Technical And Financial Parameters Effect Concession Period: A Study

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INTRODUCTION

Inadequate transport infrastructure has been recognized as an impediment to the industrial and economic progress of any country. Governments worldwide invariably must cope with the widening gap between needed investments and available budgetary resources. They increasingly attempt to involve the private sector in the financing, design, construction, and operation of major infrastructure projects, with a view to exploit the private initiatives to implement public projects. In this context, the BOT concept is becoming a popular mode of privatization of transport infrastructure development (Tiong 1990)[1].In recent years, governments in many countries have begun privatizing transportation infrastructure sectors .

Some of the forces driving this movement include a scarcity of public resources, an increase in the demand for better service and a political trend toward the deregulation of infrastructures from public monopoly. Although the discussion and case study relate to conditions in municipalities in India, the inferences are likely to be of interest to transport infrastructure managers in developing countries and to those interested in the globalization of BOT projects.

BOT PROJECT

The BOT project is essentially a form of leasing, where the government (project sponsor) allows a private entrepreneur (project promoter) to design, finance, and build an infrastructure facility. In return, the project promoter is permitted to collect tolls (user fee) and operate the facility for a specified period (called the concession period), during which he is expected to recover all of his costs and earn a reasonable profit. At the end of the concession period, the ownership of the facility is transferred to the government. This arrangement facilitates the implementation of capital intensive infrastructure projects by the government with funds from outside the budget allocation, while transferring the risks involved to the private sector. Prior experience in BOT projects is limited in India, though varied levels of success with such projects have been reported in other countries such as Malaysia, Thailand, Mexico, and China. However, for successful implementation, it is essential for both the government and the private project promoters to be fully aware of the prospects and pitfalls of these projects. The conventional financial analysis with deterministic or "point" estimates of the important parameters is variables of a transport infrastructure project such as the construction, operation, and maintenance costs, the traffic volume, and the toll revenue are not amenable to precise prediction, and the financial performance cannot be assessed accurately. For a realistic and meaningful analysis of the financial viability of BOT projects, the consideration of risk and uncertainty should be explicitly incorporated.

TECHNO ECONOMIC FEASIBILITY

The project should be viable technically during the concession period. This means that no major improvement in the form of widening is not requiring during the concession period. This maximum period shall be determined best on operating condition i.e. level of service. This depends upon the government policy. It is recommended that concession period will be terminated at the end of Level of Service C or D.

FINANCIAL VIABILITY

A BOT transport infrastructure project may be considered as financially viable, when the following the conditions are

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simultaneously satisfied (Esther Malini 1998)[2]:

- The NPV for the project should be positive. The discount rate for financial analysis may include a risk premium over the current commercial lending rate.
- The FIRR should have a value greater than the discount rate.
- The cash flow (liquidity) situation in each year of the concession period should be satisfactory. In other words, the cash balance at the end of every year should be positive.
- Pay back period/Break down year should be lesser than concession period
- Accepted FIRR and discount rate for BOT project are 15-2 % and 12-17 %.

LITERATURE REVIEW

The study by Shen et al. (2002)[3] presents a methodology for identifying a concession period that can protect both the concerned governments and the investor's interests. Generally, a longer concession period is more beneficial to the private investor, but a prolonged concession period may induce loss to the concerned government. Alternatively, if the concession period is too short, the investor will either reject the contract or be forced to increase the service fees in the operation of the project. Consequently, the risk burden due to the short concession period will be shifted to the public who use and pay for the facilities. Thus, an appropriate concession period is one of the most important decisions when agreeing upon a BOT contract.

BOTCcM MODEL

The BOTCcM model presented by Shen et al. (2002)3 calculates a concession period that balances the interests of the private investor and the concerned government, defined as:

$$IR \leq NPV(Tc) \leq NPV(Tf) \text{ ----------(1)}$$

Where,
Tc denotes the concession period in a BOT contract;
Tf is project economic life;
I is the investor's capital investment;
R is the investor' s expected return rate;
NPV(Tc) is net present value generated from operating the project during the concession period; and
NPV(Tfd) is the net present value generated from operating the project during the project economic life.
Flexible pavement is design for 20 years for national/expressway highway. Life period can be extended by rehabilitation up to 30 years. Concrete pavement is designed for design period of 30 years. Considering these aspects, economic life is adopted for 30 years for concrete and flexible pavement.

