

Build-Operate-Transfer in Infrastructure Projects in the United States

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Abstract: While the infrastructure in the United States is in need of large and immediate investment, the funds provided by public agencies are not nearly sufficient to face such a challenge. Build-operate-transfer (BOT) is a delivery/financing system that can be a solution to this problem. In this system, a private sponsor finances the design, construction, maintenance, and operation of a public project for a specified concession period, at the end of which it transfers ownership to the government agency, hopefully after recouping its costs and achieving profits. A questionnaire survey of large municipalities and state departments of transportation was conducted to determine the extent to which they are using BOT in their large projects, to investigate the implementation of BOT, and the reasons why some government agencies avoid using BOT. The findings indicate that very few agencies use BOT. The reasons why most do not use BOT were reported by the respondents to be the availability of proven alternatives and enough funds, the existence of political barriers, and resistance to change both on the part of government agencies and private sponsors. When government agencies and private sponsors explore the use of BOT, they should avoid the pitfalls perceived by the respondents in this study.

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Introduction

Public facilities known as infrastructure are vital to the nation's production and distribution of economic output as well as to its citizens' overall quality of life. Infrastructure shapes the urban environment physically, socially, politically, economically, and environmentally, and may be considered to be the skeleton on which urban society is built (Jones et al. 2004). Infrastructure includes highways, railways, ports, tunnels, bridges, power plants, hydraulic structures, mass transit, municipal facilities, and similar public facilities with the primary function of serving public needs, providing social services and promoting private economic activities (Shen et al. 1996). Having adequate infrastructure requires having adequate funding to construct and maintain that infrastructure (Jones et al. 2004). In general, implementing infrastructure projects require a large capital investment (Shen and Wu 2005).

The financing of infrastructure projects has gained importance

as the size and complexity of these projects increased in the last 2 decades. The immediate need for such projects coupled with chronic budget shortages experienced by public agencies encouraged the use of innovative financing (Zhang and Kumaraswamy 2001; Zhang 2004). Even though public owners are normally responsible for providing financing, in some cases, financing may be relegated to an outside party's responsibility. In this regard, build-operate-transfer (BOT) has established itself as a valid delivery/financing system, whereby a private sponsor (an individual private entity or a consortium of investors) finances the design, construction, maintenance, and operation of a public project for a specified concession period, at the end of which it transfers ownership to the government agency, hopefully after recouping its costs and achieving profits (Schaufelberger and Wipadapisut 2003). The main idea behind using BOT is to alleviate the spending on governments' budgets by seeking capital from external financiers especially on large-scale projects. The BOT contractual arrangement provides a mechanism for using private finance; and thus it allows governments to construct more infrastructure services without the use of additional public funds (Shen and Wu 2005). BOT gives the governments the best of both worlds—the benefit of more infrastructure projects being built, without the burden of additional public borrowing. At the same time, BOT opens up opportunities for contractors to penetrate an expanding market for infrastructure project construction and operation, with reduced government involvement and a greater opportunity to earn profits (Ngee et al. 1997). BOT is appropriate in projects that are economically viable and could assure a reasonable rate of return enough to attract investors.

Project participants include the granting authority, usually a government agency; the project sponsor; and usually one or more financial institutions. The granting authority identifies project requirements, establishes the concession period, solicits tenders, and awards the contract. The project sponsor typically is

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a consortium or a joint venture of engineering, construction, and venture capital firms. Investment capital may come from commercial banks, insurance companies, or the sale of bonds (Schaufelberger and Wipadapisut 2003). Different versions of the contractual structure of BOT can be seen in the form of concise diagrams presented by Ngee et al. (1997) and Kumarasawamy and Morris (2002).

