Study on Techno-Economic Viability of Bhopal Vidisha OMT Road Project: A Case Study

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Abstract- *The theis outlines the method of carrying out economic analysis of highway projects. The em-phasis is on the factors to be considered and their effect on the results of economic analysis. Viewpoints of various authors about inflation and discount rate are given. Various cost and benefit factors related to the highway transportation projects are given in the paper. The different concepts available to use in various economic analysis methods are highlighted. This paper outlines the important information which should be considered while selecting particular type of economic analysis methods for a specific project- This paper also covers the various applications of economic analysis methods in different projects. Primarily, the different problems, which are met usually in carrying out economic analysis, are also incorporated*

I. INTRODUCTION

1.1 Project Background:-

Bhopal-Vidisha road is a segment of **SH-18** situated on northern part of Madhya Pradesh State having existing total length of **36.15 km** and proposed length is 36.15. The Project Road for maintenance, widening and upgrading of existing road starts from Bhanpura Junction at Km 3+400 near Bhopal and terminates at Km 39+600 at Sanchi - Salamatpur junction. The Project road passes through two district of Madhya Pradesh namely, Bhopal and Raisen. The end point of project road is at existing km. 39+600 near Sanchi town with three arm junction on SH-18. The Existing length of Project road is 36.15 km.

Bhopal is a city in the central Indian state of Madhya Pradesh. It's one of India's greenest cities. There are two main lakes, the Upper Lake and the Lower Lake. On the banks of the Upper Lake is Van Vihar National Park, home to tigers, lions and leopards. The State Museum has fossils, paintings and rare Jain sculptures. Taj-ul-Masjid is one of Asia's largest mosques, with white domes, minarets and a huge courtyard. Area: 285.9 km Population: 25 lakhs.

Economy in Bhopal:-

The major industries in the old city are electrical goods, medicinal, cotton, chemicals and jewellery. Other industries include cotton and flour milling, cloth weaving and painting, as well as making matches, sealing wax, and sporting equipment The residents of Bhopal also engage in large retail businesses. Handicrafts, like zardozi and *batua* (a small string purse, usually used with Indian traditional dresses) are some of the products of the Old Cit.

Industries in Bhopal:-

- Bharat Heavy Electricals Limited, the largest engineering and manufacturing enterprise in India, has a unit in Bhopal. It occupies a large area in the Eastern Part of the city and maintains a suburb named after it. A majority of the residents of the BHEL Suburb are employed by the unit.

- Mandideep is an industrial suburb of Bhopal. It is located to the south of the city on the NH 12 Mandideep's total exports are worth some 2,300 crore rupees ($500m; £300m) per year, making it the largest industrial area in Madhya Pradesh. The town is home to Hindustan Electo Graphite (HEG), owning the largest graphite electrode plant in the world.

The following Map clearly specifies the location of the Project Road

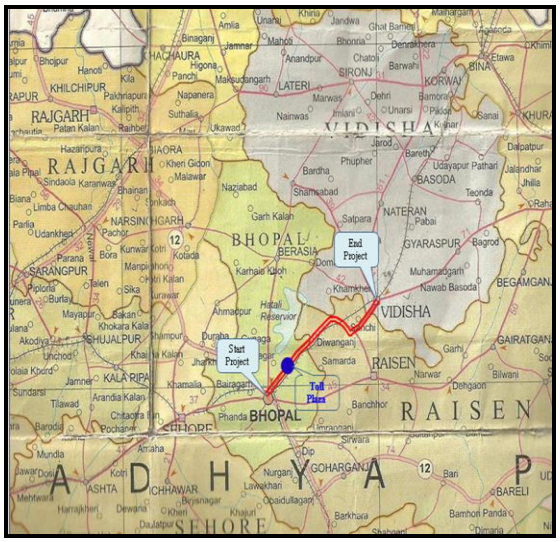

Figure 1.1 Showing the location of Project Road

PROJECT GOOGLE SATELLITE MAP

Figure 1.2 Showing the location of Project Road

Project facilities described below to form part of two lane Project Highway. The project facility shall include:-

- **a)** Toll Plaza
- **b)** Road side furniture
- **c)** Tree plantation
- **d)** Landscaping
- **e)** Cattle crossings
- **f)** Development of site for wayside amenities
- **g)** Traffic aid posts
- **h)** Medical aid posts
- **i)** Vehicle rescue posts
- **j)** Telecom system; and
- **k)** Automatic Traffic Management System

The project road is envisaged to be developed on commercial basis. Direct tolling methods of revenue generation by constructing user fee plazas (km 10-11).

