have affected the traffic in the past and could continue to influence future traffic; these are listed below:

- The introduction of a petroleum pipeline from Mangaluru – Hassan, this has caused a reduction in some of the commercial traffic carrying petroleum products;
- A new rail line has been developed parallel to the project road, to connect Bengaluru – Mangaluru. Train operations commenced for the Bengaluru – Hassan route in April 2017. At present, there is not much passenger traffic due to the time taken by the train being significantly more than that offered by road and bus connections. The bus services by operated by the state transport operator – KSRTC, even though are more expensive than the rail option have better frequency and travel time and hence is an effective competitor of the rail service. KSRTC has also increased its bus frequency to counter the train service with sleeper buses during the day. Our view is that the rail service will be a competition for the bus service due to the segment of travel demand that they both serve with relatively low willingness to pay, as compared to car users who typically have a higher willingness to pay in this corridor.

3 Traffic and Revenue History

Introduction

- 3.1 This chapter discusses the analysis of the historic revenue and traffic data made available to the consultants by the client. Further, the analysis of the independent surveys carried out by the consultants have also been discussed in the later section of the chapter.
- 3.2 The tolling operations on the asset commenced in October 2013 (FY2014). The client shared the toll revenue data of the DHTL asset up to Mar-2017 (FY2017), and the latest traffic (reported) data of the DHTL asset up to August 2018 (FY2018). The analysis has been based on transaction numbers by vehicle type and ticket category, provided by the current concessionaire of the asset.
- 3.3 For the remainder of this chapter we report average daily traffic by toll plaza across a full financial year (running from 1st April to 31st March), which is calculated based on transactions, in combination with assumptions on the number of trips made using non-single journey ticket types, as follows (note that the reported traffic is equivalent to toll-able annual average daily traffic (AADT), less exemptions and violations):
- Daily ticket = two trips per day
 - Monthly ticket = 1.67 trips per day (based on an assumed 50 trips in a 30-day month)
- 3.4 Traffic on the asset is reported in terms of passenger car equivalents (PCUs) to estimate the level of congestion and level of service. The number of PCUs are calculated by multiplying the number of vehicles using the road with an equivalent factor for different categories of the vehicles. The traffic in terms of the PCUs values is estimated on the basis of PCU equivalent factor prescribed by Indian Road Congress (IRC: 64-1990 Guidelines for Capacity of Rural Roads), which are as follows:
- Cars: 1 PCU;
 - LCVs: 1.5 PCUs;
 - 2 Axle Buses and trucks: 3 PCUs;
 - 3 Axle Buses and trucks: 3 PCUs; and
 - MAVs: 4.5 PCUs
- 3.5 For calculation of PCUs for MAVs, which includes 3 Axle within MAV as per toll rate classification, we have considered different PCU factors for each of the toll plazas. For TP01 - Kadabahalli the PCU factor taken is 3.9 (a ratio of 39:61 for 3A: MAV), and 4 for TP02-Shanthigrama (a ratio of 35:65 for 3A: MAV).
- 3.6 We have calculated the toll revenue by vehicle type reported in this chapter on a bottom-up basis, individually for each vehicle type, based on the number of transactions, types of tickets sold, and toll rates of the different ticket types.
- 3.7 The overall fit between the reported and bottom up calculated revenue is good. The overall average difference in reported and bottom-up revenue reconciliation is within 1%, which is within the expected differences. However, since November and December were the months affected by demonetisation, they have been excluded while calculating averages. The following table shows a comparison of toll revenue reported by the concessionaire and the bottom up revenue calculations.

Table 3.1: Reconciliation of average daily toll collection (Kadabahalli and Shanthigrama Toll Plaza) INR (lakhs)

DHTL	FY 17	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Kadabahalli	Reported	7.00	7.66	6.60	6.04	6.58	6.57	6.72	-	6.60	6.63
	SDG Bottom Up	6.92	7.37	6.65	6.10	6.59	6.34	7.62	-	7.07	6.69
	Difference	-1%	-4%	1%	1%	0%	-3%	13%		7%	1%
Shanthigrama	Reported	5.73	6.43	5.49	5.16	5.47	5.22	6.22	-	5.69	5.70
	SDG Bottom Up	5.62	6.31	5.57	5.13	5.47	5.11	6.26	-	5.97	5.65
	Difference	-2%	-2%	2%	-1%	0%	-2%	1%		5%	-1%

Source: Steer Davies Gleave analysis of toll transaction and toll revenue data

FY2018 and FY2017

Traffic

- 3.8 We have received traffic data till August 2017, i.e. first five months of FY2018. However, since we have full financial year data till FY 2017, in the paragraphs below we have used the FY2017 traffic and revenue data to analyse the traffic behaviour of the asset. However, for forecasts purposes we will use FY2018 traffic data as base traffic, which is discussed in detail in chapter 6.
- 3.9 The following table shows the average number of daily toll transactions in the financial year 2016/17 (FY2017) at the two toll plazas Kirasev-Kadabahalli (TP-01) and Shanthigrama (TP-02), which are located at km 119.100 and km 169.350 respectively.

Table 3.2: Average Daily Toll Transactions by Toll Plaza and total PCUs, FY 2017, reported

Plaza	CJV	Bus	LCV	2-A	MAV	Total	PCU
Kadabahalli	8,520	1,296	1,106	497	840	12,260	18,852
Shanthigrama	7,914	1,267	990	502	819	11,493	17,969
Total	16,435	2,563	2,096	999	1,660	23,753	36,822

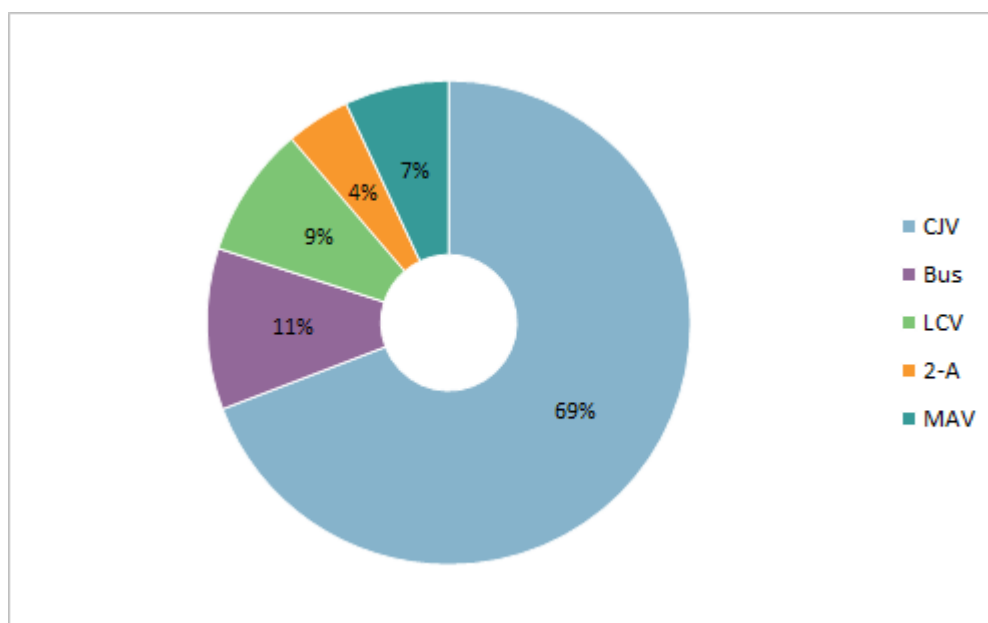
Source: Steer Davies Gleave analysis of toll transaction data provided by L&T IDPL

- 3.10 In FY2017, 12,260 daily toll transactions were registered at Kadabahalli toll plaza, located towards the east end of the concession towards Bengaluru; which is 6% more than the traffic registered at the Shanthigrama toll plaza, located east of the city of Hassan. This difference is mainly driven by a higher number of cars and equivalents at the Kadabahalli toll plaza (approximately 7% more CJV's than at Shanthigrama).

Vehicle split

- 3.11 The following figure shows the vehicle split at both plazas, in FY 2017. As can be seen, cars are the predominant mode at both plazas, contributing to nearly 70% of total trips.

Figure 3.1: Vehicle Split at DHTL (Total of Kadabahalli and Shanthigrama Toll Plaza Traffic) in FY 2017



Source: Steer Davies Gleave analysis of toll transaction data

Historic evolution of traffic

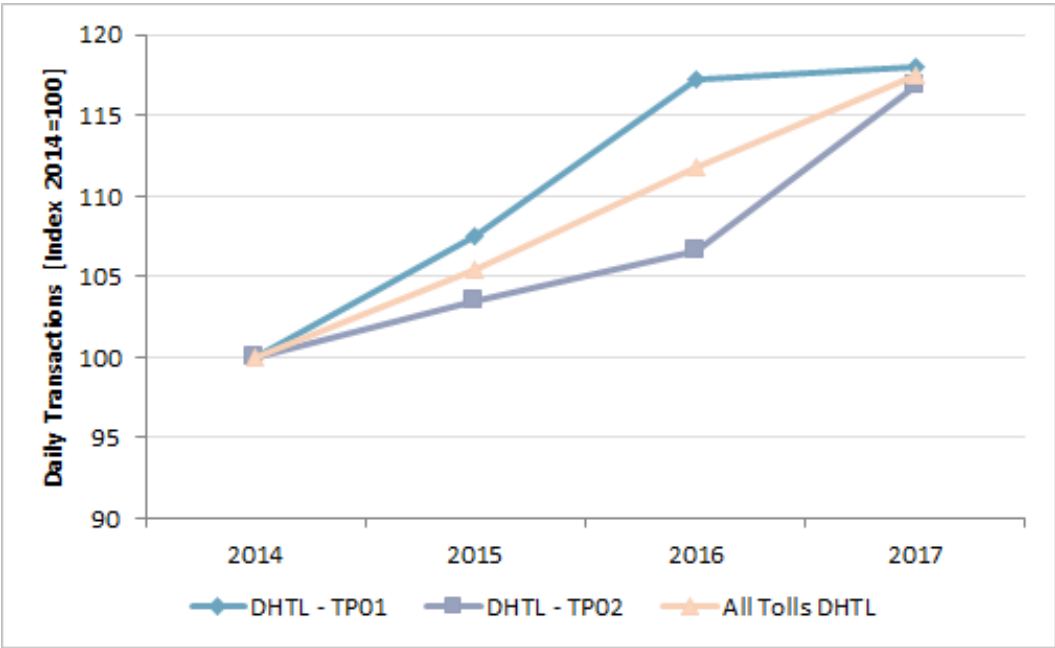
- 3.12 For DHTL, we have received historic data starting from October 2013 i.e. from when tolling commenced, up to August 2017, which gives us three full financial years of traffic data. Table below presents the AADT for the previous four financial years, the FY14 AADT has been estimated using 6 month data.

Table 3.3: AADT between FY 14-17 by plaza and vehicle type

		CJV	Bus	LCV	2-A	MAV	ADT	PCU
FY14	Kadabahalli	4850	1228	895	505	723	8201	14,222
	Shanthigrama	5269	1276	860	609	895	8909	15,773
FY15	Kadabahalli	5610	1181	952	441	628	8812	14,362
	Shanthigrama	5864	1171	901	541	728	9205	15,246
FY16	Kadabahalli	6924	1197	989	578	649	10337	16,274
	Shanthigrama	6607	1120	891	577	620	9817	15,503
FY17	Kadabahalli	8,520	1,296	1,106	497	840	12,260	18,852
	Shanthigrama	7,914	1,267	990	502	819	11,493	17,969

- 3.13 Traffic has been growing over the period and while for first two years the growth pattern is similar at both TPs, in FY 17, TP01 has seen a flat growth rate compared to the sharp upward growth for TP02. At the asset level, the number of transactions have increased at a compound annual growth rate (CAGR) of 8.5% in the same period.

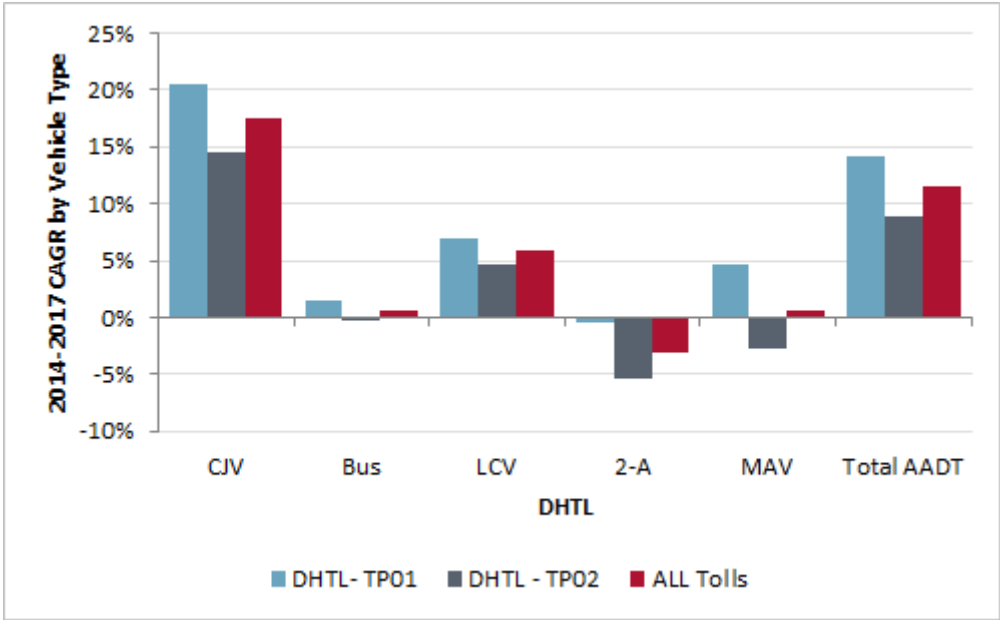
Figure 3.2: Change in AADT between FY 14-17 by plaza and vehicle type



Source: Steer Davies Gleave analysis of traffic data

3.14 The figure below shows the CAGRs between FY2014 and FY2017, by vehicle type and toll plaza. The trend in growth is generally positive for all vehicle types except 2As, which have seen a drop of approximately 5% at TP02. The declines observed at TP02 for LCVs and MAVs are also linked to the closure of Shiradi Ghat section which is discussed in later sections in more detail.

Figure 3.3: Change in AADT between FY 14-17 by plaza and vehicle type

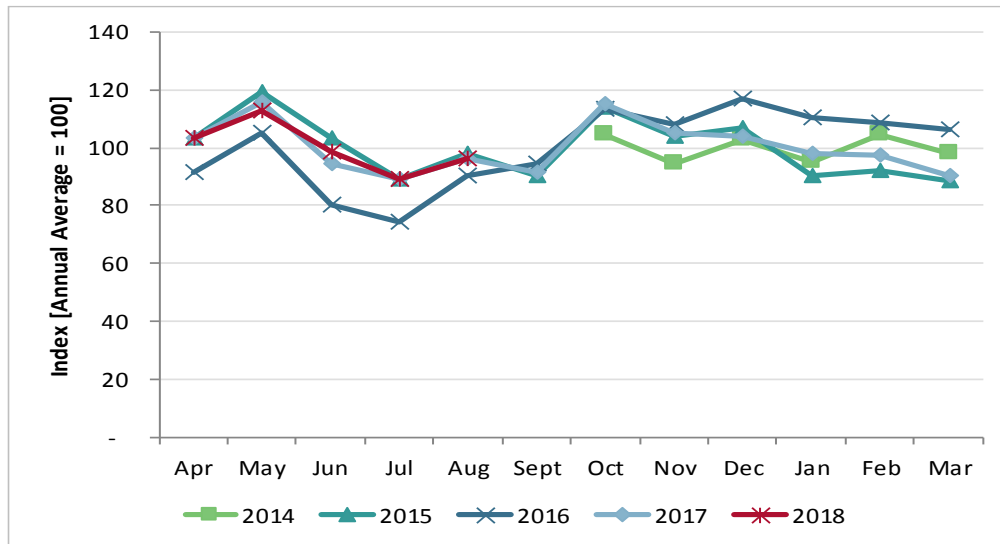


Source: Steer Davies Gleave analysis of traffic data

Seasonality

- 3.15 The figure below shows the monthly profile of total traffic, from Oct 2013 (FY14) to August 2017 (FY18). It is evident from the figure below that as expected, traffic is relatively low in the months of June to August, due to the monsoon affecting industrial production as well as traffic movement. Traffic during the months of April – May and October – December, is higher than the annual average due to crop seasons and festivals in the region.

Figure 3.4: Seasonality profile of total traffic (TP01), indexed against the AADT



Source: Steer Davies Gleave analysis of traffic data

Specific Events in 2017

Demonetisation

- 3.16 Demonetisation impacted revenues collected on the toll plazas for the months of Nov, Dec 2016 and Jan 2017. During these months, the concessionaire was expected to render the toll plaza free (for a specified time). To study the impact of such an event on toll collection, the following table shows gross revenue collections on the DHTL asset for both toll plazas for FY15, FY16 and FY17.

Table 3.4: Gross Revenue for DHTL toll plazas (INR Crore)

FY	Apr	May	June	July	Aug	Sep	YTD	Oct	Nov	Dec	Jan	Feb	Mar	Total
2014-15	2.48	2.87	2.46	2.33	2.45	2.27	14.86	2.70	2.54	3.16	2.36	2.00	2.16	29.78
2015-16	2.58	2.76	2.28	2.07	2.78	2.98	15.44	3.60	3.50	4.19	3.73	3.54	3.52	37.53
2016-17	3.92	4.35	3.70	3.40	3.78	3.49	22.63	4.35	1.11	3.88	3.68	3.45	3.48	42.59

Source: Revenue data provided by client

- 3.17 As we can see from the table above, Nov-2016 was impacted by demonetisation and the gross revenues fell to INR 1.11 crore in Nov 2016 as against INR 3.50 crore in Nov 2015. The revenues for the months of Dec 2016 and Jan 2017 are still lower than revenues in the corresponding months in FY2016, but are comparable.

- 3.18 To analyse the impact of demonetization, revenue for Nov-2016 was calculated based on the trends observed in revenue collection. In the table below we can see that if normal traffic conditions were applicable on the asset, the total revenue calculated may have been INR 4.26 crore. However, the actual revenue calculated was INR 1.11 crore; hence there is a difference of INR 3.15 crore.

Table 3.5: Gross revenue comparison for DHTL, Nov-2016

DHTL	Nov 2016 Revenue (inr crore)
Calculated	4.26
Reported	1.11
Difference	(3.15)

Source: Steer Davies Gleave analysis, Client data

- 3.19 As we can see, that the impact of demonetisation on revenues was more pronounced as all vehicles were exempted from paying tolls. We have reviewed the revenue data and used that observed effect on revenues in our forecasting process. This is discussed in detail later in the report.

