Third International Conference on Construction in the 21st Centaury (CITC-III)
"Advance Engineering, Management and Technology"
15-17, September 2005, Athens

Comparative Analysis of BOOT and BOT System For Project Delivery of Public Projects

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Abstract:
Due to increasing worldwide trend of privatisation through the concept of Public Private Partnership (PPP), most of the projects in developed countries are being delivered through Build Own Operate and Transfer (BOOT) as a procurement tool. In BOOT private party returns the entire facility to government after certain period of operation. This involves high amount of risks through out the project at construction, operation and maintenance stages of the project. Effective legal, political, financial scenario planning and sound risks mitigation strategies can overcome most of the project risks. In a developing country such as India, projects are still being delivered through an annuity kind of Build Operate and Transfer (BOT) system, in that mainly government takes traffic risk for the project and the project developer has only the right to maintain the facilities at an agreed fee. Main objective of this study is to compare the standard BOOT delivery system with the annuity BOT system used for projects in India. Two transport area projects from developing countries namely India and Colombia have been selected as case studies. A hypothetical Net Present Value (NPV) for government after the concession period has been determined. The analysis indicates that for Indian situation in BOOT kind of project delivery after the concession period (once facility returns to government) have a negative NPV within assumed economic life of infrastructure. The study concludes that a win-win solution is feasible through a BOOT system for delivery of a project with careful planning and proper constraints.

Keywords:
Risk Management, Finance Management, Project Management, Life cycle costing, NPV

1. Introduction:

Objective of the paper is to compare which kind of delivery would be better for a government in terms of achieving positive cash flow within the economic life of a project after it is returned to the government. The shortage of public funds to finance the construction of new infrastructure projects and the rehabilitation of existing facilities, coupled with increased demands for capital sources has contributed to the creation or resurgence of the alternative form of project procurement. There are well-published examples of BOOT and BOT projects where private sectors became responsible for project promotion.

Case studies in Columbia and India were selected as both countries are considered to be in developing stage and in need of infrastructures to be created.

2. BOOT Approach:

The BOOT approach to infrastructure delivery, where the private sector finance, design, build, own, operate, maintain the facility and then transfer it to the government after the specified concession period, is popular in developed countries. The opportunity for profit and reward, however, does not come easily. The responsibilities heavy and the stakes are high (Tiong 1995). There are risks involved during design, construction, operation, maintenance and commissioning stages. Sound risks allocation and contractual issues need to be embedded in contract. Generally, the private party takes risk during design, construction and operation stages. Based on the type of contract, while support during operation stage may be provided by the government.

3. Annuity Approach:

The Annuity BOT approach to the infrastructure delivery; where private sector designs and builds the facility, maintains it under a performance-based contract where the risks are shared. Private party carries all the risks pertaining to the design and construction while the government will carry the risk of traffic fluctuations and maintenance. Annuity BOT delivery is used in India where government itself is responsible for project finance and promotion while the private party is contracted to provide maintenance where most of the risks are borne by the government.

Worldwide adoption of the new procurement methods by the governments has occurred due to:

- Needs to get the projects done.
- Unwillingness of government to finance the infrastructure projects.
- Availability of project finance from lending institutions and investors.

Viability of infrastructure projects would generally be based on economic criteria such as NPV analysis, Internal Rate of Return (IRR) or Payback Period. To keep the interest of private party and government, it is important that NPV is positive; IRR is greater than Minimum Attractive Rate of Return (MARR).

4. Financial Model:

A model based on an Excel spreadsheet is developed that can be used for appraisal of the investment in an infrastructure project financed by either public or private sector. Model also facilitates risk analysis. The model is adopted from the work by Ranasinghe (1996). The total project cost (TPC) is defied as:
TPC = BC + EDC + IDC, Where BC is the base cost or constant value cost of the project estimated at market prices of a predetermined year. EDC is the cost escalation during construction period and IDC is the interest cost during construction. The base cost BC of a project consisting of *n* constant value annual cash flows A0, *A*1, *A*2,…….., *An*-1, where the first cash flow *A*0 is assumed to occur at time zero and the *n*th cash flow *An*-1 at the end of the (*n*-1) th time period, was given as

$$BC = \sum_{J=0}^{n-1} Aj$$

In most infrastructure development projects the clients have to contribute an equity portion (Ranasinghe, 1996 [4]). This is also true for the BOT/ BOOT projects where promoters have to contribute about 15 to 30%

of the project cost as equity (David and Fernando1994; Tiong, 1995). Tung (1996) shows that NPV is the preferred method for selection of capital projects as it has only one simple decision criteria without exception and encounters no computational problems and requires few steps in calculation. The formulae and other equations have been removed to fit the page limit but can be ascertained from listed references.