Since the entire project is proposed on OMT, basis (Oprate, Maintain & Transfer basis) Traffic study was done as part of the study to find out the likely toll revenue.

1.2 OBJECTIVE:-

The main objective of the study of this traffic survey for comparison between traffic surevey for the year march 2015 and august 2019 on **Bhopal - Vidisha** road section. The viability of the project for the concession period of the project.

The study primarily consist of collection of traffic data, analysis of data, estimation of seasonal variation factors, volume count survey, origin–destination survey, alternate route survey and estimation of toll revenue for entire concession period.

This report presents the traffic characteristics, methodology used to drive traffic growth rates and generated traffic if any. Based upon these, tollable traffic and toll revenue estimation for commercial vehicles (as per schedule of contract documents) at the toll plaza location have been estimated.

Tollable traffic for this Bhopal –Vidisha project has valid only for frieght vehicles.

II. LITERATURE REVIEW

Preliminary studies of road-user behaviour **(Jacobs et al., 1981)** at traffic signals and pedestrian crossings indicated that road users tended to be less disciplined than in the United Kingdom. Table-1 shows that fewer drivers chose to stop for pedestrians on uncontrolled pedestrian crossings and, not surprisingly, fewer pedestrians made use of such crossings compared with the UK. Also, observations in Pakistan **(Downing, 1985)** demonstrated relatively high proportions of drivers crossing continuous “No Overtaking” lines (15%) and not stopping at stop signs (52%). A study conducted by CRRI **(Sarin & Mittal, 1991)** in Delhi among truck drivers revealed that only 11% truck drivers knew “No Overtaking Sign”, 5% about “Right of Way” and around 90% of the truck drivers were found to be ignorant about the road signs, traffic rules and regulations that govern road users for safety. It was observed only 10% of the drivers had a correct understanding of 50% or more commonly met signs while only one percent exhibited 75% or more knowledge level. These results suggest that road safety measures such as road

signs and markings are not self enforcing; they may be less effective unless they are properly enforced with enforcement and publicity campaign.

Poor road-user behaviour exhibited by drivers in some developing countries may be due to their lack of knowledge about road safety rules and regulations or their general attitude towards road safety matters. A study of drivers' knowledge in Jamaica, Pakistan and Thailand **(Jacobs et al., 1981)** indicated that there were only a few topics where a lack of knowledge was widespread. One such example was stopping distances where 87 percent of the drivers underestimated the distance required to stop in an emergency when travelling at 30 mph. Answering questions on stopping and following distances also proved to be a problem for professional drivers in Cameroon and Zimbabwe **(Downing, 1991)**, with truck and bus drivers unable to answer more than half the questions on driving knowledge and skills correctly. Other areas of driver behaviour, such as not stopping at pedestrian crossings, traffic signals and stop signs were found to be due to poor attitudes rather than poor knowledge **(Kayvan Aghabayk et al., 2012)**.

A study conducted by **Neelima Chakrabarty & Singh (1993, 2012)** was based on the observance of drivers' behaviour at selected intersections in Delhi revealed that 13 to 37% drivers (of different vehicles) were observed jumping red lights at selected intersections in Delhi city. These results emphasize that poor attitude of the drivers can be modified up to some extent by proper enforcement procedures and effective publicity campaigns.

Sun Ye in 2014 conducted a research study on Traffic congestion is a major problem which bothers our urban traffic sustainable development at present. Congestion charging is an effective measure to alleviate urban traffic congestion. The paper first probes into several key issues such as the goal, the pricing, the scope, the method and the redistribution of congestion charging from theoretical angle. Then it introduces congestion charging practice in Singapore and London and draws conclusion and suggestion that traffic congestion charging should take scientific plan, support of public, public transportation development as the premise.