Key findings from the origin-destination survey

- 3.20 We conducted a 24-hour origin-destination (OD) survey from 5th to 6th May 2017, at each toll plaza. For calculating the sample rate of the OD surveys we have used the latest available traffic numbers shared by vendor for March 2017 and adjusted it to estimate May 2017 AADT. The overall sample rate achieved at a toll plaza level is shown in the table below. For an asset where majority of traffic is cars this is considered a very good sample rate. This has given us a very good understanding of the overall trip patterns using the asset.

Table 3.6: OD survey sample rate

Toll Plaza	March 2017 All Vehicles	Survey Sample	Sample Rate
TP01 Kadabahalli	14,344	7,780	54%
TP02 Shantigrama	13,543	6,318	47%
Total (TP 01 + 02)	27,887	14,098	51%

Source: Steer Davies Gleave analysis based on independent OD survey data

Table 3.7: Vehicle wise OD survey sample rate at TP01-Kadabahalli

Toll Plaza	May 2017 Tollable Vehicles	Survey Sample	Sample Rate
Car	10,603	5551	52%
LCV	1,196	775	65%
2A	1,908	843	44%
MAV	637	611	96%
Total	14,344	7,780	54%

Source: Steer Davies Gleave analysis based on independent OD survey data

Table 3.8: Vehicle wise OD sample survey rate for TP02-Shanthigrama

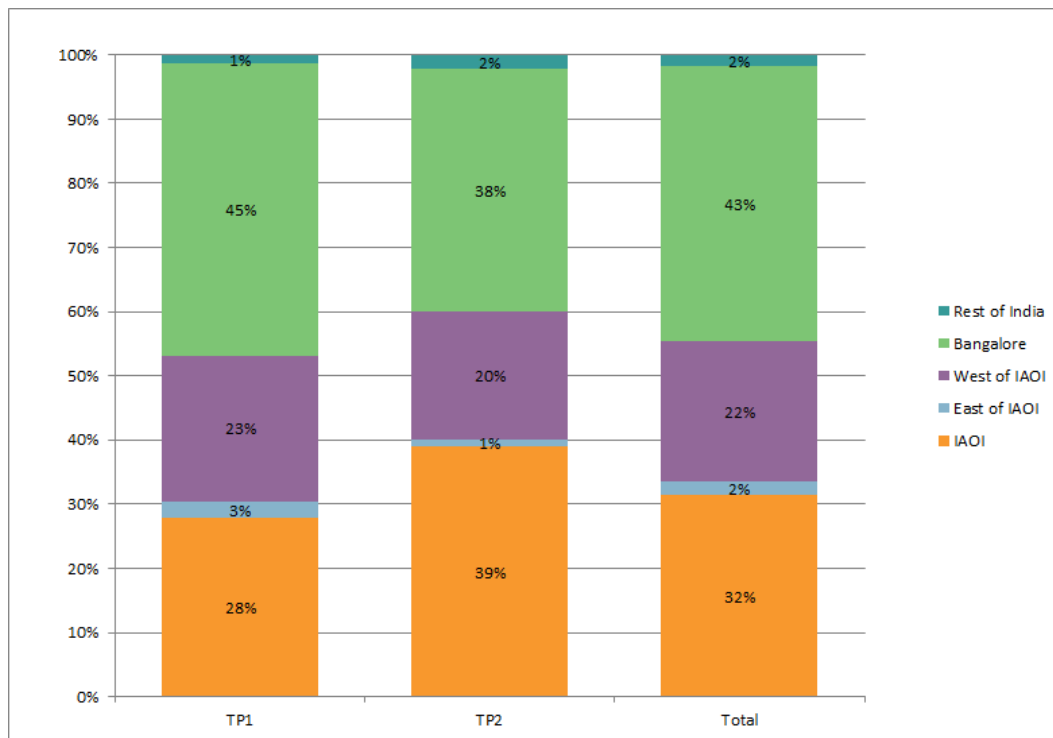
Toll Plaza	May 2017 Tollable Vehicles	Survey Sample	Sample Rate
Car	9,677	4229	44%
LCV	1,119	725	65%
2A	2,015	704	35%
MAV	732	660	90%
Total	13,543	6,318	47%

Source: Steer Davies Gleave analysis based on independent OD survey data

Trip Distribution

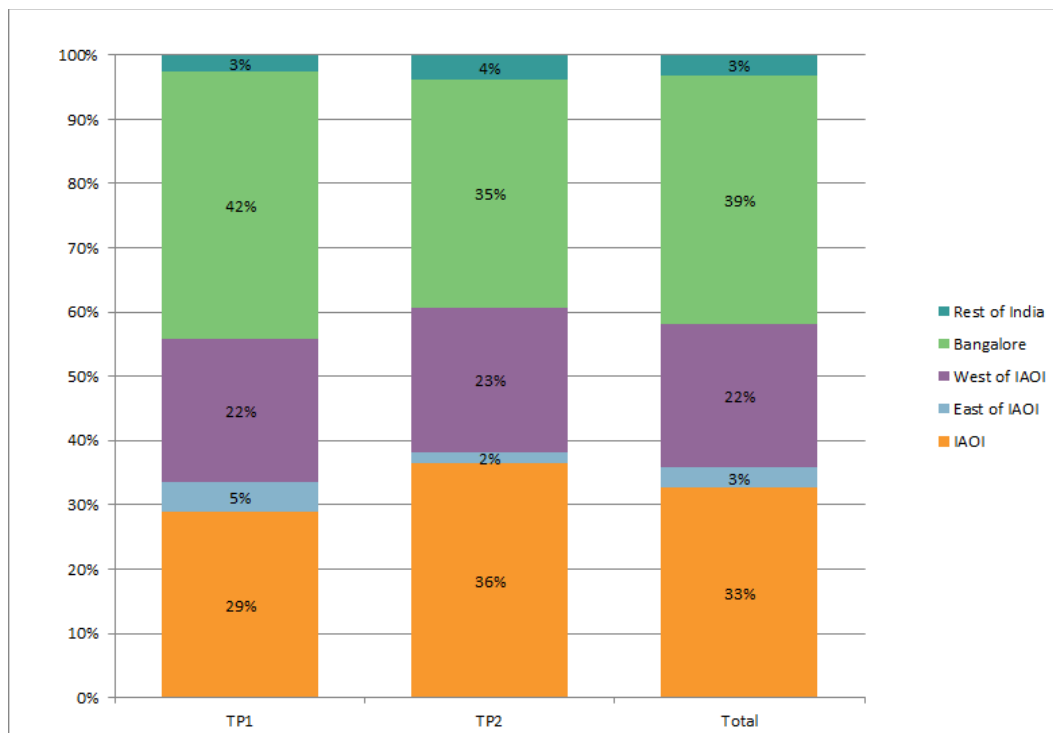
- 3.21 For ease of interpretation of the data, we have aggregated movements into trips that have either their origin or destination in the immediate area of influence, and trips that start or end outside of this area.
- 3.22 We have classified the immediate area of influence to be that which is along the tolled section, i.e. areas along the project road from Devihalli, Hassan, Chhanayapatna, Tiptur. Some of the key drivers of growth are Managlore Refinery (impacting petroleum trucks on the asset) and traffic destined to industries in and around Bengaluru. Cars are the dominant vehicle category on this asset (contributing nearly 70% of the tollable traffic) and they are mainly using the asset as a corridor for social/tourism/leisure activities.
- 3.23 Traffic on the asset is limited mainly to that which originates/ends in the state of Karnataka, as shown in the figure below. Within the state, the city of Bengaluru contributes the largest proportion, followed by areas along the project road in the immediate area of influence (IAOI), and then, areas to the east and west of the asset, i.e. traffic bound towards areas such as Mangaluru, Udupi, Chikmanglur. As shown in the figures below, CJV and LCV traffic has a relatively larger share of origins and destination in the IAOI as compared to MAV traffic.

Figure 3.5: Key drivers of traffic - CJV



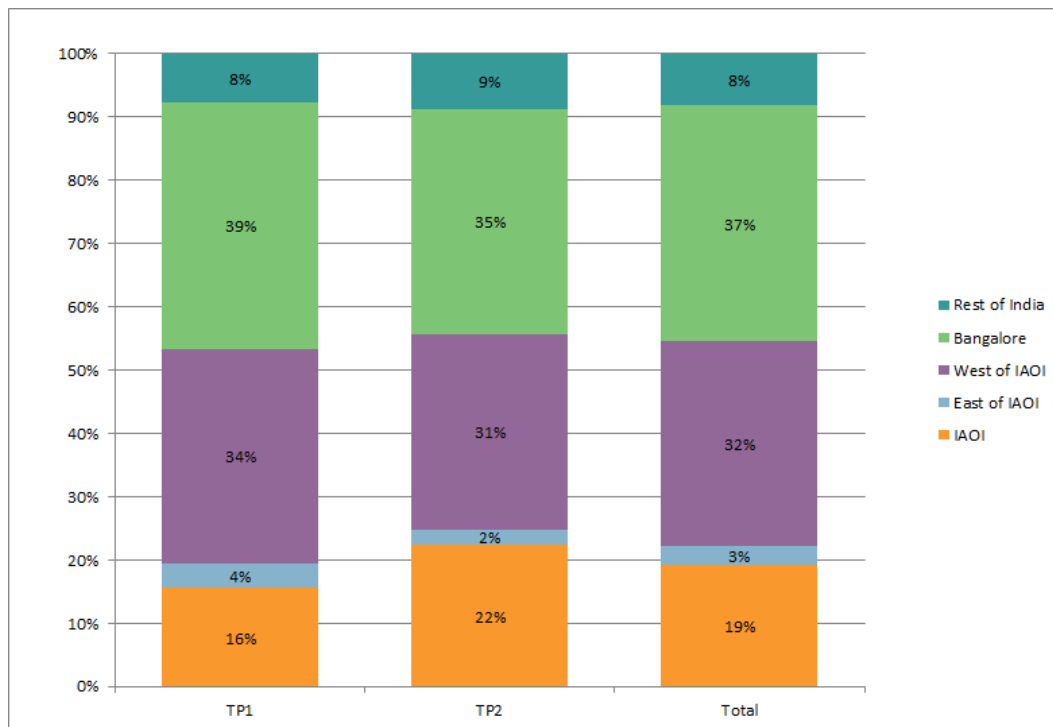
Source: Steer Davies Gleave analysis based on OD survey data

Figure 3.6: Key drivers of traffic - LCV



Source: Steer Davies Gleave analysis based on OD survey data,

Figure 3.7: Key drivers of traffic - MAV

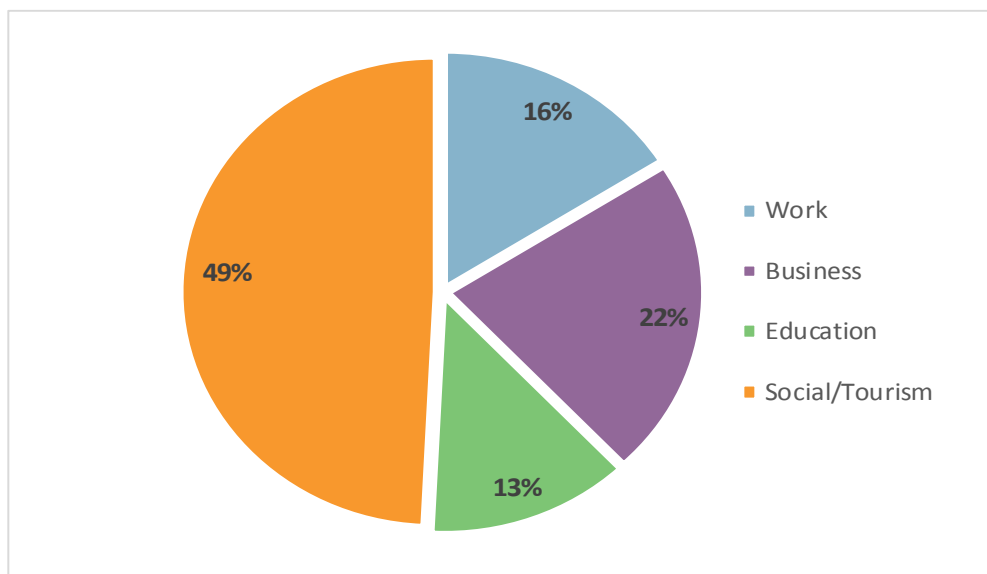


Source: Steer Davies Gleave analysis based on OD survey data,

Trip Purpose

3.24 Based on the OD data collected, we have grouped the trip purpose for cars into 4 primary categories. As mentioned previously, this corridor is primarily used for social, leisure and tourism activities with 49% of trips being associated with this purpose. The presence of several pilgrimage/religious sites along the corridor and to the west (such as Shravanabelagola and Dharamsthala) is another contributor to this category. The share of trip purposes is presented in figure below for both plazas. The trip purposes distributions at the two plazas are very similar.

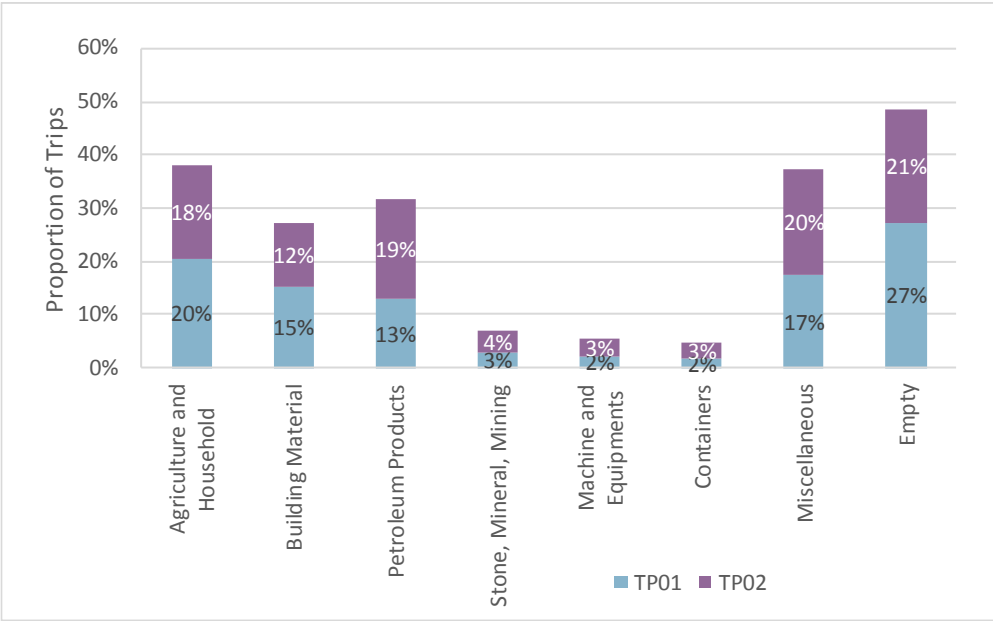
Figure 3.8: Split of Trip Purpose (Combined for two toll plazas)



Commodity Types

3.25 Based on the OD data collected, we have grouped the main commodities transported into 8 categories. Petroleum and agricultural products forms the largest proportion i.e. 18-19% of total traffic. Building material and miscellaneous commodities are the other major contributors to the total traffic passing through the plaza, as can be seen in the following figure.

Figure 3.9: Split of transported commodities by toll plazas



4 Socio-economic Context

Introduction

- 4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the asset is in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions in the region where the project road is located and the country as a whole. These include:
- Changes in population growth;
 - Changes in employment and income distribution;
 - Changes in car ownership and mode share between rail and road;
 - Economic growth (regional and national); and
 - Local factors such as tourism/religious pilgrimages etc.
- 4.2 In turn, the change in the competitive position of the project road (and thus of the traffic capture it will achieve) derives from how the relative offer for the road changes, i.e. the service offered and the prices charged on the asset, in comparison to that on competing roads; and whether any new competing road facilities are provided.
- 4.3 In this chapter, we have assessed the trends of the above growth drivers, as indicators of the socio-economic conditions in the region.

Population Growth

- 4.4 Total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% from 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease even further, till it reaches 0.6% CAGR (2030 – 45).

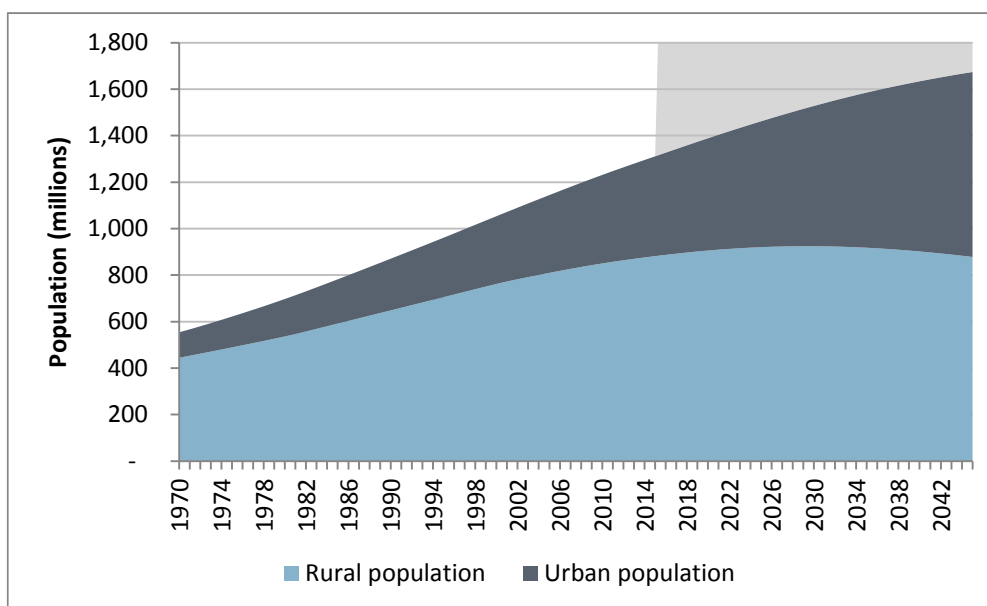
Table 4.1: CAGR of Population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth

- 4.5 The rate of growth of urban population has been consistently higher than that of total population, indicating a trend towards urban agglomeration. This is forecast to continue, with an expected shrinking of the rural population over the next 30 years, as shown in the following figure.

Figure 4.1: Historic and Projected Population: Rural vs. Urban



Source: World Bank Data on Health Nutrition and Population Statistics

- 4.6 Based on the Census of 2001 and 2011, the following table shows the evolution of population in Karnataka. Overall, it follows the trend observed at the country level, namely, a move towards urban agglomeration with the growth in rural population being slower than that of urban population.

