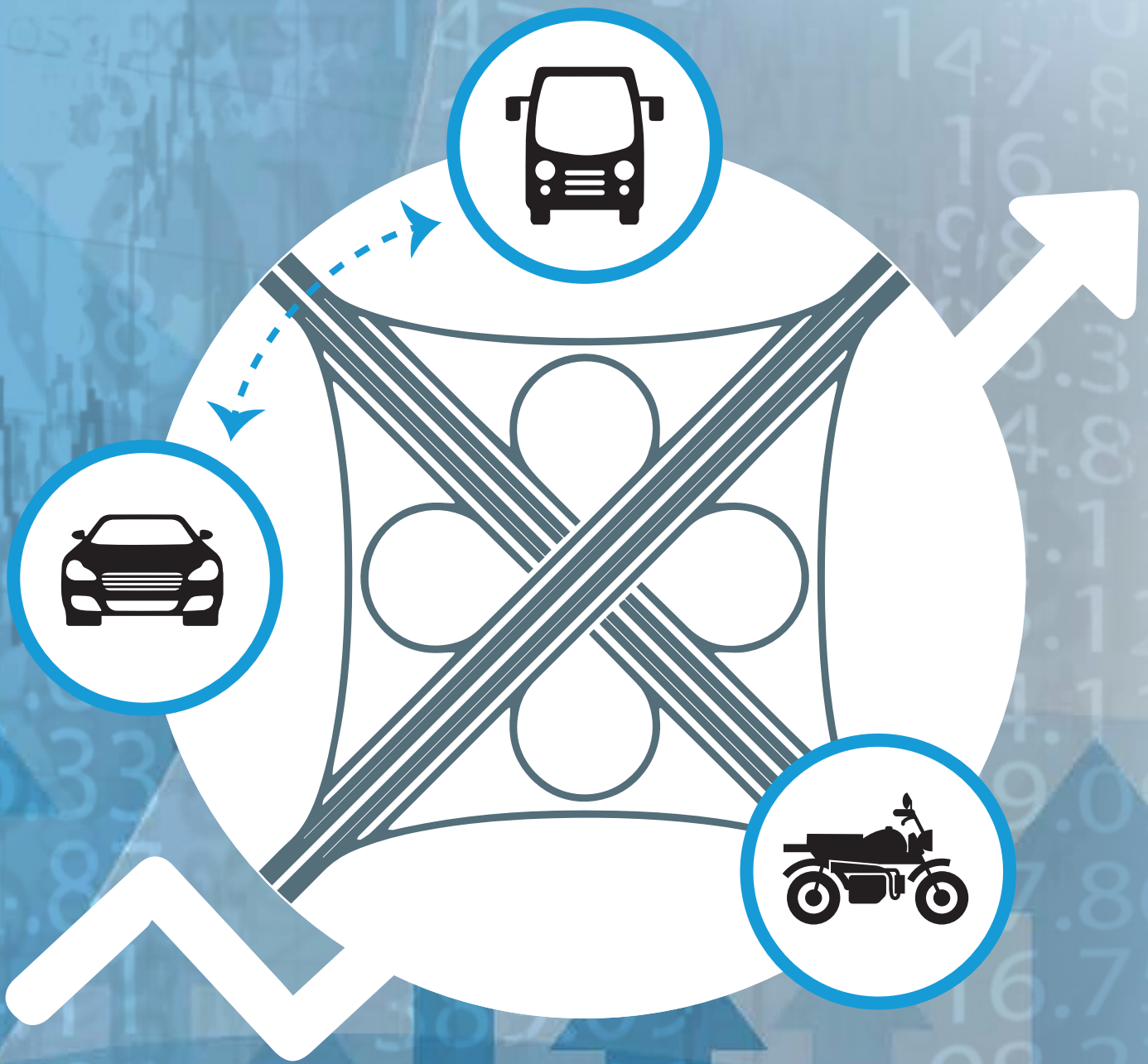
SHAKTI
SUSTAINABLE ENERGY
FOUNDATION

Developing a business case for

Integrated transport sector budgeting in states



April 2018

KPMG Advisory Services Private Limited is the knowledge partner for this report

About Shakti Sustainable Energy Foundation

Shakti Sustainable Energy Foundation works to strengthen the energy security of India by aiding the design and implementation of policies that support renewable energy, energy efficiency and sustainable transport solutions.

Disclaimer

- The views/analysis expressed in this report/document do not necessarily reflect the views of Shakti Sustainable Energy Foundation. The Foundation also does not guarantee the accuracy of any data included in this publication nor does it accept any responsibility for the consequences of its use.
- The information contained herein is of a general nature and is not intended to address the circumstances of any particular individual or entity. Although KPMG endeavor to provide accurate and timely information, there can be no guarantee that such information is accurate and as of the date it is received or that it will continue to be accurate in the future. No one should act on such information without appropriate professional advice after a thorough examination of the particular situation.

**For private circulation only*

Contents

List of tables

List of figures

Abbreviations

APSRTC	Andhra Pradesh State Road Transport Corporation
BCR	Benefit Cost Ratio
Capex	Capital Expenditure
CAGR	Compound annual growth rate
ERR	Economic Internal Rate of Return
FIRR	Financial Internal Rate of Return
GDP	Gross Domestic Product
I/O	Input-Output
MSRTC	Maharashtra State Road Transport Corporation
NH	National Highway
NHAI	National Highways Authority of India
NPV	Net Present Value
NSDP	Net State Domestic Product
OPEX	Operational expenditure
O&M	Operation and Maintenance
P&L	Profit and Loss
SCBA	Social Cost Benefit Analysis
SH	State Highway
SRTU	State Road Transport Undertaking
VOC	Vehicle Operating Cost

Executive Summary

Introduction

Transportation infrastructure is the engine of economic growth for the economy. In the past few years, there have been increased investments in the sector. However, there has been increased focus on building roads resulting in less funds being available for development of bus based public transport systems. For instance, expenditure on the construction of roads and bridges for Andhra Pradesh, Maharashtra and Haryana has been up to a maximum of 4% of the total state budget whereas the capital expenditure SRTUs and other infrastructure has never exceeded 0.5% in these states. This lesser allocation of funds in SRTUs needs to be seen alongside the impact that they create. As per data published by Ministry of Road Transport and Highways (MoRTH)[1], during 2014-15, the SRTUs carried more than 2,500 crore passengers, nearly 7 crores each day, which is more than three times that carried by Indian Railways.

There is therefore a need for development of integrated transport budgets by the state governments. This is important because state governments are currently focusing more on building roads with limited investments in development of bus based public transport systems which are critical for ensuring sustainable passenger mobility. An integrated budget would lead to a balanced allocation of funds ensuring both road infrastructure creation as well optimum road infrastructure use.

Objective of the study

The objective of this study is to build a rationale for integrated transport sector budgeting in states by analysing the budgets of three state governments with respect to the expenditures and revenues attributable to the transport sector and also by developing a quantitative model which brings out the impact of considering road investments and investments in buses together in the three states.

Methodology

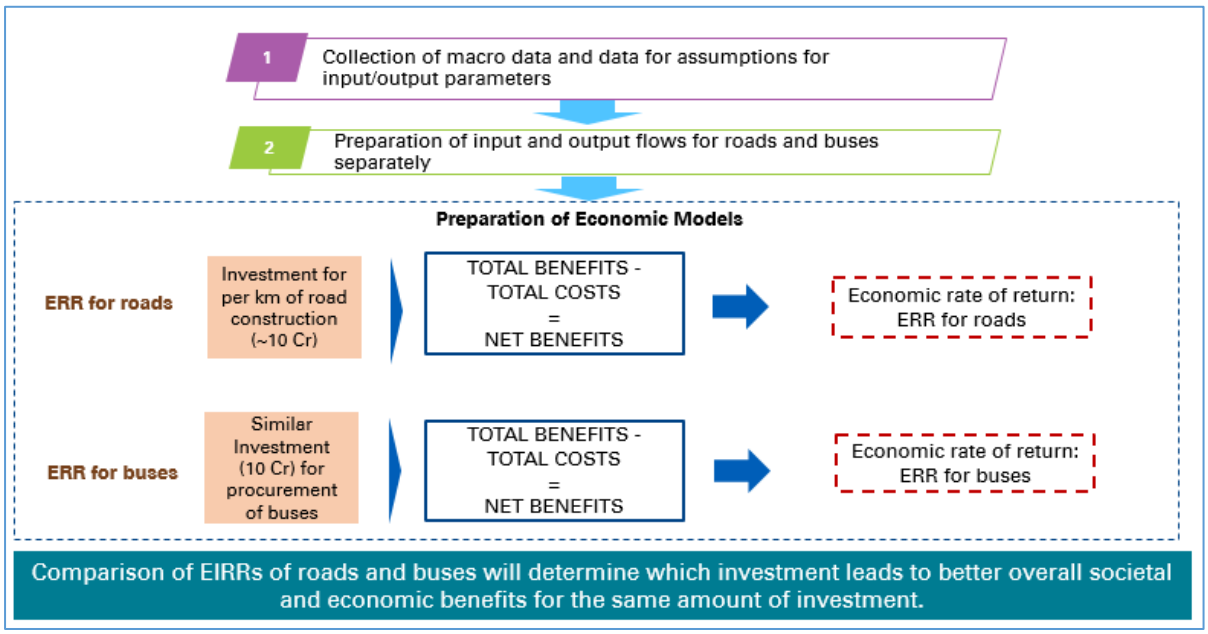
Literature review has been conducted for determining the appropriate methodology for conducting the economic analysis of road infrastructure and public transport related projects. Methods to conduct economic analysis and parameters for conducting cost-benefit analysis for road investment as well as public transport projects are the areas studied in the literature review.

Based on the above, Social Cost Benefit Analysis (SCBA) and Input-Output Analysis (I-O Analysis) were identified as the most commonly used methods for economic assessment of investment in road infrastructure and public transport projects. The key parameters considered in these methods of analysis are capital costs, operating costs, travel time savings, vehicle operating cost, accident costs and environmental impacts.

Both SCBA and I-O Analysis methods and parameters have been used for the economic analysis and for development of an integrated business model. The "input" and the "output" flows for investments in roads and buses have been separately estimated and the "net benefit" has been

[1] Review of the performance of SRTU for April 2014 – March 2015, MoRTH publication dated February 2016

calculated. The economic rate of return (ERR) has then been arrived at from the stream of net benefits over a period of time. The broad methodology of economic analysis is shown below.



In preparing a model for the case in which road infrastructure and bus investment are considered in an integrated manner the following method has been adopted.

The first step is to select three states for which the analysis is to be carried out. This has been done taking into consideration the following parameters

- Presence of a strong SRTU in the state – Physical parameters such as fleet size and percentage of over aged buses have been considered. Operational parameters such as ridership per bus per day, staff productivity and fuel efficiency have been looked at. Financial performance in terms of profit / loss per bus is also a key determinant of the strength of the SRTU in the state.
- Road infrastructure per lakh of population and outlay for roads in the state government's budget.
- Net State Domestic product.

Based on the above parameters and a discussion with Shakti Sustainable Energy Foundation (Shakti), three states have been chosen, viz. Andhra Pradesh, Maharashtra and Haryana. The state transport budgets of these states have been analyzed mapping the revenue and expenditure on buses and roads.

Post the selection of the states, one highway each in the three states of Andhra Pradesh, Maharashtra and Haryana has been selected and details of traffic (number of buses, cars, average km operated, passenger occupancy etc.) plying on the same have been collected. The vehicular share of buses and cars has been determined on the basis of traffic data. This is termed as 'base case'. Based on the methodology described above the ERR has been calculated for the base case. Post this an "alternative case" has been prepared. In the alternate case, share of buses on the same highway has been increased and a corresponding proportionate reduction in the number of cars has been assumed. This is termed as 'alternate case'. ERR has been calculated for the alternate case and compared with that of the base case.

Major Findings

Analysis of SRTUs

It was found from the analysis of different costs associated with SRTUs that the taxes levied on them constitute about 11-14% of their total costs. In case of MSRTC, the organization was making operating profits before imposition of taxes.

Financial analysis of investments in roads & buses

It has been estimated from an indicative financial analysis that the FIRR for investment in roads is positive (about 8%), while that for buses is negative. The current cost structures for operating buses in combination with the ticket prices that can be levied by SRTUs on the travelling public, render buses to be a loss making investment.

Analysis of budgets of the three states

- In all the three states viz. Andhra Pradesh, Maharashtra and Haryana, there exists a surplus of funds received from transportation sector vis-à-vis the expenditure on roads. Proportions of such surplus of sources of funds over expenditure are different for the three states and are broadly in the range of 60-80% of the overall sources of funds.
- When all fund inflows and outflows for buses are considered at the state level (i.e. clubbing both capital outlays and operating expenditure vis-à-vis total source of funds/ revenue), there exists a deficit in sources of funds/ revenues from buses vis-à-vis their overall expenditure. Proportions of such deficit for buses are different for different states and are broadly in the range of 9-17% of the overall sources of funds for buses.
- In all the three states, the growth rate of state expenditure is higher than the growth rate of GSDP. This indicates the pressure on state government finances to meet obligations under various schemes. Andhra Pradesh is a new state and it can be seen that the expenditure of the state government constitutes a larger percentage of the state GSDP (about 24-25% for Andhra Pradesh during 2014-15 to 2016-17) as compared to the other states (12% for Maharashtra and 12-16% for Haryana during 2014-15 to 2016-17).
- Looking at the trend of surplus funds alongside increasing expenditure of state governments, the pressure to deploy surplus funds under various schemes perceived to be socially and politically important can be observed. However, in all the three states, majority of the total capital outlay towards transportation services is allocated to roads and bridges and a very small portion gets allocated to road based transportation (primarily buses).

Economic analysis of investments in roads & buses

(i) Independent economic analysis[2]

ERR for investment in roads was observed to be 21.7%, while that for buses it was observed to be 24.5%. ERR for investment in buses is higher than that in roads because the economic benefits such as reduction in road fatalities, employment generation and savings on account of reduction in emissions are higher for investment in buses as compared to investment in roads. Looking at only the financial IRR and therefore not investing adequately in buses might not be justified looking at the socio economic benefits of investments in buses.

(ii) Integrated economic analysis for Andhra Pradesh, Maharashtra & Haryana

[2] Independent economic analysis has been done considering select traffic data for the state of Andhra Pradesh.

An integrated economic analysis has been performed for the three states mentioned above, wherein combined investments in roads and buses have been analyzed under the two cases viz. base case and alternate case. It has been observed that as the vehicular shift increases in favor of buses, the ERR in the alternate cases increases. The results of the integrated economic analysis under three scenarios of vehicular shift for each state are tabulated below.

Vehicular Shift	Andhra Pradesh		Maharashtra		Haryana	
	Base case	Alternate Case	Base case	Alternate Case	Base case	Alternate Case
5%	28.68%	29.19%	23.71%	24.23%	23.25%	23.77%
10%	28.68%	29.71%	23.71%	24.74%	23.25%	24.29%
20%	28.68%	30.74%	23.71%	25.76%	23.25%	25.31%

Conclusion

The higher ERR supports the philosophy of looking at roads and public transport infrastructure in an integrated manner. There is a need for considering investments in public transport in tandem with investments in intercity roads in states. This could be done either by higher allocation of transport budget towards buses or having conducive polices and incentives to encourage private sector to invest and participate in public transport services.

Development of an integrated transport model will aid in presenting the societal logic on investing in road infrastructure services and not just on roads. The analysis of the state budgets indicates that surplus funds get generated from the transportation sector, but an inadequate proportion of that surplus is directed towards investments into bus-based public transport. An integrated transportation sector view would assist the states in transitioning from the current skewed capital outlay to a more integrated/ balanced capital outlay with higher than current outlays towards road based transportation.

Suggestions from stakeholders

Interactions were held with various stakeholders (including officials of The World Bank, NITI Aayog and officials of the state transport departments) to gather inputs, present the analysis undertaken as part of this study and its outcomes. The stakeholders were in agreement with the findings of the study. Some of the salient suggestions from various stakeholders are enlisted below.

- The provision of road infrastructure is the responsibility of states. Having created the road infrastructure, the efficient use of road assets is also an objective that is important for states. Efficient use of road assets would come from higher proportion of public transport and this would maximize the returns on government's investments.
- The current conditions of SRTU buses are not up to the mark thereby resulting in lower utilization and poor service levels. To attract the travelling public and induce them to shift to buses, better services will be a key requirement.
- An integrated transport budgeting will be relevant for the rural roads being developed under the Pradhan Mantri Gram Sadak Yojna (PMGSY) as the availability of public transport in the rural areas is minimal.

- There should be a certain percentage of investment in roads which should be allocated towards public transport.
- Specific strategies might need to be formulated to encourage public transport on routes that are loss making/not lucrative.
- An appropriate level of tax exemption / relief may be looked into for SRTUs to improve their financial situation.
- Further, it may be considered to develop an ecosystem wherein government bodies should create technical capacity in terms of having transport planners on their rolls. This would enhance monitoring capabilities at the apex level and assist in ensuring efficient operations and investments in SRTUs.

1. Background

1.1. Introduction

Transport sector attracts major investments from the national and state governments. However, in the past few years, there has been increased focus on building roads resulting in less funds being available for development of bus based public transport systems. This lesser allocation of funds in SRTUs needs to be seen alongside the impact that they create. As per data published by Ministry of Road Transport and Highways (MoRTH)[3], during 2014-15, the SRTUs carried more than 2,500 crore passengers, nearly 7 crores each day, which is more than three times that carried by Indian Railways.

1.2. Need for the study and its scope

In order to address the issue of disaggregated nature of transport sector investment, there is a need to revisit the criteria adopted for transport budget allocation by states and to build a business case for integrated transport budgeting with adequate allocation towards public transport systems. An integrated budget would lead to a balanced allocation of funds ensuring both road infrastructure creation as well optimum use of road infrastructure.

The objective of this study is to build a rationale for integrated transport sector budgeting in states by analyzing the budgets of three state governments with respect to the expenditures and revenues attributable to the transport sector and also by developing a quantitative model which brings out the impact of considering road investments and investments in buses together in the three states.

The various elements of scope of the study are enlisted below:

- Identify three case states with functional SRTUs in consultation with Shakti.
- Review the annual budgets of the three selected states with respect to the expenditures and revenues from the transport sector.
- Map various revenues sources and expenditure venues of the state governments which are directed towards development of transport systems.
- Conduct a cost-benefit analysis of the expenditures made in subsectors within transport at the state level like road building and bus systems and develop metrics for economic returns in such sub-sectors (i.e. benefits will be in the terms of economic and environmental gains such as reduction in emissions, savings in fuel and reduction in accidents/ fatalities).
- Develop a business case for integrated transport budgeting in states and provide recommendations commensurate to the economic benefits of various subsectors within transport.