Deepak Sharma et. al in 2011 conducted a study on Road traffic accidents in Anand-Gujarat, Road traffic injuries are a major; but neglected global public health problem, requiring concerted efforts for effective and sustainable prevention. Objectives: The following study analyses the (i) age and sex distribution of injured in road traffic accidents (RTA), (ii) distribution of injured in road traffic accidents by mode of transport and victim role, (iii) the distribution of injured in road traffic accidents by counterpart to which they hit (iv) transportation time required to shift the patients, and (v) the fatality rate in road traffic accidents. Materials and methodology: The present study is a retrospective record based study and data was collected using questionnaire method (for collecting relevant information) A total of 423 RTA cases were studied from the case records of the medical records section of Shree Krishna Hospital, Pramukhswami Medical College in the said period: 1 st October 2007 to 31 st March 2008. All the road traffic accident cases coming in the particular specified time period were taken. Results are interpreted in terms of %, mean, S.D, median, χ 2 test Results: The results revealed that (i) out of total 423 RTA cases, 327(77.3%) of the victims were males and the rest 96 (22.7%) were females. (ii) The highest number of victims 122 (28.8%) were from 21-30 years of age group. In males the maximum numbers of cases were seen in the age group 21-30 years (31.8%); whereas in case of females the highest numbers of cases were seen in the age group 31-40(21.9%). 55.79 % of the RTA victims were drivers and riders followed by the occupants and passengers (30.26%). (iii) 41.9% of two wheeler users were hit by 4 wheelers (iv) 48.1% victims managed to reach hospital in less than an hour, 2.8% cases reached the hospital after 6 hours of delay.

III. METHODOLOGY ADOPTED

3.1 ABOUT PROJECT

OMT (Operation, Maintenance & Transfer) PROJECTS. A BOT project is typically regulated by the government on key issues of the project performances and price of the service. In the BOT approach, the government grants a private sector the rights to finance, develop, and operate a revenue producing toll road for a defined time period (i.e., concession period) after which the facility is transferred back to the government.

i. BOT is the classic tool for project finance. As it relates to new build, there is no revenue stream from the outset.
ii. Project Company obtains financing for the project, and procures the design and construction of the works and operates the facility during the concession period.
iii. Project company is a special purpose vehicle, its shareholders will often include companies with construction and/or operation experience, and with input supply and offtake purchase capabilities.
iv. Project company will co-ordinate the construction and operation of the project in accordance with the requirements of the concession agreement.

v. The revenues generated from the operation phase are intended to cover operating costs, maintenance, repayment of debt principal (which represents a significant portion of development and construction costs), financing costs (including interest and fees), and a return for the shareholders of the special purpose company.

3.2 Methodology Adopted

The study is carried out by identification of potential benefits expected to accrue to the community and comparison with the estimated construction cost, operation and maintenance cost of the project. It covers:

i. Economic Evaluation: Economic viability is assessed within the broad frame work of the cost-benefit analysis technique. It involves comparison of cost and benefit streams over a fixed analysis period. Economic analysis is carried out using HDM IV Model (Highways Development & Management).
ii. Financial Analysis: The estimated construction cost, operation and maintenance cost, traffic forecast, toll revenue are considered over a concession period of 15/ 20 years and likely rate of return is estimated.

3.3 Sampling Method

This study covers based on the IRC:SP:19 Manual for Survey, Investigation and Preparation of Road Projects:2015

- Classified traffic volume count for 24 x 7 days.
- Road side Origin Destination Survey for 24 hours.
- Intersection volume count.
- Axle load spectrum survey.
- Traffic demand Estimate.