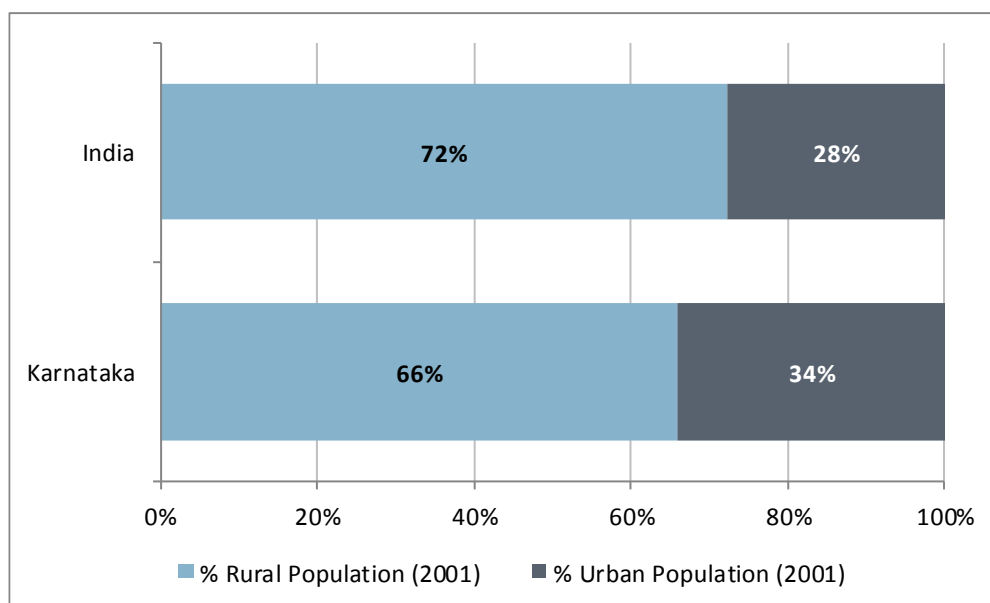
Table 4.2: Population growth Karnataka and India (2001 – 11)

Region	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Karnataka	53	35	18	61	38	24	1.5%	0.7%	2.8%
India	1,029	742	286	1,210	833	377	1.6%	1.2%	2.8%

Source: National Institution for Transforming India (NITI Aayog) – Census Data

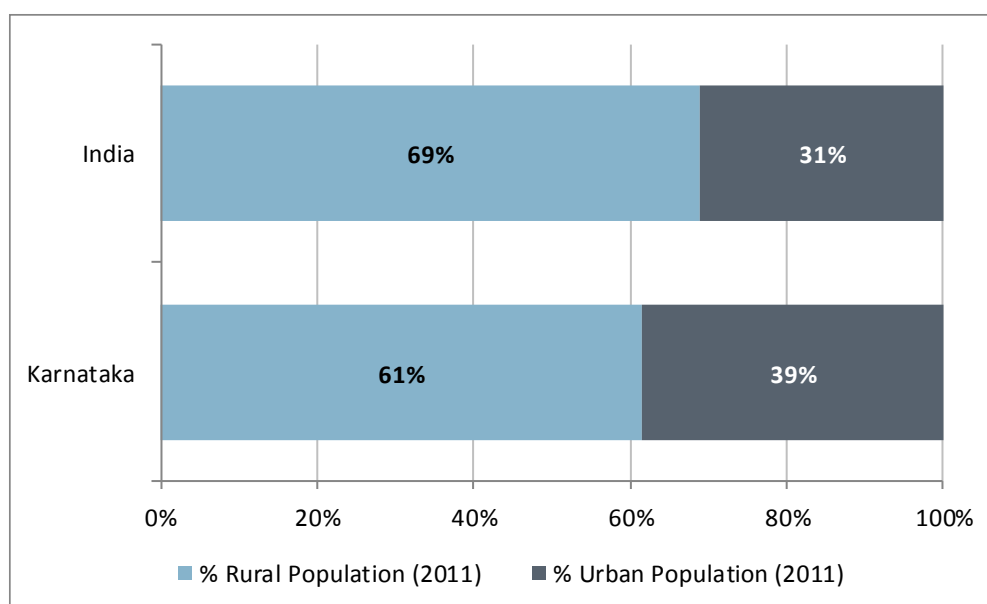
- 4.7 The figures below show the change in the distribution of urban and rural populations in the decade between 2001 and 2011, for Karnataka, as well as the country, which supports the trends observed at the country level, to increased urbanisation. It should also be noted that overall, Karnataka has a higher proportion of urban population than the country average.

Figure 4.2: Distribution of Rural and Urban Population in 2001, Karnataka and India



Source: National Institution for Transforming India (NITI Aayog) – Census Data

Figure 4.3: Distribution of Rural and Urban Population in 2011, by Karnataka and India



Source: National Institution for Transforming India (NITI Aayog) – Census Data

4.8 However, as noted by the World Bank in its report on Leveraging Urbanization in South Asia¹, a large part of the urbanisation in India is “messy” and “hidden” by nature, i.e. it results in the creation of urban sprawl, with people moving to the outskirts of large cities. Their analysis further shows that in some cases, cities’ urban areas expand at twice the rate at which the urban

¹ “Ellis, Peter; Roberts, Mark. 2016. Leveraging Urbanization in South Asia : Managing Spatial Transformation for Prosperity and Livability. Washington, DC: World Bank

population expands, creating multicity agglomerations which present opportunities for greater agglomeration economies, provided local urban governments respond in a coordinated manner.

- 4.9 Due to the complexity of the urbanisation growth it is difficult to use this indicator as a proxy for understanding future demand growth and trips on the asset.

Changes in employment and income distribution

- 4.10 With a fast growing and expanding population, there has been an increased pressure on the need for adequate job provision, especially with a dramatic growth in the proportion of the population aged 15-64 (59.5% in 1996 to 65.6% in 2015, World Bank estimates). However, as discussed in the Indian Labour Year Book², the economy of the country has historically grown faster than the growth in employment and labour force. A variety of schemes to stimulate employment and alleviate poverty such as the Mahatma Gandhi National Rural Employment Guarantee Act have been tested over the years with mixed results.

- 4.11 The following chart indicates the employment participation per 1000 persons since 1978 till 2012, split by gender, using the usual status approach³, at the country level. As can be seen, the growth in employment has not kept pace with the growth in overall population, and further, with an increasing inequality in the distribution between genders. Similarly, there has been no substantial decrease in the unemployment level, as shown in the following table.

Table 4.3: Employment and Unemployment Scenario in India

Year	Persons in the labour force (m)	Persons and person days employed (m)	Unemployment Rate
1999-2000	407.0	398.0	2.2%
2004-2005	469.0	457.9	2.3%
2009-2010	468.8	459.0	2.0%
2011-2012	483.7	472.9	2.2%

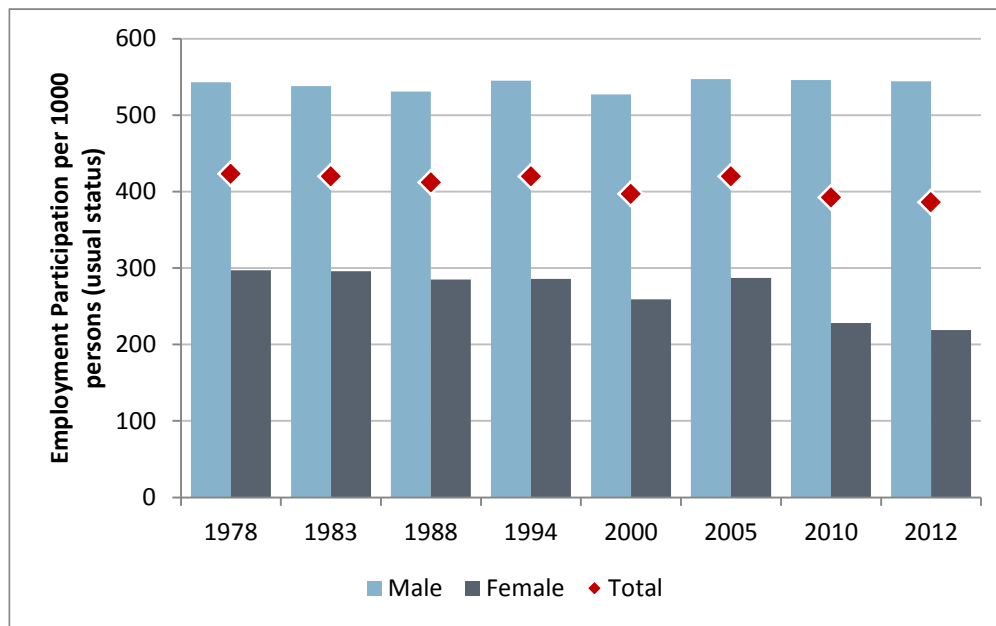
Source: Indian Labour Year Book⁴, Table 1.01(a)

² Indian Labour Year Book 2013 and 2014, Government of India, Ministry of Labour and Employment, Labour Bureau

³ Usual status employment includes people who have been employed on a principal activity for a majority of a year and those who have been classified as unemployed but have conducted some activity for a minority of time during the year (not less than 30 days).

⁴ Indian Labour Year Book 2013 and 2014, Government of India, Ministry of Labour and Employment, Labour Bureau

Figure 4.4: Employment participation per 1000 persons, by gender

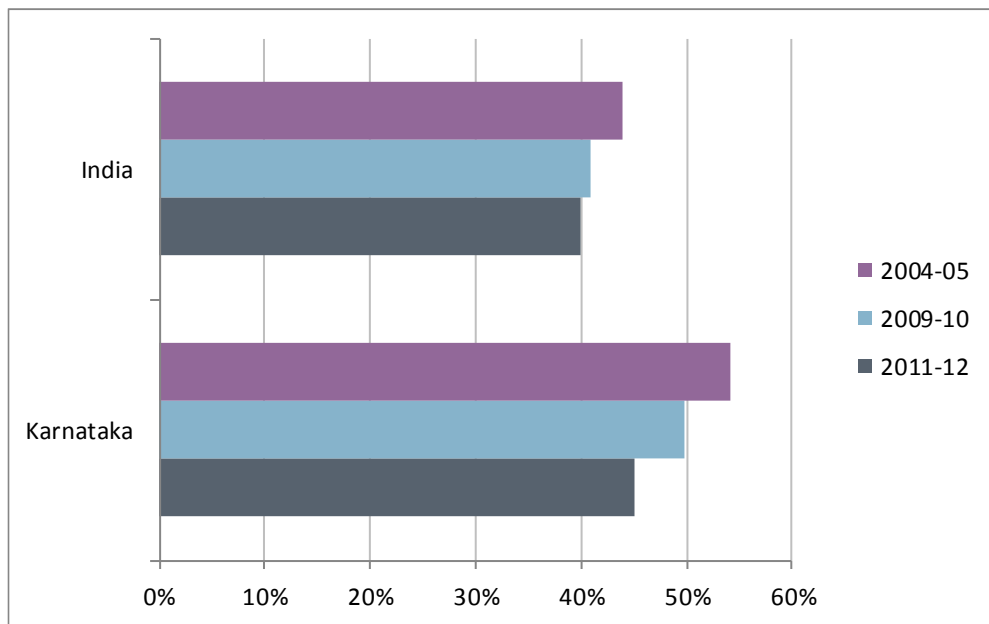


Source: National Sample Survey Organisation, Open Government Data (OGD) Platform

- 4.12 A positive trend observed over the years is a diversification of employment from primary sector activities such as agriculture to the secondary and tertiary sector (industry and services respectively), where, for the first time (in 2011 – 12), the share of agriculture/the primary sector, fell to 48.9%, compared to 58.5% (in 2004 – 05). This is likewise evidenced by the increased share of organised labour vs. unorganised labour, over the same time period, which supports the government’s push towards growing the manufacturing sector in the country⁵. Both of these trends support the type of background growth which could contribute to an increase in travel/transportation demand, over time.
- 4.13 Considering the changes in employment patterns in Karnataka, separated by rural and urban areas (see Figures 4.5-4.6), it can be seen, firstly, that the employment levels for both the rural and urban areas in Karnataka, are higher than the national average, and secondly, there has been a more marked decline in employment in the rural areas vs. the urban areas.

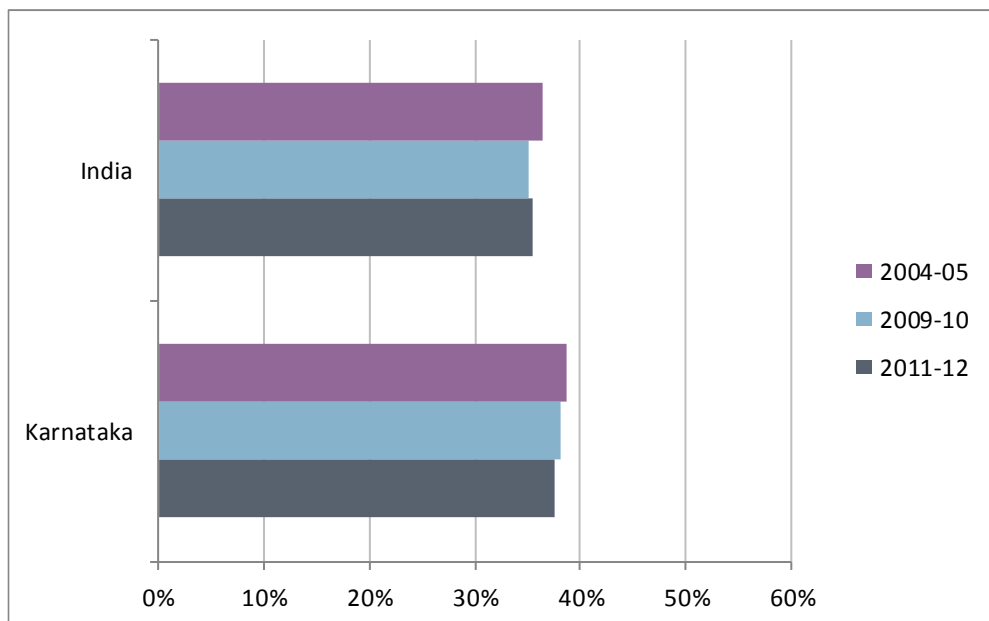
⁵ Ibid

Figure 4.5: Proportion of employment in Rural areas on usual status basis



Source: National Sample Survey Organisation Reports 2004-05, 2009-10 and 2011-12, Open Government Data (OGD) Platform

Figure 4.6: Proportion of employment in Urban areas on usual status basis



Source: National Sample Survey Organisation Reports 2004-05, 2009-10 and 2011-12, Open Government Data (OGD) Platform

- 4.14 While an increase in population and employment along with associated shifts towards urbanisation would contribute at a certain level to growing numbers of travellers, a sustained move towards a wealthier society with a more equitable distribution of wealth would further result in increased numbers of individuals with higher willingness to pay for better transport facilities.

- 4.15 Over the past 2 decades, India has succeeded in dramatically lowering its poverty levels, from 45% in 1993 – 94 to just under 22% in 2011 – 12, as shown in the table below, however, it continues to struggle with income inequality and an equitable distribution of wealth.

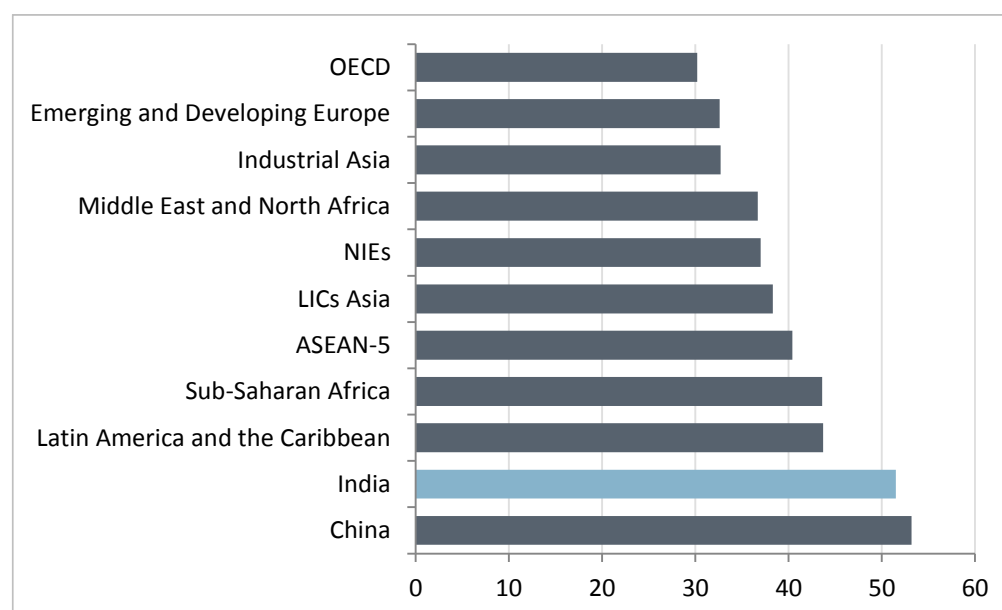
Table 4.4: Poverty Ratio: percentage of persons below the Poverty Line

Years	Rural	Urban	Total
1993-94	50.1%	31.8%	45.3%
2004-05	41.8%	25.7%	37.2%
2011-12	25.7%	13.7%	21.9%

Source: Press Note on Poverty Estimates, 2011-12, Government of India Planning Commission (July 2013)

- 4.16 The following figure compares the Gini⁶ coefficient (net of taxes) of regions across the globe with that of India, which in comparison is second to China. However, given that this comparison shows regional aggregates, the Gini coefficients of individual countries may differ substantially. The Gini coefficient has been on the rise in Asia and even more so in the more populous countries of Asia such as China and India, where between 1990 and 2013 this measure has increased by six and twenty Gini points respectively. This phenomenon has been credited to the increase in the rural-urban gap and a lack of proper education and health provisions, combined with a low level of tax collection revenues⁷.