The current condition of the infrastructure in the United States received a poor average grade (D) in a recent ASCE report card for America's infrastructure (ASCE 2005). Grades were assigned on the basis of condition and capacity, and funding versus need (ASCE 2005). The ASCE report was based on the outcomes of a panel of 24 of the nation's leading civil engineers, the analysis of hundreds of studies, reports and other sources, and the survey of more than 2,000 engineers (ASCE 2005). The ASCE report concluded that \$1.6 trillion is needed over the next 5 years to improve the condition of the infrastructure in the United States (ASCE 2005).

While the infrastructure in the United States is in need of large and immediate investment, the funds provided by public agencies are not nearly sufficient to face such a challenge (ASCE 2005). In the absence of sufficient public funds for infrastructure projects, it makes sense to explore innovative financing models such as BOT that were successfully used in developing countries, which are faced by much the same problems as local, state, and federal agencies in the United States (Shen and Wu 2005). Privatization is seen by some as one of the solutions to the current condition of the infrastructure of the United States (Jones et al. 2004).

The objectives of this study are to determine to what extent government agencies in the United States are using BOT in their large projects, to investigate the implementation of BOT, and the reasons why some government agencies avoid using BOT. For this purpose, a questionnaire survey was conducted of large municipalities and state departments of transportation.

BOT Project Financing

Project financing involves the raising of funds to finance an economically feasible capital investment project by issuing securities that are designed to be serviced and redeemed exclusively out of project cash flow. Project financing requires careful financial engineering to allocate the risk and rewards among the involved parties in a manner that is acceptable to all parties. Schaufelberger and Wipadapisut (2003) developed a decision model that can be used by BOT project sponsors in selecting appropriate financing strategies based on the analysis of 13 transportation and power generation BOT projects in North America and Asia. The findings of this study suggest that project risks, project conditions, and availability of financing are the major considerations in selecting a financing strategy. In a recent study by Xenidis and Angelides (2005), 27 BOT financial risks are identified and their content is presented, in detail, to provide the risk analysts involved in BOT projects with a comprehensive list of contingencies and risks associated with the economic aspect of the development of such projects. These risks are classified considering both the project's lifecycle phase and the source for each risk.

Infrastructure projects are usually considered to be necessary for industrialization and economic growth and have been traditionally the government's responsibility. These projects mainly cause large budget deficits, debts, and cutbacks in other sectors

such as health, education, and social welfare. BOT may be used when the aging infrastructure needs to be improved even though the government is strapped for revenues (rapidly growing demand in services and financial shortage) (Shen and Wu 2005).

Many sources of capital for project financing are available including national commercial banks, leasing companies, institutional investors, individuals, investment management companies, foreign investors, customers, suppliers, government agencies, export agencies, and international agencies (Nevitt 1980). But the public customer must decide whether it can afford to finance the project with its own debt or whether a different financing approach such as BOT would be preferable. The public customer would weigh the tradeoffs with respect to quality, cost, and schedule. The gap between a public customer's objectives and available resources would determine the financing approach. If resources are limited, then an innovative project delivery and financing method is needed (Sweeney 2001).

After World War II most public projects were built under government supervision and financing. An alternative way was needed in the 1980s due to some dramatic changes particularly in developing countries. First, the infrastructure needed to be upgraded due to population and economic growth. Second, the growing debt of developing countries had limited borrowing capacity and budgetary resources. Third, the major international companies were busy in the middle 1970s in the oil rich countries, but by the early 1980s they had experienced a downturn in business. They were looking for a creative approach to promote projects. Finally, in the middle of the 1980s a number of countries as well as the international lending institutions had become interested in the "privatization" of traditional public enterprises, whereby the process in which goods or services delivered by the government are shifted to the private sector (Augenblick and Custer 1990). Privatization can take the form of: (1) contracting for defined services and supplies; (2) contracting for large-scale operation and maintenance of the relevant infrastructure; (3) contracting for the design, construction, and operation of new infrastructure (typically BOT); and (4) selling infrastructure assets to a private company (NAS 2002).