1. Project Cases:

Table 1: Projects Profile

Description	*Allahabad Project (1998)*	*Colombian toll road (1998)*
Case profile	The performance of national highway system in India has been poor by international standard due to serious road capacity constraint on the core national highway network; poor management of road infrastructure; inadequate institutional capacity for development, management and operation of national highways; with total value of US $314.66million	The project has an operation period of 20 years and a construction period of 4 years. The project cost included an US$ 137.1 million contribution by INVIAS (Colombia's national institute of road).
Borrower	Government of India	Republic of Columbia
Responsible agency	National highway authority of India	INVIAS, Colombia's national institute of road
Inflation rate	9%	5%

Table 1: Projects Profile (continued)

Description	*Allahabad Project (1998)*	*Colombian toll road (1998)*
Interest rate	10%	7%
Discount rate	10%	7%
Economic Life	45 years	45 years

IRR (Assume)	20%	20%
Project Costs	□□ Total Project Cost US $314.66 □□ Civil work cost (84.7Km) $240.41 million □□ Supervision of civil work $m 13.68 million □□ Land acquisition, resettlement and Utility relocation $39.08 million □□ Corridor management $21.19 million □□ Institutional strengthening $0.30 million	□□ Total Turnkey contract US $496.6 million □□ Development, Engineering, construction management $18.5 million □□ Government supervision $4.0 million □□□ Financing fees and IDC $53.2 million □□□ Annual maintenance cost $4.5 million □□□ Tunnel maintenance cost 1% of investment □□□ Periodical maintenance 0.88 □□□ Foreign exchange premium 6.4%
Traffic variable	□□ AADT in commencement year 7,500 vehicles/day □□ Traffic Growth: 5% per annum 7 to 37 years (Assumed)	□□ AADT in commencement year 5,400 vehicles/day □□ Traffic Growth: 3% per annum on new road

Table 1: Projects Profile (continued)

Description	*Allahabad Project (1998)*	*Colombian toll road (1998)*
Toll rate	$0.35/km average	$0.40/km average

Assume parameters	□□$60 on land value to $200,000 plus 0.2 cents for each dollar in excess of $200,000. □□ 0.8725 cents per dollar of value of property	Income tax 35.05% Asset tax base 1.5%Equity tax base 5.0% Municipalities 1%

6. Analysis of the Net Present Value in BOOT Contract:

6.1 Colombian Toll Road Project:

Analysis of Net Present Value (‘000)

Years	Inflow	Outflow	Net NPV	Years	Inflow	Outflow	Net NPV
1998	10.45	15.3	-4.85	2014	118.2	54	64.2
1999	21.72	134	-112.287	2015	129.3	58.5	70.8
2001	28.46	200	-171.54	2016	139	60.21	78.79
2002	38.88	138	-99.12	2017	151.1	63.04	88.06
2003	45.82	47	-1.18	2018	120	60.15	59.85
2004	50.59	38.5	12.09	2022	63	18.33	44.67
2005	54.59	35.5	19.06	2028	60	36.28	23.72
2006	59.35	32.5	26.85	2030	60	43.33	16.67
2007	65.68	30.26	35.42	2033	50	50	0
2008	70.12	32.28	37.84	2036	50	64	-16
2009	75.38	34.5	40.88	2037	45	67	-22
2010	82.15	36.5	45.65	2040	38	76	-31
2011	92.45	38.5	53.95	2041	36	79	-32
2012	101.34	48.06	53.28	2042	34	82	-35
2013	110.1	52	58.1	2045	32	91	-46