BARGAINING THEORY

Research in bargaining and game theory has already experienced a long history. Among the early contributors to the study in this field were Nash (1950a,b, 1951)[4,5], Raiffa (1953)[6], and Harsanyi (1956)[7]. Bargaining theory deals with the situations where people interact rationally with each other, assuming that an individual's action depends essentially on what other individuals may do. The theory is commonly used to describe the situation similar to where a chess player thinks about all issues that may arise logically in the game Montet and Serra (2003)[8]. Muthoo (1999)[9] opined that bargaining is any process through which the players try to reach an agreement. This process is typically time consuming and involves the players making offers and counteroffers to each other. There are a large number of analytical models examining the bargaining process. Bargaining Concession Model developed (L. Y. Shen et al 2007)[10] was based on the first round offer by the government and the first round offer by BOT Operator and finally, the bargaining model was developed.

LEAD FROM PREVIOUS RESEARCH WORK

Technical viability of concession periods is essential, otherwise, the project will fail or become unsuccessful before the end of the concession period. Technical viability means that the project will not require major improvement in the

form of widening during the concession period. If required, the concession period will be modified and re- agreement is essential or reviewed.
Again, concession period depends on the following major factors:

☸MACROECONOMIC PARAMETERS

1) Debt Equity Ratio;**2)**Government subsidy; and **3)**Minimum and maximum FIRR of project and promoter.

☸TECHNICAL FEASIBILITY PARAMETER

1) Level of Service; and **2)** Model Concession Agreement(MCA).

☸DEBT EQUITY RATIO

Earlier, the contribution required from the promoters used to be between 12.5 % and 22.5 % of the project cost depending on factors like the background of the promoter, location of the project and so on. Promoter contribution in highway project is 15 % or more. Upper and lower limit of concession period has been determined by varying debt equity ratio from 90:10 to 10:90.A case study has been carried out.

☸GOVERNMENT'S SUBSIDY

Sometimes, it is found that due to low traffic volume or high construction cost or both, a project is not viable financially. The government bears some portion of construction cost and maintenance cost during the operation to make the project viable. This amount varies from 0 to 40 % in the Indian scenario.

☸MINIMUM AND MAXIMUM FIRR OF PROJECT AND PROMOTER

Concession period range is determined based on varying debt equity ratio from debt financing (Equity =0) to equity financing (debt =0) and minimum as well as maximum FIRR.

☸LEVEL OF SERVICE

Level of service is a measure of traffic flow and congestion. As defined in the Highway Capacity manual, it is a qualities measure describing operational conditions within a traffic stream, generally described in terms of such factors as speed and travel time, freedom to manoeuver, Traffic interruptions, comfort and convenience, and safety. Level of services are A, B, C, D, E and F. Level of service (IRC: 64-1990)[11] is an important parameter for selecting appropriate level of service for a highway project on BOT basis. BOT highway project is different from power, water supply, building and other projects. Major highway projects are operated on Level of Service B (V/C=0.5) .No further improvement is required up to the end of LOS C (V/C≥0.7) or LOS D (V/C ≥ 0.85).This consideration depends on the government's policy/decision. Minimum concession period is found when traffic reach volume capacity (V/C) ratio is equal to =0.5 and maximum concession period for V/C=0.85.

☸MCA GUIDELINES

The Government of India developed MCA guidelines for BOT project. Based on this guideline, growth rate of all tollable vehicles is assumed at 5% per year. Concession period will be terminated at the year when total PCU of tollable traffic is 56,000 and 90,000 for four lanes and six lanes road.

OBJECTIVE OF THE PRESENT STUDY

The objective of the present study is to calculate the ranges of concession period for various parameters.

CASE STUDY

TRAFFIC

A case study has been taken. Traffic study has been carried out in December 1999 on selected section of existing two lanes of NH 4 and growth factors for vehicle mode wise traffic wise have been established.
Growth Rate has been determined based on the following methods:

❁ Past trend analysis;
❁ Net State Domestic Product and Per Capita Income; and
❁ Previous Study.

Considering above mentioned all methods, suitable growth factors are established for projected traffic. Projected traffic (Tollable) is shown in Table 1.