BOT is fashionable worldwide, especially in developing countries, to attract private capital to assist in developing public infrastructure (Shen and Wu 2005). The first BOT project officially implemented in modern times was in the mid-1980s, as part of a move to privatize infrastructure projects and large power plants in Turkey. The BOT method was used as early as 1834 when the Egyptian government was financially supported by European capital to build the Suez Canal (Levy 1996).

Financing has replaced the availability of technology and expertise as the main problem in infrastructure development around the world. After years of large cost overruns and numerous change orders on 100% publicly funded projects, many governments started seeking greater efficiency by centralizing the management and control of complex projects in the hands of private experts. Public deficits, resistance to taxes, and a shift among development strategists toward private investment incentives have created opportunities for private companies and public agencies to cooperate in the form of BOT projects. Ideally, BOT projects put large, well-capitalized private firms at the service of governments with a strong commitment to economic development, in the process of finding design and construction efficiencies, reducing the drain on the public purse, and distributing risks and rewards fairly (Reinhardt 1993; Yang and Meng 1998). The success of BOT projects depends on the motivations of a market

Table 1. Status and Impact of Condition of Infrastructure across United States (ASCE 2005)

Infrastructure facility	Status	Impact
Aviation facilities	Enormous increases in the number of passengers and flights and larger planes represent a significant challenge for airports' current infrastructure and looming air traffic control system.	More congestion.
Bridges	27.1% structurally deficient or functionally obsolete.	Speed and weight limits, delays and increases in hauling cost due to lengthy detours and more traffic congestion.
Dams	10,213 high-hazard potential dams, 3,500 unsafe dams.	Large floods, direct risk to human life.
Rail transit facilities	1/5 in poor condition.	Curtailed services.
Deep-draft shipping ports	Confronted with service access problems.	Delays and increases in shipping cost.
Inland waterways	47% of locks are more than 60 years old. Many are small to handle barges.	Delays and increases in shipping cost.
Drinking water piping system	Annual shortfall of at least \$11 billion to replace aging facilities and to comply with existing and future federal water regulations.	Leaks, contaminations, and illnesses.
Roads	33% in poor, mediocre, or fair condition.	Lost productivity, travel delays, wasted fuel, fatal highway accidents, medical costs, and insurance and legal costs.
Waste water treatment facilities	Many of the nation's 16,000 wastewater treatment systems are in poor condition due to a lack of investment in plant, equipment, and other capital improvements over the years.	Inadequate for cleaning up, overflows, and human health and environmental problems caused by pollution.

economy that benefit all parties (government, end user, and sponsor) (Li et al. 2005).

Since the late 1700s, the existence of privately built and operated public facilities was commonplace in the United States. But after World War II, even though some national agencies have successfully tested BOT on their projects and despite the extensive use of BOT and its variations in many countries around the world, many United States public agencies were still reluctant to implement BOT in their projects. Ashley et al. (1998) pointed out that there is a limited history of public-private partnership projects in the North American market. According to Zhang and Kumaraswamy (2001), countries in need of BOT-type infrastructure development should learn lessons from projects that have assisted the Hong Kong government to develop a well-structured BOT process.

According to Cohen (1995), in the recessions of the 1980s and 1990s, the federal government transformed many federal programs into block grants (money from the federal budget granted to state or local governments to spend on local services), cut funding levels, and handed them over to state and local governments. This led to fewer infrastructure projects being built. According to Jones et al. (2004), there is a chronic underinvestment in the nation's infrastructure that is threatening our national economy and living standards. The ASCE report (2005) examines the status and impact of the condition of various categories of infrastructure as shown in Table 1, where one can observe that the overall condition of the United States infrastructure is not good. The Economic Policy Institute (EPI) compared the infrastructure investment in industrialized nations and found that the United States ranked dead last in terms of infrastructure investment as percentage of gross domestic product. In 1992, Japan invested roughly three times as much in infrastructure as the United States

(Cohen 1995). A source of financing has to be developed to meet the transportation and environmental infrastructure needs in the United States since public funds for these urgently needed infrastructure projects are not sufficient.