Various traffic surveys and analysis have been carried out for addressing the objectives and issues pertaining to widening and strengthening of the project stretch. The surveys conducted include 7-day volume count, Turning movement survey, origin & destination survey, speed and delay survey, pedestrian count survey, willingness to pay survey etc. The study aims at obtaining the existing traffic and travel characteristics on the project corridor and forecasting the same for the project horizon year considering various constituent streams and various scenarios. The results of this analysis will form inputs for developing capacity augmentation proposals, designing the pavement, design of intersections, decisions regarding grade separators, pedestrian facilities, designing the toll plaza, wayside amenities, planning the tolling strategy and carrying out economic and financial analysis

3.4 Research Location

The research was carried out in Bhopal – Sanchi Road belt which is a fast developing surrounding area in Bhopal. The different locations selected for traffic survey study at Bhopal – Sanchi Road.

IV. ANALYSIS &COMPARISON OF THE STUDIES

TRAFFIC SURVEY AND OTHER STUDIES:-

- **Scope of the Project:-**

Following traffic survey and studies were under the scope as part of the study to assess the base year traffic pattern.

1. A comprehensive 7 days, 24-hours Traffic Volume count at toll plaza location.
2. Origin- Destination (OD) Survey at toll plaza location.
3. Collection of Petrol/Diesel data to evaluate seasional traffic variations.
4. Traffic projections by category of vehicles.
5. Estimation of Toll revenue for the entire concession period.

4.2 Classified Volume Count for both Surveys:-

Comparison Classified traffic volume count survey:

To study of the prevailling traffic characteristics on project road classified traffic volume count survey was conducted for comparison in the Month of March 2015 and August 2019.

Classified traffic volume count survey was carried out at Toll Plaza for Seven days. Location of survey and the dates are given in **Table: 4.1.**

TABLE:4.1- (Classified Traffic Volume Count Location & Schedule)

SL. NO.	LOCATION	Chainage (Km.)	Duration	Start Date	End Date
1	At Sukhisewania	11+400	7 Days	05/03/2015	12/03/2015
2	At Sukhisewania	11+400	7 Days	08/08/2019	15/08/2019

The classified volume count surveys were typically conducted for 7 consecutive days (both directions and for both surveys) from 8:00 AM to the next day 8:00 AM continuously for 24 hours as per the above mentioned schedule. The analysis of the classified traffic volume count observed at the count locations has been carried out to arrive at the:

- Average Daily Traffic (ADT)
- Day wise Variation & Hourly Variation
- Direction Distribution
- Traffic Composition
- Annual Average Daily Traffic (AADT)

4.3 Comparison for Average Daily Traffic (ADT):

The traffic volume data collected at the survey location was averaged out to arrive at the location wise average daily traffic (ADT) on the project road section. The summary of Camparison ADT in terms of vehicles at the both survey locations is given below. 7 days volume count survey has been carried out at toll plaza location.

TABLE:4.2 – COMPARISON SUMMARY OF AVERAGE DAILY TRAFFIC (ADT)

LOCATION	KM - 11+400 For March 2015	KM - 11+400 For August 2019	Difference
MAV	0	0	0
TRUCK-2 AXLE	276	317	41
TRUCK-3 AXLE	323	352	29
TRUCK-4/6 AXLE	157	196	39
LCV	805	842	37
MINI BUS	34	45	11
PVT BUS	132	148	16
STATE BUS	0	0	0
SCHOOL BUS	38	37	-1
CARS	2674	2754	80
TWO WHEELER	2881	2846	-35
AUTO RIKSHAW	147	151	4
TRACTOR	11	12	1
TRACTOR TROLLEY	54	54	0
ANIMAL DRAWN	0	1	1
TOTAL VEHICLES	7532	7755	223
TOTAL PCUS	8556	9079	523

Note.

1. **Tollable traffic valid for only Commericial vehicles only for this project as per schedule of Bid Documents. Which is shown above in yellow color.**

2. **As we can see the School Bus and Two Wheeler traffic volumes is little bit droped in August 2019 volume count.**

4.4 Day Wise Comparison Variation Graph of Traffic:-

Day wise comparision variation graff of traffic during the surveys in between March 2015 and August 2019 is shown below.