Figure 4.7: Regional Comparison of Income Inequality in 2013, in Gini Points



Source: IMF, 2016

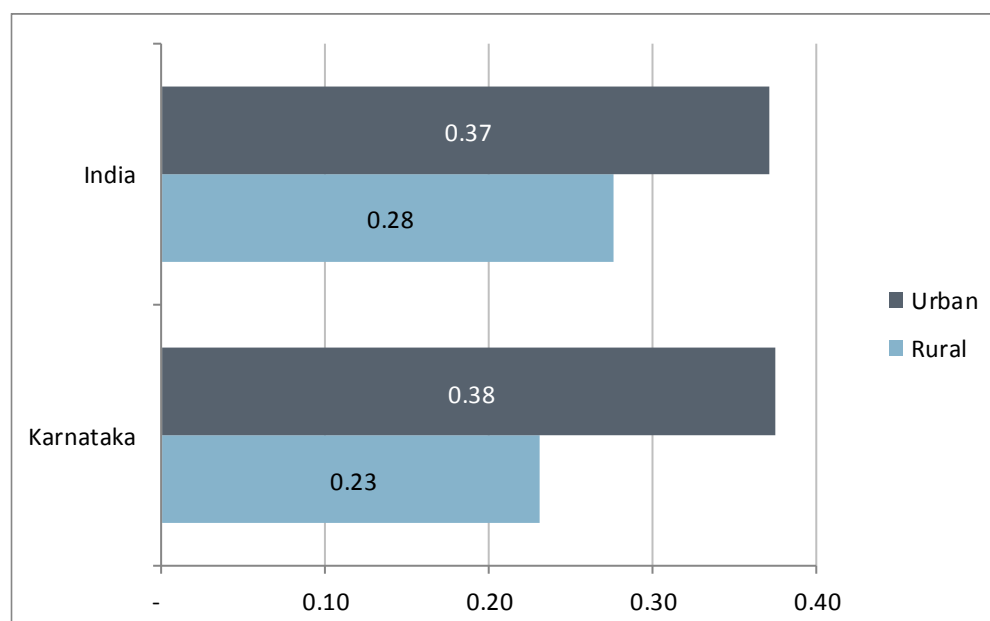
- 4.17 The following figure indicates the income inequality in Karnataka vs. the country as a whole (2009 – 10). The trends show that employment has not kept pace with the growth of the overall population and that there is still more employment in rural rather than urban areas. In addition there is still a considerable part of the population in urban areas that lives below the poverty

⁶ The Gini index measures inequality over the entire distribution of income or consumption. A value of 0 represents perfect equality, and a value of 100 perfect inequality.

⁷ World Economic and Financial Surveys, Regional Economic Outlook – Asia and Pacific, 2016, IMF

line and the income inequality is still among the highest in the world. This very complex picture of the labour market shows that employment and income distribution cannot be reliably linked to traffic demand.

Figure 4.8: Gini Coefficient of Distribution of Consumption, 2009 – 10



Source: Planning Commission of India, 2014

Changes in car ownership/registrations

- 4.18 Since the early 60's, India has seen a consistently strong growth in the numbers of motor vehicle registrations across the country, of the order of 10-16% CAGR per decade, as shown in the table below.

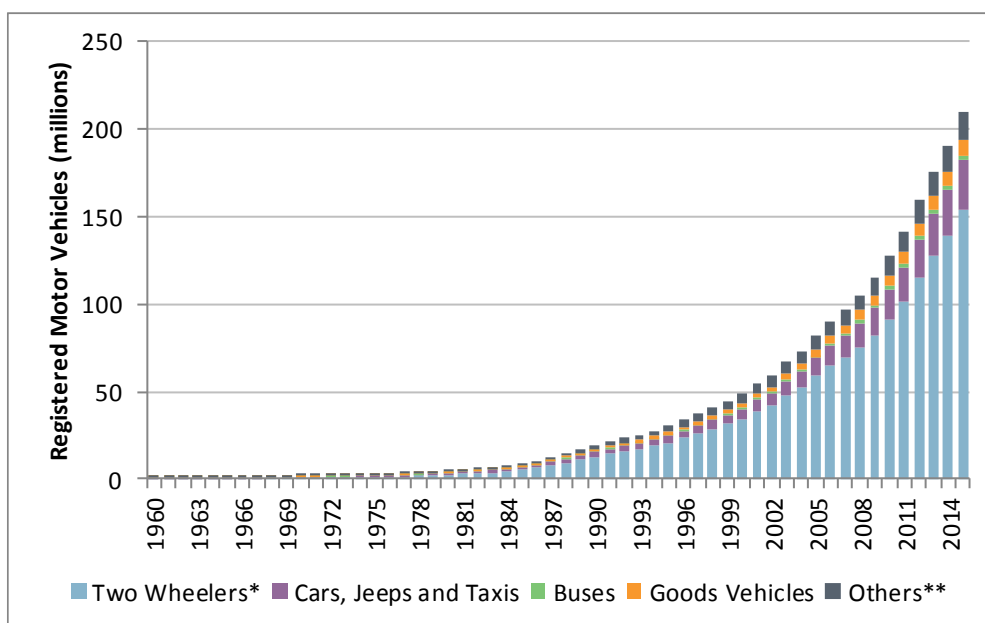
Table 4.5: CAGR of Registered Motor Vehicles in India

Years	All Vehicles	Two Wheelers*	Cars, Jeeps and Taxis	Buses	Goods Vehicles	Others**
1960 - 1970	11%	21%	8%	5%	7%	12%
1970 - 1980	11%	15%	5%	4%	4%	21%
1980 - 1990	16%	20%	10%	8%	10%	12%
1990 - 2000	10%	10%	9%	7%	8%	9%
2000 - 2010	10%	10%	11%	11%	9%	8%
2010 - 2015	10%	11%	11%	5%	8%	7%

Source: Offices of State Transport Commissioners/UT Administration, Road Transport Year Book-2011-12, Open Government Data (OGD) Platform. *Two-wheelers include auto-rickshaws for the years ending 31st March 1959, 1960, 1962, 1963, 1964, 1965, 1967, 1968 and 1969. For the remaining years, auto-rickshaws are included in Others; **Others include tractors, trailers, three wheelers (passenger vehicles)/LMV and other miscellaneous vehicles which are not classified separately; Buses include Omni buses since 2001.

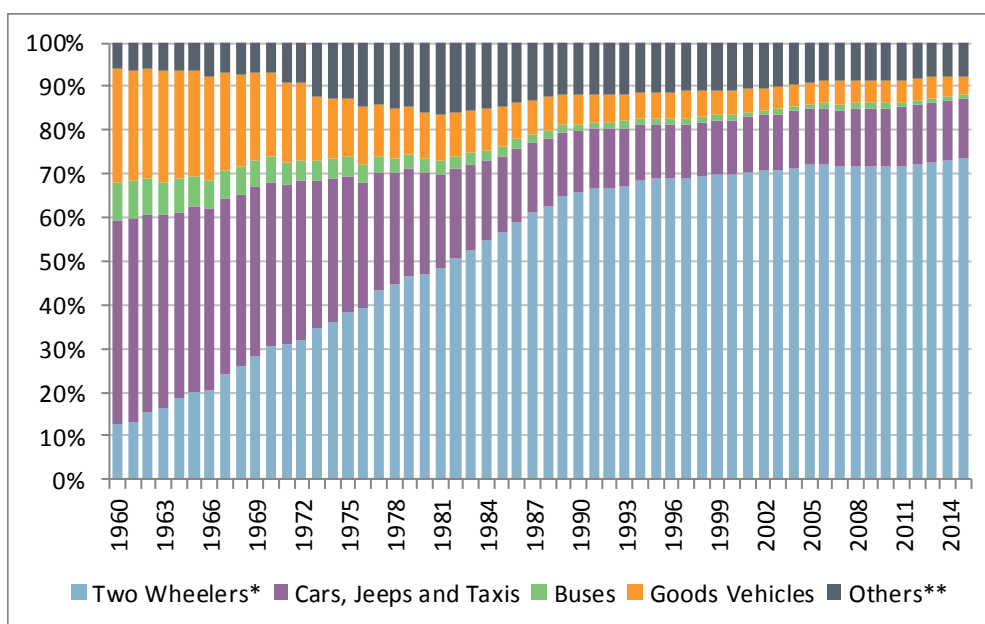
- 4.19 The CAGR of two wheelers was almost double that of cars in the years from 1960 – 90, resulting in the share of two wheelers growing from 9% of total registered vehicles in 1960 to 66% in 1990 and 73% in 2015, vs. that of cars falling from 52% in 1960, to 14% in 1990 and staying the same till 2015. This can be seen in the following two figures.

Figure 4.9: Registered Motor Vehicles in India by type (m), 1960 – 2013



Source: Offices of State Transport Commissioners/UT Administration, Road Transport Year Book-2011-12, Open Government Data (OGD) Platform. *Two-wheelers include auto-rickshaws for the years ending 31st March 1959, 1960, 1962, 1963, 1964, 1965, 1967, 1968 and 1969. For the remaining years, auto-rickshaws are included in Others;**Others include tractors, trailers, three wheelers (passenger vehicles)/LMV and other miscellaneous vehicles which are not classified separately; Buses include Omni buses since 2001.

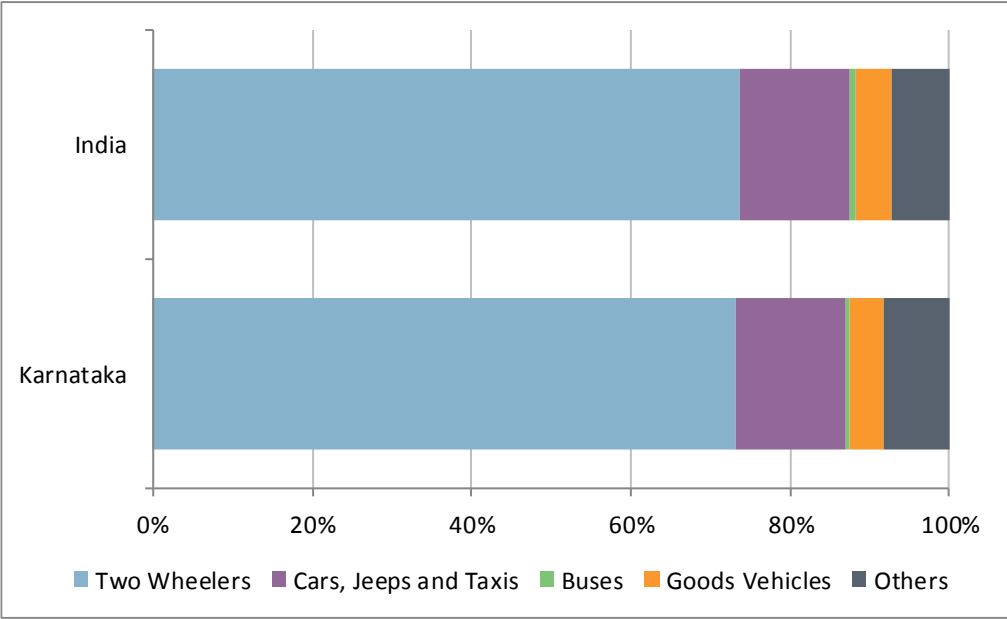
Figure 4.10: Proportional Share of Registered Motor Vehicles in India by type, 1960 – 2013



Source: Offices of State Transport Commissioners/UT Administration, Road Transport Year Book-2011-12, Open Government Data (OGD) Platform. *Two-wheelers include auto-rickshaws for the years ending 31st March 1959, 1960, 1962, 1963, 1964, 1965, 1967, 1968 and 1969. For the remaining years, auto-rickshaws are included in Others;**Others include tractors, trailers, three wheelers (passenger vehicles)/LMV and other miscellaneous vehicles which are not classified separately; Buses include Omni buses since 2001.

4.20 The proportional share of the type of registered vehicles in Karnataka is similar to that of the country average as shown in the following figure.

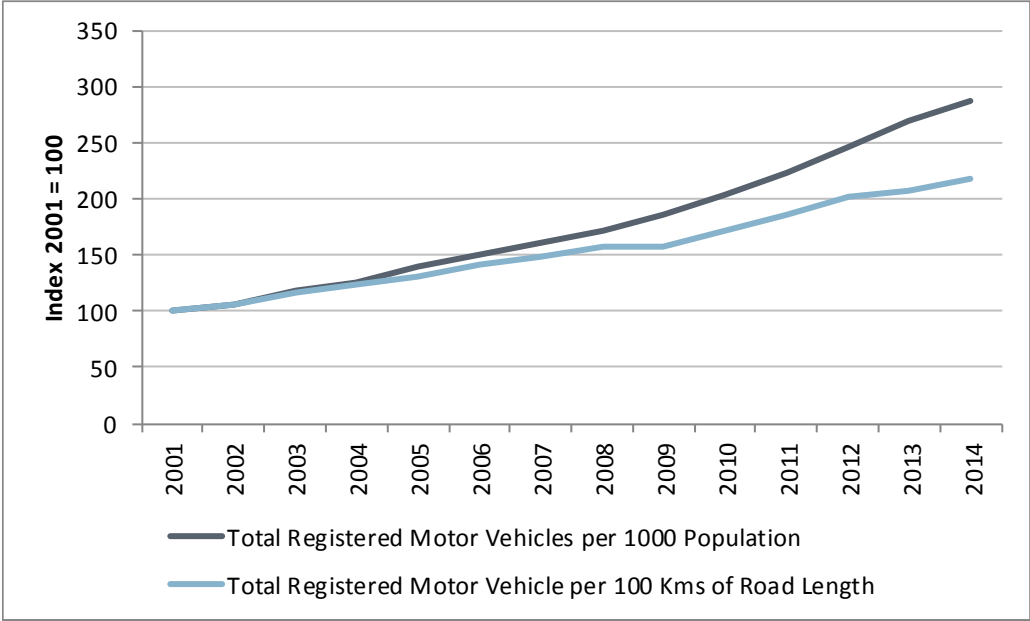
Figure 4.11: Proportional Share of Registered Motor Vehicles, 2011 – 12



Source: Offices of State Transport Commissioners/UT Administrations; The data has been sourced from Road Transport Year Book-2011-12, Open Government Data (OGD) Platform.

4.21 Registration of motor vehicles has consistently grown faster than the growth in population, while simultaneously, the increase in road length has only been at a CAGR of 3%. As can be seen in the figure below, the rate of growth of registered motor vehicles per 1000 population far outpaces that of registered motor vehicles per 100 km of road length. While the government is pushing for the development of large sections of road network, there will be a time lag before this can be completed, and in the interim, it is likely that the trend seen below will continue. This trend essentially suggests that traffic growth on national highway network is expected to continue at a healthy pace even as the network expands.

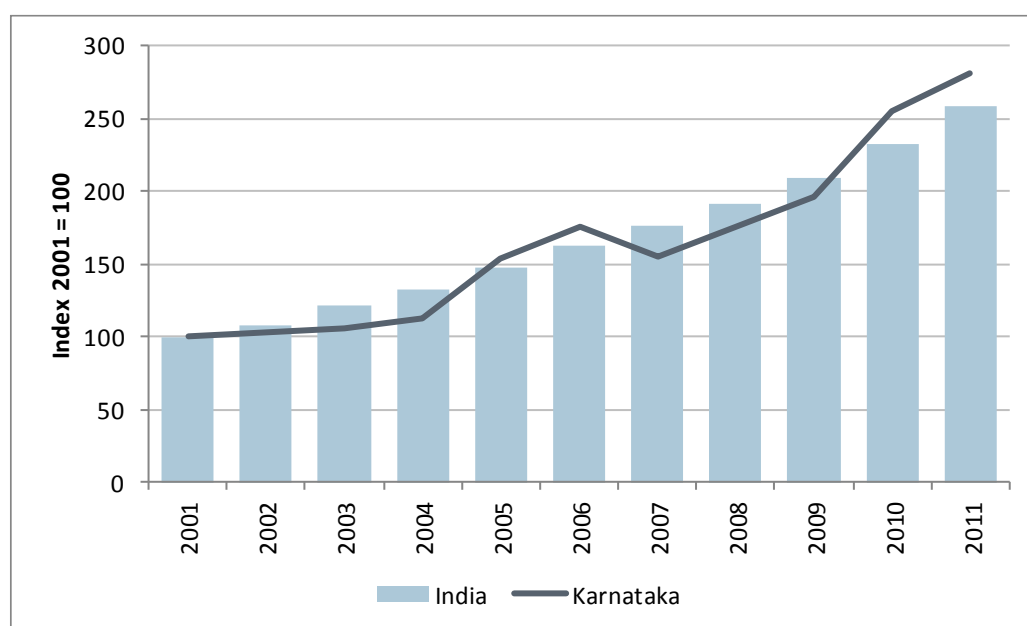
Figure 4.12: Index of growth in registered motor vehicles per 1000 population and per 100 km



Source: Registered Motor Vehicles - Offices of State Transport Commissioners/UT Administrations, Population - Report of the Technical Group on population projections constituted by the National Commission on Population, Office of registrar General & Census Commission, India, Road Length - Basic Road Statistics, Ministry of Road Transport & Highways; Road Transport Year Book-2011-12, Open Government Data (OGD) Platform.

- 4.22 For Karnataka, the growth in motor vehicle registrations has been in line with the country average, as can be seen in the following chart. At 11% CAGR over the period, it is marginally higher than the country average (10%).

Figure 4.13: Index of growth in registered motor vehicles (Karnataka vs. India)



Source: Offices of State Transport Commissioners / UT Administrations, Road Transport Year Book-2011-12, Open Government Data (OGD) Platform.

- 4.23 Combining the strong growth history of vehicles in India, it is important to consider the global context of car ownership and benchmark the same, vs. developed economies. India is still at the lower end of the spectrum, in terms of cars per 1000 inhabitants, as can be seen in the following table and figure. Based on the historic growth rate of motorization and the evidence in the table below, we believe there is still room for growth of motorisation, constrained only by the supply of roads, discussed in the following sections.