BOT Project Delivery Variations

The BOT system involves the investment of private risk capital to design, finance, construct, operate, and maintain a project for public use for a specific term during which a private sponsor (an individual entity or an investment consortium) is able to collect revenue from the use of the facility. The private sponsor charges the users appropriate fees not exceeding those proposed in the bid. When the consortium's limited term of ownership expires, the title to the project reverts to the government. By then, the consortium expects to have collected enough revenue to recapture its investment and make a profit on the investment (Levy 1996). A number of variations have been used on different occasions.

1. Build-own-operate (BOO): The private entity possesses the ownership and has no obligation to transfer it to the government. BOO's incentive to the sponsor involves recouping the invested cost within a timeframe set by the sponsor (Isr 2001). The disadvantage of this approach to the government is that the private sponsor owns the public facility to operate forever. Also, the government may have political difficulty in exercising administrative power to assist a private entity in owning a public facility even if the intention is to promote public welfare. Finally, when a different private entity is to take charge of the operation, it is the government's obligation to pay special attention to the interface between the new and

old operators, by making sure that the new operator understands the system characteristics well, and the new personnel in charge is well trained (Liao 2000).

2. Build-transfer-operate (BTO): The transfer of the ownership to the government takes place before operation starts by the private sponsor. A concession period is given to the sponsor to operate the facility in return for either a certain payment by the government or for the right to collect revenues from users to cover their cost while the facility is owned by the government all through the concession period (Isr 2001). This scheme reduces the insurance cost to the sponsor during the operation period (Levy 1996).
3. Build-operate and renewal of the concession (BOR): This is a contractual agreement similar to the standard BOT agreement except that the private sponsor has the right to request a negotiation for the renewal of the concession at the end of the term.
4. Build-lease-own (BLO): The private sponsor possesses the ownership of the facility after completion of construction and leases the facility to the government for long-lasting operation (no transfer). The government is responsible for the operation, maintenance, replenishment, and replacement of assets, and pays attention to the interface between construction and operation (Liao 2000).
5. Build-lease-transfer (BLT): The private sponsor rents or leases the constructed facility to the government and/or others for a concession period until it recoups its investment before transferring the ownership of the facility to the government (Isr 2001).

Research Methodology

Using the information collected in the literature survey and presented in the preceding two sections, a short questionnaire was designed to investigate the use of BOT by municipal and state government agencies in the United States (see the Appendix). The survey was mailed to 98 respondents in charge of large project procurement in large cities and in state departments of transportation. Large cities are defined as cities with a population of 1 million inhabitants or more in their metropolitan areas. They constitute the top 48 metropolitan areas in the United States according to the Geography web site, the 48 Metropolitan Areas with a Population above One Million, Ranked, (<http://geography.about.com/library/weekly/aa122099c.htm>) (accessed in June 2002). Large cities and state departments of transportation are likely to commission large projects and as a consequence may be using or planning to use the BOT financing/delivery method in carrying out their projects. The questionnaire was mailed to the mayors of these 48 cities and to the officials of the 50 state departments of transportation.

The first question of the questionnaire asks if the BOT financing/delivery method is used in large projects commissioned by the respondent's organization. If it is not, the respondent is directed to go to a question which seeks the respondent's opinion concerning why the BOT financing/delivery method or a variation is not used.

The respondents answered the remaining questions only if BOT was used by their organization. These questions seek information about the reasons why BOT is used, the difficulties encountered while implementing BOT, the methods of financing used by private entities, the types of projects involved in BOT

applications, and whether any BOT variations are used.

A total of 61 responses were received out of the 98 questionnaires sent out, accounting for 28 out of the largest 48 cities across the nation, and 33 out of the 50 state departments of transportation. This translates into an overall rate of response of 62%.