The ensuing sections in this chapter include the following:

- A broad overview of SRTUs in India (in terms of number of SRTUs in India, total fleet size, total number of passengers carried, average occupancy levels, total revenues, etc.).
- Comparison of India vis-à-vis other developing countries in terms of availability of buses and roads.
- Comparison of growth in road network and fleet size of buses and fund allocations from state budget towards road network and public transport (buses).

[3] Review of the performance of SRTU for April 2014 – March 2015, MoRTH publication dated February 2016

1.3. SRTUs in India

It is a well acknowledged fact that mobility plays an important role in the economic and social development of any country. In India, bus-based public transport system continues to be dominated by SRTUs in terms of coverage. During 2014-15, the SRTUs carried more than 2,500 crore passengers, nearly 7 crores each day on 140,000 buses, which is more than three times those carried by Indian Railways.

Different states in India have their own SRTUs for urban and intra-state movement. SRTUs vary extensively in their fleet sizes, intensity of operations and penetration in terms of connectivity. Figure 1 presents a snapshot of the SRTUs in India.

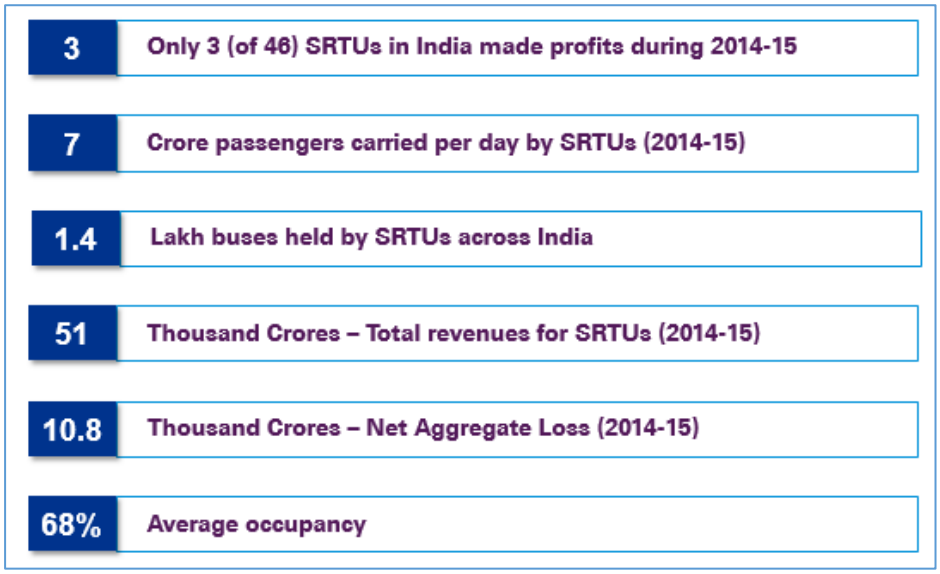


Figure 1 Snapshot of SRTUs in India

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, MoRTH publication dated February 2016

It is observed that only 3 out of 46 SRTUs in the country made profits in the year 2014-15 and on an aggregate level, the losses of SRTUs were to the tune of INR 10,800 crore.

1.4. Availability of roads and buses - Comparison of India with other developing countries

India offers an average of 1.66 buses per thousand people whereas in countries such as Brazil, Malaysia, Mexico, an average of 3-4 buses are available per thousand people. The comparison of availability of buses and road network in different countries is provided below.

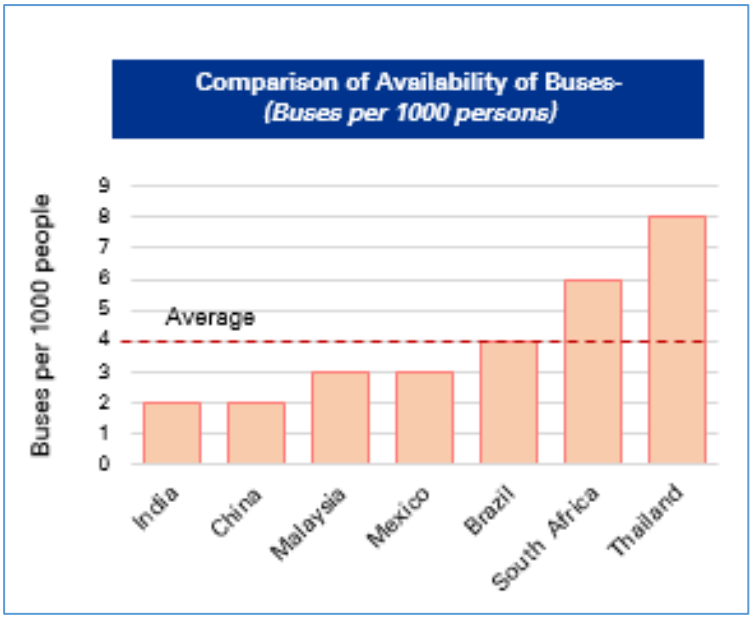


Figure 2: Comparison of availability of buses across select countries

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, MoRTH publication dated February 2016

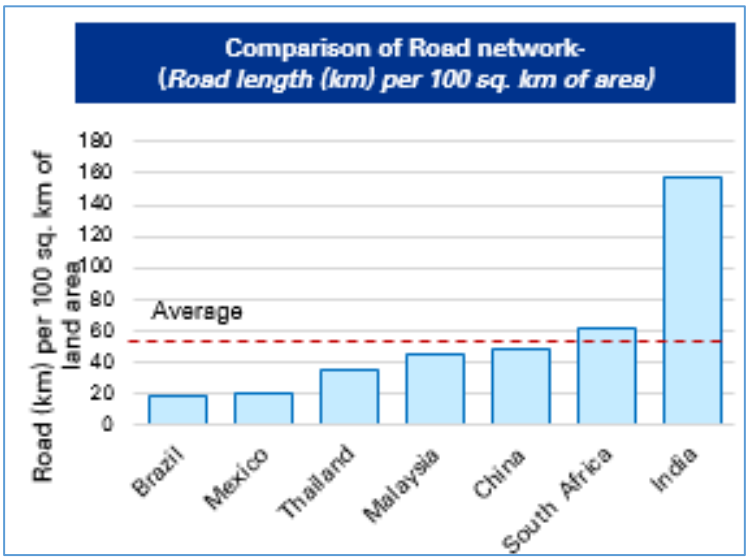


Figure 3: Comparison of Road Network across the globe

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, MoRTH publication dated February 2016

The situation in India seems to be counter intuitive. Among the major developing nations, India has one of the lowest availability of buses per thousand persons, whereas it has the highest road network per hundred sq. km of area.

1.5. Need for more investment in bus transport

There is a mismatch in the growth of road network within states and size of fleets held by SRTUs. On comparing the growth of road network (State Highways [SH] and National Highways [NH]) in the states of Andhra Pradesh, Haryana and Maharashtra with the fleet size of the respective SRTUs, it is seen that although road construction has steadily improved over the years; the fleet size of SRTUs has remained practically stagnant. The following figure presents this comparison for the period from FY 2011 to FY 2015.

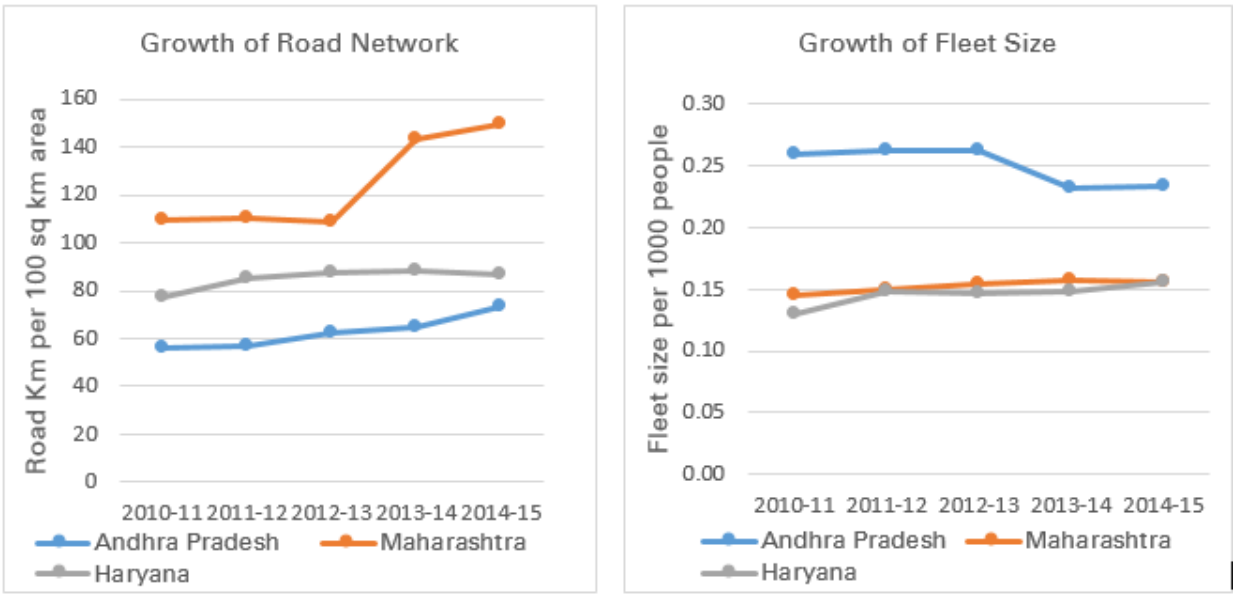
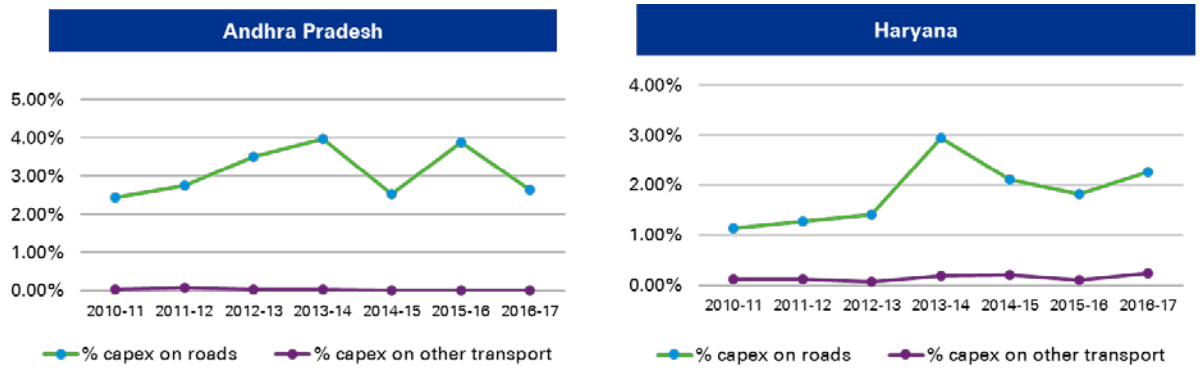


Figure 4: Growth in road network and bus fleet in select states of India

Source: Indiastat database

The fund allocations from the state budgets towards SRTUs have been sporadic over the period from 2011 to 2017. The following figure shows the comparison of share of capital expenditure on roads and bridges against that on other transportation services (which include investment in SRTUs), as a percentage of the total budget expenditure.



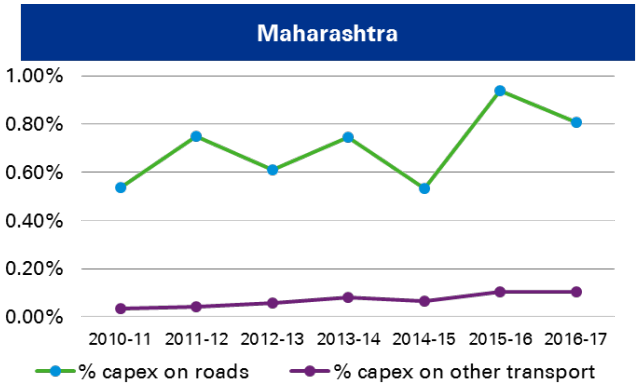


Figure 5: Spending on roads in select states of India

Source: Reserve Bank of India

The capital expenditure on construction of roads and bridges for the selected states is seen to vary between 0.6% and 4% of the total state budgets whereas the capital expenditure on other transport heads (which includes investment in SRTUs) is seen to vary between 0% and 0.5% of the total state budgets.

There is thus a clear preference for investment in construction of roads over investment in public transport in the selected states. In order to address the issue of disaggregated nature of transport sector investment, there is a need to revisit the criteria adopted for transport budget allocation by states. It is essential that economic and environmental benefits of various subsectors within transport (road building and bus systems) be analyzed both at independent and integrated levels to ascertain the societal impact of such subsectors.

2. Selection of states for the study

The data for ten states was collected based on the following parameters:

I. **Presence of a strong State Road Transport Undertaking(SRTU)**
   The sub parameters used for measuring the performance of the SRTU are:
   a. Physical - Fleet size and percentage of over aged buses
   b. Operational - Ridership per bus per day, staff productivity (measured in staff per productive km) and fuel efficiency (kms per litre)
   c. Financial - Profit/loss per bus(INR)

II. **Road Infrastructure in terms of extent of road network and outlay on the same**
   a. Road length per one lakh population
   b. Outlay on roads and bridges

III. **Economic Parameter**
   a. Net State Domestic Product

The data pertaining to above parameters is depicted below.

Table 1 Data of select parameters of various states

Sl. No.	State	Fleet Size	Financial Parameter Profit/Loss/ Bus (INR)	Ridership/ bus/day	NSDP/ Capita (INR)	Fuel Efficiency (km/l)
1	Telangana	10329	(3,88,227)	885	95361	5.1
2	Orissa	446	1,15,471	39	52559	4.6
3	Uttar Pradesh	9415	2632	158	36250	5.1
4	Gujarat	765	(1,71,281)	272	106831	5.4
5	Maharashtra	17957	(2,17,742)	374	117091	4.7
6	Karnataka	8321	(51,676)	333	89545	4.2
7	Haryana	4079	(11,82,863)	315	113427	4.7
8	Rajasthan	4704	(6,59,014)	208	65974	5.0
9	Andhra Pradesh	12079	(4,92,590)	526	81397	5.2
10	Kerala	5691	(13,26,707)	532	103820	4.2

Sl No.	State	Staff Productivity (km/staff/day)	%of overaged buses	Road Length/100,000 Persons(2011)	Outlay on Roads and Bridges(2009-10) (INR Bn)
1	Telangana	60.1	8.8	NA	NA
2	Orissa	141.0	6	617.0	9.0
3	Uttar Pradesh	127.2	0.03	195.5	41.3
4	Gujarat	73.6	2.8	258.6	19.1
5	Maharashtra	53.1	5.43	365.6	39.2
6	Karnataka	72.5	6.4	460.9	26.9
7	Haryana	70.0	20	164.5	10.1
8	Rajasthan	83.4	5.9	351.6	6.1
9	Andhra Pradesh	72.9	16.3	281.1	11.7
10	Kerala	37.0	25	692.8	5.8

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, MoRTH publication dated February 2016

It is evident from table 1 that:

Andhra Pradesh has a sizeable fleet (12,079) with reasonable passenger ridership and NSDP per capita. Maharashtra has the highest fleet size and the least quantum of losses. Moreover, it has the highest outlay on roads and is one among the financially well performing states. Haryana has decent coverage of road network and outlay on roads.

Based on discussions with Shakti, following three states were selected for the study:

- Andhra Pradesh
- Maharashtra
- Haryana

Analysis of operations and financials of SRTUs in the selected states

APSRTC had the highest fleet size (approximately 22,400) in 2012-13, thereafter in 2014 the state of Andhra Pradesh got bifurcated, therefore the SRTU also got bifurcated. Consequently APSRTC was left with approximately 12,000 buses.

Maharashtra State Road Transport Undertaking (MSRTC) had the highest fleet size amongst all SRTUs (~18,000 buses) in 2015, while the fleet of Haryana Roadways ranged over 3,700-4,100 buses during 2012-15.

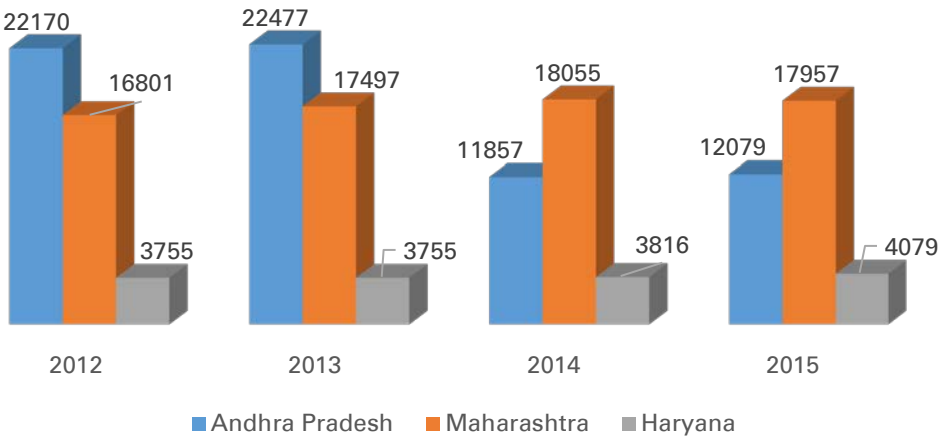


Figure 6 Fleet size

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, April 2013-March 2014, MoRTH publication

The cost per km (CPKM) of APSRTC varied from about INR 25 in 2012 to about INR 33 in 2015. The earning per km (EPKM) of APSRTC varied from about INR 23 in 2012 to about INR 29 in 2015.

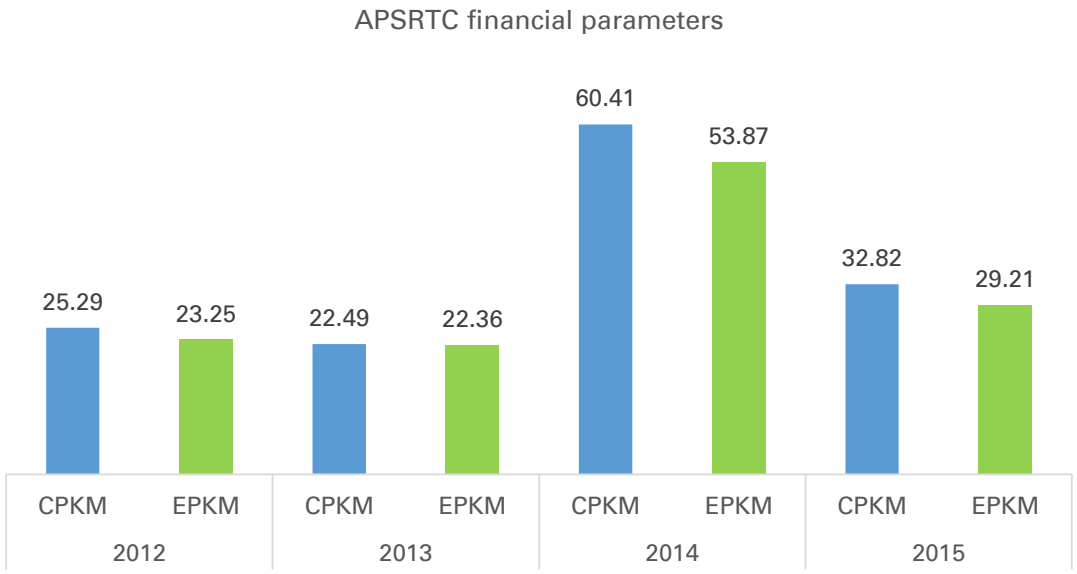


Figure 7: Financial parameters of APSRTC

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, April 2013-March 2014, MoRTH publication

The CPKM of MSRTC varied from about INR 28 in 2012 to about INR 36 in 2015. The EPKM of MSRTC varied from about INR 28 in 2012 to about INR 35 in 2015.The CPKM and EPKM have exhibited an increasing trend during the period.