Table 4.6: Passenger Cars in use per 1000 inhabitants

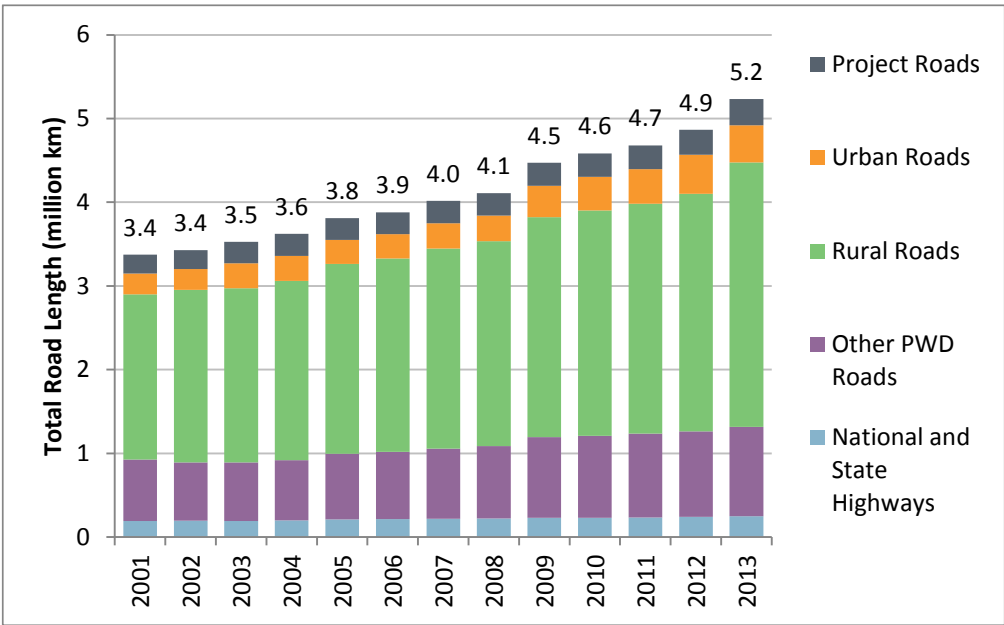
Country	2005	2014	CAGR (2005 – 2014)
Europe	557.51	645.29	2%
Russia	178.17	301.65	6%
America	615.88	652.95	1%
Central & South America	66.98	103.62	5%
India	6.66	16.96	11%
Africa	21.74	28.28	3%
All Countries	100.35	124.92	2%

Source: Passenger car data from Organisation Internationale des Constructeurs d'Automobiles, Population from World Bank

Evolution of Road Kilometres and Road-Rail Competition

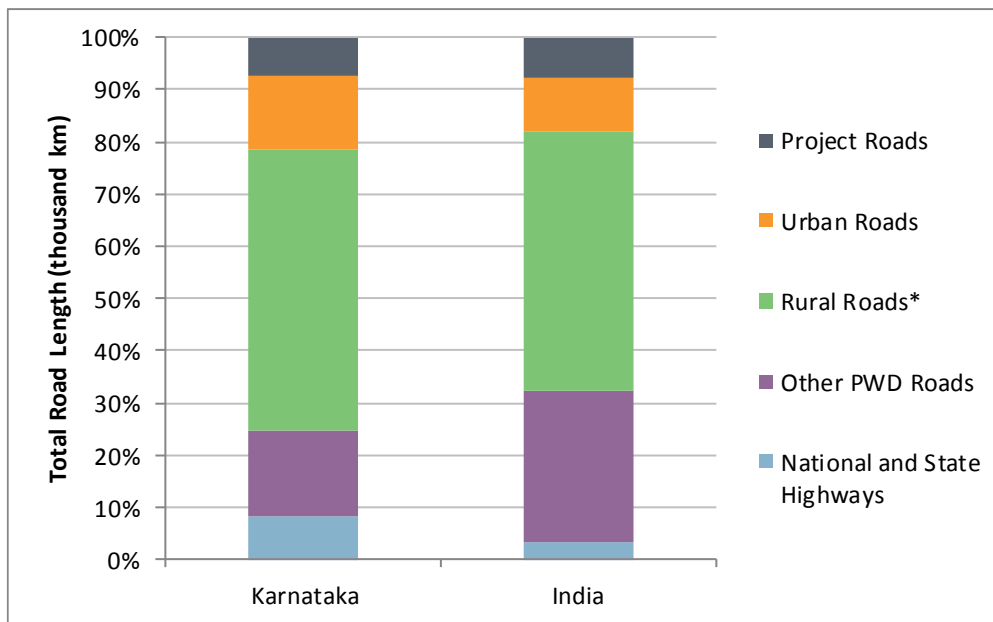
- 4.24 The first of the following figures shows the evolution of the supply of roads, over the years, disaggregated by type of road. As can be seen, a vast majority of roads in India are of the “rural” variety, with highways being a very minor (<5%) proportion of all roads.
- 4.25 The second figure shows a similar distribution, for the state of Karnataka compared to India. While not directly comparable with the previous figure due to the fact that rural roads do not maintain the same definition across both sources, it is nonetheless clear that that the state is ahead of the Indian average in terms of provision of roads especially National and State Highways.

Figure 4.14: Proportional distribution of roads by type (million km) in India, 2001 – 13



Source: Transport Research Wing, Ministry of Road Transport and Highways, Roads build under JRY have been included in Rural Roads & Total Roads.

Figure 4.15: Proportional distribution of roads by type Karnataka vs. India (million km), 2013

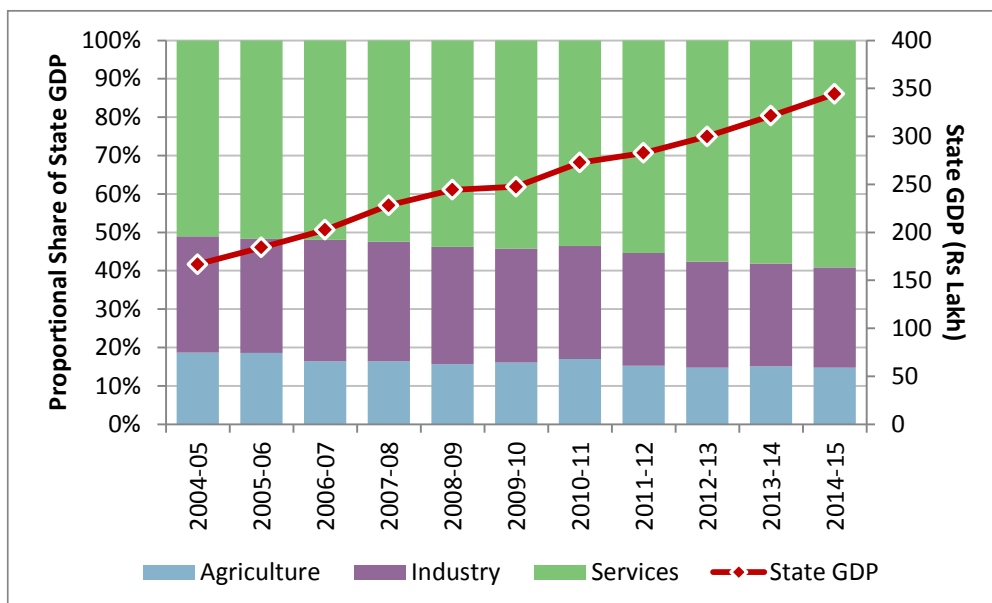


Source: Transport Research Wing, Ministry of Road Transport and Highways, *Rural Roads exclude roads built under JRY.

Economic growth

- 4.26 The Indian economy as a whole has grown at a CAGR of 7.5% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, 2005 – 2013). For the DHTL project road, while Karnataka is the only state the road lies in, traffic would likely be influenced by a combination of different drivers, being a road that serves an east west movement across 4 southern states in India. As a state, Karnataka has seen a growth in the share of services and industry over the years, and a decline in the share of agriculture, following the national trend. The chart below shows the proportional split of Karnataka's GDP as well as total State GDP.

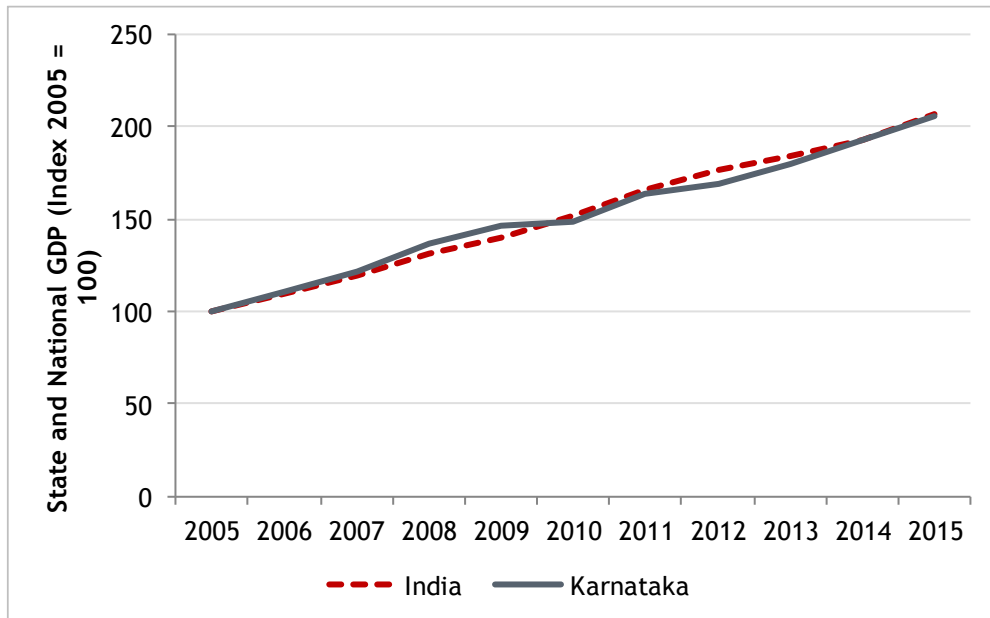
Figure 4.16: Karnataka: Composition and Total Volume of GDP



Source: Open Government Data (OGD) Platform

4.27 The following figure shows the evolution of the State GDP and the national GDP between 2005 and 2015, which indicates that the state GDP has grown at a very similar rate compared to National GDP across the last decade. Based on the available data, we believe that the relative trend observed in the last decade is an appropriate representation of the present and future, and have projected this going forward, as described in the following chapters.

Figure 4.17: Comparison of evolution of State GDP and National GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

Summary

4.28 The trends of the drivers of future traffic growth in India and in Karnataka, are all positive:

- **Population** has grown at a fast pace and is forecast to continue growing, with Karnataka having grown at a similar rate as the national average and there is an increasing trend towards urbanisation.
- **Employment** levels have been improving with a faster growth in urban areas, however income inequality is still an issue India continues to struggle with.
- **Registration of motor vehicles** has consistently grown faster than the growth in population, while simultaneously, the increase in road length has lagged. This trend indicates that traffic growth on national highway network is expected to continue at a healthy pace even as the network expands. **Car ownership**, on the other hand, is still very low compared to other countries, implying a huge potential for further increases in car ownership, in India.
- **Roads** continue to dominate the primary mode of transport for both freight and passengers, when compared to the **railways**. However, over the past 15 years, the mode share has remained broadly constant, likely influenced by the slow growth on the supply side, of roads and similar capacity constraints on the railways.
- The **Indian economy** has grown at strongly over the past decade, aided by a strong growth in the services/tertiary sector. **Karnataka's GDP** has seen an increase in the share of services, and a decrease in the share of agriculture.
- The growth of **domestic and international tourism** in the state of Karnataka is expected to continue supporting the growth of social/leisure/tourism related traffic on the asset.

5 Traffic Growth

Introduction

- 5.1 In this chapter we discuss the approach used to estimate background traffic demand growth, to be used for forecasting future traffic and revenue on the asset.
- 5.2 Through our assessment of the corridor and the areas served by the DHTL asset, we have first established the key background growth drivers of traffic for the corridor. We have then assessed the historic growth trends of these drivers based on publicly available information and developed forecasts for the same. Subsequently, we established plausible relationships between these growth drivers and traffic levels at each of the toll plazas based on historical trend analysis.

Our approach

Growth Drivers

- 5.3 The DHTL asset acts as a direct link between the cities of Bengaluru and the coastal city of Mangaluru. The asset also connects a number of pilgrim sites in the state of Karnataka for different communities and a fair share of traffic is related to religious tourism.
- 5.4 The assessment of the demand characteristics is based on our observations during our site visit and discussions with the toll plaza managers. This is further confirmed by an analysis of historic traffic and revenue data provided by the client and OD data collected during the surveys carried out as part of this study.
- 5.5 In FY2017 CJV traffic volume on DHTL was 8,500 AADT at Kadabahalli and 7,900 AADT at Shantigrama, which forms about 70% of total traffic (i.e. 12,000 AADT) on DHTL. Our assessment, based on observations during our site visit and analysis of the OD survey data, shows that a significant proportion of these CJV trips are of social/leisure/tourism in nature, with nearly 40% of CJV trips being to/from Bengaluru and nearly 35% to/from the immediate area of influence of the asset. Given the local and tourism nature of the CJV traffic it is our assessment that the primary driver of CJV traffic across all toll plazas would be the growth in the local economy and local tourism driven by movements to/from Bengaluru.
- 5.6 Our assessment of bus and LCV and Bus traffic shows a similar profile. The LCV traffic forms a 9% share of total traffic and buses approximately 11% (i.e. 1,000 AADT for LCVs and 1,200 for buses):
- This traffic is influenced by the economic activity patterns along the corridor and its connection with Bengaluru, and these vehicle movements (being of an interurban nature) primarily serve the local market.
 - Analysis of OD data has further confirmed the local characteristic of LCVs which nearly 35% of LCV trips being to/from the immediate area of influence and over 40% being to/from Bengaluru. It is our assessment that the growth in LCVs will be driven by the growth in the local economy and its relationship with Bengaluru.
 - Buses, both publicly and privately operated, connect various towns along the corridor to Bengaluru. However, bus traffic has shown a more steady profile over the period for which traffic history is available.
 - The introduction of the new rail corridor connecting Hassan to Bengaluru has further created competition for the bus market. Bus travel to Bengaluru still has an advantage over

rail travel in terms travel time (2 hours on the bus vs. 4 hours by rail from Hassan) which is offset by costs, with rail being significantly cheaper (INR 80 by rail vs. INR 200 by bus). It is therefore expected that bus traffic will remain steady at current levels as it competes with rail for market share.

- 5.7 Commercial vehicles make up a relative minor share (11%) of traffic on this asset with MAVs being the predominant vehicle type (approximately 800 AADT) and 2-A having a smaller share (around 500 AADT). This corridor doesn't have any significant industry or manufacturing bases which require heavy vehicles movements. There is a major LPG bottling plant at Yadiyur to the east of the asset which attracts gas tanker trucks from Mangaluru port from where LPG is imported. This gas plant has recently been connected to Mangaluru by a gas pipeline which is expected to have an impact on trucks on the asset (discussed in more detail in following sections). There are a few local construction material generating sites along the corridor from where sand and stone chips are sourced. Our analysis of historical trends has shown that the 2-A share of total trucks has consistently declined from around 40% in 2013 to about 36% in 2017. This is in line with trends we have observed elsewhere in the country, where, as the loads have increased, there has been a shift to MAVs from 2-A trucks.
- 5.8 The analysis of OD data for trucks has also shown that a majority of MAV demand on the asset has its origins or destinations in the immediate area of influence of the asset (defined previously as the area within 20kms of the asset). Agricultural produce, manufacturing material and petroleum products (LPG) form the major goods being carried by these trucks. In our assessment, MAV traffic growth to/from these areas (except for the movement of petroleum goods) would be driven by the growth in the wider economy of Karnataka similar to all other traffic on the corridor. As previously mentioned, the 2-A truck share has declined and stabilised at a low level. Based on our understanding of 2-A truck growth trends observed across various similar assets in the country, it is therefore our assessment that 2-A trucks will remain stable at this level, and will see little or no growth as all the goods vehicle demand growth will be taken up by MAVs.

Growth Trends and Projections

- 5.9 The historic trends for each of the growth drivers and the assumptions used for their forecasts are discussed below.

GDP and GSDP Forecasts

- 5.10 There are reliable estimates available for historic Indian national GDP and Karnataka state GSDP from publicly available sources. We have used IMF's estimates for historic Indian GDP growth as an input to the analysis and we have used Karnataka's socio-economic review publications as a source for historic Karnataka GSDP.

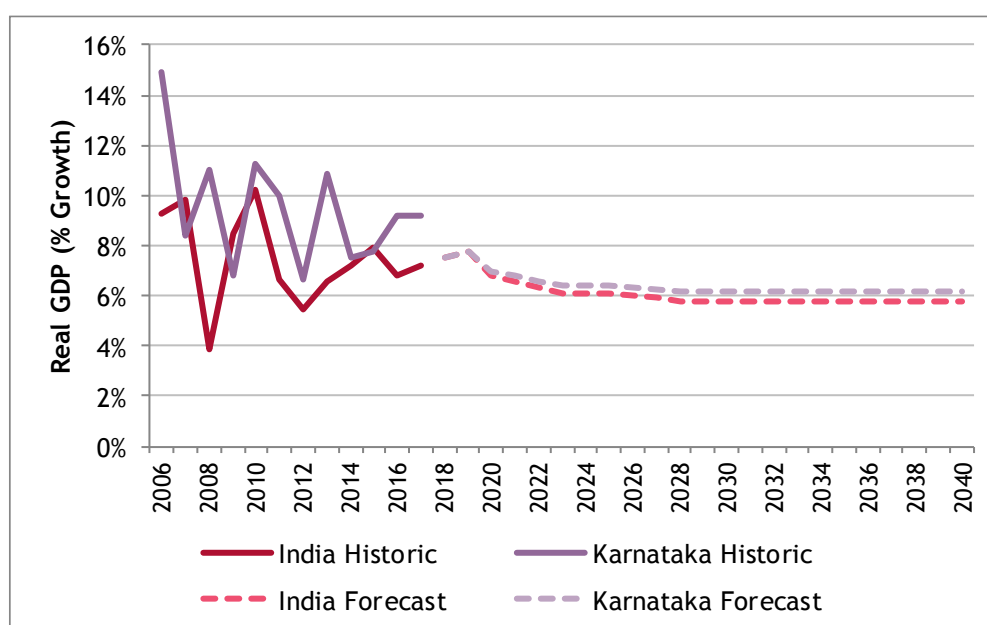
- **GDP:**
 - The GDP forecasts were sourced from Oxford Economics by the client.
 - Indian GDP is projected to continue growing at a CAGR of 7% in the short term (2017-2022) slowing to just under 6% towards the end of the concession period.
- **GSDP:**
 - For forecasting GSDP, the client had sourced the historical data for state GSDPs and national GDP from the NITI Aayog website⁸ and computed the linear correlation

⁸ Niti Aayog, <http://niti.gov.in/content/gsdg-constant2004-05prices-percent-growth-2004-05-2014-15>

between the growth rate of state GSDPs with the national GDP growth in the historical period (From 2005-06 to 2013-14). This linear correlation for individual states was then applied on the forecast national GDP growth rate to arrive at the forecast growth rates for the state GSDPs.

- Karnataka's GSDP growth has outpaced national GDP growth historically. In the forecast period Karnataka GSDP is projected to continue growing marginally faster by approximately 0.3% per annum as compared to national GDP growth, which is expected to slow down (see the figure below Figure 5.1). The projection is for Karnataka's GSDP to grow at 7.1% CAGR in the short term (2017-2022) slowing to 6.2% CAGR by the end of concession period.

Figure 5.1: India GDP and Karnataka GSDP: Historic and Forecast



Source: Steer Davies Gleave analysis using publicly available data, and macro-economic forecasts

5.11 The Indian GDP growth forecasts sourced from oxford economics is in line with other independent forecasts available form from reliable sources such as IMF, World Bank and RBI. The assumption that Karnataka's stated GSDP will follow the national GDP throughout the concession period is plausible. We believe that as other smaller state economies of India catch up with the national economic growth, the gap between growth rates of larger state economies, such as Gujarat, Maharashtra and Karnataka, and the national GDP growth rate, will start reducing. In the short-term, Karnataka's GSDP is expected to outpace India national GDP growth.

