Current Trends in Technology and Science
ISSN: 2279- 0535. Volume: 3, Issue: 4 (June-July 2014)

Economical Evaluation of Build-Operate-Transfer Project, A Case Study

Vivek Sadashiv Jadhav
P.G. Student, Rajarambapu Institute of Technology, Rajaramnagar, Islampur, Sangli, Maharashtra, India.
vivekjadhav7797@gmail.com

Abdul Rashid Chand Attar
Dean, Quality Assurance, Rajarambapu Institute of Technology, Rajaramnagar, Islampur, Sangli, Maharashtra, India.
abdulrashid.attar@ritindia.edu

Abstract - India is growing very fast infrastructural Development is happening with huge investment. The Traffic intensity and traffic volume on the road is high. Therefore, the present road network is required to improve and widen for access the future traffic and to provide the good riding quality. The Indian infrastructure has limitations due to financial unavailability and scarce budgetary sources. Hence government has allowed the participation of private firm for the development of road infrastructure. The Build Operate Transfer has been one of the recent innovations in project finance. In Indian Road infrastructure development has mostly Utilize the BOT model. This study examines the details of road section and Traffic volume study conducted on this. The analysis of traffic volume data is done by projection up to 30 years. A case study of IRDP project implemented in Kolhapur Municipal Corporation area through BOT is study in detail.

Keywords - BOT, IRDP, Toll, Traffic Survey.

1. INTRODUCTION

BOT is a form of project planning and financing, wherein a private party receives a concessions from the private or public sector to finance, design, construct and operate a infrastructure facility for a particular time. The Facility is transferred back to the government authority after the concession period ends. Day by day the Indian Infrastructure development has been growing due to huge investment therefore; the traffic intensity on the road is more than capacity of road. The existing road network is necessary to improve to accommodate the future traffic and to provide the good quality. The BOT model has many of challenges concerned in developing and financing the road projects. The huge funds are required to develop road networks. The Indian infrastructure has restrictions due to financial unavailability and limited budgetary sources. So, there is need of attracting the private finance in India.

1.1 Project Background

Kolhapur is a historical, educated, industrially developed and politically vital city of Western Maharashtra. It is major developing city of west Maharashtra as well as historical importance with rich heritage. This city is well known for Industrial development and agricultural products such as sugarcane, cotton, leather & dairy. This city contains many education institutes, divisional and regional offices of government and private sectors as well as universities. Thus in view considering the ever increasing traffic needs of the city and to provide better connectivity and traffic ability.

Kolhapur City Road Development plan was approval by the Government. Besides national highway there are four major highways are connected to the heart of the city. These connections bring heavy amount of traffic from various directions as well as national highways and the traffic is increasing with addition of existing traffic in city. Thus in the view of the increasing traffic needs of this city there is requirement of improve the traffic condition and to provide better connectivity. To solve the traffic problems in the city, an integrated road development program (IRDP) has been formed. The Municipal funds are limited therefore here it is decided to implement this project through BOT. BOT model plays an important role in the infrastructural development. The Government of Maharashtra has entrusted to MSRDC, the implementation of IRDP Kolhapur on BOT basis and the development is entrusted to Private Limited Company. It is been proposed that around 50km stretch of internal roads of Kolhapur city would be widened under this project, it would take nearly 24 months for the completion of the project.

1.2Need for the project

- Increase in Pollution.
- Intersection geometrics
- Increase in Vehicular Traffic
- Increase in Travel Time
- Increase in Traffic Congestion
- Lack of Public transport
- Mixed Traffic Condition
- Lack of pedestrian facilities
- Narrow Row (Road over Width)

1.3 Objectives of IRDP

- Develop and establish network of main roads in the city.
- Development of main entrance & link routes to the city.
- Widen & develop roads to full DP width.
- Provide storm water drain.
- Provide central divider and footpaths

- Improvement of junctions.
- Provide advanced street light illumination
- Facilitate beautification to enhance aesthetics of the roads.

2. Details of Road Under Study

2.1 Salient Features of the project

1. Client – Maharashtra State Road Development Corporation
2. Concessionaire- IRB Pvt. Ltd.
3. Independent Consultant- PQR Ltd.
4. Letter of Acceptance- 27th March 2008
5. Signing of Agreement - 10th July 2008
6. Date of Commencement - 09Th January 2009
7. Project Cost - 220.00 Crores
8. Construction Period - 24 months
9. Concession Period - 30 years

2.2 Cost Estimate

Following table shows the cost estimate of proposed roads.