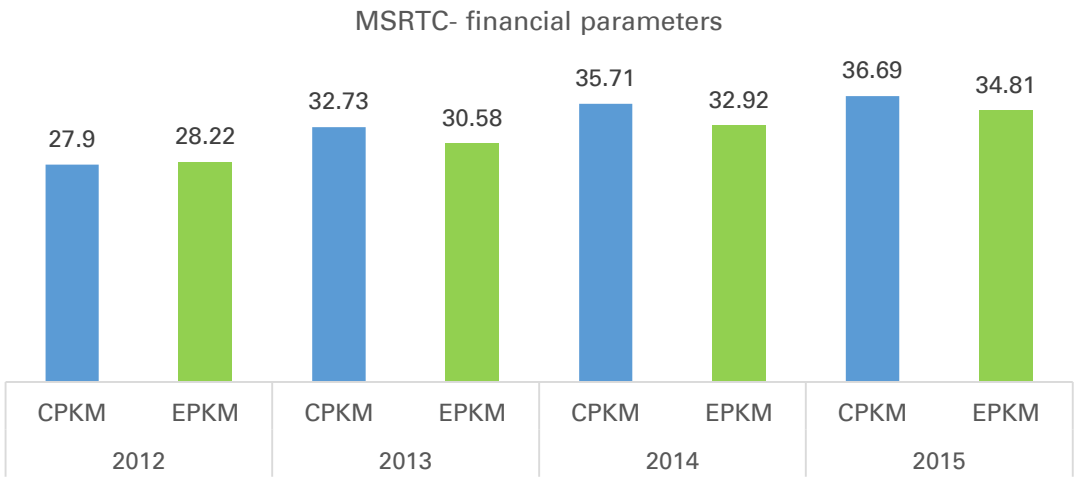


Figure 8: Financial parameters of MSRTC

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, April 2013-March 2014, MoRTH publication

CPKM of Haryana Roadways varied from about INR 31 in 2012 to about INR 41 in 2015. The EPKM of Haryana Roadways varied from about INR 25 in 2012 to about INR 30 in 2015. The CPKM and EPKM have exhibited an increasing trend during the period.

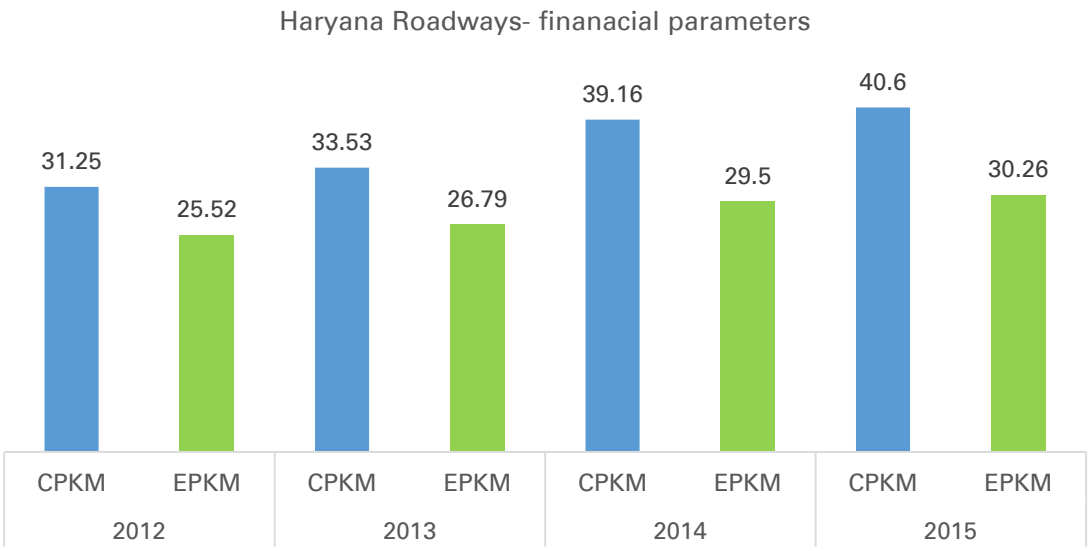


Figure 9: Financial parameters of Haryana Roadways

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, April 2013-March 2014, MoRTH publication

It can be seen from figures 10-12 that staff costs and fuel costs account for 66-75% of the total costs per km across the SRTUs, while tax accounts for 9-14% of the total costs per km. Thus staff and fuel costs account for a major proportion of the total cost.

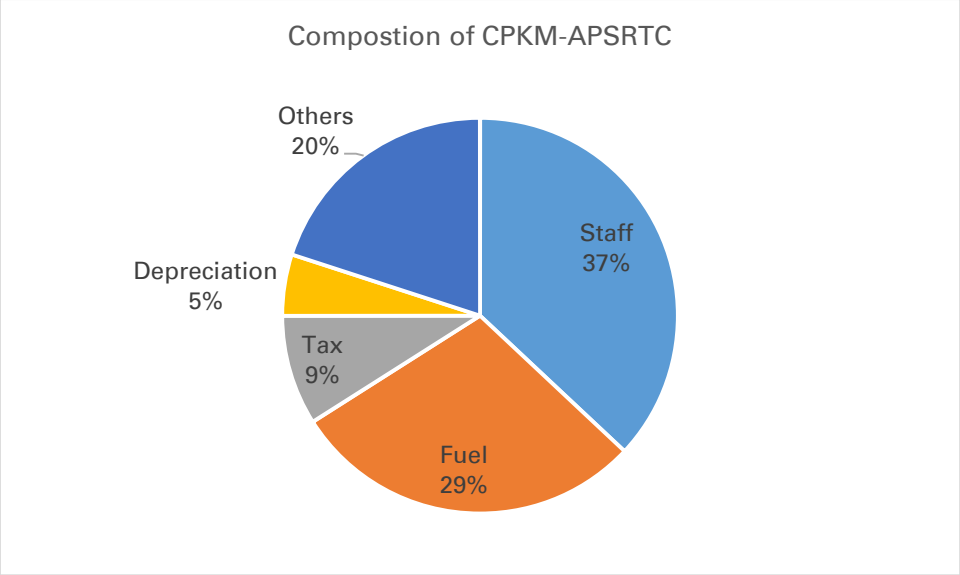


Figure 10: Composition of CPKM - APSRTC

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, April 2013-March 2014, MoRTH publication

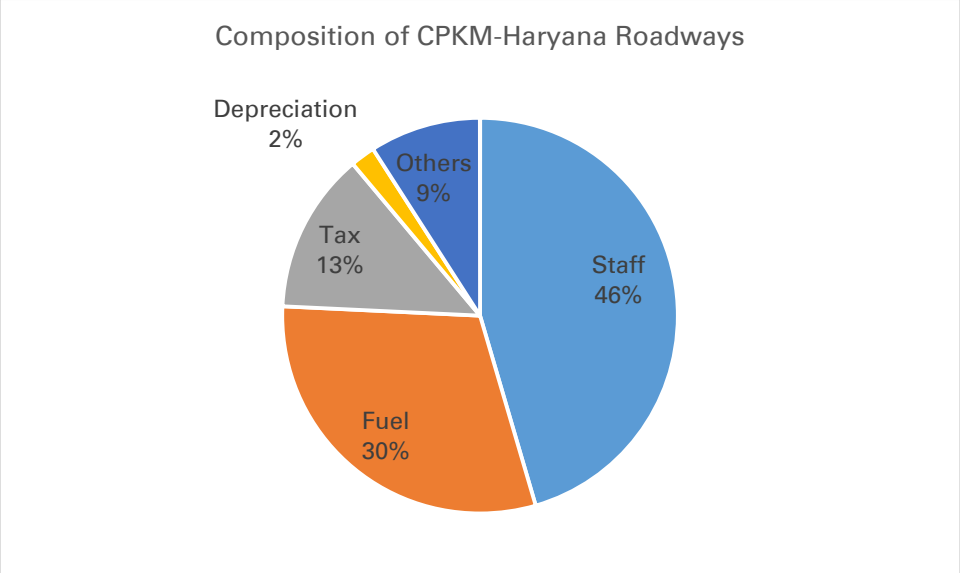


Figure 11: Composition of CPKM – Haryana Roadways

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, April 2013-March 2014, MoRTH publication

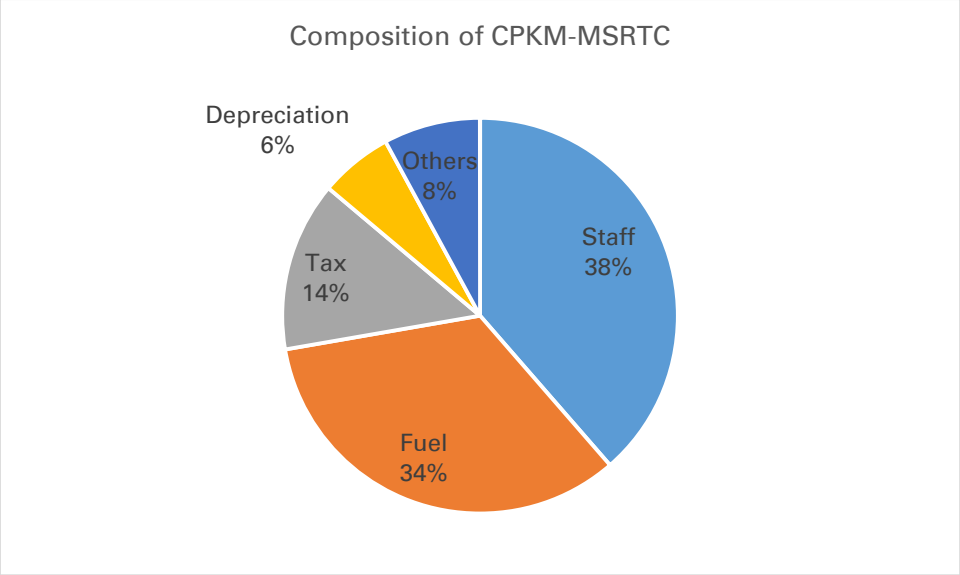


Figure 12: Composition of CPKM - MSRTC

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, April 2013-March 2014, MoRTH publication

It is interesting to note that in case of MSRTC for the period 2012-15, tax outgo is greater than the losses for each year and for APSRTC the tax outgo is greater than the losses in the year 2013.

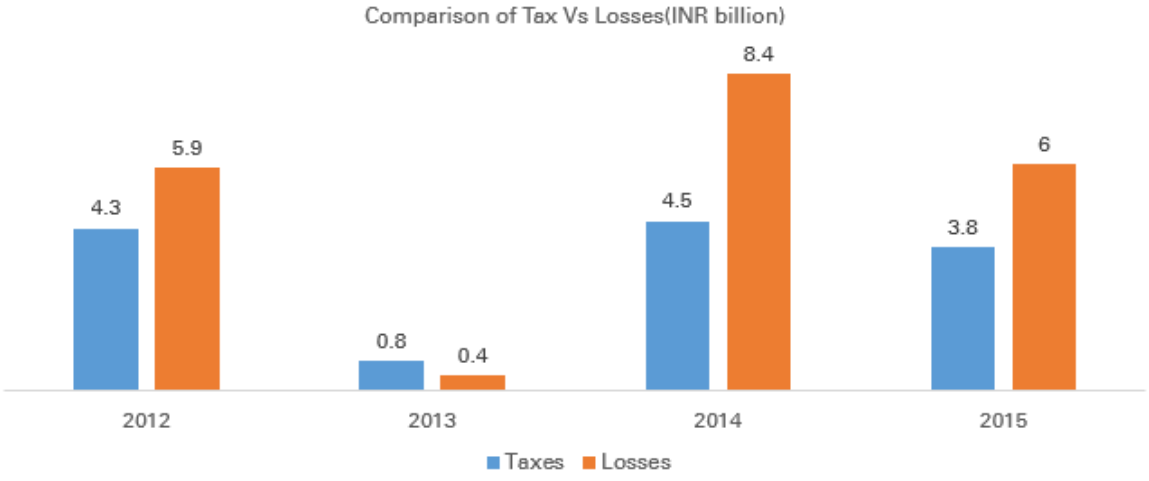


Figure 13 Comparison of Tax and Losses-APSRTC

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, April 2013-March 2014, MoRTH publication

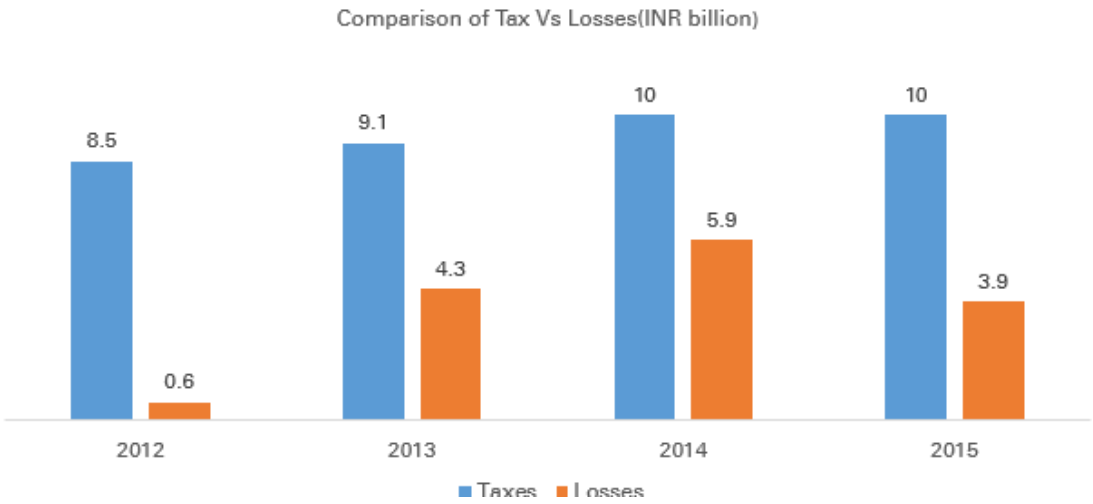


Figure 14 Comparison of Tax and Losses-MSRTC

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, April 2013-March 2014, MoRTH publication

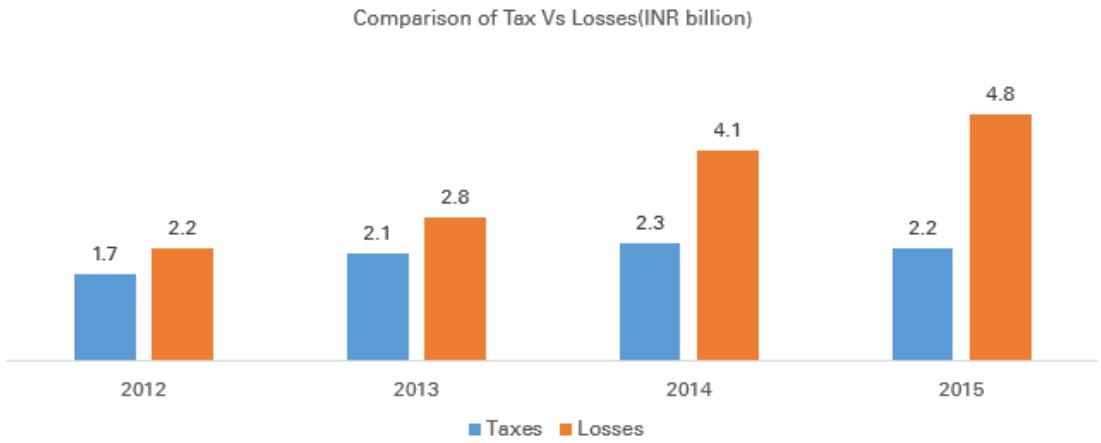


Figure 15 Comparison of Tax and Losses-Haryana Roadways

Source: Review of the performance of State Road Transport Undertaking for April 2014 – March 2015, April 2013-March 2014, MoRTH publication

Tax as a percentage to revenue ranges from 1%-8% in Andhra Pradesh, 14-15% in Maharashtra and 18-21% in Haryana.

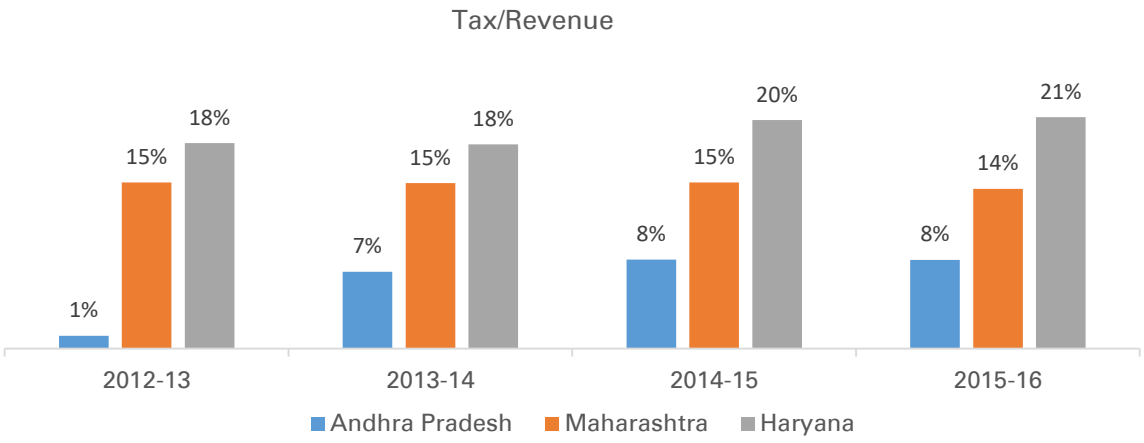


Figure 16 Comparison of Tax as percentage of revenue

Details of transport budget of the selected states are presented in the next chapter.

3. Analysis of state transport budgets

This chapter details the analysis of transport budgets of the three selected states viz. Andhra Pradesh, Maharashtra and Haryana. The analysis has been done to ascertain the following:

a) Expenditure incurred on the roads,
b) Sources of funds (i.e. various receipts) from the transportation sector and
c) Surplus or deficit of sources of funds over expenditure on the roads, if any.

The above three aspects are also analyzed for the buses. Below are the steps which have been undertaken to conduct the analysis.