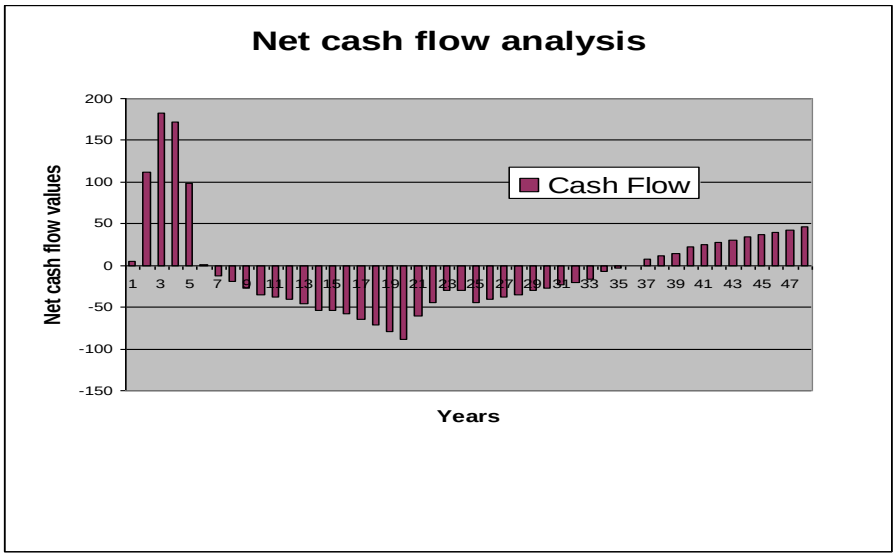

Fig 1: Analysis of Net Cash Flow in Colombian Toll Road Project

6.2 Allahabad Bypass Project:

Table2: Analysis of Net Present Value in Allahabad Bypass Project:

Years	Expenditure (‘000)	Inflow	NPV	Years	Inflow	Outflow	NPV
2004	60901.27	47367.92	60821439.15	2019	7538.29	359472.9	6932437.089
2005	55368.33	91757.74	55213682.7	2020	7105.765	358682.9	6501243.713
2006	54173.94	132807.3	5350111.95	2021	6689.581	356291.8	6089089.675
2007	51810.23	170291.3	51523223.74	2022	6290.342	352485.9	5696264.73
2008	39413.11	204095.6	39069123.86	2023	5908.406	347440.8	5322831.523
2009	24145.39	234194.5	23750685.08	2024	5543.926	341321.1	4968666.035
2010	11874.21	260632.6	11434943.58	2028	4258.26	308993.1	3737485.548

Table2: Analysis of Net Present Value in Allahabad Bypass Project (continued)

Years	Expenditure (‘000)	Inflow	NPV	Years	Inflow	Outflow	NPV

2011	11390.77	283508.7	10912943.09	2030	3714.134	289836	3225646.711
2012	10897.09	302962.7	10386475.2	2035	2608.746	239123.5	2205728.798
2013	10399.03	319165	9861109.225	2036	2426.598	229021.7	2040606.728
2014	9901.467	332307.1	9341398.496	2037	2256.008	219047.1	1886827.938
2015	9408.429	342594.3	8831022.767	2040	1807.692	190221.7	1487094.047
2016	8923.204	350239.4	8332912.722	2041	1677.514	181065.6	1372347.578
2017	8448.446	355458.5	7849358.787	2042	1556.065	172167.8	1265894.811
2018	7986.262	358466.1	7382106.072	2045	1239.085	147145.2	991087.5771