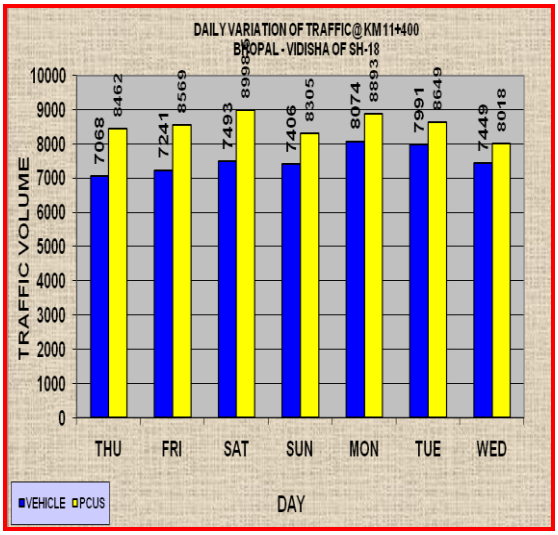

Figure -4.1 (for March 2015 Survey)

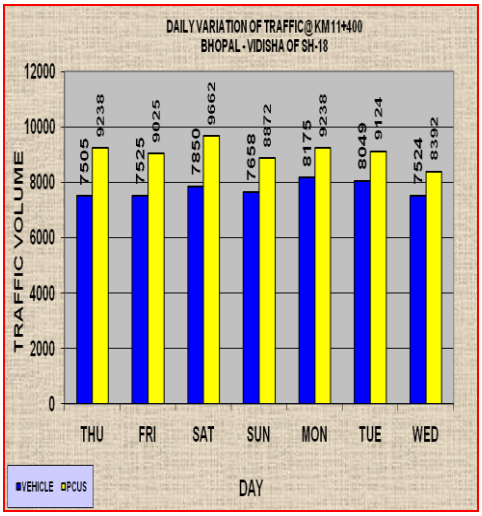

Figure -4.2 (for August 2019 Survey)

Comparison of Hourly Variation of Traffic:-

Seven days of hourly variations of traffic for toll plaza location are shown in Graph respectively**.** Generally peak flow occurs during 5 PM to 6 PM hours in Evening of both survey in March 2015 and August 2019.

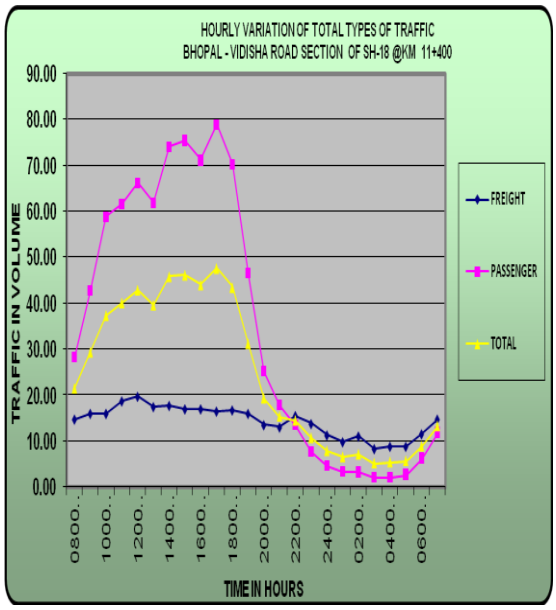

Figure -4.3 Hourly Variation (for March 2015 Survey)

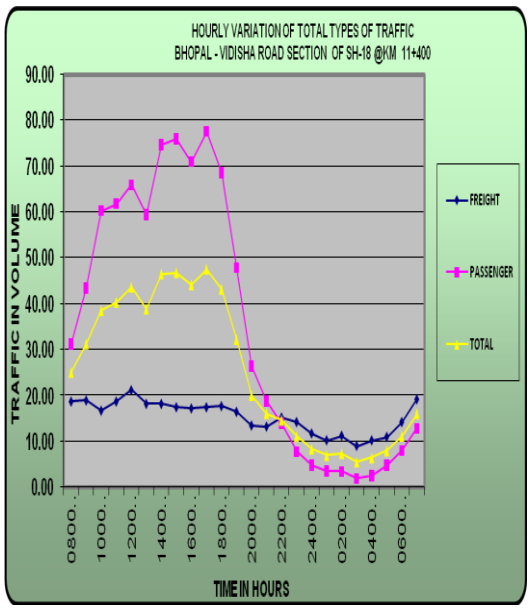

Figure -4.3 Hourrly Variation (for August 2019 Survey)