First up, expenditure incurred on the roads is obtained by summing up revenue expenditure, capital outlay and loans towards roads and bridges from the budgets of respective states. Thereafter, sources of funds are obtained by summing up taxes on vehicles (under Indian Motor Vehicles Act including various fees such as driving license fees, permit fees and other receipts associated with state Motor Vehicles Act), taxes on goods and passengers (such as toll tax and tax on entry of goods), VAT receipts on sale of petroleum products and grants (such as grants under PMGSY scheme). Surplus or deficit is obtained by subtracting the expenditure from the sources of funds.

For buses, expenditure for a state is obtained by summing up capital outlays, loans, subsidies and operating expenditure of each of the three state transport corporations/ undertakings. Sources of funds/ revenues for a state is obtained by summing up taxes so received from the state transport corporations/ undertakings and their operating revenues (both traffic and non-traffic revenues). Thereafter, surplus or deficit is obtained by subtracting the overall expenditure from the overall revenues.

Apart from the above analysis, snapshots of major macroeconomic parameters such as GSDP, its growth rate, per capita income, fiscal deficit, etc. for each of the three states have been looked at.

3.1 Andhra Pradesh

Snapshot of major macroeconomic parameters of Andhra Pradesh's budget are shown below.

Table 2 Macroeconomic Parameters- Budget of Andhra Pradesh

Parameters	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
GSDP (INR Cr) at 2011-12 constant prices	379,402	380,629	407,114	441,741	490,134	547,021
GSDP Growth Rate (%)	-	0.3%	7.0%	8.5%	11.0%	11.6%
Per capita Income (INR per annum)	69,000	74,688	74,062	79,441	87,487	122,376
Total Receipts(INR Cr)	81,000	103,830	127,770	92,080	85,808	110,578

Parameters	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Total Expenditure (INR Cr)	92,800	121,340	152,260	104,140	108,415	135,689
Fiscal Deficit(INR Cr)	11,800	17,510	24,490	12,060	22,606	25,111
Fiscal Deficit %	3.1%	4.6%	6.0%	2.7%	4.6%	4.6%

Source: Socio Economic Survey 2016-17, Government of Andhra Pradesh, RBI

GSDP of Andhra Pradesh increased by about 23% during the period from 2014-15 to 2016-17, while, during the same period, the per capita income increased by about 54%. The expenditure has increased from INR 104,140 crores in 2014-15 to INR 135,689 crores in 2016-17, an increase of around 30%. The expenditure of the state as a percentage of the state GSDP is around 24% to 25% for the years from 2014 to 2017.

The analysis of the transport budget of Andhra Pradesh for ascertaining the expenditure on roads and their sources of funds is provided below.

Table 3: Sources of funds from transport sector and expenditure on roads for the state of Andhra Pradesh (INR Cr[4])

Parameters	2015-16	2016-17
Sources of funds from transport sector		
Tax on vehicles under Indian Motor Vehicles Act (including various fees such as driving license fees, permit fees and other associated receipts)	525	421
Receipts under State Motor Vehicles Act (including receipts in the form of quarterly tax, life tax and other associated receipts)	1,470	1,915
VAT receipts^ on account of sale of petroleum products (motor spirit and diesel)	5,480	5,861
Taxes on goods and passengers (such as toll tax and tax on entry of goods)	10	18
Grants (such as receipts under Pradhan Mantri Gram Sadak Yojna (PMGSY) and other grants for state roads)	688	490
A. Total of sources of funds on account of roads	**8,173**	**8,705**
B. Total of expenditure on roads and bridges	**3,237**	**3,497**
C. Surplus/ (deficit) of sources over expenditure (A-B)	**4,936**	**5,208**
D. Surplus as a percentage of sources of funds (C/A)	**60.4%**	**59.8%**

Source: Andhra Pradesh Budget

^ VAT receipts are computed by utilizing (i) annual sales of petroleum products (motor spirit, diesel oil) in Andhra Pradesh from the annual statistics of Ministry of Petroleum and Natural Gas, (ii) applicable VAT rates on sale of petroleum products in Andhra Pradesh and (iii) pre-VAT prices of petroleum products.

[4] The likely impact of GST on tax revenues of states is explained in Annexure 3

Majority of such VAT receipts would be on account of the transportation sector and hence, they have been considered in the sources of funds from the transportation sector. Same methodology has been used for computation of VAT receipts for other states also.

As can be seen above, there is a surplus of funds received from the transportation sector over the expenditure on roads and bridges in the state. Such surplus is to the tune of 60% of funds received and is adequate to fund the expenditure on roads and bridges. It may be noted that majority of such surplus is attributable to the VAT receipts on account of sale of petroleum products (motor spirit and diesel) and tax receipts on vehicles.

An analysis of sources of funds/ revenues and expenditure on account of buses in Andhra Pradesh has also been done and is as under.

Table 4: Sources of funds/ revenue and expenditure on buses for the state of Andhra Pradesh (INR cr)

Parameters (INR crores)	2014-15	2015-16
Expenditure for the state		
Capital outlay/ loans to APSRTC	124	249
Subsidies paid to APSRTC	322	404
Operating expenditure	4,129	5,166
A. Total expenditure for the state to buses	**4,576**	**5,819**
Sources of funds/ revenue for the state		
Taxes so received from APSRTC	319	399
Operating revenue of APSRTC	3,686	4,613
Traffic revenue	3,428	4,272
Non-traffic revenue	257	341
B. Total sources of funds/ revenue for the state	**4,005**	**5,011**
C. Surplus/ (Deficit) of sources of funds over expenditure (B-A)	**(571)**	**(808)**
D. Percentage of surplus/ (deficit) over total sources of funds (C/B)	**-ve 14.3%**	**-ve 16.1%**
E. Ratio[5] of operating expenditure to operating revenue	**112%**	**112%**

Source: Andhra Pradesh budget, MoRTH – Review of performance of SRTUs

As shown above, there is a deficit of sources of funds/ revenue over the expenditure on buses in Andhra Pradesh. Such deficit is to the tune of 14-16% of the overall sources of funds/ revenue on account of buses. It may be noted that the deficits so shown above are not only depicting the operating losses of APSRTC (as operating revenues are less than the operating expenditures),

[5] Operating ratio has been computed by excluding the taxes so paid by APSRTC to the state government of Andhra Pradesh. This has been done to consolidate all the expenditures and revenues at the state level towards buses. If such taxes are included in the operating expenditure of APSRTC, the operating ratio would deteriorate further to 120%

but also showing a deficit situation for the state when analyzed with all expenditures/inflows towards buses clubbed together (irrespective of their nature i.e. capital/operating).

Further, as per the state budget of Andhra Pradesh, it may be noted that the capital outlay on roads and bridges account for about 84% whereas outlay towards road transport account for a mere 10% of the overall capital expenditure towards various transportation services.

3.2 Maharashtra

Snapshot of major macroeconomic parameters of Maharashtra's budget are shown below.

Table 5 Macroeconomic Parameters- Budget of Maharashtra

Parameters	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
GSDP (current prices) INR Crore	1,272,967	1,448,466	1,647,506	1,792,122	1,967,171	2,203,231
GSDP Growth Rate (%)	-	13.8%	13.7%	8.8%	9.8%	12.0%
Per capita Income- (INR per annum)	98,910	111,005	125,146	134,081	147,939	-
Total Receipts- INR Cr	122,301	143,810	151,400	166,401	199,378	221,961
Total Expenditure- INR Cr	149,228	165,469	187,982	217,748	247,325	270,764
Fiscal Deficit -INR Cr	19,969	13,740	26,018	31,827	37,950	35,031
Fiscal Deficit %	1.6%	0.9%	1.6%	1.8%	1.9%	1.6%

Source: *Socio Economic Survey 2016-17, Government of Maharashtra, RBI*

GSDP of Maharashtra increased by about 23% during the period 2014-15 to 2016-17.The expenditure of the state increased by 24% in the same period. As a share of the state GSDP the expenditure is around 12%.

The analysis of sources of funds from transport sector and expenditure on roads for Maharashtra has been performed on similar lines as presented in case of Andhra Pradesh.

Table 6: Sources of funds from transport sector and expenditure on roads for the state of Maharashtra (INR Cr)

Parameters	2014-15	2015-16
Sources of funds from transport sector		
Tax on vehicles under Indian Motor Vehicles Act (including various fees such as driving license fees, permit fees and other associated receipts)	860	931
Receipts under State Motor Vehicles Act (including receipts in the form of quarterly tax, life tax and other associated receipts)	4,565	4,793

Parameters	2014-15	2015-16
VAT receipts on account of sale of petroleum products (motor spirit and diesel)	12,316	13,430
Taxes on goods and passengers (such as toll tax and tax on entry of goods)	418	451
Grants (such as receipts under Pradhan Mantri Gram Sadak Yojna (PMGSY) and other grants for state roads)	171	1,740
A. Total of sources of funds on account of roads	**18,330**	**21,345**
B. Expenditure on roads and bridges	**3,042**	**3,976**
C. Surplus/ (deficit) of sources over expenditure (A-B)	**15,288**	**17,369**
D. Surplus as a percentage of sources of funds (C/A)	**83.4%**	**81.4%**

Source: Maharashtra state budget, https://mahades.maharashtra.gov.in/MPSIMS/

The analysis of sources of funds/ revenue and expenditure on buses in the state of Maharashtra is as under.

Table 7: Sources of funds/ revenue and expenditure on buses for the state of Maharashtra (INR cr)

Parameters (INR crores)	2014-15	2015-16
Expenditure for the state		
Capital outlay/ loans to MSRTC	18	16
Subsidies paid to MSRTC	1,334	1,335
Operating expenditure	6,821	6,459
A. Total expenditure for the state to buses	8,174	7,810
Sources of funds/ revenue for the state		
Taxes so received from MSRTC	1,079	1,038
Operating revenue of MSRTC	5,924	5,925
Traffic revenue	5,727	5,714
Non-traffic revenue	197	211
B. Total sources of funds/ revenue for the state	7,003	6,963
C. Surplus/ (Deficit) of sources of funds over expenditure (B-A)	**(1,170)**	**(846)**
D. Percentage of surplus/ (deficit) over total sources of funds (C/B)	**-ve 16.7%**	**-ve 12.2%**
E. Ratio[6] of operating expenditure to operating revenue	**119%**	**113%**

Source: Maharashtra budget, MoRTH – Review of performance of SRTUs

[6] As explained in the analysis of Andhra Pradesh, operating ratio has been computed by excluding the taxes so paid by MSRTC to the state government of Maharashtra. If such taxes are included in the operating expenditure of MSRTC, the operating ratio would deteriorate further to 138% in 2015 and 131% in 2016.

The deficit of sources of funds over expenditure on buses in Maharashtra is in-line with the trend so observed for the state of Andhra Pradesh. As per the state budget of Maharashtra, it may be noted that majority of the capital outlay on various transportation services is allocated towards roads and bridges (which accounts for about 79-80%) whereas a minor share is allocated towards road based transport (which accounts for about 0.3-0.5%).

3.3 Haryana

Snapshot of major macroeconomic parameters of Haryana's budget are shown below.

Table 8: Macroeconomic Parameters- Budget of Haryana

Parameters	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
GSDP (current prices) INR Crore	297,539	347,032	400,662	437,462	485,184	547,396
GSDP Growth Rate	-	16.6%	15.5%	9.2%	10.9%	12.8%
Per capita Income- INR per annum	106,085	121,269	138,300	148,485	162,034	180,174
Total Receipts- INR Cr	30,861	38,281	38,284	41,090	54,642	63,666
Total Expenditure- INR Cr	38,014	46,413	46,597	53,676	85,037	88,782
Fiscal Deficit INR Crore	7,153	8,133	8,313	12,586	30,396	25,116
Fiscal Deficit %	2.4%	2.3%	2.1%	2.9%	6.3%	4.6%

Source: Socio Economic Survey 2016-17, Government of Haryana, RBI

GSDP increased by about 25% during the period from 2014-15 to 2016-17, while the per capita income increased by 21%. Expenditure of the state has increased by close to 65% in the same period. As a share of the state GSDP the state's expenditure has increased from 12% to 16%.

The analysis of sources of funds from transport sector and expenditure on roads and buses for Haryana are presented in table numbers 9 and 10 respectively.

Table 9: Sources of funds from transport sector and expenditure on roads for the state of Haryana (INR Cr)

Parameters	2015-16	2016-17
Sources of funds from transport sector		
Tax on vehicles under Indian Motor Vehicles Act (including various fees such as driving license fees, permit fees and other associated receipts)	596	600
Receipts under State Motor Vehicles Act (including receipts in the form of quarterly tax, life tax and other associated receipts)	803	1,000

Parameters	2015-16	2016-17
VAT receipts on account of sale of petroleum products (motor spirit and diesel)	4,146	4,209
Taxes on goods and passengers (such as toll tax and tax on entry of goods)	673	825
Grants (such as receipts under Pradhan Mantri Gram Sadak Yojna (PMGSY) and other grants for state roads)	382	156
A. Total of sources of funds on account of roads	**6,600**	**6,790**
B. Expenditure on roads and bridges	**1,898**	**1,552**
C. Surplus/ (deficit) of sources over expenditure (A-B)	**4,702**	**5,238**
D. Surplus as a percentage of sources of funds (C/A)	**71.2%**	**77.1%**

Source: Haryana state budget

Table 10: Sources of funds/ revenue and expenditure on buses for the state of Haryana (INR cr)

Parameters (INR crores)	2014-15	2015-16
Expenditure for the state		
Capital outlay/ loans to Haryana Roadways	62	111
Subsidies paid to Haryana Roadways	-	-
Operating expenditure	1,636	1,627
A. Total expenditure for the state to buses	**1,698**	**1,738**
Sources of funds/ revenue for the state		
Taxes so received from Haryana Roadways	265	275
Operating revenue of Haryana Roadways	1,298	1,324
Traffic revenue	1,288	1,314
Non-traffic revenue	10	10
B. Total sources of funds/ revenue for the state	**1,563**	**1,599**
C. Surplus/ (Deficit) of sources of funds over expenditure (B-A)	**(135)**	**(139)**
D. Percentage of surplus/ (deficit) over total sources of funds (C/B)	**-ve 8.6%**	**-ve 8.7%**
E. Ratio[7] of operating expenditure to operating revenue	**127%**	**124%**

Source: Haryana budget, MoRTH – Review of performance of SRTUs

As per the state budget of Haryana, the capital outlay on roads and bridges account for about 94% whereas outlay towards road transport account for a low 5% of the overall capital expenditure towards various transportation services.

[7] As explained in the analysis of Andhra Pradesh and Maharashtra, operating ratio has been computed by excluding the taxes so paid by Haryana Roadways to the state government of Haryana. If such taxes are included in the operating expenditure of Haryana Roadways, the operating ratio would deteriorate further to 148% in 2015 and 145% in 2016.

Following observations may be deduced from the above analysis on sources of funds and expenditure for roads and buses for the three states:

- In all the three states viz. Andhra Pradesh, Maharashtra and Haryana, there exists a surplus of funds received from transportation sector vis-à-vis the expenditure on roads.
- Proportions of such surplus of sources of funds over expenditure are different for the three states and are broadly in the range of 60-80% of the overall sources of funds.
- When all fund inflows and outflows are considered (i.e. clubbing both capital outlays and operating expenditure vis-à-vis total source of funds/ revenue) for buses in the three states, there exists a deficit in sources of funds/ revenues from buses vis-à-vis their overall expenditure.
- Proportions of such deficit for buses are different for different states and are broadly in the range of 9-17% of the overall sources of funds for buses. Difference in proportions is on account of several factors including varying operating efficiencies of road transport corporations, difference in capital outlays in different years, etc.
- In all the three states, majority of the total capital outlay towards transportation services is allocated to roads and bridges and a very small portion gets allocated to road based transportation (primarily buses).
- The table below captures the a few parameters for each state.

	Haryana	Maharashtra	Andhra Pradesh
Growth rate of GSDP in the period 2014-15 to 2016-17	25%	23%	24%
Growth rate of state expenditure in the period 2014-15 to 2016-17	65%	24%	30%
Expenditure as a percentage of state GSDP in the period 2014-15 to 2016-17	12%-16%	12%	24%-25%
Surplus of funds received from transport sector over the expenditure on roads infrastructure	77%	81%	60%

In all states the growth rate of state expenditure is higher than the growth rate of GSDP. This indicates the pressure on state government finances to meet obligations under various schemes and to make the state budget arithmetic to work. Andhra Pradesh is a new state and it can be seen that the expenditure of the state government constitutes a larger percentage of the state GSDP as compared to the other states. The surplus from the transportation sector is higher as well in the other established states as compared to Andhra Pradesh. Looking at the surplus funds alongside the increasing expenditure trend of state governments, the pressure to deploy surplus funds under various schemes perceived to be socially and politically important can be perceived.

At entity level, all the three road transport corporations are loss making mostly on account of higher cost of operations and higher taxes. Also, the states are in an overall situation of financial deficit when all sources of funds from buses are compared with all streams of expenditure.

In this scenario, development of an integrated transport model will aid in presenting the societal logic on investing in road infrastructure services and not just on roads. As has been indicated, surplus does get generated from the transportation sector, but that surplus is not directed

towards investments into bus based public transport. An integrated transportation sector view would assist the states in transiting from the current skewed capital outlay to a more integrated/ balanced capital outlay with higher than current outlays towards road based transportation.

The subsequent chapter presents different work streams which are carried out for development of business case for integrated budgeting.

4. Work streams for development of business case

The different work streams adopted for development of business case for integrated transport sector budgeting are shown in the below figure.