Table 1: Projected Toll Able Traffic

Year	Car	Bus	LCV	2-Axle Trucks	3-Axle Trucks	Multi-Axle Trucks	Total PCU
2000	2555	1150	925	1340	95	40	11878
2001	2785	1208	988	1427	102	43	12672
2002 (Con Year)	3036	1268	1055	1520	110	46	13520
2003 (Con Year)	3309	1331	1127	1619	119	50	14432
2004*	3967	1538	1324	1724	141	59	16428
2005	4165	1615	1390	1810	148	62	17249
2006	4374	1696	1460	1901	155	65	18111
2007	4592	1780	1533	1996	163	68	19017
2008	4822	1869	1609	2096	171	72	19968
2009	5063	1963	1690	2200	180	75	20966
2010	5316	2061	1774	2310	189	79	22014
2011	5582	2164	1863	2426	198	83	23115
2012	5861	2272	1956	2547	208	87	24271
2013	6154	2386	2054	2674	219	92	25484
2014	6462	2505	2157	2808	230	96	26759
2015	6785	2631	2264	2949	241	101	28097
2016	7124	2762	2378	3096	253	106	29501
2017	7480	2900	2497	3251	266	111	30977
2018	7854	3045	2621	3413	279	117	32525
2019	8247	3197	2753	3584	293	123	34152
2020	8659	3357	2890	3763	308	129	35859
2021	9092	3525	3035	3951	323	135	37652
2022	9547	3701	3186	4149	339	142	39535
2023	10024	3886	3346	4356	356	149	41511
2024	10526	4081	3513	4574	374	157	43587
2025	11052	4285	3689	4803	393	164	45766
2026	11605	4499	3873	5043	412	173	48055
2027	12185	4724	4067	5295	433	181	50457
2028	12794	4960	4270	5560	455	190	52980
2029	13434	5208	4484	5838	477	200	55629
2030	14105	5469	4708	6130	501	210	58411
2031	14811	5742	4943	6436	526	220	61331
2032	15551	6029	5190	6758	553	231	64398
2033	16329	6331	5450	7096	580	243	67618
2034	17145	6647	5722	7451	609	255	70999
2035	18002	6980	6008	7824	640	268	74549

Note: x: Added induced/generated traffic at the opening year.

INDUCED AND GENERATED TRAFFIC

After improvement of existing facilities, traffic of other roads may be attracted to improve roads for better road geometric, riding quality, lesser travel time, shorter distance etc. Existing traffic may be capable to generate more trip due lesser travel time/increasing travel speed for the up gradation of the road. This traffic is assumed at 10 % of traffic at the time of opening. Year 2004 is the year of opening. Traffic at this year is obtained by multiplying projected 2004 year traffic by 1.1 and shown in Table 1.Tollable traffic is determined based on growth rate factor 0.05 for all vehicles as mentioned in MCA Guideline .

TOLL RATE

Toll rate is selected by using guidelines prepared by the Government of India. Inflation rate has been determined based on Reserve Bank of India Bulletin; 2000.Whole Price Index (WPI) for all commodities is shown in Table 2.

Table 2 : Whole Price Index

Year	WPI (All Commodities) (1982=100)	Actual growth (%)
1985-86	125	-
1986-87	132.7	6.16
1987-88	143.5	8.14
1988-89	154.2	7.46
1989-90	165.7	7.46
1990-91	182.7	10.26
1991-92	207.8	13.74
1992-93	228.7	10.06
1993-94	247.8	8.35
1994-95	274.7	10.86
1995-96	296	7.75
1996-97	314.6	6.28
1997-98	329.8	4.83
1998-99	352.4	6.85
January 2000	364.9	4.26
AACGR(%) 1986-1999		**8.30**

Using this value, future toll rate has been projected for future year and toll rate for the opening year, 2004 is mentioned in Table 3.Toll rate increasing factor for the year 2004 is 1.0837=1.74.

Table 3: Toll Rate Per /Km Vehicle Wise

Year	Car	Full Bus	Multi Axle	LCV	2A,3A Truck
Toll Rate Rs (1997)	0.40	1.40	3.00	0.70	1.40
Toll Rate Rs (2004)*	0.69	2.40	5.20	1.20	2.40

Note: Toll rate in 2004 is obtained by multiplying toll rate in 1997 by 1.74.

PROJECT COST

The project road is 11 km long and project cost worked out and was found to be Rs 41 million per km (2000 costing).The cost of anti glare screen barrier is also added in the analysis.