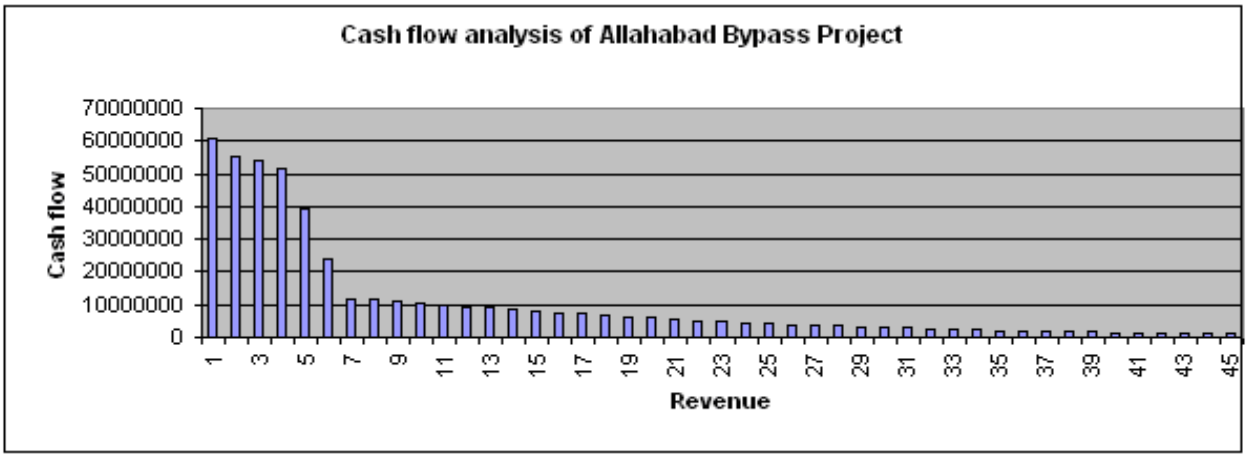

Fig 2: Analysis of Cash Flow in Allahabad Bypass Project

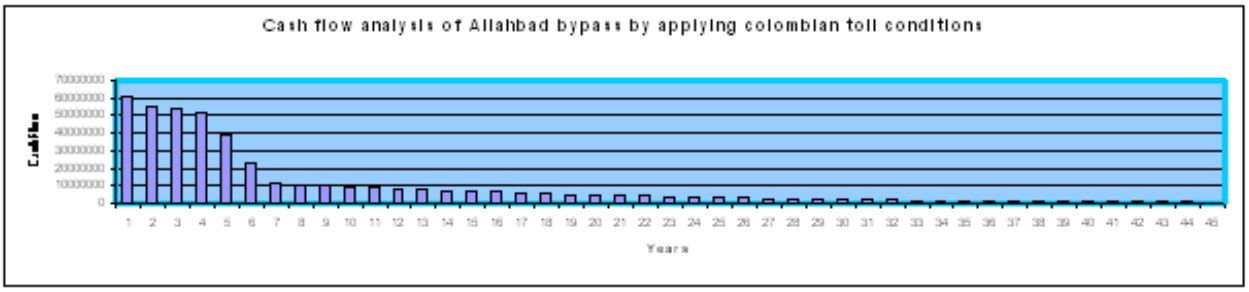

Fig 3: Analysis of cash flow in Allahabad bypass project with application of toll rate same as Colombian project.

Discussion:

It can be seen from the cash flow graph that government of Columbia receives a positive return after 37 years of operation. This is due to the fact that market forces have been allowed to operate and toll charges are based on user pay system. Referring to above analysis of cash flows within the expected economic life of the infrastructure, it seems clear from cash flow profile of Allahabad project that it is not possible for Indian government to achieve a positive return from the project. The toll rate set by Indian government is quite low when compared with other developing countries. This is a policy decision of the Indian government where public transport is subsidized and tolls are artificially kept low. It can be seen that if the same average toll rate through out the section as the Columbian project is applied to Allahabad project, the cash flow still remains negative after 45 years, this may be due to several factors. The cost of the project may be high when compared with similar other country. The government is subsidizing the traveling public.

Conclusion:

From analysis of Allahabad bypass project, it is clear that Indian Government will not get positive cash flow within the economic life of the infrastructure project from the tolls charged. In case of Colombian toll project it does get positive net present value which clearly indicates difference between two procurement methods and the policy adopted by the two governments. In case if India, the toll is subsidized while in case of Colombian project 'user pay'principle is adopted to set the toll rate. The difference also indicates the impact of different procurement methods adopted. In Colombian case the risks are borne by the private consortium while in Indian case the risks are borne by the Government.

The paper suggests the need for identification of procurement method, allocation of risks between government and private party and determination of concession period.These are the key parameters to achieve win-win situation in a country with different legal, political and financial requirements.

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