5.12 The table below summarises our assumptions for GDP and GSDP used in our forecasts.

Table 5.1: Key Socio-Economic Drivers Growth Assumptions (CAGR)

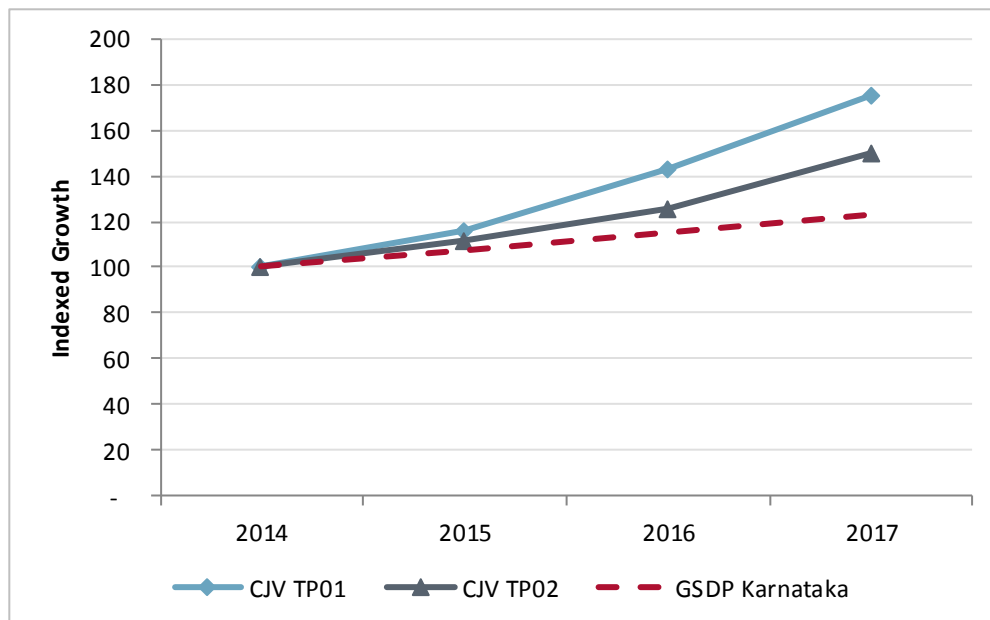
Growth Driver	2007-2017 (Outturn)	2018-2028 (Forecast)	2028-2031 (Forecast)
India GDP	7.0%	6.4%	5.8%
Karnataka GSDP	7.3%	6.6%	6.2%

Source: Steer Davies Gleave analysis using publicly available data and GDP and GSDP forecasts, Oxford Economics

Traffic Growth elasticities

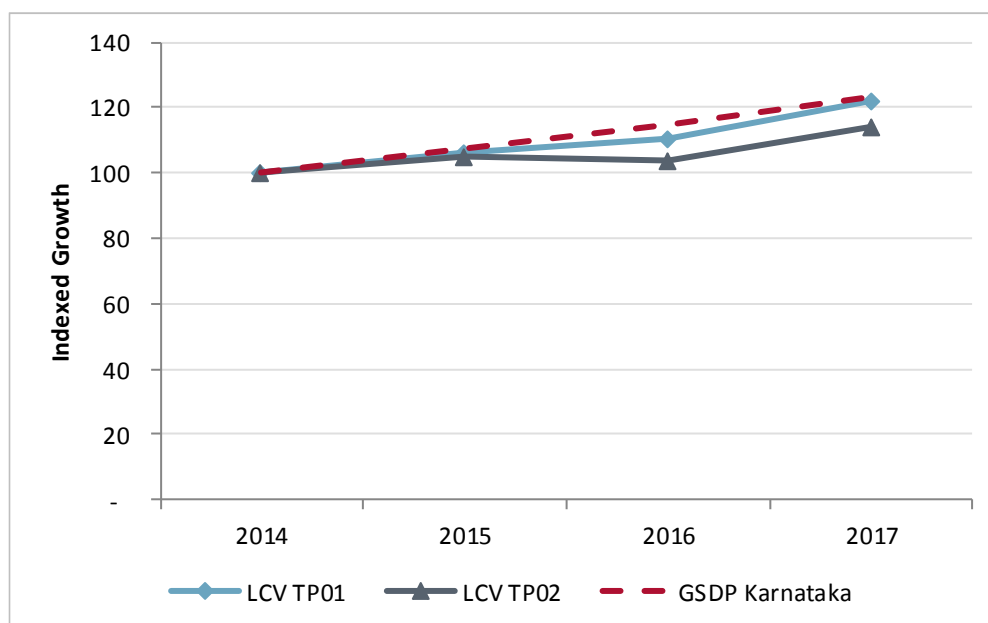
- 5.13 In estimating traffic elasticities, we compared historic growth of traffic at each of the toll plazas and the evolution of the growth drivers described above. This analysis was carried out for different vehicle categories at each toll plaza, as follows:
- CJVs – GSDP
 - Bus – Nominal growth
 - LCVs – GSDP
 - 2-A - No growth assumed
 - MAV – GSDP
- 5.14 For CJVs and LCVs the observed trends of traffic and GSDP growth show a reasonable relationship, with CJVs growing at a slightly faster pace than the wider economy and LCVs almost at the same pace, as shown in the following figures. This is also in line with our experience of growth trends observed on similar assets in India. Based on this, traffic growth elasticities were estimated for CJVs and LCVs growth with respect to GSDP growth.
- 5.15 Although it is common to use GSDP/capita to estimate car ownership growth, we believe that this relationship excludes the impact of population growth. The comparison of GSDP/capita growth with GSDP growth of Karnataka for 2011 to 2015 period shows that GSDP/capita grew at 4.7% per annum whereas GSDP growth was around 6.9% per annum. During the same period, the estimated population growth was around 2%. GSDP/capita growth is a good proxy for income growth whereas GSDP growth incorporates both income growth and population growth. Therefore, total growth in cars is better explained by the growth in the overall economy which includes income growth and population growth.

Figure 5.2: Relationship between CJV traffic growth and Karnataka GSDP by toll plaza



Source: Steer Davies Gleave analysis

Figure 5.3: Relationship between LCV traffic growth and Karnataka GSDP by toll plaza

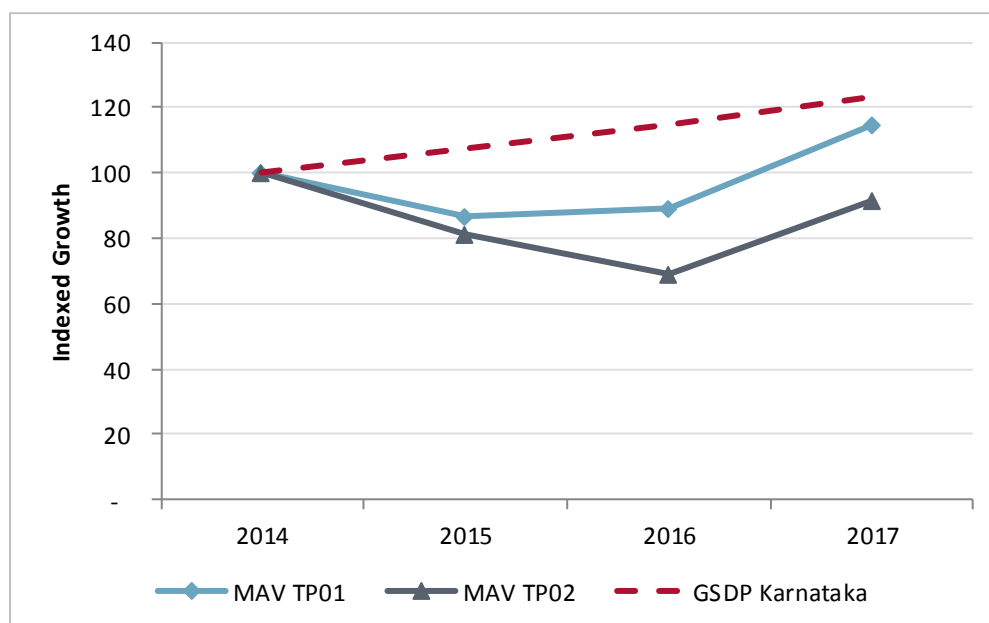


Source: Steer Davies Gleave analysis

- 5.16 The CJV growth is noted to be faster than GSDP growth which can be explained by the leisure/tourism link of a significant share of the CJV traffic on the asset. Across the country tourism, both domestic and foreign, has grown at nearly twice the national GDP growth rates in recent years⁹. Karnataka features in the top six states in the country in terms of total tourists arriving in the state and has experienced similar fast growth rates of tourist activity. The increasing disposable incomes combined by increasing car ownership rates generated by growth in technology and other sectors concentrated in and around Bengaluru are expected to continue boosting growth in tourism.
- 5.17 A similar trend analysis showed that for MAVs, the evolution of traffic was impacted by a specific event – closure of Shiradi Ghat in 2015-16 (discussed in more detail below). Over the long term the trend analysis shows a good relationship with state GDP, as shown in the figure below.

⁹ Investment in Tourism Infrastructure, Unleashing the Growth Potential, FICCI-YES Bank Report, July 2016

Figure 5.4: Relationship between MAV traffic growth and Karnataka GSDP by toll plaza



Source: Steer Davies Gleave analysis

Elasticities by toll plaza level and vehicle type

- 5.18 We have established elasticities of different vehicle type growth at each of the toll plaza based on the trend-based analysis described above. These relationships between each vehicle type and the key influencing factors have been adopted for developing our forecasts.
- 5.19 The table below shows the derived trend based elasticities, used as the starting point for each of the vehicle types.

Table 5.2: DHTL vehicle type elasticities at each toll plaza by individual influencing factor

Vehicle Type	Elasticities	
	TP01 Kadabahalli	TP02 Shantigrama
CJV	1.42	1.22
Bus	-	-
LCV	0.99	0.93
2-A	-	-
MAV	0.93	0.83

Source: Steer Davies Gleave analysis

- 5.20 As the Indian and Karnataka economy grows rapidly as per the input assumptions (~7% CAGR for India GDP and ~7.1% for Karnataka GSDP growth), it is expected that over time tourism sector growth will fall back in line with state GSDP growth and other sectors of the local economy will catch up with the overall state level growth rates. In this scenario, we expect the CJV traffic growth relationship to stabilise closer to a 1 to 1 relationship with GSDP growth. To reflect this trend, the historical trend based elasticities for CJV traffic have been further dampened by a factor of 0.1 every 2 years until the elasticity values come below 1 and then remain stable across the concession period. This reduction is applied for a period of 10 years for

TP1-Kadabahalli and for a period of 6 years for TP2-Shantigrama to achieve the elasticity values of 1.

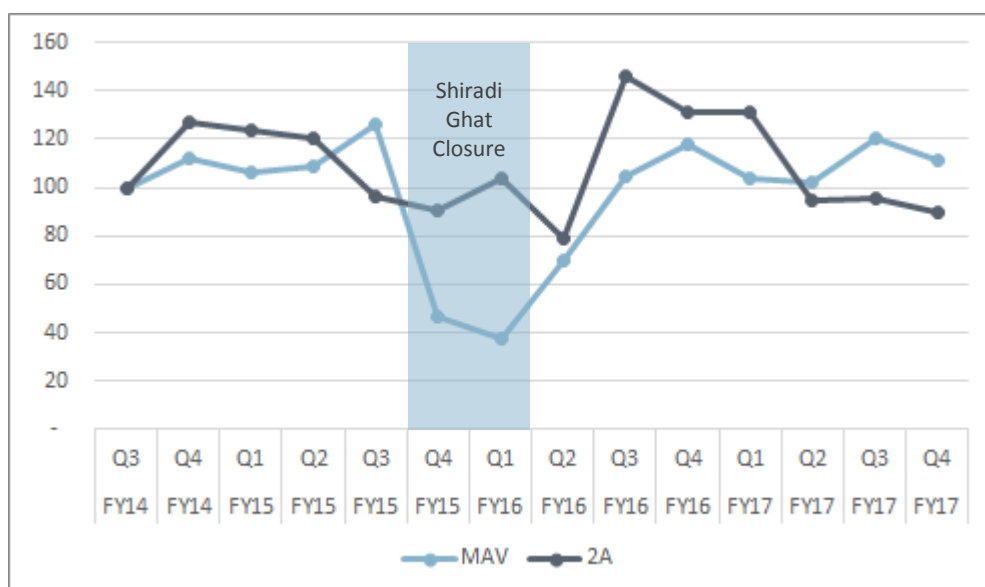
- 5.21 These estimated elasticities are applied to the growth rates of the influencing factors to derive traffic growth for each vehicle type. E.g. for car traffic, the growth calculation would be:

$$\text{Car Traffic } (y+1) = \text{Traffic } (y) * 1.42 * \text{GSDP Growth.}$$

Shiradi Ghat Closure

- 5.22 The Shiradi Ghat section of the NH75 crosses through hilly terrain with over 24 km of 2-lane road. This section is managed and maintained by the government through the PWD. Due to the hilly terrain and relatively poorer quality of the road (as compared to the DHTL asset) this section acts as a bottleneck for long-distance movements, as well as, movements from Mangaluru towards Bengaluru. There are both local and strategic alternatives to this section of NH75 which are either equally hilly, or longer.
- 5.23 From January 2015 to May 2015 PWD had to close this section to repair it. The objective was to repair the entire 24km section, however due to contractual difficulties only 12km was completed in this period. The remaining 12 km repair is currently being planned and is going through contract award stages. This closure resulted in a drop-in traffic levels, particularly for trucks, on the DHTL asset for the period of two quarters of the closure. The figure below shows the impact on truck traffic (2-A and MAV) at TP02 Shantigrama toll plaza – the impact on other vehicle categories was relatively smaller.

Figure 5.5: Impact of Shiradi Ghat Closure at TP02 Shantigrama on truck traffic



Source: Steer Davies Gleave analysis

- 5.24 Since the remaining 12km section is to be closed again for repairs it is expected that a similar impact will be observed during the upcoming closure. Based on the latest information available from the toll plaza managers and the client, it is assumed this closure will take place during January to May 2018. As we can see from the figure above that both MAV and 2A traffic returns to normal levels only in Q3-FY16, which signifies the impact of ghat closure for a much longer period (almost four quarters). However, in our discussion with the client it was highlighted that, due to poor conditions of the road and presence of leftover construction material; heavy

vehicles were restricted to use the road. Hence, it is expected that, in the planned closure between Jan-May2018, the 2A and MAV traffic will return to use the road immediately after the construction of the road is finished.

- 5.25 To reflect the impact of this, closure the following traffic dampening factors have been calculated using historic data analysis, which have been applied to forecast traffic levels at a vehicle type and toll plaza level.

Table 5.3: Shiradi Ghat closure impact on forecast traffic

Plaza	Vehicle Type	FY18Q4	FY19Q1
TP 01 - Kadabahalli	CJV	-1%	-11%
	Bus	-12%	-8%
	LCV	-10%	-18%
	2A	-24%	-22%
	MAV	-54%	-61%
TP 02 -Shantigrama	CJV	-6%	-19%
	Bus	-27%	-27%
	LCV	-15%	-23%
	2A	-29%	-16%
	MAV	-61%	-69%

Source: Steer Davies Gleave analysis

- 5.26 Once, the Shiradi ghat is fully constructed, it is expected that the asset will experience an overall boost in traffic primarily due to the better condition of road. After due consultation with the client and benchmarking similar improvements in overall infrastructure against other assets, it will be reasonable to assume for the traffic profile Devihalli Hassan will experience a jump in traffic in four subsequent quarters from FY19Q3 to FY20Q2, over and above the normal forecasted growth. The growth assumptions are given in the below table.

Table 5.4: Post Shiradi Ghat Jump in traffic assumptions for different vehicle types

Vehicle Type	TP 01	TP02
CJV	5%	5%
Bus	5%	5%
LCV	5%	5%
2A	2.5%	2.5%
MAV	2.5%	2.5%

Yadiyur gas pipeline

- 5.27 The town of Yadiyur has a major liquefied petroleum gas (LPG) bottling plant operated by Hindustan Petroleum Corporation Limited (HPCL). Yadiyur is connected to Mangaluru port where LPG is imported by NH75. LPG tanker trucks (referred to as 'bullet tankers') have been using the asset to move the raw material from Mangaluru to Yadiyur. Over the past 3 years HPCL has been implementing a new 355 km long gas pipeline in Mangaluru-Hassan-Yadiyur corridor. This pipeline has recently been commissioned in October 2016 and has started delivering raw material to the Yadiyur plant. Anecdotal evidence suggests that this has already had an impact in the number of LPG trucks plying on the NH75 corridor.

- 5.28 There are also plans to increase the capacity of the Yadiyur bottling plant to three times its existing size as per a pre-feasibility report published by HPCL. They expect to continue using the gas pipeline and trucks to source the raw material for this expanded plant.
- 5.29 In our view the introduction of this pipeline will result in further declines in LPG trucks on the DHTL asset. As per the OD data analysis 27% of MAVs (~200 AADT) are known to be carrying petroleum gas and associated products. We have assumed that these trucks will significantly reduce over the coming two years to about a quarter of their current levels. However, as the expansion of Yadiyur plant is completed we have assumed that the remaining trucks will grow again by three times.

6 Traffic and Revenue Forecasts

Introduction

- 6.1 In this chapter, we present the forecasting inputs and assumptions used within our modelling framework to create both traffic and revenue forecasts for the DHTL project road corridor. The assumptions on the expected future values of various parameters (such as changes in GSDP, inflation linked toll changes and changes specific to the DHTL asset) have been benchmarked against independent data where possible.
- 6.2 All traffic is presented as total traffic (AADT at each plaza or total traffic summed across all plazas). All revenue is presented in INR (nominal terms).

FY2018 Base and Forecast Years

FY2017

- 6.3 As mentioned earlier in paragraph 3.8, FY2018 has been used as the base year in developing the forecasts for this study. Since observed traffic data for FY2018 base year is only available for April to August period therefore FY2017 traffic and revenue data have been used as the basis to develop the forecasts for rest of FY2018.
- 6.4 The FY2017 data has been validated by an independent toll revenue verification process, as shown in Chapter 3, and is therefore considered to be fit for purpose to be used for forecasting. In this verification exercise we estimated the annual toll revenue collection using the monthly traffic data, the toll levels and the shares of ticket types for each vehicle type. Note that the ticket shares were not available on monthly basis but rather for entire financial years. Therefore, these shares were applied for corresponding months in each of the financial year. Our estimates of toll revenue were then compared against the annual toll collection figures for the DHTL asset that had been provided in the historical toll revenue data. If the months of Nov, Dec 2016, and Jan 2017, which were affected by demonetisation, are excluded, the difference between the reported and bottom up is an average of 1% (refer Table 3.1) over the financial year at both the toll plazas.