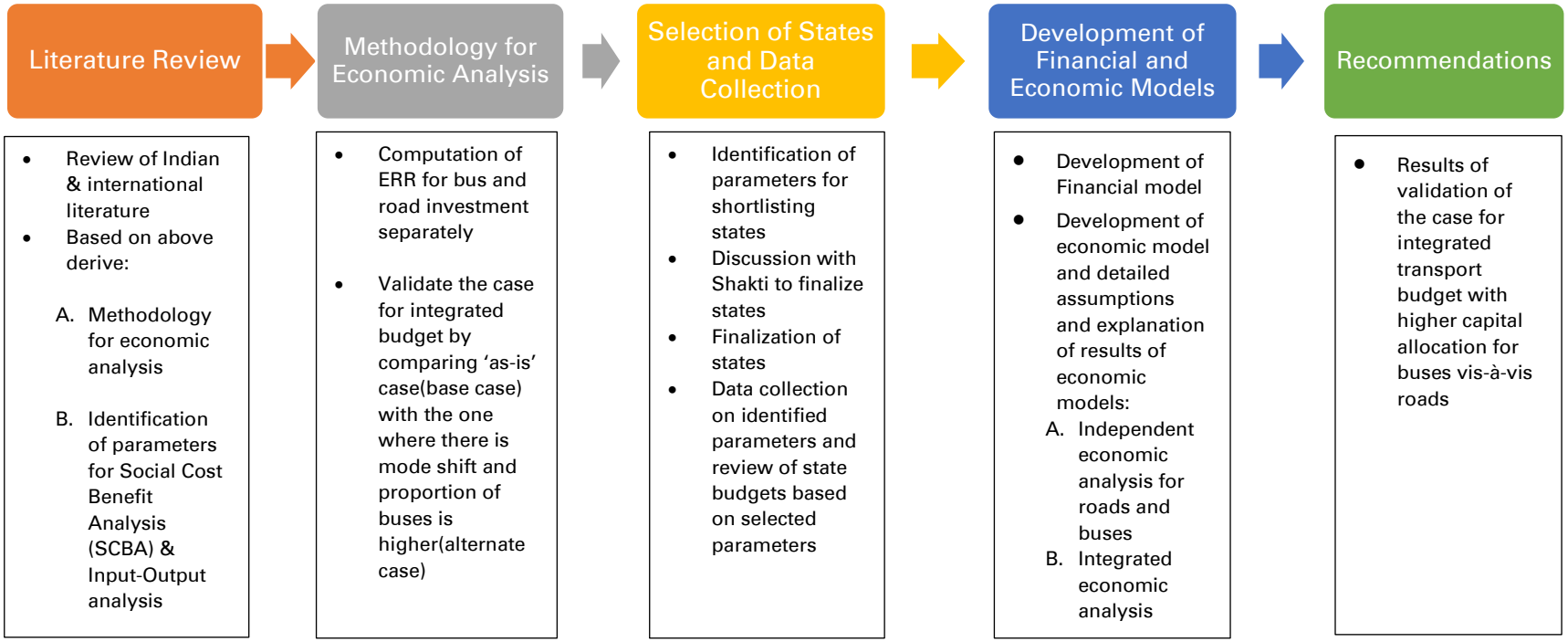


Figure 17: Work Streams

4.1 Literature Review

Review of literature has been performed with the objective of determining the methodology of conducting economic analysis of road infrastructure and/or public transport related projects. The key aspects covered and references for the literature review are enlisted below.

Key aspects covered

- Methods to conduct economic analysis for road investment and transport infrastructure
- Parameters to consider for conducting cost benefit analysis of road investment and public transport projects

The references for the literature review are provided in Annexure 4.

4.2 Methods for conducting economic analysis

The most commonly used methodologies for economic assessment of investment in road infrastructure and public transport are as follows: Social Cost Benefit Analysis (SCBA) and Input-Output Analysis (I-O Analysis).

1. **Social Cost Benefit Analysis (SCBA)**

SCBA is a popular method of identifying, evaluating and comparing social costs and benefits of an investment project with another similar project. This method quantifies in monetary terms, the value of all social benefits to all stakeholders in the society. The net social benefits (social benefits minus social costs) measure the value of investing in a project to the society.

SCBA provides metrics such as Net Present Value [NPV] of net project benefits and Benefit Cost Ratio (BCR) which indicate the extent to which the society is better off investing in a particular project, as compared to some other alternative. NPV is the difference between present value of project costs and benefits. A positive value of NPV signifies that investment in the project is profitable. BCR is the ratio of project benefits and project costs. Hence, a BCR over one means the project provides more benefits as compared to costs. Further, the project which provides a higher BCR provides more benefits as compared to an alternative project with a lower BCR.

SCBA in the transportation sector takes into account the following factors:

- Capital costs
- Operating costs
- Travel time savings (or additional costs)
- Vehicle operating cost savings (or additional costs)
- Accident cost savings (or additional costs)
- Environmental impacts

Other induced benefits like increased demand, and diverted demand are also considered in the analysis. A simplified structure of the SCBA is shown below:

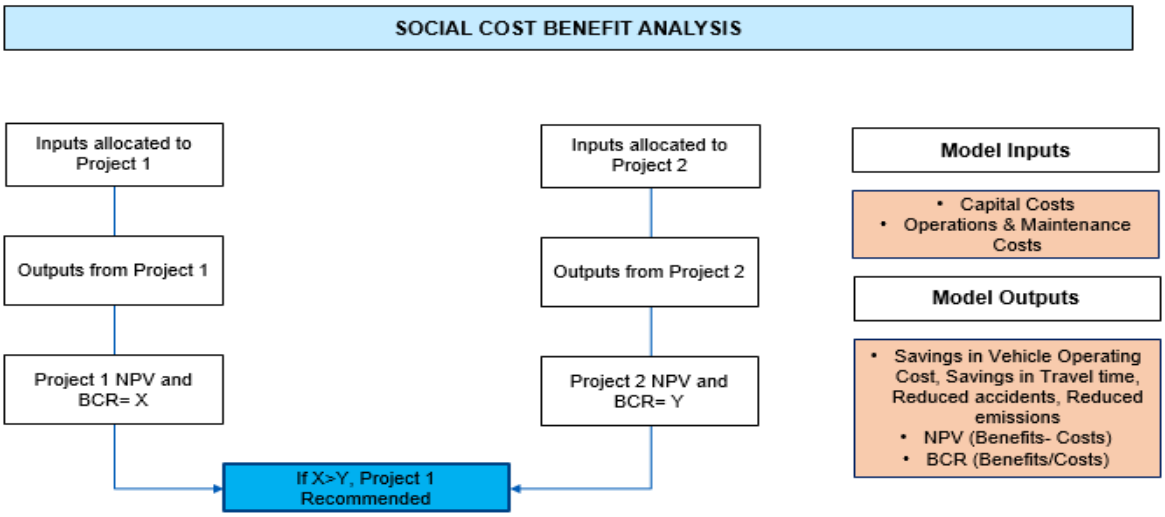


Figure 18: Structure of SCBA

2. Input Output Analysis (I-O)

Input-Output Analysis ("I-O") is a form of economic analysis based on the interdependencies between economic sectors. The foundation of I-O analysis is based on input-output tables. In the input- output table, industries are listed in the headers of each row and each column. The data in each column corresponds to the level of inputs used in that industry's production function. The input-output table contains coefficients or "multipliers" which show the relationships between different sectors, suppliers and consumers in the economy. These multipliers describe the direct, indirect and induced effects on outputs, income and employment and provide the overall change in the level of an activity that results from a change in the inputs to a particular activity. The concept of multiplier, especially employment multiplier is explained in figure 19.

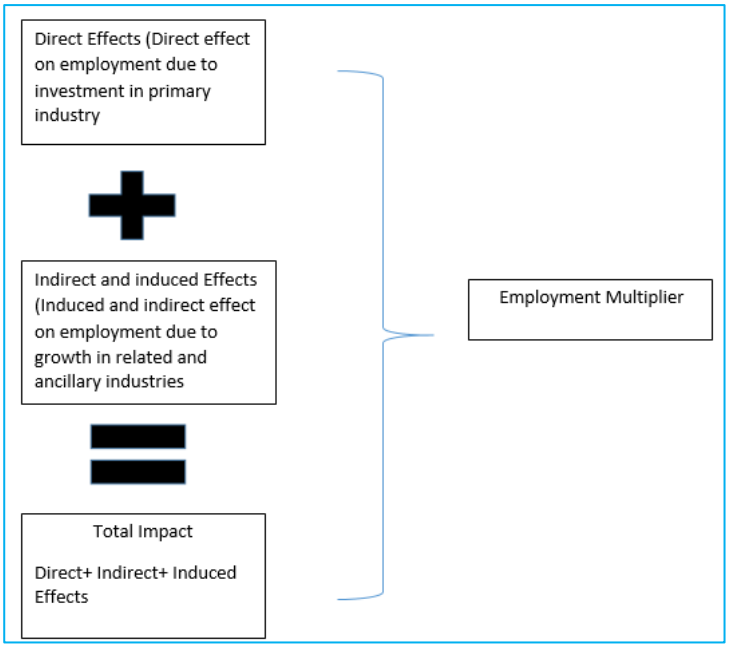


Figure 19: Employment Multiplier

However there are some drawbacks associated with both the methods mentioned above. These are as follows:

- **Drawbacks of SCBA:** It is based on an assumption of perfect competition which ignores the competitive gains arising from improved transport links and the additional benefits resulting from regional and economic development of the country.

- **Drawbacks of I-O Analysis**: It does not include the impact of non-macroeconomic items such as non-work travel time, accident costs, environment externalities etc.

However, based on the review of literature, a combination of Social Cost Benefit Analysis (SCBA) along with Input-Output Method is considered appropriate for conducting economic analysis of road infrastructure and/or public transport related projects. Combining the two methods would help in capturing both social/economic as well as macroeconomic factors that are relevant for such analysis.

4.3 Relevant Parameters for Social Cost Benefit Analysis and Input Output Analysis

The parameters identified for analysis are as under:

- Capital costs
- Operating and maintenance costs
- Vehicle operating costs
- Cost of road fatalities
- Pollution costs
- Employment generation. This can be further disaggregated as under:

    - Direct jobs which are generated directly in the bus sector e.g. in SRTUs etc.
    - Indirect Jobs which are generated in ancillary industries

These parameters can further be classified as:

- Costs
- Benefits

This section explains the above parameters in context of economic analysis.

Costs

Capital costs: This refers to the cost of purchase of buses and the cost of construction of road as the case may be.

Maintenance costs for roads: This refers to the periodic and routine maintenance costs with respect to road:

- Periodic maintenance: These are expenditures incurred over pre-decided fixed intervals
- Routine maintenance: These are expenditures incurred on a day-to-day basis to have the road in working condition

Operation and maintenance costs for buses: These are costs associated with bus operations and can be further disaggregated to:

- Wages and salaries that need to be paid to the staff
- Fuel costs viz. diesel
- Administrative costs associated with the SRTU

- Establishment costs comprising of rent, insurance etc.
- Consumables viz. spare parts etc.

Benefits

Benefits can be broadly classified into societal, economic and environmental benefits.

- Societal benefits
  - Employment generated - road construction, procurement of buses and operation of buses will result in employment being generated (direct, indirect and induced employment)
  - Reduction in road fatalities - Due to better quality of roads and lesser km travelled on account of vehicular shift from cars to buses, there will be reduction in road fatalities.

- Economic benefits
  - Savings in vehicle operating cost- Better quality of road and vehicular shift from cars to buses will result in reduction in vehicle operating cost. The vehicle operating cost is further comprised of:
    - Fuel costs
    - Crew wage
    - Maintenance cost
    - Lubricants cost
    - Tyre cost
    - Spare parts cost
    - Depreciation cost
    - Fixed cost

- Environmental Benefits
  - Due to better quality of roads, there will be reduction in pollutants such as:
    - Carbon monoxide
    - Particulate matter
    - Sulphur dioxide
    - Nitrogen dioxide

4.4 Methodology for Economic Analysis

The basic premise is to compare the economic rates of return (ERR) on identical investments in buses and roads separately. The broad methodology of economic analysis is shown below.

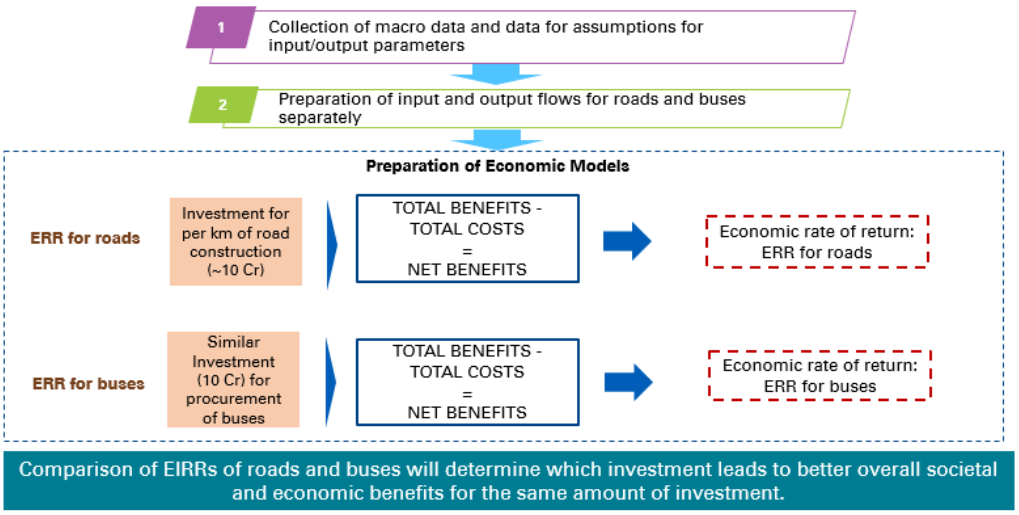


Figure 20: Broad methodology of economic analysis

The input and output parameters used in the economic analysis are presented below.

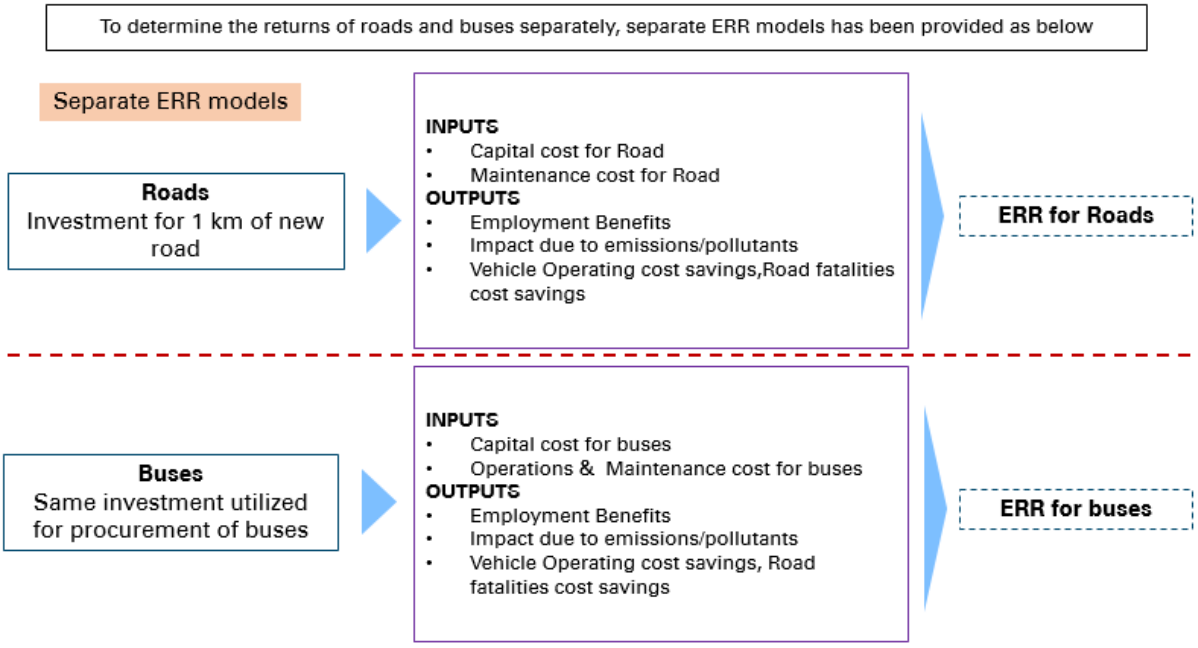


Figure 21 Input and Output parameters in ERR analysis of bus and road investments

Based on the result obtained using the above methodology, a case shall be presented that whether investment in buses is more beneficial to the society than investment in roads. However to make the case for an integrated transport budget, the following construct has been used:

One highway in the state(s) has been selected and details of traffic (number of buses, cars, average km operated, passenger occupancy etc.) plying on the same have been collected. The vehicular share of buses and cars has been determined on the basis of traffic data. This is termed as 'base case'. Based on the methodology described above the ERR would be calculated for base case.

In the second case, the share (number) of buses on the same highway has been increased based on an assumption that there is a vehicular shift (assumed percentage[8]- represented as X% in figure 22) which results in more buses and proportionate decrease in cars ('alternate case'). Based on the methodology described above the ERR has been calculated. The steps are illustrated in figure below (Figure 22).

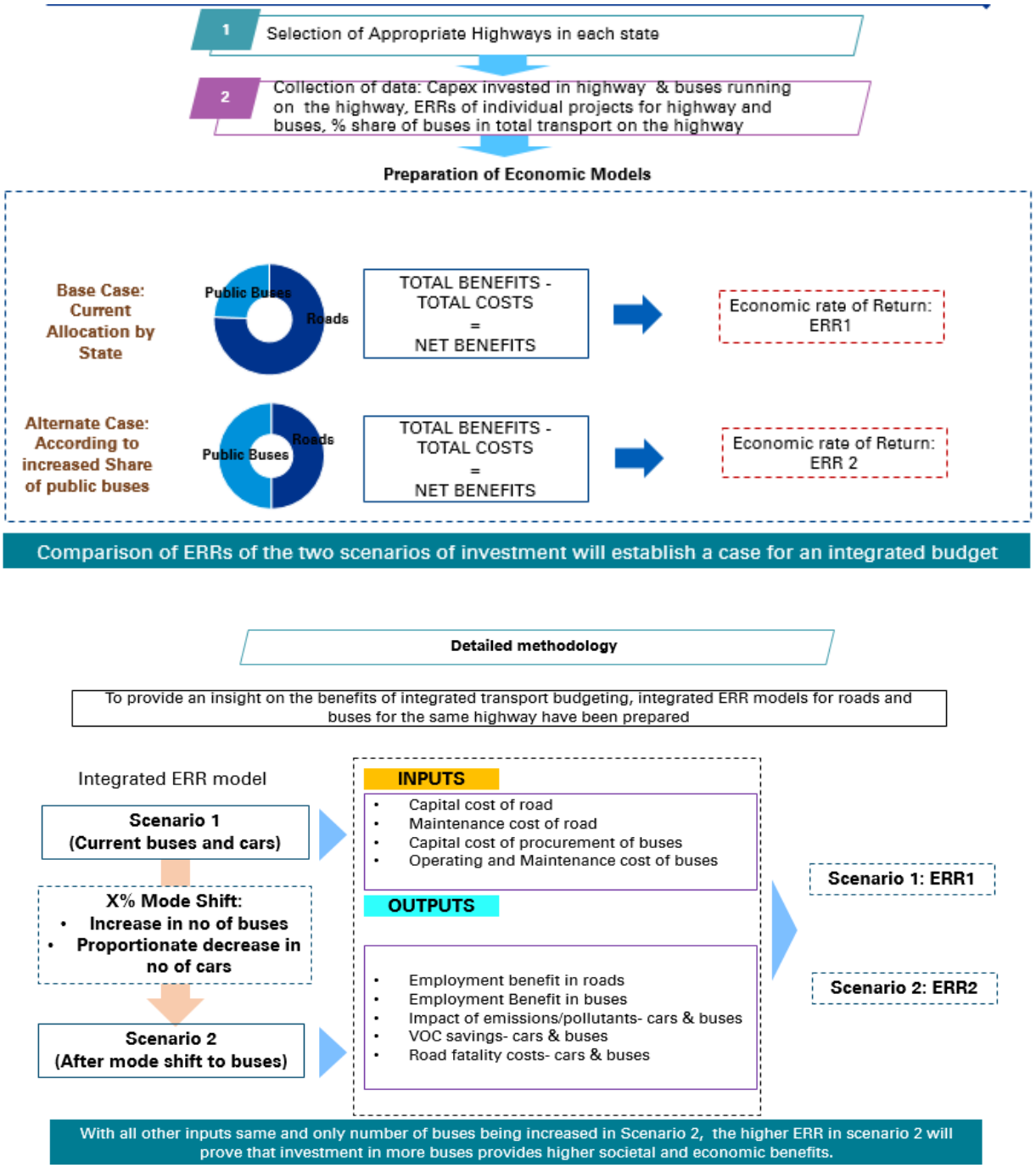


Figure 22: Depiction of Cases

[8] As per International Journal of Sustainable Built Environment, September 2013 (Gulf Organization for Research and Development) titled 'Introduction of public bus transit in Indian cities', a case study was developed for investigating the impact of introduction of new bus transit system in Gujarat. As per the case study, the vehicular shift from cars to buses with introduction of new bus transit system was found out to be in the range of 6.78% to 11.49%. The extent of vehicular shift was found out to depend on several factors including socio-economic profile and traffic quality parameters of the region. For the purpose of integrated economic analysis in the current study, three scenarios of 5%, 10% and 20% vehicular shift have been considered.