4.5 COMPARISON OF ORIGIN & DESTINATION PATTERNS:

In order to understand the travel demand pattern in the region, both Origin and Destination (O-D) Surveys for the Month of March 2015 and August 2019 were carried out at one location i.e., at km. 11+400. The survey was typically started in the morning and continued as per above schedule. The OD survey elicited characteristics like origin, destination, frequency, purpose and commodity etc. both for passenger and goods vehicles. The information collected during roadside interviews was analysed to obtain the trip distribution. Location of OD survey has given in Table -3.6

Table. – 4.3 - OD Location for both survey

S. No.	Location	Chainage	Duration	Date
1.	At Sukhisewania	11+400	1 Day	March 2015
2.	At Sukhisewania	11+400	1 Day	August 2019

4.6 Comparison of Traffic Zoning System (Both Survey)

A zoning system was developed in order to analyze the Origin – Destination (OD) data for both survey in March 2015 and August 2019. The description of the zones was adopted in Table:3.7 origin destination data was used to identify the zones that contribute to the traffic on the road. Growth of traffic on the road will depend upon the economic developments in the influence areas of the road. Observed O-D pattern in the form of mode wise matrices at toll plaza location of both survey is presented in **Annexure-3.**

Table – 4.4 -Zone Description for both survey

Zone Code	Zone Description
1	REST OF INDIA
2	RAJASTHAN
3	GUJARAT
4	DELHI
5	CHATTISHGARH
6	MAHARASHTRA
7	UTTARPRADESH
8	REST OF MP
9	BHOPAL
10	VIDISHA
11	KURWAI
12	ASHTA
13	KANNNOD
14	SANCHI
15	BINA/SAGAR
16	RAISEN
17	GUNA
18	GWALIOR
19	SHIVPURI
20	UJJAIN
21	DEWAS
22	INDORE
23	SEHORE
24	RAJGARH
25	BETUL/HOSANGABAD
26	HARDA/EAST NIMAR

4.7 Comparison Calculation of Influence Factor:

Totaling the sum of origins and destinations to any particular zone dividing by twice the total number of trips interviewed gives the influence factor for the zone.

Influence factor = $A_i+B_j/2*P$
A_i=origin from the $_i^{th}$ zone.
B_j= destination to the $_j^{th}$ zone
P=Total trips from $_i^{th}$ to $_j^{th}$ zone

Influence factor based on origin and Destination surveys conducted for freight and passenger vehicles for project road section is given in table below.

ONE NO.	ZONE DESCRIPTION	FREIGHT VEHICLE PERCENTAGE (in August 2019 Survey)	PASSENGER VEHICLE PERCENTAGE (in August 2019 Survey)	FREIGHT VEHICLE PERCENTAGE (in March 2019 Survey)	PASSENGER VEHICLE PERCENTAGE (in March 2015 Survey)	DIFFERENCES FOR FREIGHT VEHICLES	DIFFERENCES FOR PASSENGER VEHICLES
1	REST OF INDIA	1.30	0	0.96	0	0.34	0
2	RAJASTHAN	0.65	0	0.48	0	0.17	0
3	GUJARAT	0.49	0	0.24	0.23	0.25	-0.23
4	DELHI	0.97	1.39	0.24	0.23	0.73	1.16
5	CHATTISHGARH	0	0	0	0	0.00	0
6	MAHARASHTRA	0	0	0.24	0	-0.24	0
7	UTTARPRADESH	3.41	0.46	1.91	0.23	1.50	0.23
8	REST OF MP	7.63	1.23	6.94	0.91	0.69	0.32
9	BHOPAL	46.43	50.46	47.85	51.36	-1.42	-0.90
10	VIDISHA	18.99	20.52	22.49	26.14	-3.50	-5.62
11	KURWAI	0	2.93	0	0.91	0.00	2.02
12	ASHTA	0	0	0	0	0.00	0
13	KANNOD	0	0	0	0	0.00	0
14	SANCHI	4.87	7.41	5.98	8.41	-1.11	-1.00
15	BINA/SAGAR	3.73	5.40	3.35	4.32	0.38	1.08
16	RAISEN	4.06	5.25	4.31	5	-0.25	0.25
17	GUNA	0	1.23	0	0.68	0.00	0.55
18	GWALIOR	1.30	0	0.96	0	0.34	0
19	SHIVPURI	0	0	0	0	0.00	0
20	UJJAIN	0.49	0	0.48	0	0.01	0
21	DEWAS	0	0	0	0	0.00	0
22	INDORE	5.68	3.70	3.59	1.59	2.09	2.11
23	SEHORE	0	0	0	0	0.00	0
24	RAJGARH	0	0	0	0	0.00	0
25	BETUL/HOSANGABAD	0	0	0	0	0.00	0
26	HARDA/EAST NIMAR	0	0	0	0	0.00	0
Average	REST OF MADHYA PRADESH	93.18	98.15	95.93	99.32	-2.75	-1.17
Average	REST OF INDIA	6.82	1.85	4.07	0.68	2.75	1.17