FINANCIAL ANALYSIS

Financial analysis has been carried out taking the following major cost components:

❁ Project Cost (Rs 41 million per km);
❁ Annual Routine Maintenance(repair of potholes, clearing C D structure etc) Cost(Rs 0.2 million per km);
❁ Periodic Maintenance(Thin overlay every 3 to 5 years) Cost(Rs 2.8 million per km); and
❁ Toll Operation(Toll administrative cost) Cost(Rs 6 million for toll plaza).

CONCESSION PERIODS

Concession periods are determined based on the following considerations.

❁ BASED ON MCA GUIDELINES

Concession period has been determined based on MCA guidelines and found the concession period to be 31 years.Debt equity ratio varies from 90:10 to 10:90 and FIRR and discount rate are calculated and shown in Table 4.

Table 4 : Concession Period Based on FIRR

Debt %	Equity %	Max Promoter FIRR %	Discount Rate* %
90	10	15.59	15.5
80	20	16.23	16
70	30	16.90	16.5
60	40	16.51	17
50	50	16.23	17.5
40	60	15.99	18
30	70	15.88	18.5
20	80	15.64	19
10	90	15.5	19.5
* Discount Rate=Int(debt)* % of Debt+Equity Return * % of Equity IRR ≥ Discount Rate			

From the above table, it has been found that promoter IRR is dependent of debt equity ratio. Maximum FIRR is found for debt equity ratio 70/30.

❁ GOVERNMENT SUBSIDY

20 % subsidy is required for the viability of the project. Concession period may be determined based on Government subsidy. Concession period is found 29 years.

❁ MINIMUM AND MAXIMUM FIRR OF PROJECT AND PROMOTER

Concession period range is determined based on varying debt equity ratio and shown in Table 5 .

Debt/Equity Ratio	Minimum FIRR and Year %		Maximum FIRR and Year %	
	FIRR	Year	FIRR	Year
90/10	15.0	29	15.59	31
80/20	15.0	25.5	16.23	31
70/30	15.0	27	16.90	31
60/40	15.0	26	16.51	31
50/50	15.0	26.2	16.23	31
40/60	15.0	27.8	15.99	31
30/70	15.0	28	15.88	31
20/80	15.0	28.8	15.64	31
10/90	15.0	29	15.5	31

☸CONCESSION PERIOD BASED ON LEVEL OF SERVICE

I R C: 64-1990 is used in India to determine design service volume and capacity of a road for various lane configurations. A two lanes road is to be upgraded to four lanes when the capacity of the existing road exceeds 15,000 PCU/Day and maximum design service volume recommended 40,000 PCU/Day (Capacity 80,000 PCU/Day) for four lanes with paved shoulder for LoS B. Volume/capacity ratio is 0.5 for LoS B. This value increased to 0.7 for Los C , 0.85 for LoS D and 1 for LoS E. For a BOT Project, thr Government may allow to operate road with LoS B and maximum Los C or D. Minimum concession period is the year when capacity of the road just exceeds LoS B and maximum concession period ,capacity exceeds=80,000 * 0.85=68,000 PCU/Day. From table 1, minimum and maximum concession periods are 21 and 32 years respectively considering 2004 is the opening year.

SUMMARY OF CONCESSION PERIODS

Concession period ranges have been determined by various methods and summarized and shown in Table 5.

Table 5: Summary of Concession Period

Method Used	Minimum Concession Period(Year)	Maximum Concession Period(Year)
Level of Service	21	32
Government subsidy up to 20 %	31	
Based on Promoter FIRR	25.5	31
Based on Optimum Debt Equity Ratio(Maximum FIRR)	27	31
MCA Guideline(Refer Table 1)	31	

CONCLUSIONS

One of the key factors of a BOT project is the length of the concession period. The concession period directly affects both the investors and the government's interest. In general, the longer the concession period, the beneficial it is to the promoter, but prolonged concession period may result in a loss to the public. On the other hand, if the concession period is too short, the investor will either reject the contract or will be forced to increase the toll rate and uncertain level of profit. The establishment of this agreement is usually based on project cash flow measured by NPV. Traditionally, this cash flow is a deterministic flow, and agreed upon by both sides. This paper argues that various factors exist in the process of determining concession period and that they have significant impact to project cash flow/NPV/FIRR. Concession period should be determined considering all these factors mentioned in this paper to determine the expected concession period. The selection of an expected concession period in committing a BOT contract is described in this study considering concession period ranges based variation of debt equity ratio ranges, government's subsidy ranges, Project/Promoter FIRR ranges and Level of service. These factors determine a concession period satisfying all risk factors and the approach is more logical and practical.

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