The subsequent chapters detail the outputs of financial and economic analysis.

5. Financial and independent economic analysis - Investment in roads and buses

5.1 Financial analysis

A comparison of financial IRR has been made for same amount of investment in roads and buses. This analysis helps postulate the financial feasibility of both investments.

Methodology

- For roads, capital cost of construction and maintenance cost (including routine and periodic maintenance cost) have been considered as input while toll revenue has been considered as output[9].
- For buses, capital cost of bus procurement and operation and maintenance costs, have been considered as input, while ticket revenue has been considered as output[10].
- Net benefits for road investment and bus investment have been estimated on a standalone basis. The net benefits have been used to compute the financial IRRs.

Output

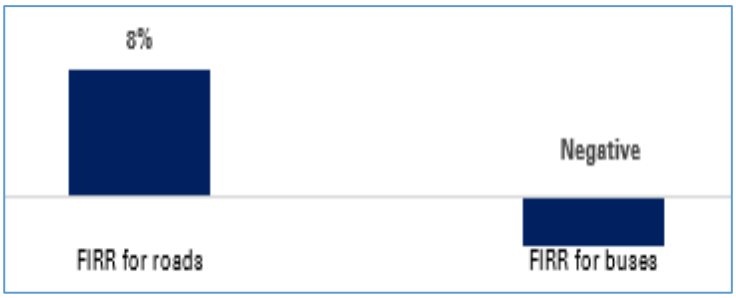


Figure 23: Comparison of FIRR- roads and buses

As can be observed from figure 23, financial IRR of roads is positive, while it is negative for buses which implies that in financial terms, roads provide higher return on investment than buses.

However, for socially relevant projects, it is advisable to compare ERRs of the two investments.

5.2 Economic Analysis

Independent ERR analysis

In order to compare overall social and economic benefits of investment in roads and buses, ERR analysis has been performed for equivalent investment in roads and buses on a standalone basis.

The steps involved in independent ERR analysis are enlisted below.

1. Determination of input and output parameters for road and bus investments
2. Finalization of assumptions for various input and output parameters
3. Collection of data for analysis[11]

[9] Capital cost of INR 10 Cr per km for highway construction and Maintenance cost: 0.5% of capex (Periodic maintenance), 0.5% of capex (Routine maintenance) and INR 0.5 crore per toll plaza per annum; Toll Rates as per NHAI.

[10] Capital cost of INR 0.3 crore per bus.

[11] Total road network, total number of cars, buses, trucks, Multi axle vehicles, GSDP,

4. Preparation of year wise input and output flows in INR terms for both buses and roads investment separately. ERR is computed on net economic benefits i.e. all economic outputs minus all economic inputs
5. Use of shadow prices to convert market prices into economic equivalents in order to eliminate the effect of taxes, duties etc. The shadow pricing factor considered for analysis are as under

Table 11 Shadow prices

Parameter	Factor
Capital Cost	0.85
Savings in Vehicle Operating Cost	1.10
Savings in Operating and Maintenance Cost	0.80
Savings in Accident Costs	1.0
Savings in Pollution Cost	1.0

Source: Detailed Project Report, Kochi Metro

6. Estimation of ERRs for roads and buses on standalone basis

The underlying assumptions used in the independent economic analysis are as follows:

- The returns on investments in roads and buses on a standalone basis are computed with reference to an inferior quality road on which 20% of the total number of vehicles ply.
- The inferior quality road is a single lane road having a capacity of 2,000[12] passenger car units (PCU) per day.
- Ratio of cars to buses has been taken as 85%: 15%[13] of the total vehicles plying on the road. Other vehicles have not been considered for the analysis.
- The time required for construction of the new (superior) road is one year.
- Capacity utilization of the road is assumed to increase in the following manner:

Table 12 Capacity Utilization of the road

Capacity utilization of the road %	Years							
	1	2	3	4	5	6	7	8
	Construction year	50	60	70	80	90	100	100

Computation of the outputs namely (i) Impact due to emissions (ii) Impact due to vehicle operating costs and (iii) Impact due to road fatalities is dependent on the vehicle km i.e. car km and bus km per year. The quantum of car km and bus km have been derived by multiplying the number of cars and buses (based on the capacity utilization of road as depicted in table 15) by the kms operated on annual basis on both inferior and superior roads.

[12] IRC:64-1990, Table 2, Page 9 of 11
[13] Primary interaction with NHAI

- With respect to investment in buses, it is assumed that with introduction of 34 buses (each costing INR 0.3 crore) there would be a vehicular shift from cars to buses.

Detailed explanation of the independent ERR analysis is presented as under:

Inputs under the two investments

Investment in roads:

- Capital cost of construction of road is assumed to be INR 10cr/ km. Length of road constructed is assumed to be 1 km therefore the total capital cost of construction of road is INR 10cr.

- Maintenance cost of road: Maintenance of road consists of routine maintenance and periodic maintenance. In addition to the above, it is assumed that there is one toll plaza on the stretch. The costs of each of these elements is as under:

    - Periodic maintenance: 0.5% of capital cost of construction of road
    - Routine maintenance: 0.5% of capital cost of construction of road
    - Toll plaza: INR 0.5 crore/toll plaza

Computation of inputs for investment in roads:

Capital cost of construction of roads: Cost of construction of road* km of road constructed* shadow pricing factor

Maintenance cost of roads: ((periodic maintenance + routine maintenance)* capital cost of construction of road* km of road constructed* shadow pricing factor* escalation) + (cost of operating toll plaza* number of toll plazas* shadow pricing factor* escalation)

Investment in buses:

- Capital cost of procurement of bus is assumed to be INR 0.3 crore/bus. This is multiplied with the number of buses (34) to arrive at the total capital cost of procurement of buses.

- Operating and maintenance cost of buses: Operation of buses entails various components viz. wages and salaries of staff, fuel costs, taxes, depreciation, insurance etc. All components are summed up to arrive at per km cost of bus operations.

Computation of inputs for investment in buses:

Capital cost of procurement of buses: Cost of procurement of bus* number of buses procured*shadow pricing factor

Operating and maintenance cost of buses: Operating and maintenance cost/km* km of operations per annum* shadow pricing factor* escalation

The values and sources for various assumptions are as below:

Table 13 Assumptions

S.No	Assumption	Value	Source

1.	Cost of construction of road/km	INR 10 crore	Interaction with industry experts
2.	Capital cost of procurement of bus	INR 0.3 crore	Value so obtained from APSRTC has been used as a sample for independent analysis
3.	Periodic Maintenance cost	0.5% of capital cost	Interaction with industry experts
4.	Routine Maintenance cost	0.5% of capital cost	Interaction with industry experts
5.	Cost of maintaining toll plaza	INR 0.5 crore	Interaction with industry experts
6.	Number of toll plazas	1	Interaction with industry experts
7.	Operating and maintenance cost of buses/km	INR 32.82	Value so obtained from APSRTC has been used as a sample for independent analysis
8.	Escalation-Capex	3% p.a.	Assumption
9.	Escalation-Opex	5% p.a.	Assumption
10.	Shadow Pricing Factor- Capex	0.85	Kochi Metro DPR, 2011- Table 12.4, page 319 of 335
11.	Shadow Pricing Factor- Opex	0.80	Kochi Metro DPR, 2011- Table 12.4, page 319 of 335
12.	Kms of road constructed	1	Assumption
13.	Number of buses procured	34	Derived using the total investment (INR 10 crores) and cost of procurement of a unit of bus.

Using the above assumptions, the inputs under both scenarios in various years are presented in table below:

Table 14 Value of inputs (INR cr)

Inputs	Years								Total
	1	2	3	4	5	6	7	8	
Capital Cost-Roads	8.76								**8.76**
Maintenance Cost-Roads	0.49	0.51	0.54	0.56	0.59	0.62	0.65	0.69	**4.65**
Cost of procurement of Buses	8.93								**8.93**
Operating and Maintenance cost of buses	0.34	0.36	0.38	0.40	0.42	0.44	0.46	0.48	**3.27**

Outputs

1. **Impact due to generation of employment**

Benefits on account of generation of employment are computed using employment multiplier. Employment multiplier is based on the premise that investment made in the form of construction of road/ procurement of buses will lead to generation of employment in the economy. The employment so generated is comprised of:

- Direct Employment which is generated within the sector
- Indirect Employment which is generated in ancillary industries viz. inputs required for construction/manufacturing

The employment thus generated will lead to generation of income which shall be spent by the individuals in procurement of goods and services of various other industries, which leads to a multiplier effect.

The number of jobs created in a sector is calculated by multiplying the employment linkage coefficient (the employment linkage coefficient calculates the persons employed in the economy per one lakh unit of investment) with the investment made (capital cost plus operating and maintenance cost). This is further multiplied to the annual per capita income. The resultant figure is then multiplied by escalation factor (year on year) and shadow pricing factor.

The independent economic model calculates employment benefits for investments in:

- Roads
- Buses

Computation of impact due to generation of employment

Investment in roads:

((Capital cost of construction of road + Maintenance cost of road)* employment linkage coefficient for roads* per capita income* shadow pricing factor* escalation (year on year).

Investment in buses:

((Capital cost of procurement of buses + Operating and maintenance cost of buses)* employment linkage coefficient for buses* per capita income* shadow pricing factor* escalation (year on year)).

The values and sources for various assumptions are as below:

Table 15 Assumptions

S.No	Assumption	Value	Source
1	Employment linkage coefficient- Roads (other construction)	0.9046	NCAER Report April 2014 for 'Other construction sector' Table 2.12 Page 41 of 94
2	Employment linkage coefficient- Buses(Transport by other means)	0.8131	NCAER Report April 2014 for 'Other construction sector' Table 2.12 Page 41 of 94
3	Per capita income of India- per annum	INR 103,219	Press information Bureau, Government of India, Ministry of Statistics and Programme Implementation,03 August 2017,

Using the above assumptions, the impact due to generation of employment in the various years are presented in table below:

Table 16 Impact due to generation of employment

Impact due to generation of employment	Years								Total
	1*	2	3	4	5	6	7	8	
Roads(INR Cr)	Construction year	9.51	0.55	0.61	0.67	0.74	0.82	0.90	**13.81**
Buses(INR Cr)	Construction year	8.58	0.35	0.38	0.42	0.47	0.52	0.57	**11.29**

*Year 1 is assumed as the year of construction of road. Benefits are assumed to accrue in the next year.

2. Impact due to emissions

Impact on account of emissions have been computed for the following four pollutants:

- Carbon monoxide (CO)
- Hydrocarbons (HC)
- Nitrogen oxide (NOx)
- Particulate Matter (PM)

Investment in roads: The increased number of vehicles due to investment in roads, would emit more pollution and therefore are treated as costs to the society.

Computation of emissions:

For each pollutant: (Number of vehicles i.e. buses and cars (as per capacity utilization in each year)* kms per year* emission factor (respective factors for buses and cars)* economic cost of emission* escalation factor*shadow pricing factor)

Emissions from all pollutants are added to arrive at the total costs of emissions.

Investment in buses:

As explained above, there is assumed to be a vehicular shift[14] from cars to buses. In order to accommodate this shift of passengers from cars to buses, there is an investment in procuring new buses. Therefore there is a reduction in number of cars (as passengers shift from cars therefore less number of cars ply on the road) and increase in the number of buses (to accommodate the passengers shifting from cars to buses).

The cars have been reduced in a phased wise manner as depicted below:

Table 17 Phased reduction of cars

Cars getting reduced on	Years							
	1	2	3	4	5	6	7	8
	Construction year	50	60	70	80	90	100	100

[14] As per International Journal of Sustainable Built Environment, September 2013 (Gulf Organization for Research and Development) titled 'Introduction of public bus transit in Indian cities', a case study was developed for investigating the impact of introduction of new bus transit system in Gujarat. As per the case study, the vehicular shift from cars to buses was found out to be in the range of 6.78% to 11.49%. The extent of vehicular shift depends on several factors including socio-economic profile, traffic quality parameters of the region. For the purpose of integrated economic analysis as part of the current study, three scenarios of 5%, 10% and 20% vehicular shift have been considered.

account of new buses (%)								

Reduction in emissions from reduced cars are treated as savings (as lesser number of cars will emit less pollution than before) while increase in emission from increased buses are treated as costs (as more number of buses will add to the emissions). The difference between the values of emissions (emissions from buses minus emission from cars) is the net impact of emissions.

Computation of emissions:

For each pollutant: (Number of vehicles i.e. buses and cars* kms per year* emission factor* economic cost of emission* escalation factor*shadow pricing factor)

The values and sources for various assumptions are as below:

Table 18 Assumptions

S.No	Assumption	Value	Source
1	Emission Factor for cars(g/km)		
	CO	0.40	Central Pollution Control Board
	HC	0.15	Central Pollution Control Board
	NO_X	0.29	Central Pollution Control Board
	PM	0.06	Shakti
2	Emission Factor for buses(g/km)		
	CO	3.92	Central Pollution Control Board
	HC	0.16	Central Pollution Control Board
	NO_X	6.53	Central Pollution Control Board
	PM	0.36	Shakti
3	Economic Value (INR/gm)		
	CO*	0.00004	A.K.Sen et.al, Transport Policy 17(2010), Table 9, Page 6 of 11
	HC*	0.0104	A.K.Sen et.al, Transport Policy 17(2010), Table 9, Page 6 of 11
	NO_X*	0.0932	A.K.Sen et.al, Transport Policy 17(2010), Table 9, Page 6 of 11
	PM*	4.6197	A.K.Sen et.al, Transport Policy 17(2010), Table 9, Page 6 of 11
4	Shadow Pricing factor	1	Kochi Metro DPR, 2011- Table 12.4, page 319 of 335
5	Escalation	5%	Assumption
6	Kms of road under investment in road	1	Assumption
7	Kms of road under investment in buses	10	Assumption

* These values have been escalated to reflect prices in 2018. Rate of escalation applied is 6.71% p.a. The rate of escalation has been derived from the values of consumer price index in India (during 2009 and 2018).

Using the above assumptions, the impact of emissions in various years is presented in table below:

Table 19 Impact of emissions

Impact of emissions	Years								Total
	1	2	3	4	5	6	7	8	
Roads(INR Cr)	Construction Year	(0.02)	(0.03)	(0.04)	(0.04)	(0.05)	(0.07)	(0.07)	**(0.31)**
Buses(INR Cr)	Construction Year	0.004	0.02	0.03	0.04	0.06	0.08	0.08	**0.30**

3. Impact due to vehicle operating costs(VOC)

The concept of vehicle operating costs has been explained in section 4.3.

Investment in roads:

It is assumed that the cars and buses are initially plying on an inferior quality road. The per unit (km) vehicle operating cost on inferior quality road is high (INR 28.18-cars and INR 39.87-buses).The per unit (km) vehicle operating cost of cars and buses respectively is multiplied by the annual car km and bus km respectively to arrive at the vehicle operating cost of cars and buses per annum. Subsequently, cars and buses ply on a superior quality road. The per unit (km) vehicle operating cost on superior quality road is low (INR 2.38-cars and INR 6.86-buses)).The per unit (km) vehicle operating cost of cars and buses respectively is multiplied by the annual car km and bus km respectively to arrive at the vehicle operating cost of cars and buses per annum. The difference between the vehicle operating costs for cars and buses on the superior and inferior quality roads is the net benefit on account of vehicle operating costs.

Computation of vehicle operating costs:

This is computed as (Vehicle operating costs of cars and buses on inferior quality road) minus (Vehicle operating costs of cars and buses on superior quality road). This is further detailed as below:

A. Vehicle operating cost of cars on inferior road = No of cars * kms traveled in a year* vehicle operating cost (per km) on inferior road* capacity utilization of road* shadow pricing factor* escalation per annum

B. Vehicle operating cost of cars on superior road = No of cars * kms traveled in a year* vehicle operating cost (per km) on superior road* capacity utilization of road* shadow pricing factor* escalation per annum

C. Vehicle operating cost of buses on inferior road = No of buses * kms traveled in a year* vehicle operating cost (per km) on inferior road* capacity utilization of road* shadow pricing factor* escalation per annum

D. Vehicle operating cost of buses on superior road = No of buses * kms traveled in a year* vehicle operating cost (per km) on superior road* capacity utilization of road* shadow pricing factor* escalation per annum

Net vehicle operating cost savings= (A-B) +(C-D)

Investment in buses:

Since the vehicle operating costs of buses are included under the operating and maintenance costs, therefore the vehicle operating costs of buses are not computed to avoid double counting. Therefore the vehicle operating cost savings is equivalent to the savings from the reduced number of cars.

Computation of vehicle operating costs:

Vehicle operating cost of cars = Car km * vehicle operating cost per km
The number of car km can be computed as: ((Number of buses introduced* average occupancy)/ average occupancy of cars)* percentage of cars getting reduced * km operated by car annually* escalation* shadow factor

The values and sources for various assumptions are as below:

Table 20 Assumptions

S.No	Assumption	Value	Source
1	VOC of cars on inferior quality road(INR/Km)*	28.18	Source: IRC SP30-2009, Annexure D, Table 14, Page 110 of 368
2	VOC of cars on superior quality road(INR/Km)*	2.38	Source: IRC SP30-2009, Annexure D, Table 1, Page 104 of 368
3	VOC of buses on inferior quality road(INR/Km)*	39.87	Source: IRC SP30-2009, Annexure D, Table 14, Page 198 of 368
4	VOC of buses on superior quality road(INR/Km)*	6.86	Source: IRC SP30-2009, Annexure D, Table 1, Page 192of 368
5	Shadow Pricing Factor	1.1	Kochi Metro DPR, 2011- Table 12.4, page 319 of 335
6	Km of road under investment in road	1	Assumption
7	Km of roads under investment in buses	10	Assumption
8	Escalation	5%	Assumption

* These values have been escalated to reflect prices in 2018. Rate of escalation applied is 6.71% p.a.