V. RESULT & CONCLUSION

This study was carried out to identify the Techno-Economic feasibility of Bhopal-Vidisha Road SH-18 to know the variation of traffic load, composition, growth rate and forecasts done in and compare the study done in March 2015 and April 2019 at same location. The aim is to find out how the traffic model is adopted and forecast future growth is justified or not. The study included various factors their importance to check the methods and remedies as encountered in construction of highways. The study included helps in OMT and BOT projects concession period design more effectively by considering growth and future requirement. The study was carried out considering the all the surveys carried out to check the feasibility of the project and check the projected growth in this road only commericial traffic is consideried as tollable traffic but study is conducted considering all the vehicles using the road. The study revealed the reluctance in using growth rate and rely more on judgment and past experience on similar types of road in same vicinity. It also brought out the fact that there is a tendency to do certain things by the traditional ways rather than apply RMP. It is recommended that if the future projection of traffic growth is taken by considering all the factors the concssion period is designed more economically.

CONCLUSIONS

Based on the study, it was concluded the following things:

1) The comparative study of traffic volume count survey shows slightly decrease in school bus traffic, and the two wheeler traffic dropped at considerable rate on the other hand the cars traffic is increased.
2) The comparative study of Annual Average Daily Traffic (A.A.D.T.) shows that Light Commercial Vehicles (LCV) dropped considerably.
3) The comparative study of Tollable traffic revenue shows that there is considerable growth in revenue collection than predicted at the time of construction of highway.
4) The study also concluded that as agricultural production increases in the Vidisha district also causes increase in commericial vehicles movement than predicted.
5) The study show that till there is no alternative route and leakage of traffic.
6) The comparative study of W.P.I. (Wholesale Price Index) for base year was 6.15 which is reduced to 5.2 in the present study.

Recommendation for future work

These are some recommendation for future work in this field.

1. Comparative study shows some more factors has to be incorporated while designing the BOT or OMT projects.
2. A further study conducted for finding the WPI of the area.
3. It is suggested to have more precise on deciding the rates of tollable vehicles.

4. It is also suggested that the concession period for the project is decided more minutely to minimize the financial loss of the government.

The construction industry has characteristics that distinguish it from other sectors of the economy. It is extremely sensitive to economic cycles. This business is highly competitive because of the large number of firms present and the relative ease of entry into this business. This makes it an all the more risky business.

In this study, identifying the risk factors faced by developers of residential complexes and township projects is based on collecting information about construction risks, their consequences and corrective actions that may be done to prevent or mitigate the risk effects. Determination of severity and allocation of these risk factors was the main result of this research.

REFERENCES

[1] Kadiyali, L.R., "Traffic Engineering and Transport Planning". Khanna Publishers , Delhi, 1987.

[2] Ralph Hass, Ronald Hudson, W., .and Jojn Zaniewskui "Modren Pavement Management ", Krieger Publishing Company, Florida, 1994.

[3] AASHTO, "Guide for Design of Pavement Strucres'., American Association of State Highway and Transportation Officials, Washington, 1993.