Base Year –FY2018 adjustments

- 6.5 Historic traffic data for all vehicles from the start of tolling till August 2017 was provided. The information on various ticket types sold was provided for FY2017. As the most recent data available covers the entire FY17 period, and the asset has been in operation since FY14, the FY17 observed ticket types shares have been used in the basis of our toll revenue forecasts. Note that our forecasts have been developed for each vehicle type at a monthly level and then aggregated to annual level.
- 6.6 For the base year FY2018 (April 2017 to March 2018) observed traffic data is available till August 2017, hence this actual traffic is used for the first five months (April to August 2017). For rest of the year i.e. September 2017 to March 2018 traffic figures have been estimated using FY2017 outturn traffic as the basis. The following adjustments have been made to the traffic figures to arrive at the final base traffic for FY18.
- Firstly, as discussed earlier in chapter 3, in FY2017, months from November 2016 to January 2017 were affected by demonetisation. Traffic figures for these months have been estimated using the seasonality factor obtained from the historic data of an adjacent toll

road, having a similar traffic profile (this seasonality factor was shared by the client). An average of monthly outturn traffic, excluding the months of Nov 2016 to Jan 2017, was taken and the given seasonality variation was applied for each vehicle type. The revised monthly ADT for the period Nov-Jan were calculated.

- Secondly, the growth model developed, as discussed in chapter 5, was applied to the revised monthly FY2017 ADT figures to get the ADT from September 2017 to March 2018; and
- Finally, as discussed earlier in paragraph 5.22, Shiradi Ghat closure is expected to take place in FY18Q4, hence adjustment factors, discussed in paragraph 5.25, have been implemented to get the final monthly ADT for each of the toll plaza.

6.7 After implementing the above discussed adjustments to the historic traffic, the resultant base traffic for FY2018 used for forecasts is given below.

Table 6.1: AADT by Toll Plaza and total PCUs, FY 2018, adjusted for actual traffic in FY2018

Plaza	CJV	Bus	LCV	2-A	MAV	AADT	PCU
TP01- Kadabahalli	9,431	1,285	1,148	477	686	13,027	19,125
TP02- Shantigrama	8,500	1,195	995	468	651	11,810	17,572
Total	17,931	2,480	2,143	945	1,337	24,837	36,696

Forecast Years

- 6.8 We developed monthly forecasts which have then been aggregated to quarterly forecasts whereby Q1 is the first quarter of the financial year, equating to the period April – June, and Q4 is the fourth quarter of the financial year, equating to the period Jan – March. The forecasts are presented at an annual level at financial year level (April-March) for reporting purposes.
- 6.9 Since the remaining concession period for the DHTL asset is assumed to be 23 years with the potential to extend the concession length depending on traffic levels and other construction activities, we have developed our forecasts till FY40.

Future Year Traffic Forecasts

Background Growth Calculation

- 6.10 The elasticity values discussed in the previous chapter were applied to base year traffic levels at a vehicle type level together using the forecast growth rates of corresponding growth drivers to estimate the forecast year traffic levels. The calculation is carried out at a monthly level to estimate the monthly AADTs for each vehicle type. These forecasts form the basis of the revenue forecasts. For presentation purposes, these forecasts are aggregated to annual levels.
- 6.11 The growth rates implied by the elasticity values discussed in the previous chapter show a near 1 to 1 relationship with background economic growth. To summarise the input assumptions discussed in the traffic growth elasticities section of the previous chapter, the following key trends are implicit in the growth forecasts:
- **CJV traffic growth:** This is higher than the wider economic growth for this asset with a relationship of 1.42 to GSDP growth for the Kadabahalli toll plaza (declining to 0.92 by FY27), and a relationship of 1.22 for the Shantigrama toll plaza (declining to 0.92 by FY23). In a fast-growing economy with relatively low car ownership levels (especially where growth in disposable incomes of car owners is known to be growing at a faster rate than the wider economy), the growth rate of car traffic is expected to outpace the overall GSDP

growth. The asset primarily feeds the tourist traffic along the Bengaluru-Mangalore section which attracts high volumes of car traffic especially during the peak tourism months. Tourism, both domestic and international is known to be growing at a faster pace than national and state GDP growth. Therefore, the forecasts of CJV traffic growth rates on the DHTL asset are reasonable.

- **Bus traffic growth:** Bus traffic is assumed to grow at a nominal rate during the concession period. Historically bus traffic has shown a varying growth pattern with small positive and negative year on year growth being registered with the long term trend being no growth. We believe this is related to the supply side impacts, i.e. provision of additional buses by the state and private operators, rather than any direct impact of changes in the economy. The recent introduction of the new rail corridor is further expected to result in increased competition of the bus traffic. However, a nominal growth reflecting the historic growth of bus traffic on the asset is a reasonable assumption.
- **LCV traffic growth:** Light commercial vehicles are projected to grow at a slightly slower rate than Karnataka GSDP across the concession period. This in line with trends we have observed on similar assets for LCVs where the growth is closely linked to growth in the local economy and a preference for using bigger vehicles for long distance movements.
- **2-A Truck growth:** 2-A trucks are assumed to stay flat during the concession period. Although, 2-A share of total trucks has declined from an average of 41% in FY14 to 38% in FY17, there is a growing preference for larger trucks as the loads are increasing. This is in line with trends we have observed everywhere else in the country where as the loads have increased MAVs have taken up the share of 2-A trucks in the vehicle types. We believe that 2-A trucks will stabilise at current levels, as has been the trend in the recent years, and growth in freight demand will be predominantly served by MAVs. Therefore, taking a no growth assumption for 2-A is reasonable.
- **MAV growth:** Across the concession period the growth of MAVs is forecast to be slightly slower than the GSDP growth. The growth on the DHTL asset is also linked to growth in the local movement of freight in the region, feeding traffic into the Yediyur bottling plant and transportation of agricultural related products and construction materials. Therefore, MAV traffic is assumed to grow with a relationship of 0.93 to GSDP growth for TP01 and 0.83 for TP02 based on the relationships established using historical trends. Although, as mentioned above major events such as Shiradi Ghat closure and increased use of the recently commissioned gas pipeline, will impact the overall growth of MAV's in the short term, in medium and long term we expect growth coming in from other sectors such as agriculture, construction material, and residual gas tanker traffic will continue to support the growth of MAV traffic on the asset. Hence, we consider the growth relationships assumed as a reasonable growth trend.

Toll levels changes

- 6.12 To forecast the revenues, we multiplied the estimated traffic forecasts for each vehicle type by the relevant toll level for each year. The assumption was that toll levels will continue to increase at normal inflation-linked rates as specified in the concession agreement.

Inflation-Linked Changes

- 6.13 The concession agreements and the toll notification specify the toll calculation process for each of the plaza on the asset. This allows changes in toll levels at each of the plazas directly linked to inflation (WPI) changes. The concession agreement based toll escalation formula also includes a rounding of the toll levels to the nearest INR 5. The exact formula as prescribed in the

latest toll modification notices issued by the government for the concession has been implemented in our forecasting model.

- 6.14 The WPI forecasts sourced from Oxford Economics are used as the inputs to the toll level calculation. Table 6.2 below shows the assumed WPI rates. The upward trend in inflation is expected to continue in the medium term. Note that the toll level is set in this formula is in nominal terms, hence the total revenue calculated in our forecast model is also the nominal revenue.

Table 6.2: WPI forecast assumptions

Financial Year	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30 onwards
Growth Rates (%)	4.59	5.67	3.80	6.02	5.73	5.36	5.16	4.99	4.48	4.11	4.00	3.93	3.93

Source: Oxford Economics

Ticket Type Shares

- 6.15 Based on the ticket type frequency data provided by the client we have analysed the toll ticket types (Single, Return, Monthly, Local, Exempt, Violations, Discounts) from the data provided for our base case for each vehicle type. We have assumed that the ticket types will stay the same in the future for all plazas as that observed in FY17. This assumption is reasonable as the proportion has stabilised over time and there are unlikely to be further changes in tolls, unless specific discounts are offered. The proportions are as shown in the following table.

Table 6.3: Proportion of ticket types used in the forecasts

	Ticket Type/Vehicle Type	CJV	Bus	LCV	2A	MAV
TP01 - Kadabahalli	Single	63%	18%	63%	61%	80%
	Return	26%	46%	32%	36%	20%
	Monthly	0%	35%	0%	0%	0%
	Local	0%	0%	0%	0%	0%
	Exempt	10%	0%	4%	3%	1%
	Violation	0%	0%	0%	0%	0%
	Discounts	0%	0%	0%	0%	0%
	Total	100%	100%	100%	100%	100%

Source: L&T IDPL Traffic and Revenue Data

	Ticket Type/Vehicle Type	CJV	Bus	LCV	2A	MAV
TP02-Shanthigrama	Single	56%	22%	66%	69%	83%
	Return	33%	44%	30%	29%	17%
	Monthly	0%	33%	0%	0%	0%
	Local	1%	0%	0%	0%	0%
	Exempt	10%	0%	3%	1%	0%
	Violation	0%	0%	0%	1%	0%
	Discounts	0%	0%	0%	0%	0%
	Total	100%	100%	100%	100%	100%

Source: L&T IDPL Traffic and Revenue Data

Trip Factors

- 6.16 The tolling on the asset commenced in FY2014, the client has shared actual trip factors for return trips for various vehicle types. These are given below:

Table 6.4: Vehicle type return trip factors for TP01 and TP02

Vehicle Type	DHTL TP01 - Kadabahalli	DHTL TP02 - Shanthigrama
CJV	1.93	1.93
Bus	1.98	1.97
LCV	1.94	1.94
2A	1.91	1.89
MAV	1.95	1.93

Source: Client Inputs

- 6.17 Monthly trip factors have been assumed as 1.67 for all vehicle types. As per the toll notifications a user can use the monthly pass for 50 trips, which can be used over a period of 30 days. This pass can be bought through multiple options such as online, rfid, and tags. Hence, using 1.67 as the monthly trip factor is a reasonable assumption.
- 6.18 As per the concession agreement, CJV users can by a local pass if they stay within 20kms of the respective toll plaza. Hence, as per historic data the client has shared the following trip factors for local trips, which have been used for revenue calculations

Table 6.5: Local trip factor for CJV vehicles for TP01 and TP02

Vehicle Type	DHTL TP01 - Kadabahalli	DHTL TP02 - Shanthigrama
CJV	0.949	0.999

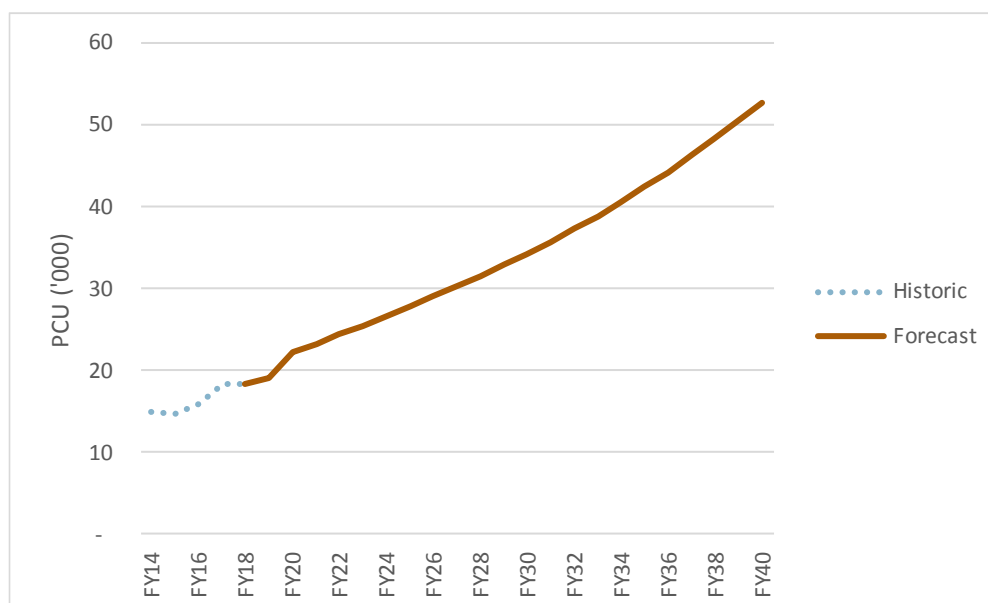
Source: Client Inputs

Traffic and Revenue forecasts

Forecasts

- 6.19 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities as described above. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc. Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices.
- 6.20 Therefore for the most likely case we have used base case inputs as the starting point and then varied them to reflect the risk around the input assumptions. We have modified the base case GDP growth assumptions and reduced them by -0.4% per annum. Similarly, a lower GSDP forecast line with the reduced GSDP (by -0.4%) forecast. We have also reduced the traffic growth elasticities by -0.04 for vehicle categories at all toll plazas. Figure 6.1 summarises the traffic forecasts expressed in PCUs in the most likely case.

Figure 6.1: Historic and forecast traffic



Source: Steer Davies Gleave analysis

- 6.21 The volumes for FY18 are based on actual observed traffic till August 2017 and adjusted traffic for rest of the year as discussed earlier. As seen from the table below, the slowing of growth rates across all vehicle types is directly related to the slowing growth rates assumed for national GDP and state GSDP which are the primary drivers in our forecasts. The table below shows the AADT CAGR for three periods (2018-25, 2025-32, and 2032-40), for both the toll plazas.

Table 6.6: Total Traffic (AADT): Forecasts of Total Traffic at DHTL

Toll Plaza	Vehicle Type	AADT				CAGR (%)		
		FY18	FY25	FY32	FY40	FY25	FY32	FY40
TP1- Kadabahalli	CJV	9,431	16,333	23,343	34,803	8.2	5.2	5.1
	Bus	1,285	1,450	1,514	1,590	1.7	0.6	0.6
	LCV	1,148	1,869	2,730	4,200	7.2	5.6	5.5
	2A	477	519	519	519	1.2	0.0	0.0
	MAV	686	1,162	1,656	2,477	7.8	5.2	5.2
	Total AADT	13,027	21,333	29,763	43,589	7.3	4.9	4.9
	Total PCU	19,125	29,594	40,022	57,127	6.4	4.4	4.5
TP2- Shantigrama	CJV	8,500	13,759	19,510	29,014	7.1	5.1	5.1
	Bus	1,195	1,399	1,460	1,534	2.3	0.6	0.6
	LCV	995	1,596	2,274	3,400	7.0	5.2	5.2
	2A	468	514	514	514	1.4	0.0	0.0
	MAV	651	1,049	1,438	2,058	7.0	4.6	4.6
	Total AADT	11,810	18,317	25,197	36,520	6.5	4.7	4.7
	Total PCU	17,572	26,062	34,562	48,438	5.8	4.1	4.3

Source: Steer Davies Gleave analysis

- 6.22 As seen from the table above, the total AADT CAGR varies from an average of 6.9% (FY 18-FY 25) to 4.8% (FY32-FY40) across the asset.

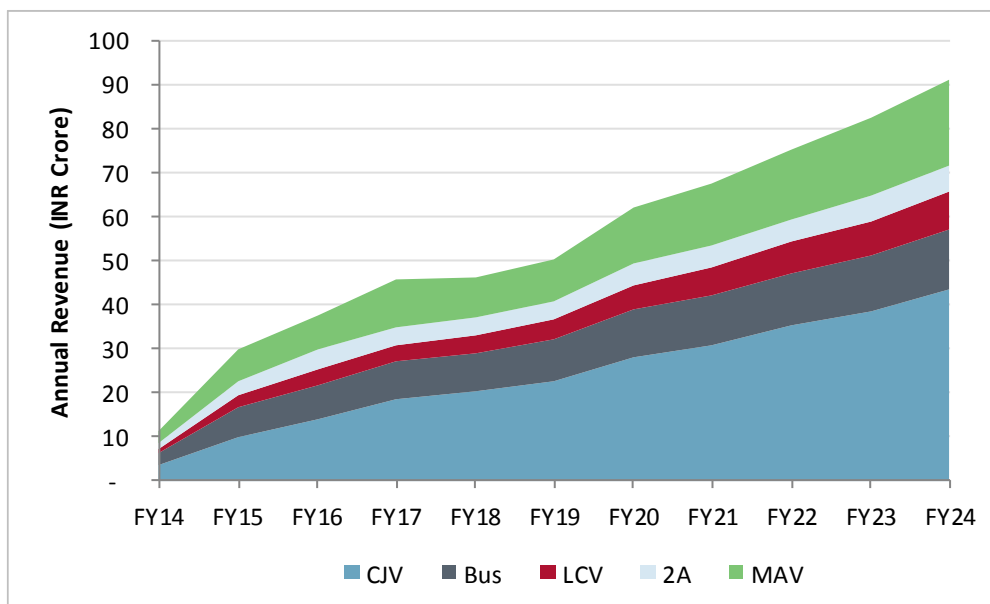
Table 6.7: Revenue INR (Nominal): Forecasts of Total Revenue at DHTL

Toll Plaza	Average Daily Revenue (INR)			
	2018	2019	2025	2040
DHTL TP01	705,485	773,408	1,535,293	5,828,915
CAGR		9.6%	12.1%	9.3%
DHTL TP02	558,121	598,198	1,192,983	4,210,309
CAGR		7.2%	12.2%	8.8%

Source: Steer Davies Gleave analysis

- 6.23 Revenue forecasts at DHTL are presented in the table above. The projected revenue grows at an CAGR of 12.1% between FY25 and FY19 and by 9.3% between FY40 and FY25. The growth in revenue is expected to be slower in the future years as the effect of GDP and other growth factors normalise to a lower number. As discussed earlier, two quarters in FY18 and FY19 would experience the Shiradi Ghat closure, which will result in reduction in traffic on the asset and subsequently a reduced growth (<10%) in revenue for FY19.
- 6.24 The figure below presents the changes in revenues for each vehicle type for the FY14-FY17 observed and FY18-FY24 forecast periods. (see Figure 6.2).