Using the above assumptions, the impact of vehicle operating costs in the various years are presented in table below:

Table 21 Impact due to vehicle operating costs

Impact due to vehicle operating costs	Years								Total
	1	2	3	4	5	6	7	8	
Roads(INR Cr)	Construction Year	0.54	0.53	0.52	0.50	0.48	0.45	0.48	**3.49**
Buses(INR Cr)	Construction Year	0.49	0.62	0.75	0.90	1.07	1.25	1.31	**6.39**

Impact due to road fatalities

The number of road fatalities is a function of vehicle km operated and is presented as road fatalities per billion vehicle km.

Investment in roads:

It is assumed that the vehicles are initially plying on an inferior quality road and subsequently, on a superior quality road. The difference in impact of road fatalities on superior road and inferior road is the net impact on account of road fatalities.

Computation of impact of road fatalities:

Impact of road fatalities= (Vehicle km travelled on inferior road* number of road fatalities per 1 billion km* economic cost of road fatality*shadow pricing factor* escalation) minus (Vehicle km travelled on superior road* number of road fatalities per 1 billion km* economic cost of road fatality*shadow pricing factor* escalation)

Investment in buses:

Computation of impact of road fatalities:

Impact of road fatalities= (Vehicle km travelled on inferior road* number of road fatalities per one billion km* economic cost of road fatality*shadow pricing factor* escalation) minus (Vehicle km travelled on superior road* number of road fatalities per 1 billion km* economic cost of road fatality*shadow pricing factor* escalation)

The values and sources for various assumptions are as below:

Table 22 Assumptions

S.No	Assumption	Value	Source
1	Number of road fatalities per one billion km	12.6	Road fatality per billion km has been considered for Malaysia- Road Safety Annual Report 2015, OECD, Table 25.1, Page 3 of 13
2	Economic cost of road fatality(INR)*	864,350	IRC SP30-2009, Table8, Page 35 of 368
3	Shadow Pricing Factor	1	Kochi Metro DPR, 2011- Table 12.4, page 319 of 335
4	Escalation	5%	Assumption

* These values have been escalated to reflect prices in 2018. Rate of escalation applied is 6.71% p.a.

Using the above assumptions, the impact of road fatalities in the various years are presented in table below:

Table 23 Impact due to road fatalities

Impact due to road fatalities	Years								Total
	1	2	3	4	5	6	7	8	
Roads(INR Cr)	Construction Year	(0.0004)	(0.0005)	(0.0007)	(0.0008)	(0.0010)	(0.0012)	(0.0013)	**(0.0059)**

Buses(INR Cr)	Construction Year	0.0018	0.0023	0.0028	0.0035	0.0041	0.0048	0.0051	**0.0244**

Summary of economic benefits

Table 24: Summary of Economic Benefits

Parameter	Unit	Investment in roads	Investment in buses
Total benefits	INR Cr	16.98	18.01
Impact due to employment generated	INR Cr	13.8	11.29
Impact due to emissions	INR Cr	(0.31)	0.30
Impact due to vehicle operating cost	INR Cr	3.49	6.39
Impact due to road fatalities	INR Cr	(0.006)	0.0244

ERR for buses is 21.7% and ERR for roads is 24.5%.

Figure 24 Comparison of ERR-roads and buses

Conclusion

An investment in efficient bus based transport services is likely to lead to the following:

- With good frequency and efficient services, there is likely to be a vehicular shift from cars to buses. This would lead to the number of cars plying on roads to decrease and the number of buses to increase. As a result, there would be an overall reduction in the number of vehicles plying on the road and consequently a reduction in overall emissions.
- With reduction in the number of vehicles plying and the corresponding vehicles km, a reduction in vehicle operating costs would result.
- The number of road fatalities is directly proportional to the vehicles km operated. Therefore with reduction in vehicles km, the road fatalities also reduce.

The cumulative effect of the above impacts result in higher ERR for buses as compared to roads, for the same amount of investment. This presents the case that investment in buses provides more overall benefits to the society, as compared to road investment.

6. Business case for integrated transport budget in states

Integrated ERR analysis

To validate the case for an integrated transport budget, an integrated ERR analysis has been performed for the three states (Andhra Pradesh, Maharashtra and Haryana). As explained in section 4.4, the ERRs under two cases ('base case' and 'alternate case') have been compared to establish whether providing higher allocation to bus transport in an integrated scenario provides more overall societal benefits.

Methodology

Two cases with combined investments in roads and buses have been analyzed. Broad steps for the analysis are described below.

- Selection of a highway in each of the three states
- Finalization of various input and output parameters for roads and buses
- Preparation of year-wise input flows and output flows for the two cases- base case (with lesser investment in buses) and alternate case (with higher investment in buses)
- Estimation of ERRs for both cases
- Sensitivity analysis to observe variation in ERR at different levels of vehicular shift from cars to buses

The underlying assumptions for the analysis are:

Base case

- It is assumed that the cars and buses are initially plying on an inferior quality road .The number of cars and buses plying on inferior road are assumed to be 50% of the total number of cars and buses plying on superior road
- The number of cars and buses have been increased to full capacity of road in a phased manner year on year using separate growth rates for cars and buses as depicted in table 15.

Alternate case

- It is assumed that the cars and buses are initially plying on an inferior quality road. The number of cars and buses plying on inferior road are assumed to be 50% of the total number of cars and buses plying on superior road
- The basic premise of the alternate case is that there is a vehicular shift from cars to buses, therefore the number of cars have been reduced gradually in a phased manner. Conversely, number of buses have been increased in phased manner in order to arrive at the total bus requirement to accommodate the vehicular shift

Inputs

The methodology of calculating the inputs has been explained under the independent economic analysis.

Outputs

The methodology adopted to calculate the output streams has been explained below:

1. Impact due to generation of employment

The methodology to calculate the impact due to generation of employment is similar to that explained under independent economic analysis. The total impact due to generation of employment in the integrated economic analysis is the summation of impact of generation of employment due to investment in roads and impact of generation of employment due to investment in buses.

Computation of cost of road fatalities in base and alternate case:

The basis of computation of impact due to generation of employment is the same as explained under independent economic analysis.

2. Impact due to emissions

Base case:

The basic premise has been explained under independent economic analysis.

Computation of emissions:

The emissions under the base case are computed in the same way as done under independent economic analysis. The methodology of computation of impact on account of emissions under the alternate case is as under:

Alternate case

In this case there is a vehicular shift from cars to buses, thereby reducing the number of cars. To calculate car km on superior road, starting from 50% of number of cars in the first year, the number of cars are increased gradually to arrive at the final number of cars in the final year. The number of cars in each year are multiplied with the km traveled on the highway in each year to arrive at the car km.

Subsequently for each pollutant the emissions are calculated as: (Number of car kms * emission factor (respective factor for cars)* economic cost of emission* escalation factor*shadow pricing factor)…….. ……..(A)

Similarly, to calculate bus km on superior road, starting from 50% of number of buses in the first year, the number of buses are increased gradually to arrive at the final number of buses in the final year. The number of buses in each year are multiplied with the km traveled on the highway in each year to arrive at the bus km.

Subsequently for each pollutant the emissions are calculated as: (Number of bus kms * emission factor (respective factor for buses)* economic cost of emission* escalation factor*shadow pricing factor)…….. (B)

Therefore the emissions from the superior road is the summation of (A) and (B)

The emissions from the inferior road is derived in the following manner:

For each pollutant the emissions from cars on inferior road are calculated as: 50% of number of cars* km travelled on the highway per year* emission factor (respective factor for cars)* economic

cost of emission* escalation* shadow factor. This is done for each pollutant and summed up……(C)

For each pollutant the emissions from buses on inferior road are calculated as: 50% of number of buses* km travelled on the highway per year* emission factor (respective factor for buses)* economic cost of emission* escalation* shadow factor. This is done for each criteria pollutant and summed up…….. (D)

The difference of (A+B)-(C+D) is the net impact of emissions in the alternate case.

3. Impact due to vehicle operating costs(VOC)

The concept of vehicle operating costs has been explained in section 4.3

Base Case

It is assumed that the cars are initially plying on an inferior quality road. The per unit (km) vehicle operating cost on inferior quality road is high (INR 5.50).The per unit (km) vehicle operating cost is multiplied by the annual car km to arrive at the vehicle operating cost of cars per annum. Subsequently, cars ply on a superior quality road. The per unit (km) vehicle operating cost on superior quality road is low (INR 2.25).The per unit (km) vehicle operating cost is multiplied by the annual car km to arrive at the vehicle operating cost of cars per annum. Moreover, buses which were plying on the inferior road (50% of total buses) shall incur lower vehicle operating cost/km (INR 6.17/km on superior road as against INR 11.78/km on inferior road) as they now ply on the superior road. As explained above, the number of cars are assumed to increase from 50% capacity utilization to 100% capacity utilization in a phased manner as depicted in table 15. The difference between the vehicle operating costs for cars on the superior and inferior quality roads plus savings in vehicle operating costs of the buses previously plying on the inferior road, on account of lower vehicle operating cost/km(INR 6.17) on superior road is the net benefit on account of vehicle operating costs.

Details of the computation are as below:

A. Vehicle operating cost of cars on inferior road = No of cars * kms traveled in a year* vehicle operating cost (per km) on inferior road* capacity utilization* shadow pricing factor* escalation per annum

B. Vehicle operating cost of cars on superior road = No of cars * kms traveled in a year* vehicle operating cost (per km) on superior road* capacity utilization* shadow pricing factor* escalation per annum

C. Vehicle operating cost savings of buses= Number of buses travelling on inferior road *kms traveled in a year* (VoC/Km on inferior road- VoC/Km on superior road)* kms traveled in a year* shadow pricing factor* escalation per annum

Net vehicle operating cost savings= (A-B) + C

Alternate Case

Formula for computation of vehicle operating costs is the same as base case.

4. Impact due to road fatalities

The number of road fatalities is a function of vehicle km operated and is presented as road fatalities per one billion vehicle km.

Computation of cost of road fatalities in base and alternate case:

The basis of computation of impact of road fatalities is the same as explained under independent economic analysis.

Using the above methodology, integrated economic models have been developed for three states namely:

- Andhra Pradesh
- Maharashtra
- Haryana

In each of these states, traffic data pertaining to National Highways was collected. The National Highways selected for the study are as under:

Table 25 Selection of Highways

State	National Highway
Andhra Pradesh	Vijayawada- Visakhapatnam
Maharashtra	Pune- Sholapur
Haryana	Rohtak- Hissar

The values of parameters used in the integrated economic models for various states are as under:

Table 26 Value of Parameters

Parameter	Values			Source
	Andhra Pradesh	Maharashtra	Haryana	
No of cars	5066	4064	4180	Interaction with NHAI representative
No of buses	919	565	487	
Passenger occupancy -cars	2.5	1.9	2	
Passenger occupancy - buses	38	42	44	
Length of National Highways(km)	350	254	109	
O&M cost of buses(INR/Km)	32.82	36.69	40.60	Review of Performance of State Road Transport Undertakings April 20-14-March 2015- Annexure II, Page 38 of 53

The values of inputs and outputs used in the integrated economic model at various levels of vehicular shift from cars to buses are as follows:

Table 27 Values of Parameters (INR Cr)

Vehicular Shift	Parameter	Andhra Pradesh		Maharashtra		Haryana	
		Base case	Alternate Case	Base case	Alternate Case	Base case	Alternate Case
5%	Capital Cost of construction of roads	3064	3064	2224	2224	954	954
	Maintenance Cost of roads	229	229	167	167	74	74
	Capital Cost of procurement of bus	138	143	85	87	73	76
	Operating and maintenance cost of buses	753	778	376	387	154	159
	Impact due to generation of employment	4119	4143	2839	2850	1247	1254
	Impact due to emissions	(194)	(190)	(98)	(95)	(40)	(38)
	Impact due to vehicle operating costs	1744	1810	936	974	395	411
	Impact due to road fatalities	(4)	(3)	(2)	(2)	(1)	(1)
10%	Capital Cost of construction of roads	3064	3064	2224	2224	954	954
	Maintenance Cost of roads	229	229	167	167	74	74
	Capital Cost of procurement of bus	138	148	85	90	73	79
	Operating and maintenance cost of buses	753	804	376	398	154	165
	Impact due to generation of employment	4119	4167	2839	2861	1247	1261
	Impact due to emissions	(194)	(186)	(98)	(92)	(40)	(37)
	Impact due to vehicle operating costs	1744	1876	936	1013	395	428
	Impact due to road fatalities	(4)	(3)	(2)	(2)	(1)	(1)

Vehicular Shift	Parameter	Andhra Pradesh		Maharashtra		Haryana	
		Base case	Alternate Case	Base case	Alternate Case	Base case	Alternate Case
20%	Capital Cost of construction of roads	3064	3064	2224	2224	954	954
	Maintenance Cost of roads	229	229	167	167	74	74
	Capital Cost of procurement of bus	138	158	85	96	73	84
	Operating and maintenance cost of buses	753	854	376	421	154	176
	Impact due to generation of employment	4119	4214	2839	2884	1247	1274
	Impact due to emissions	(194)	(177)	(98)	(85)	(40)	(34)
	Impact due to vehicle operating costs	1744	2012	936	1092	395	463
	Impact due to road fatalities	(4)	(3)	(2)	(1)	(1)	(1)

The ERR under various level of vehicular shift from cars to buses is as under:

Table 28 Sensitivity Analysis

Vehicular Shift	Andhra Pradesh		Maharashtra		Haryana	
	Base case	Alternate Case	Base case	Alternate Case	Base case	Alternate Case
5%	28.68%	29.19%	23.71%	24.23%	23.25%	23.77%
10%	28.68%	29.71%	23.71%	24.74%	23.25%	24.29%
20%	28.68%	30.74%	23.71%	25.76%	23.25%	25.31%

As the vehicular shift (people shifting from cars for buses) increases, ERR also increases.

Conclusion

The higher ERR of alternate case as compared to base case across the three states, presents the case that a vehicular shift from cars to buses is beneficial to society.

7. Conclusion

The salient findings of the study are presented below.

1. **Assessment of costs of SRTUs**

   It is clear from the analysis of different costs associated with SRTUs, that the taxes levied constitute about 11-14% of their total costs. In case of MSRTC, the organization was making operating profits before imposition of taxes. In view of above, it may be considered by policy makers/ governments that taxes levied on buses/ SRTUs be reduced/ waived off. The National Urban Transport Policy 2006 has laid emphasis on prioritizing public transport. This can be ensured practically through enabling fiscal policies and appropriate relaxation in taxation.

2. **Independent Economic Analysis**

   It is observed that investment in buses leads to the following:
   - There is a vehicular shift from cars to buses, on account of passengers shifting from cars to buses. Therefore the number of cars plying on the road decrease and the number of buses increase. As a result, there is an overall reduction in the number of vehicles plying on the road and consequently there is a reduction in overall emissions.
   - With reduction in the number of vehicles plying and the corresponding vehicles km, there is a reduction in vehicle operating costs.
   - The number of road fatalities is directly proportional to the vehicles km operated. Therefore with reduction in vehicles km, the road fatalities also reduce.

   On a standalone basis, Economic Rate of Return (ERR) for investment in roads was observed to be 21.7%, while that for buses it was observed to be 24.5% (on account of the cumulative effect of the impacts listed above). This presents a case that investment in buses provides more benefits to the society as compared to investment in roads.

3. **Integrated Economic Analysis**

   An integrated economic analysis has been performed for the three states wherein combined investments in roads and buses have been analyzed under the following two cases:
   - "Base Case" which takes into account the existing traffic conditions i.e. current mode split on the selected highway in a state and
   - "Alternate Case" which takes into account a vehicular shift from cars to buses and higher investments in buses vis-à-vis roads.

The ERR in alternate case is higher than the base case for all the three states. This presents a scenario supporting a targeted initiative aiming towards increasing the proportion of buses on intercity roads. This could be done either by higher allocation of transport budget towards buses or having conducive polices and incentives to encourage private sector to invest and participate in public transport.

Based on the foregoing analysis, an integrated transport budget for roads and buses is recommended to be followed. While investments in infrastructure such as roads are essential for the economic development of a state, infrastructure services such as public transport should be looked at in tandem with the road investment. If a policy directive can be considered which establishes a linkage between investment in roads and investment in public transport, such a directive will go a long way in leading to a superior socio-economic solution for the state governments.

As part of the study, several interactions were held with various stakeholders (including officials of The World Bank, NITI Aayog and government officials of transport departments of the three states) to gather inputs, present the analysis undertaken and its outcomes. Detailed minutes of such interactions are reported in Annexure 0.

Stakeholders were in agreement with the findings of the study. Some of the salient suggestions from various stakeholders are enlisted below.

- The provision of road infrastructure is the responsibility of states. Having created the road infrastructure, the efficient use of road assets is also an objective that is important for states. Efficient use of road assets would come from higher proportion of public transport and this would maximize the returns on government's investments.
- The current conditions of SRTU buses are not up to the mark thereby resulting in their lower utilization and poor service levels. To attract the travelling public and induce them to shift to buses, better services will be a key requirement.
- An integrated transport budgeting will be relevant for the rural roads being developed under the Pradhan Mantri Gram Sadak Yojna (PMGSY) as the availability of public transport in the rural areas is minimal.
- There should be a certain percentage of investment in roads which should be allocated towards public transport as well.
- Specific strategies might need to be formulated to encourage public transport on routes that are loss making/not lucrative. Route dispersal guidelines as followed in the aviation sector could be looked at while formulating strategies for such routes in the respective states.
- An appropriate level of tax exemption / relief may be looked into for SRTUs to improve their financial situation.
- Further, it may be considered to develop an ecosystem wherein government bodies should create technical capacity in terms of having transport planners on their rolls. This would enhance monitoring capabilities at the apex level and assist in ensuring efficient operations and investments in SRTUs.

Annexures

1. Annexure: Correlation of growth in roads to growth in vehicles

There is a popular perception that as more roads are built in a region, the number of vehicles also proportionately rises. Thus growth in roads appears to be a key driver for the growth in vehicles.

The data for eight states is shown in the table below. As can be seen, the growth rate of registered vehicles and fuel consumption has increased at a faster pace than road construction.