Findings and Discussion

Only 12% (seven out of 61) of the respondents reported using the BOT method of delivery/financing or a variation in their large projects. They include two municipalities (Las Vegas and Houston) and five state departments of transportation (California, Colorado, Massachusetts, South Carolina, and Virginia). In addition, Levy (1996) reported that Arizona and Washington had enacted laws for using BOT and evaluated many RFPs to build large state projects, but had not commissioned any BOT projects.

The findings concerning the details of BTO implementation are based on the responses obtained from these seven respondents who reported using BOT or a variation in at least one large project. No statistical inference is possible given the small number of respondents. The findings are therefore presented below with no attempt at generalization.

Some of the seven respondents marked more than one reason why they used BOT or a variation. Five respondents reported using BOT to overcome their budget deficit, a situation quite common in many municipalities and states, Report of the Budget and Finance Committee Discussing the (Los Angeles) Mayor's Proposed Budget for 2007–2008, (http://161.149.240/clkc/budget/clkc/budget106945300_05182007.pdf) (accessed June 2007); Shrinking Budget Gap: Wall Street and Real Estate put \$3.3B in City Coffers, (http://www.nydailynews.com/news/2006/11/02/2006-11-02_shrinking_budget_gap_wall_street_real_e.html) (accessed June 2007); Cities Get and Spending More, (<http://pgasb.pgarchive.com/chicagotribune/access/1128929071.html?dids=1128929071:1128929071&FMT=ABS&FMFS=ABS:FT&type=current&date=Sep+18%2C+2006&author=Liam+Ford%2C+Tribune+staff+reporter&pub=Chicago+Tribune&edition+&startpage=3&desc=Cities+get+and+spend+more+>) (accessed June 2007); (http://news.mpr.org/features/200201/03_mccalluml_sos/sos.shtml). Four respondents wanted to overcome the deficiencies of the existing delivery/financing methods, particularly of the shortcomings of the traditional design/bid/build system. Two respondents' reason was to reduce public spending, a reason associated with budget shortfalls in the face of the multitude of desirable investments.

It was found that some respondents encountered more than one difficulty when using the BOT delivery/financing method. Three respondents reported that they faced legal obstructions while implementing BOT. Since BOT is not commonly used as a delivery method, it normally needs special legislation by governments. Three respondents met citizens' opposition, which is expected because such projects would be funded by private money that will directly be recouped through payments by citizens or indirectly through government payments after raising taxes. Conflict of interest was a problem to only two respondents. Only one respondent met resistance by small contractors to embark in such ventures, believing that they would not be able to compete with larger contractors with access to larger financial resources. Hesitance of the private sector or reluctance by lenders was not a problem to any respondent.

The respondents reported that four sponsors financed their projects using loans: Two used equity, while another two used