[4] Roger L. Brockenbrough, Jr. P. E., "Highway Engineering Hand Book Building and Rehabili tating the Infrastructure ", Mc Graw - Hill, New York.

[5] Leo J. Ritter, JR.Radnor J. Pagnetts , "Highway Engineering ", The Ronald Press C o m pany, New York.

[6] NCHRP 122, "Life-cycle Cost Analysis of Pavements". Transportation Research Board, National Research Council, Washington, 1985.

[7] Ggenereux, R.J., "The Use of Economic Tools in Highway Decision Making", Transport Economic Selected Readings, Hardwood Academic Publishers, The Korean Research Foundation For the 21" century, 1997.

[8] Yoder, E.J_, and Wit. C Zak, "Principles of Pavement Design ", A Wiley-lnterscience Publication, John Wiley & Sons, Inc. New York.

[9] Finlay, M.J., and Campbell, K.D., "Discount Rates for Pavement Alternatives ", 1311 arrb/5th reaaa, 1986.

[10] Beatly, D. W. and Noel, S. L. "Economic Appraisals of Highway Projects", N.Z, Roading Symposium, 1971.

[11] S K Khanna CEG Justo "Highway Engineering" Nem chand Bros. Rorkee, India, IX edition, pp. 159-211, 2011.

[12] Kolhapur Muncipal Corporation, Kolhapur City Integrated Road Development Project".

[13] The Indian Road Congress "Manual for Survey, Investigation and Preparation of Road Projects" IRC:SP:19;2015.

[14] The Indian Road Congress "Guide lines for Traffic prediction on rural high ways" pp2-1996.

[15] Esther Malini (1998) "Build Operate Transfer Municipal Bridge Project in India." Journal of Indian. Road CongressVol.58, Issue187-123IRC.

[16] Kumaraswamy Mohan M. (2001) "Procurement Protocols for Public-Private Partnered Projects" ASCE, Journal of Construction. Engg. & management., Volume 127, Issue 5, pp. 351358. [6] Anathanarayanan K. (2003) "Risk factor & Management for BOT Road Project in India". Indian Highway Sector" Vol.31No.12 PP.53-75.

[17] Neelima Chakrabarty, Shukla Anuradha & Shokeen Nancy (2012), "Driver Training: An Effective Tool for Improving Road Safety in India", Journal of Engineering and Technology, Vol. 2, No. 2, Pp. 113–117.

[18] Neelima Chakrabarty & H. Singh (1993), "Driver Observance related to their Obedience of Traffic Rules and their Need for Traffic Education", Paper Published and Awarded in All India Scientific and Technical Paper Writing Competition Organized by CSIR.

[19] AJ. Downing (1985), "Road Accidents in Pakistan and the Need for Improvements in Driver Training and Traffic Law Enforcement", PTRC. Summer Annual Meeting, University of Sussex, Proc of Seminar H. London: PTRC Education and Research Services.

[20] AJ. Downing (1991), "Driver Training in Africa: The UN-ECA Driving Manual", Proceedings of the Second African Road Safety 16, Congress. Oslo: Institute of Transport Economics (TOI).

[21] Kayvan Aghabayk, Majid Sarvi & William Young (2012), "A Macroscopic Study of Heavy Vehicle Traffic Flow Characteristics", 25th ARRB Conference – Shaping the Future: Linking Policy, Research and Outcomes, Perth, Australia.

[22] S.M. Sarin & N. Mittal (1991), "Traffic Accidents in India", Internal Report Published at CRRI.

[23] Farheena Shaikh, Dr. Prof. M. B. Chandak, 2014, CORPUS An Approach towards Traffic Management System using Density Calculation and Emergency Vehicle Alert.

[24] Sun Ye 2014, "Research on Urban Road Traffic Congestion Charging Based on Sustainable Development" ELSEVIER Physics Procedia Volume 24, Part B, 2012, Pages 1567-1572.

[25] Deepak Sharma, Uma Shankar Singh, Sidhyartha Mukherjee Published 201, "A study on road traffic accidents in Anand- Gujarat.