Table 29 Growth Rates

State	Compound Annual Growth Rate(FY11-FY16)		
	Surfaced Roads	Motor Spirit Consumption	Registered Vehicles
Andhra Pradesh+ Telangana	4%	10%	12%
Chhattisgarh	3%	12%	12%
Gujarat	3%	9%	10%
Haryana	4%	5%	11%
Karnataka	4%	11%	10%
Rajasthan	2%	12%	12%
Uttar Pradesh	5%	10%	13%
West Bengal	0.50%	11%	22%
India	**7%**	**9%**	**10%**

Surce: Indiastat database

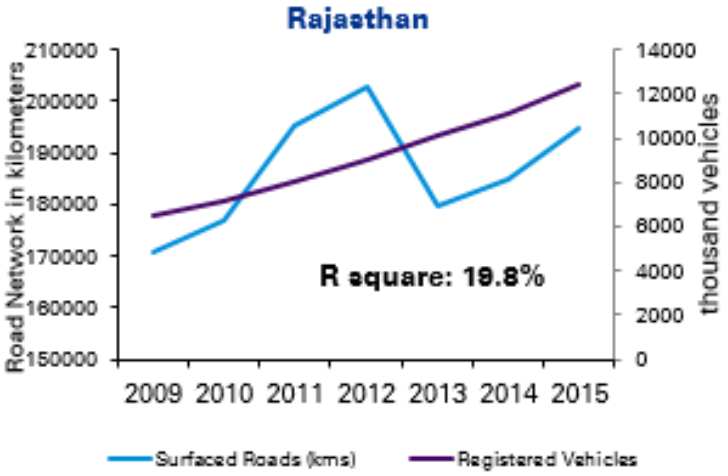


Figure 25 Relation between roads and vehicles

Source: Indiastat database

The figure above illustrates the specific case of Rajasthan. In Rajasthan, there have been years when the growth rate of roads has reduced as compared to previous years. However the growth rate in registered vehicles has steadily grown. India is an aspirational society where culturally, ownership of vehicles is associated with a rise in societal status. Thus it would not be wrong to propose that privately owned vehicles will increase irrespective of whether road infrastructure grows or not. To reverse this trend a strong push for better, efficient and well planned public transport is essential.

2. Annexure: Minutes of meetings held with various stakeholders

Minutes of Meeting for the engagement titled "Developing business case for integrated transport sector budgeting in states" held on 09/01/2018

Date and Time	January 09, 2018 11:00 AM – 12:00 PM
Shakti Representatives	▪ Mr. Vivek Chandran (Program Manager-Transport)
NITI Aayog Representatives	▪ Mr. Ravinder Goyal (Adviser Transport) ▪ Ms. Shikha Juyal (Economic Officer-Connectivity) ▪ Mr. Arpit Gupta (Research Assistant-Connectivity)
KPMG Representatives	▪ Mr. Rajaji Meshram ▪ Mr. Nikhil Mittal ▪ Mr. Umang Jain
Place	NITI Aayog, Sansad Marg, New Delhi – 110001
Objective of the meeting	To present the findings of the Report to NITI Aayog and solicit their views

a) KPMG team presented the following:
   1 Background of the assignment
   2 Methods of conducting economic analysis namely social cost benefit analysis and input output analysis
   3 Performance of the state road transport undertakings
   4 Two scenarios were presented:
      a) Independent analysis- Economic Rate of Return of same amount of investment in roads and buses were compared on a standalone basis to determine which investment provided more economic benefits
      b) Integrated analysis- Economic Rate of Return were compared under two cases:
         i. Base case which depicts the existing mode share with respect to cars and buses
         ii. Alternate case wherein it is assumed that there shall be a mode shift from cars to buses

      The integrated analysis was done for specific national highways in the selected three states
   5 Outputs of the financial and economic analysis were presented:
      a) Financial internal rate of return for roads is positive while for buses it is negative
      b) The economic rate of return under independent analysis was higher for buses that roads. In the integrated analysis, with increasing mode share in favour of buses, there was improvement in the economic rate of return

6 The analysis indicated that there is economic rationale for states to look at investment in buses and roads in an integrated fashion.

b) NITI Aayog representatives were in agreement with the findings of the study. It was suggested that specific strategies might need to be formulated to encourage public transport on routes that are loss making/not lucrative. Route dispersal guidelines as followed in the aviation sector could be looked at.

c) It was pointed out by NITI Aayog representatives that the condition of the SRTU buses is not up to the mark and therefore passenger ridership is less. Less ridership coupled with low fares leads to poor quality of service and lead people to use private modes of transport.

Minutes of Meeting for the engagement titled "Developing business case for integrated transport sector budgeting in states" held on 22/01/2018

Date and Time	January 22, 2018 11:00 AM – 12:00 PM
Principal Secretary Transport	▪ Mr. Manoj Saunik (Principal Secretary-Transport, Government of Maharashtra)
KPMG Representatives	▪ Mr. Rajaji Meshram ▪ Mr. Umang Jain
Place	Office of Principal Secretary, Transport, Government of Maharashtra- Mantralaya, Mumbai
Objective of the Meeting	To present the findings of the project report and analysis to Principal Secretary - Transport and solicit his views

a) KPMG team presented the following:

1 Background of the assignment

2 Methods of conducting economic analysis namely social cost benefit analysis and input output analysis

3 Performance of the state road transport undertakings

4 Two scenarios were presented:

a) Independent analysis- Economic Rate of Return of same amount of investment in roads and buses were compared on a standalone basis to determine which investment provided more economic benefits

b) Integrated analysis- Economic Rate of Return were compared under two cases:

i. Base case which depicts the existing mode share with respect to cars and buses

ii. Alternate case wherein it is assumed that there shall be a mode shift from cars to buses

The integrated analysis was done for specific national highways in the selected three states

5 Outputs of the financial and economic analysis were presented:

a) Financial internal rate of return for roads is positive while for buses it is negative

b) The economic rate of return under independent analysis was higher for buses that roads. In the integrated analysis, with increasing mode share in favour of buses, there was improvement in the economic rate of return

6 The analysis indicated that there is economic rationale for states to look at investment in buses and roads in an integrated fashion.

b) The Principal Secretary Transport made the following observations:

1. Road fatalities are directly linked to the number of vehicles plying on the road. If public transport proportion is increased, this might have a positive impact by leading to reduction in fatalities.

2. If looked at from the perspective of the state governments, their receipts from SRTUs are in the form of tax collections (under MV Act and other associated fees). Their outlays towards SRTUs are in the form of capital outlay for renewal of bus fleet, reimbursement of various concessions offered by SRTUs to the citizens, subsidies, etc. In light of above transactions, the taxes levied on SRTUs are a critical aspect as the financial positions of both i.e. SRTUs and the states (from the perspective of receipts and outlays and hence their net surplus/deficit) become contingent on the applicable/ effective tax rates. An appropriate level of applicable taxes may be looked into which on the one hand, provides certain minimum financial avenues to SRTUs to improve their service levels and on the other hand, optimize their other operating expenditures (especially wages). The improved financial performance of SRTUs would also reduce the burden to be borne by the states towards subsidies of SRTUs.

3. The high tax imposed on State Road Transport Undertakings can be looked into. From the State Government perspective, there is a linkage between the tax collected from the SRTU and the capital investment done

4. It is acknowledged that provision of road infrastructure is states' responsibility. The efficient use of the road asset would allow the returns of the State Government's investment to be maximized. Efficient use of road assets, without doubt, comes from higher proportion of public transport. Higher public transport leads to lesser emissions and is environmentally friendly.

Minutes of meeting for the engagement titled "Developing business case for integrated transport sector budgeting in states" held on 07/02/2018

Date and Time	February 07, 2018 03:00 PM – 03:30 PM
Director General, Haryana Roadways	▪ Mr. Vikas Gupta
KPMG Representatives	▪ Mr. Nikhil Mittal ▪ Mr. Umang Jain
Place	Office of Director General (DG) - Haryana Roadways, Chandigarh
Objective of the Meeting	To present the analysis and findings of the engagement to DG Haryana Roadways and solicit his views

a) KPMG team presented the following:
   1 Background & context of the engagement
   2 Methodologies of conducting economic analysis namely social cost benefit analysis and input output analysis
   3 High-level performance of the state road transport undertakings (SRTUs) in Andhra Pradesh, Maharashtra and Haryana
   4 Two scenarios of economic analysis were presented:
      a) Independent analysis - Economic Rate of Return (ERR) of same amount of investment in roads and buses were compared on a standalone basis to determine which investment provided more economic benefits
      b) Integrated analysis- ERR were compared under two cases:
         i. Base case which depicts the existing mode share with respect to cars and buses
         ii. Alternate case wherein it is assumed that there shall be a mode shift from cars to buses
         iii. The integrated analysis was done for specific national highways in the three states
   5 Outputs so obtained from the financial and economic analysis were presented:
      a) Financial internal rate of return for roads is positive while for buses it is negative
      b) ERR under independent analysis was higher for buses that roads. In the integrated analysis, with increasing mode share in favour of buses, there was improvement in the ERRs
   6 The analysis indicated that there is economic rationale for states to look at investment in buses and roads in an integrated manner.

b) DG Haryana Roadways acknowledged the findings and made the following observations:

1. There should be an apex authority on the lines of Unified Metropolitan Transport Authority (UMTA) at the states level to coordinate and be responsible for matters pertaining to transport.

2. There should be seamless mobility for buses across India and the current system of obtaining permits should be done away with.
3. There should be indexation of investment in roads vis-à-vis investment in buses i.e. certain percentage of investment in roads should be allocated towards public transport as well.
4. Efforts should be made to ensure that the operations of SRTUs become efficient and investments so put in do not end up funding inefficiencies/ losses.
5. There is a need to develop an ecosystem wherein government bodies should create technical capacity in terms of having transport planners on their rolls.

Minutes of meeting for the engagement titled "Developing business case for integrated transport sector budgeting in states" held on 09/02/2018

Date and Time	February 09, 2018 11:30 AM – 12:30 PM
The World Bank	▪ Mr. Arnab Bandyopadhyay, Lead Transport Specialist GTITR
KPMG Representatives	▪ Mr. Rajaji Meshram ▪ Mr. Umang Jain
Place	Office of The World Bank, Hindustan Times House, Kasturba Gandhi Marg, New Delhi
Objective of the Meeting	To present the analysis and findings of the engagement to The World Bank and solicit their views

a) KPMG team presented the following:

1 Background & context of the engagement

2 Methodologies of conducting economic analysis namely social cost benefit analysis and input output analysis

3 High-level performance of the state road transport undertakings (SRTUs) in Andhra Pradesh, Maharashtra and Haryana

4 Two scenarios of economic analysis were presented:

a) Independent analysis - Economic Rate of Return (ERR) of same amount of investment in roads and buses were compared on a standalone basis to determine which investment provided more economic benefits

b) Integrated analysis- ERR were compared under two cases:

i. Base case which depicts the existing mode share with respect to cars and buses

ii. Alternate case wherein it is assumed that there shall be a mode shift from cars to buses

iii. The integrated analysis was done for specific national highways in the three states

5 Outputs so obtained from the financial and economic analysis were presented:

a) Financial internal rate of return for roads is positive while for buses it is negative

b) ERR under independent analysis was higher for buses that roads. In the integrated analysis, with increasing mode share in favour of buses, there was improvement in the ERRs

6 The analysis indicated that there is economic rationale for states to look at investment in buses and roads in an integrated manner.

b) Mr. Arnab Bandyopadhyay acknowledged the findings and made the following observations:

1. There should be a certain percentage of investment in roads which should be allocated towards public transport as well.

2. The study will be particularly relevant for rural roads being developed under the Pradhan Mantri Gram Sadak Yojna (PMGSY) as the availability of public transport in the rural areas is minimal.
3. Application of this study may be of relevance to state of Rajasthan, which is embarking on the concept of integrated transport investments. Moreover, investment in public transport- especially plying electric buses, on intercity routes is being thought of by the Ministry of Road Transport and Highways (MoRTH). The ministry, on a pilot basis has identified seven intercity routes for the same.

3. Annexure: Impact of Goods and Service Tax (GST) on state tax revenues

The composition of estimated tax revenue of Andhra Pradesh, Maharashtra and Haryana in 2017-18 is shown below.

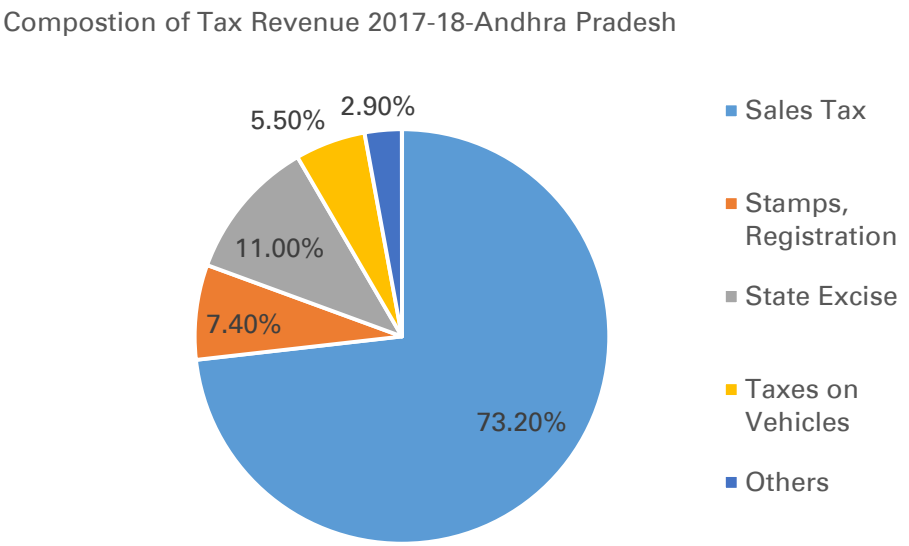


Figure 26 Composition of estimated tax receipts 2017-18-Andhra Pradesh

Source: Andhra Pradesh budget analysis 2017-18; PRS Legislative Research

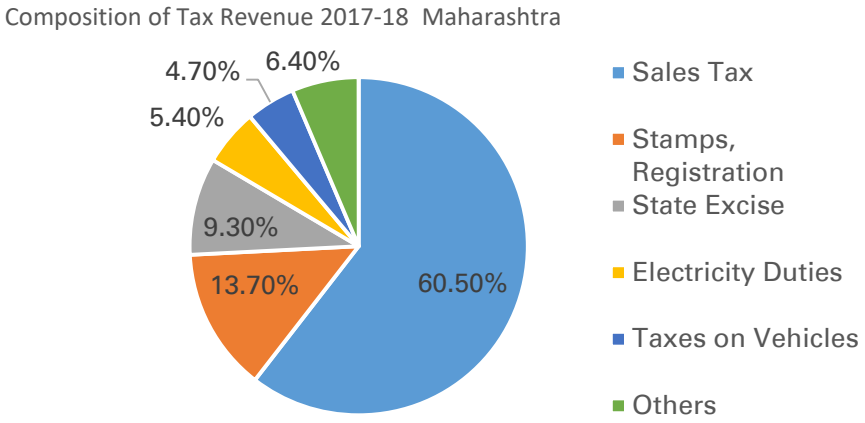


Figure 27 Composition of estimated tax receipts 2017-18- Maharashtra

Source: Maharashtra budget analysis 2017-18; PRS Legislative Research

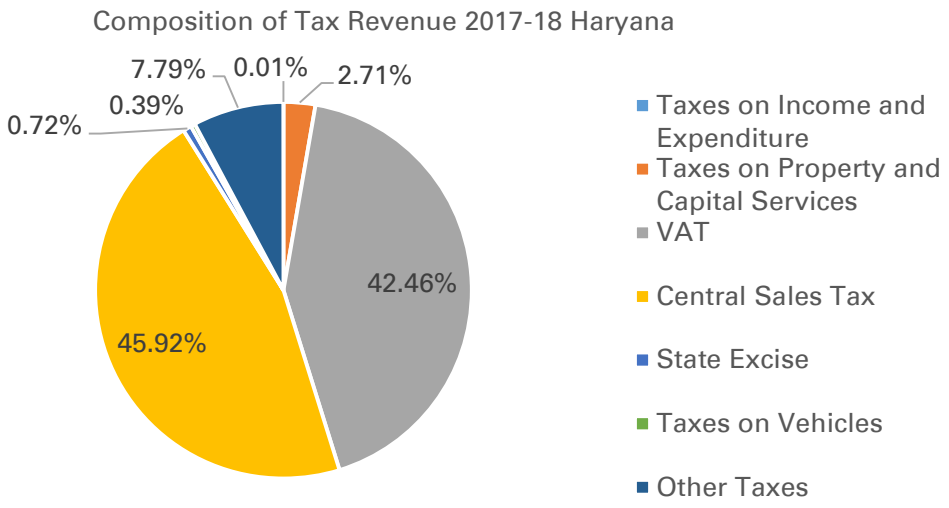


Figure 28 Composition of estimated tax receipts 2017-18- Haryana

Source: Statement of Fiscal Policy, 2017-18 Government of Haryana

The total tax receipts (Andhra Pradesh) in 2017-18 is estimated to be INR 53,717 crore. It is observed that 73.2% of the total receipts (INR 39,321 crore) are attributable to sales tax.

The analysis of total tax receipts and contribution of sales tax to the total tax receipts has been done in the same way as in case of Andhra Pradesh. For the year 2017-18, total tax receipts are estimated to be INR 153,453 crore. Sales tax contributes to 60.5% of the total receipts (INR 92, 839 crore).

The analysis of total tax receipts and contribution of sales tax to the total tax receipts has been done on similar lines as for the other two states. Total tax revenue in 2017-18 is estimated to be INR 29,220 crore. VAT and sales tax contribute more than 88% of the total receipts (INR 25, 824 crore).

It is evident from the analysis of composition of tax revenues of the three states that indirect taxes such as sales tax attribute to a large proportion of the total revenues. Such indirect taxes (including sales tax, VAT, etc.) would be subsumed by GST. Hence, with introduction of GST, there would be an impact on the overall state tax revenues. The impact of GST would further depend on the following factors:

- Base amount/volume of goods and services being transacted in the respective states
- Rate of growth of transactions involving various goods and services
- Effective tax rates applicable on different goods and services

In light of above factors, the actual impact of GST on tax revenues of states would be known once the financial statements of states get released later in the year. The central government has given an assurance to the respective state governments to compensate for the shortfall (if any) in tax revenues for the first five years post implementation of GST.

4. Annexure: References

References for literature review are as under:

- Elsevier 2010, Sen A.K. et al "Estimating Marginal External costs of transport in Delhi"(AK)
- New Zealand Transport Agency 2009, "Economic Development Benefits of Transport Investment"(NZ)
- Congress of the United States Congressional Budget Office 2016, "Approaches to making Federal Highway spending more productive"(Fed)
- Michigan Department of Transportation 2007," Economic Impact Analysis of the Michigan Transportation investment Packages"(MDOT)
- Indian Roads Congress 2009, "Manual on Economic Evaluation of Highway projects in India"(SP-30)
- Victoria Transport Policy Institute 2017, Todd Litman "Evaluating Public Transit Benefits and Costs"(VTPI)
- Cambridge Systematics Inc. 1999, "A Quantitative analysis of Public Transportation's Economic Impact(Cambridge)
- KPMG, 2010 "Macroeconomic Impact Study of the Cape Town International Airport Rail Link"(Cape Town)
- American Public Transport Association 2014, "Economic Impact of Public Transportation Investment"(APTA)
- National Council of Applied Economic Research 2012, "Economic Impact Assessment of Delhi International Airport" (NCAER)