Figure 6.2: DHTL total revenues (INR nominal) by vehicle type for FY2014-2024

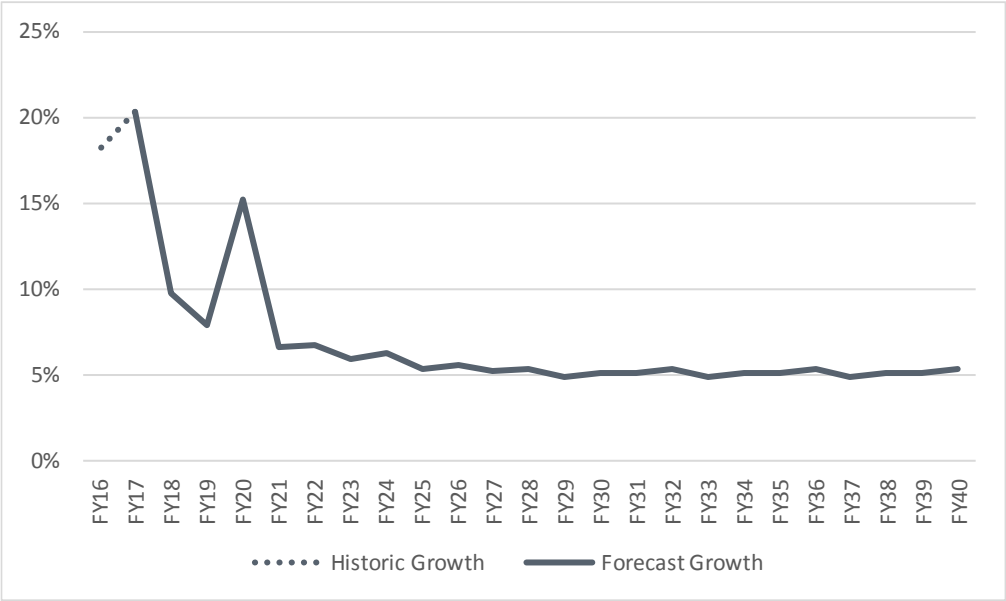


Source: Steer Davies Gleave analysis

Traffic forecast trends

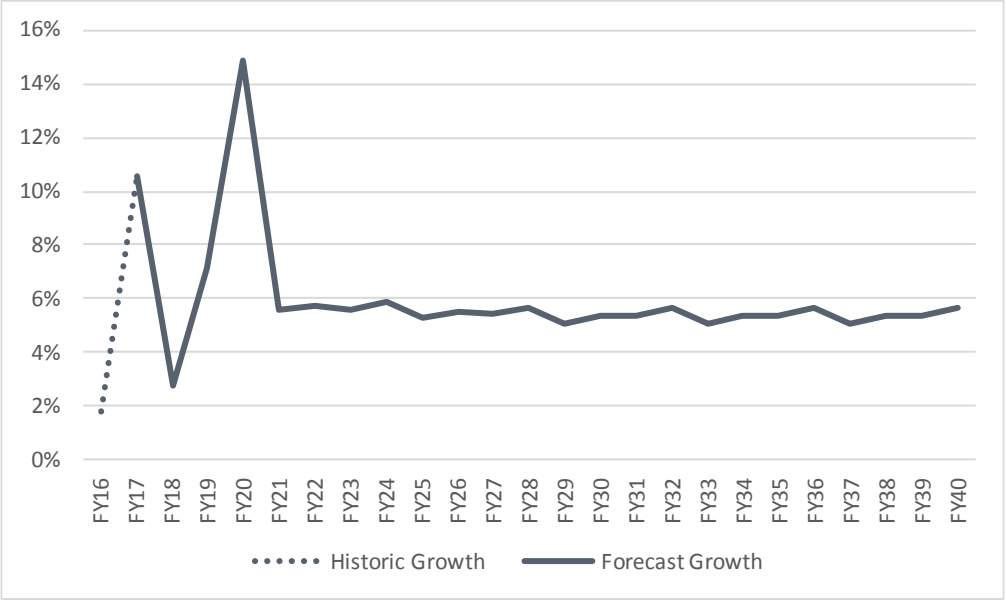
- 6.25 Forecast traffic growth has been compared against the recent observed growth trends in the figures below for the period between FY2016 and FY2040.

Figure 6.3: DHTL CJV historic and forecast traffic growth rates for FY2016-2040



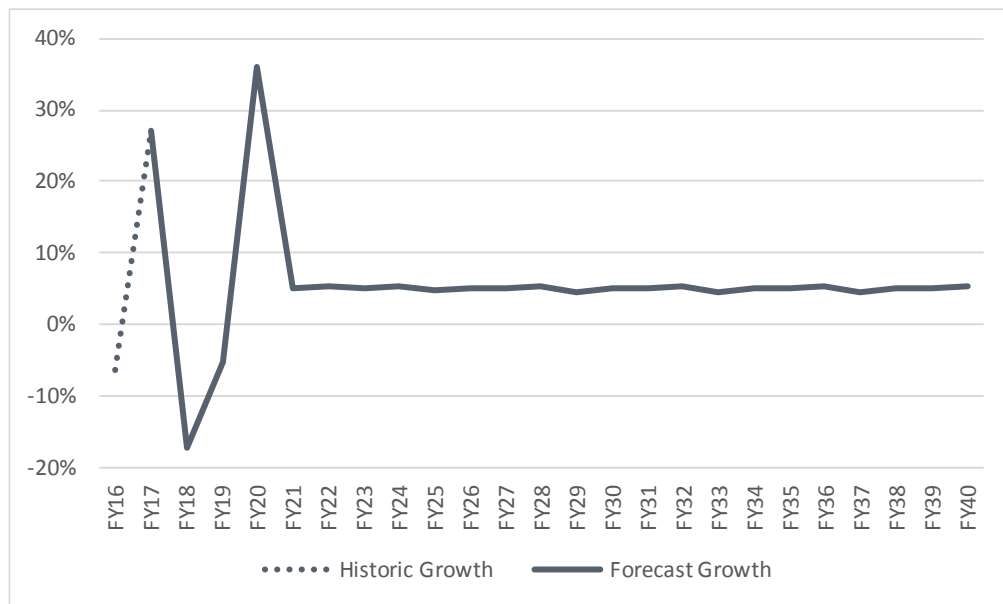
Source: Steer Davies Gleave analysis

Figure 6.4: DHTL LCV transactions historic and forecast growth rates for FY2016-2040



Source: Steer Davies Gleave analysis

Figure 6.5: DHTL MAV historic and forecast traffic growth rates for FY2016-2040



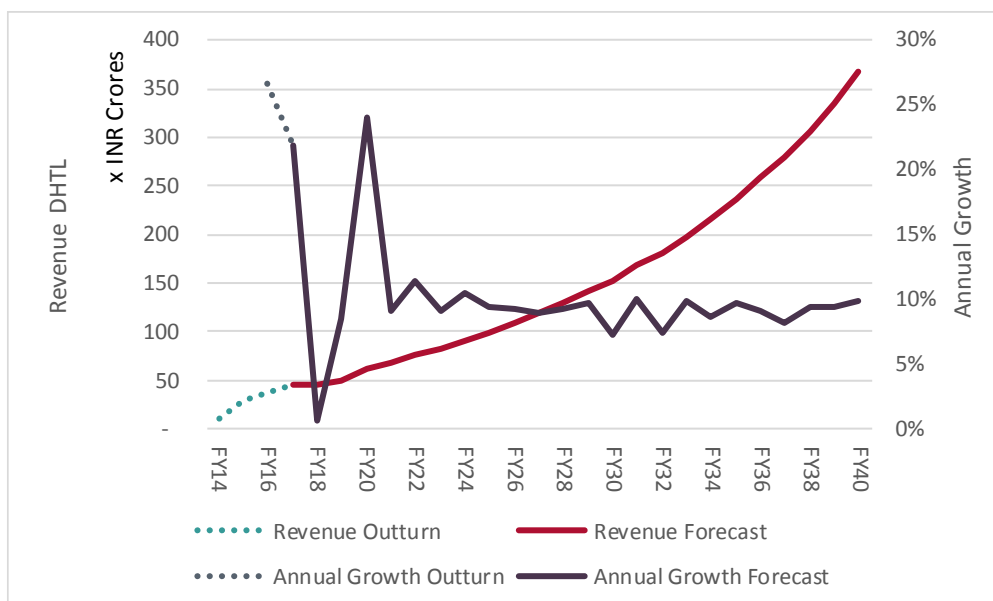
Source: Steer Davies Gleave analysis

6.26 It can be seen from the figures above that:

- A general drop in growth over the forecast horizon across all vehicle types, which is linked to the drops in state GSDP and national GDP growth rates.
- **CJVs** are forecast to grow at the fastest rate in the early years averaging at 10% per annum, at both toll plazas, slowing to 6% towards the end of the concession period. This compares to an average 15% growth rate that has been observed in recent years. We consider this to be a reasonable growth trend for cars where growth in car ownership and disposable incomes results in faster growth of car traffic compared to the wider economy and the growth slows in line with long term slowdown in the wider economic growth.
- **LCVs** growth trends show a growth rate of 7% per annum in the short term slowing to just below 6% per annum in the long term. LCV traffic is relatively short distance serving the local areas connected by the DHTL asset and its growth is therefore closely linked to the forecast growth in the local economy. The drop in LCV traffic growth in FY18 and FY19 followed by the recovery in FY20 is linked to the Shiradi Ghat closure during FY18Q4 till FY19Q1.
- **Bus** traffic is forecasted to grow at a nominal growth rate of 0.60% per annum for the period of the concession, across both the toll plazas. Bus traffic, is primarily driven by supply side rather than demand side and hence a nominal growth is considered to be a reasonable assumption.
- **MAV** traffic is forecast to grow faster than the trends observed in the recent past with short term growth starting at an average of 6.5% per annum (across the toll plazas) slowing to an average of 5.5% per annum (across the toll plazas) towards the end of the concession period. The drop in MAVs traffic growth in FY18 and FY19 followed by the recovery in FY20 is linked to the Shiradi Ghat closure during FY18Q4 till FY19Q1. The drop is higher as FY18 growth is also impacted by the declining gas tanker trucks due to the increased use of the recently implemented gas pipeline at Yediyur bottling plant. The subsequent recovery in FY20 is also noted to be higher as the increasing

- 6.27 The figure below shows the historic and forecast revenue growth rates of total revenue in nominal terms (right axis) as well as the absolute revenue per annum (left axis). Note that these revenue estimates are from FY18 onwards.

Figure 6.6: DHTL revenue (nominal) historic and forecast and growth rates for FY2014-2040



Source: Steer Davies Gleave analysis

- 6.28 The growth in nominal revenues is expected to be an average of 12% per annum in the short term slowing to just below 10% per annum towards the end of concession period. While over the whole forecasting horizon, trends of growth in the nominal toll revenue follow those of transactions with the impact of inflation linked increases in toll level negating the impact of slowing transaction growth. Growth in revenues is seen to slow in FY17 with the demonetisation in November 2016 pushing revenue growth down. The drop in FY19 revenue growth rates followed by an increase in FY20 revenue growth rate is linked to the impact of Shiradi Ghat closure, boost in traffic due to improved roads post road upgrade, and the commissioning of Yedyur gas pipeline which has been discussed in detail in the previous chapter.

Concession agreement: effect of variations in traffic growth

- 6.29 The 'Target Traffic' of the asset is determined by excluding the number of local users from the total forecast traffic. This is as per the guidance provided by the client.
- 6.30 As per the concession agreement, the level of target traffic estimated as on Oct 1,2020 is 18,840 PCU's per day. The "**Actual Average Traffic**" will be calculated by computing the average of the traffic on the date that falls one year prior to the target date, on the target date, and on the first anniversary of the target date. The traffic sampling will be undertaken for a continuous period of 7 days during anytime within 15 days prior to the date specified and the average thereof will be deemed as actual average traffic. In the event, that the target traffic falls short or exceeds by 2.5% the concession period shall be deemed to be modified using the laid-out conditions in the concession agreement. After due consultation with the client, Annual AADT is used for calculation of target traffic. In the table given below the target traffic is estimated for most likely scenario.

Table 6.8: Concession agreement: target traffic estimation

Target Traffic Impact	Date	Annual Basis
Concession Agreement	1st October 2020	18,840
Most Likely case	Average of three years	23,221
Difference		23.26%
Impact on length of concession (years)	2.5% Threshold	17%
Concession Length	30	Cap 10%
Reduction in Concession Length	Years	3.0

Source: Steer Davies Gleave analysis

- 6.31 As seen from the table above, the forecasted target traffic exceeds the concession agreement target traffic by 25.96%. Therefore, it is expected that a renegotiation of the length of the concession agreement will take place. As per the rules laid out in the concession agreement, a 25.96% variation from the target traffic would result in a reduction of concession length by 16%. However, a cap of 10% in reduction has been put in the concession agreement. Hence, the reduction would be approximately 3 years in the length of the concession period. If the concessionaire decides to pay premium equal to 25% of the Realisable fee, the authority can waive off the reduction in the length of the concession agreement.

Forecast Summary

- 6.32 The tables below show the overall growth rates of total traffic in PCU terms for each of these scenarios at a toll plaza level, vehicle wise growth rates for various scenarios for each of the toll plazas, and total annual revenue across the toll plazas.

Table 6.9: Total traffic (PCU) growth rates (%) for both toll plazas

Toll Plaza	TP01 - Kadabahalli	TP02 - Shanthigrama
Year		
FY18		
FY19	5.7	3.4
FY20	14.5	16.7
FY21	5.4	4.5
FY22	5.3	4.4
FY23	4.9	4.0
FY24	4.9	4.1
FY25	4.7	4.1
FY26	4.7	4.1
FY27	4.3	4.1
FY28	4.3	4.1
FY29	4.3	4.1
FY30	4.4	4.1
FY31	4.4	4.2
FY32	4.4	4.2
FY33	4.5	4.2
FY34	4.5	4.2
FY35	4.5	4.3
FY36	4.5	4.3
FY37	4.6	4.3
FY38	4.6	4.3
FY39	4.6	4.4
FY40	4.6	4.4

Source: Steer Davies Gleave analysis

Table 6.10: Vehicle wise forecasted growth rates (%)

Toll Plaza	TP01 - Kadabahalli					TP02 - Shanthigrama				
Period	Car	Bus	LCV	2A	MAV	Car	Bus	LCV	2A	MAV
FY 18										
FY 19	9.01	4.02	7.55	1.17	-2.50	6.58	2.70	6.71	4.06	-8.13
FY 20	14.50	5.19	13.93	7.46	33.35	15.50	10.51	15.20	5.64	38.45
FY 21	7.56	0.61	6.08	0.02	5.66	6.25	0.61	5.67	0.02	5.01
FY 22	7.31	0.62	5.90	0.00	5.50	6.04	0.62	5.50	0.00	4.88
FY 23	6.55	0.62	5.77	0.00	5.38	5.31	0.62	5.38	0.00	4.78
FY 24	6.51	0.62	5.75	-0.02	5.37	5.27	0.62	5.37	-0.02	4.78
FY 25	5.92	0.61	5.73	0.02	5.33	5.29	0.61	5.34	0.02	4.72
FY 26	5.86	0.62	5.68	0.00	5.30	5.23	0.62	5.30	0.00	4.70
FY 27	5.20	0.62	5.62	0.00	5.24	5.17	0.62	5.24	0.00	4.65
FY 28	5.11	0.62	5.54	-0.02	5.17	5.07	0.62	5.17	-0.02	4.60
FY 29	5.13	0.61	5.53	0.02	5.14	5.10	0.61	5.15	0.02	4.55
FY 30	5.12	0.62	5.53	0.00	5.16	5.09	0.62	5.16	0.00	4.58
FY 31	5.12	0.62	5.53	0.00	5.16	5.09	0.62	5.16	0.00	4.58
FY 32	5.11	0.62	5.54	-0.02	5.17	5.07	0.62	5.17	-0.02	4.60
FY 33	5.13	0.61	5.53	0.02	5.14	5.10	0.61	5.15	0.02	4.55
FY 34	5.12	0.62	5.53	0.00	5.16	5.09	0.62	5.16	0.00	4.58
FY 35	5.12	0.62	5.53	0.00	5.16	5.09	0.62	5.16	0.00	4.58
FY 36	5.11	0.62	5.54	-0.02	5.17	5.07	0.62	5.17	-0.02	4.60
FY 37	5.13	0.61	5.53	0.02	5.14	5.10	0.61	5.15	0.02	4.55
FY 38	5.12	0.62	5.53	0.00	5.16	5.09	0.62	5.16	0.00	4.58
FY 39	5.12	0.62	5.53	0.00	5.16	5.09	0.62	5.16	0.00	4.58
FY 40	5.11	0.62	5.54	-0.02	5.17	5.07	0.62	5.17	-0.02	4.60

Source: Steer Davies Gleave analysis

Table 6.11: Forecasted annual total revenue (INR crore)

Period	Revenue
FY 18	46.12
FY 19	50.06
FY 20	62.11
FY 21	67.74
FY 22	75.48
FY 23	82.32
FY 24	90.98
FY 25	99.58
FY 26	108.86
FY 27	118.67
FY 28	129.59
FY 29	142.28

FY 30	152.73
FY 31	168.13
FY 32	180.63
FY 33	198.41
FY 34	215.61
FY 35	236.68
FY 36	258.09
FY 37	279.40
FY 38	305.65
FY 39	334.60
FY 40	367.44

Source: Steer Davies Gleave analysis

CONTROL INFORMATION

Prepared by	Prepared for	
Steer Davies Gleave Suite No. S3, Vatika Business Centre, Vatika Triangle, MG Road, Gurgaon, Haryana, 122002 +91 124 441 8650 www.steerdaviesgleave.com	L&T Infrastructure Development Projects Ltd. Mount Poonamallee Road, Manapakkam, Chennai, India	
SDG project/proposal number	Client contract/project number	
23138401		
Author/originator	Reviewer/approver	
Nandini Ravindranath	Jon Peters	
Other contributors	Distribution	
Anuj Maitrey, Vaibhav Gupta	<i>Client:</i>	<i>SDG:</i>
Version control/issue number	Date	
Report FMV Release	17/11/2017	



013

Our offices

Bogotá, Colombia

+57 1 322 1470

colombiainfo@sdgworld.net

Bologna, Italy

+39 051 656 9381

italyinfo@sdgworld.net

Boston, USA

+1 (617) 391 2300

usainfo@sdgworld.net

Denver, USA

+1 (303) 416 7226

usainfo@sdgworld.net

Leeds, England

+44 113 389 6400

leedsinfo@sdgworld.net

London, England

+44 20 7910 5000

sdginfo@sdgworld.net

Los Angeles, USA

+1 (213) 337 6790

usainfo@sdgworld.net

Madrid, Spain

+34 91 541 8696

spaininfo@sdgworld.net

Mexico City, Mexico

+52 (55) 5615 0041

mexicoinfo@sdgworld.net

New York, USA

+1 (617) 391 2300

usainfo@sdgworld.net

Rome, Italy

+39 06 4201 6169

italyinfo@sdgworld.net

San Juan, Puerto Rico

+1 (787) 721 2002

puertoricoinfo@sdgworld.net

Santiago, Chile

+56 2 2757 2600

chileinfo@sdgworld.net

São Paulo, Brazil

+55 (11) 3151 3630

brasilinfo@sdgworld.net

Toronto, Canada

+1 (647) 260 4860

canadainfo@sdgworld.net

Vancouver, Canada

+1 (604) 629 2610

canadainfo@sdgworld.net