Sr.No.		Name of the Road	Length (in m)	Costs in Lakhs
1	ER-1	Shiye naka to chimaso chawk	8.30	2681.96
2	ER-2	Shiroli naka to shivaji bridgh	6.20	2110.29
3	ER-3	Shahu naka to dsp office	6.22	2263.93
4	ER-4	Kalamba naka to kalamba filter house	2.97	861.97
5	ER-5	Puikhadi to rankala chawpati	5.40	1873.21
6	ER-6	Fulewadi naka to rankala chawpati	2.20	683.95
7	IR-1	Syber chawk to kalamaba filter house	4.30	1608.83
8	IR-2	Kalamba filter house to mohite park	1.30	377.29
9	LR-1	Khanvilkar petrol pump to line bajar	3.40	986.77
10	LR-2	Rankala lake to Mahalakshimi temple	0.80	232.18
11	LR-3	Dasara chawk to ford corner	2.50	725.57
12	LR-4	Temblai gate to Uma theater	2.70	760.02
13	LR-5	Bagal chawk to Shivaji post office	3.20	949.39
14	1	Widening of Nala	1 No.	100.00
15	2	Small Bridge	8 No.	320.00
16	3	Cd Works	8 No.	67.50
17	4	Railway Over Bridge	1 No.	1369.00
18	5	Roads	49 Km	462.00
19	6	Toll Station	9 No.	360.00
20	7	Bus Stops	2 No.	30.00
21	8	High masts	45 No.	225.00
23	**A**	**Total Road and Infrastructural Cost**	**-**	**19257.00**
24	1	Land acquisition cost	-	850.00
25	2	office expenditures & Railway dept. deposits	-	1594.00
26	3	Technical consultant fee	-	400.00
28	B	Total general cost	-	2844.00
29	**A+B**	**Total project cost**	**-**	**220.00 Crores**

Table No.1

2.3 Crust Details

Composition	Thickness
AC	40 mm
DBM	50 mm
BM	75 mm
WMM	300 mm
Metal GSB Drainage Layer	200 mm
Sub grade	500 mm (8% CBR)
Total	**1165 mm**

Table No.2

2.4 Traffic Volume Survey

Traffic volume is the number of vehicles crossing a section of road per unit time at any chosen time. Traffic capacity or traffic volume is used as a amount measure of vehicle flow; the commonly used units are vehicles per day and vehicles per hour. Traffic volume survey was carried out on 9 entry/ leaving points in Kolhapur. Table gives the details of Traffic volume Survey in terms of Average Daily Traffic (ADT). The following table no. 3 shows the traffic survey was carried out in Kolhapur city entry/ leaving points.

Current Trends in Technology and Science
ISSN: 2279- 0535. Volume: 3, Issue: 4 (June-July 2014)

Toll Plaza Locations	Car/Jeep/Van / 6S/ Auto	LCV	ST Bus	Other Bus	Truck	MAV	Tractor	Total
Shahu Naka	3888	290	715	153	541	9	20	**5615**
Uchagaon Naka	3859	309	286	16	437	3	65	**4975**
Vashi Naka	1730	177	346	44	462	1	82	**2841**
Shiye Naka	1568	177	90	14	432	1	115	**2398**
Phulewadi Naka	2077	379	569	96	931	5	213	**4271**
Kalamba Naka	887	152	200	17	283	5	25	**1567**
Shiroli Naka	11159	1191	2355	523	2655	16	72	**17792**
Total Vehicles	**25168**	**2675**	**4561**	**863**	**5741**	**40**	**592**	**39459**
Total PCU	**25168**	**2675**	**10034**	**1899**	**12630**	**88**	**2368**	**54862**

Table No.3

2.5 Traffic Growth

The following table shows the traffic growth rate of Kolhapur IRDP Project as per the IRDP Tender document.

Years	Traffic growth rate
Up to 10 years	7%
10 – 20 years	6%
20-30 years	5%

Table no.4

2.6 Passenger Car Unit

Various types of vehicles in a traffic flow have different characteristics like width, length and height And sometimes they produce cause inconvenience to other vehicles, so for expressing highway capacity, a unit is used called passenger car unit. Following table shows the PCU factor suggested by IRC 108-1996.

Sr. No.	Vehicle class	Equivalency factors
1.	Car, pick up Van , auto rickshaw	1.0
2.	Bus, truck	3.0
3.	LCV	1.50
3.	Motor cycle, scooter and pedal cycle	0.5
4.	Truck Trailer, agricultural tractor-tailor unit	4.5

Table no.5

2.7 Traffic Projection Up to 2038

Year	Car/ 6s/ Van	LCV/MB	Truck	Bus	Tractor	MAV
2007	**25168**	**2675**	**5741**	**5424**	**40**	**592**
2008	26930	2862	6143	5804	43	633
2009	28815	3063	6573	6210	46	678
2010	30832	3277	7033	6645	49	725
2011	32990	3506	7525	7110	52	776
2012	35299	3752	8052	7607	56	830
2013	37770	4014	8616	8140	60	888
2014	40414	4295	9219	8710	64	951
2015	43243	4596	9864	9319	69	1017
2016	46270	4918	10555	9972	74	1088
2017	**49509**	**5262**	**11293**	**10670**	**79**	**1165**
2018	52480	5578	11971	11310	83	1234
2019	55629	5913	12689	11989	88	1308
2020	58966	6267	13451	12708	94	1387
2021	62504	6643	14258	13470	99	1470
2022	66255	7042	15113	14279	105	1558
2023	70230	7464	16020	15135	112	1652
2024	74444	7912	16981	16043	118	1751
2025	78910	8387	18000	17006	125	1856
2026	83645	8890	19080	18026	133	1967
2027	**88664**	**9424**	**20225**	**19108**	**141**	**2086**
2028	93097	9895	21236	20063	148	2190

Current Trends in Technology and Science
ISSN: 2279- 0535. Volume: 3, Issue: 4 (June-July 2014)

2029	97752	10390	22298	21067	155	2299
2030	102639	10909	23413	22120	163	2414
2031	107771	11455	24583	23226	171	2535
2032	113160	12027	25813	24387	180	2662
2033	118818	12629	27103	25607	189	2795
2034	124759	13260	28458	26887	198	2935
2035	130996	13923	29881	28231	208	3081
2036	137546	14619	31375	29643	219	3235
2037	144424	15350	32944	31125	230	3397

Table no.6

3. Economical Evaluation of Project

There are various methods available for economic evaluation of highway projects, which is useful to evaluate relative benefits which could be derived from various alternative projects. The various methods of economic evaluation of highway projects are discussed briefly in the following.

Given Data:-

Analysis Period= 30 Years

Interest rate= 10 %

Construction Period= 2 Years

3.1 Benefit Cost Ratio

BCR = CF0/ (1 + i)1 + CF1/ (1 + i) 2 + CF2/ (1 + i) 3 + ……..... + CFn/ (1 + i) n/Initial Investment

BCR = 2.14

BCR is >1, Hence Project is Accepted.

3.2 Net Present Value Method

In the net present value method, a project is equal to the sum of present values of all the cash flows associated with the project. The Net Present Value (*NPV*) at the base year can be written as:

NPV = CF0/ (1 + i)0 + CF1/ (1 + i)1 + CF2/ (1 + i)2 + ……..... + CFn/(1 + i)n

NPV = 377.04 Crore

Hence NPV is Positive, The project is accepted.

3.3 Internal Rate of Return Method (IRR)

The IRR of a project is the discount rate which makes NPV equal to zero.

IRR = CF0/ (1 + i) 0 + CF1/ (1 + i) 1 + CF2/ (1 + i) 2 + ……..... + CFn/ (1 + i) n

IRR = 19 %

The Internal Rate of Return for 30 years has been computed with the above formulas for the road section is 19 %.

3.4 Toll Rates

Type of Vehicle	Toll In Rs.
Car/ 6S	15
LCV	20
Bus	35
Truck	35
MAV	40
Tractor	35

Table no.7

4. Conclusion

1. The traffic was 54862 PCU/day in the year 2007 is exceeding the capacity of existing road. Hence there is a need to widen the road. Hence the road is to be widened up to four lanes.
2. The result of economic evaluation shows that Internal Rate of Return for the road is 19 % and it is more than the required interest rate of 10%, The Net Present Value is 377.04 Crore and Hence the NPV is positive.
3. The Benefit Cost Ratio of Project is more than 1, hence the project is accepted.
4. It can be concluded that the road is economically viable for the proposed up gradation & improvements.

5. References

[1] S.K.Khanna, C.E.G.Justo, "Highway Engineering", Nem Chand and Bros., Roorkee, U.K., India, Ninth Edition, pp. 159-211, 2011.

[2] R. Panneerselvam, "Engineering Economics", PHI learning Private Limited, New Delhi, Thirteenth Edition, pp. 26-67, 2012.

[3] Kolhapur Municipal Corporation, "Kolhapur City Integrated Road Development Project", Presentation.

[4] The Indian Roads Congress, "Guidelines for Traffic Prediction on Rural Highways", pp. 2-4, 1996.

[5] The Indian Roads Congress, "Manual on Economic Evaluation on Highway Projects In India", pp. 20-37, 1993.

[6] Dr. (Mrs.) Vandana Tare, Er. Raj Mohammad Khan, "Economic Evaluation of BOT Projects", Highway Engineering, Project Reports, Research Papers, pp. 1-7.

[7] Engineer Rinaj Pathan, Prof. Dr. S. S. Pimplikar, "Case Study of Tolled Road Project", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), Volume 7, Issue 6 PP 26-32, Jul. - Aug. 2013.

[8] Prof.(Dr.) R.K. Khitoliya, Dr. Pardeep Kumar Gupta, Ashish Sharma, "Development of Techno-economic Evaluation Methodology for Proposed BOT based Highway Railway-Over-Bridge Project", New Building Material and construction world, pp. 1-17.

[9] Tender Document for IRDP Project.