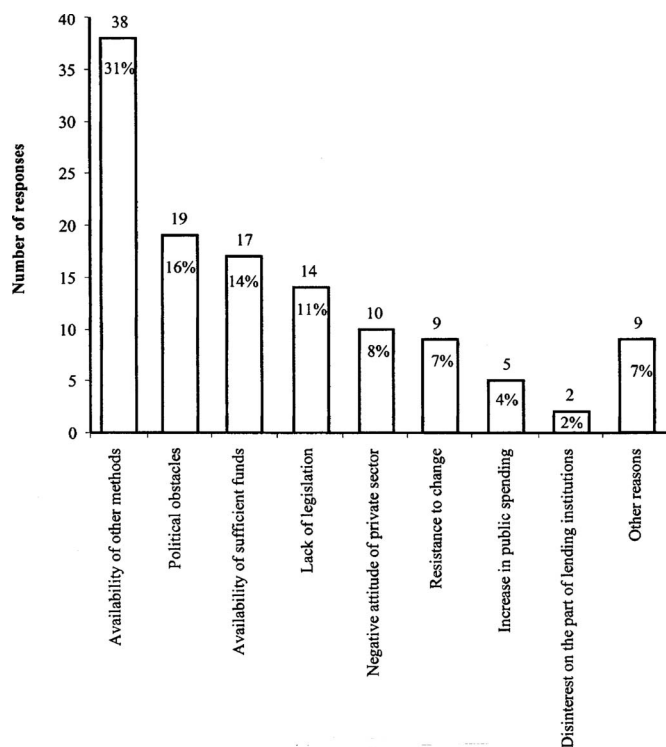


Fig. 1. Reasons why BOT is not used in the United States

subordinate loans. Another type of financing that was noted under the “others” option was using bonds.

The respondents reported that BOT was used in highway projects by five organizations, in bridge projects by two, and in a golf course project by one organization. Finally, three respondents reported using variations of BOT in the form of BTO and BLO. BOT variations are perceived by public owners as alternatives that allow them to meet their requirements and yet accommodate their financial and administrative capabilities.

Why BOT Is Not Being Used in the United States

The 61 respondents’ answers to the question concerning why BOT or a variation was not used in their large projects can be seen in Fig. 1. In this bar chart, the number of responses as well as the normalized percentages (total of 100%) of the responses are given. One should note that a respondent may have picked more than one reason.

1. *Availability of other methods:* Thirty one percent of the responses indicated that availability of other methods of delivery/financing such as design/bid/build, design/build, construction management, design/manage, and super turnkey is a reason for not using BOT. Some of these delivery systems are very popular and were the subject of several research studies. For example, Konchar and Sanvido (1998) found that construction management at risk, design/build, and design/bid/build are the three principal project delivery systems used in the United States today. In contrast, BOT is a relatively new approach and its adoption appears to be resisted by most public owners as evidenced by very few municipalities and state departments of transportation (only 12% of the population surveyed) that adopt its use.
2. *Political obstacles:* Sixteen percent of the responses indi-

cated that political obstacles stand in the way of using BOT. This finding is not surprising since BOT projects always need special legislation. This approach is of much concern to citizens as well as politicians. Citizens are always wary of government officials and developers making deals behind their backs. Thus politicians who seek votes have to take voters’ concerns into consideration and therefore avoid being supportive of delivery/financing methods that may be misinterpreted by the public. This finding is consistent with the results of former studies conducted by Frillet (1997), Qiao et al. (2001), and Li et al. (2005). Frillet (1997) and Li et al. (2005) revealed that social support is one of the critical success factors in public-private partnership (PPP) projects. Social support is based on the public acceptance of the concept of private provision (Li et al. 2005). Qiao et al. (2001) and Li et al. (2005) found that politics has a close relationship with the development and implementation of public policy. A positive political attitude towards the private sector involved in an infrastructure project would support the growth of PPP. On the other hand, inadequate political support would pose a great risk to PPP projects.

In Virginia when building the Dulles Greenway using the BOT method, most residents liked the project, but some opponents were very vocal. Thus a public relations campaign had to be launched in the communities in the vicinity of the project in order to gain more cooperation from residents before the construction process.

3. *Enough funds available:* According to 14% of the responses, sufficient funds were available in city and state budgets to make it unnecessary for these cities and states to search for an alternative financing method to build public facilities. Yet, only 1/3 of the required allocation is being committed for infrastructure development today. Despite substantial investment during the 1960s, capital assets are suffering from years of neglect, overuse, deferred maintenance, and delayed repair (Yates and Mukherjee 1994). The United States infrastructure is in a critical stage of decay and during the last 25 years there has been a dramatic reversal in the relationship between infrastructure investment and economic growth. Net public investment as a percentage of gross national product has in fact declined from a maximum of 2.3% in 1965–1969 to 0.4% in 1980–1984.

During the current economic situation that many cities and states are facing, some large cities such as New York, Chicago, and Los Angeles, and many states including New York, Illinois, California, and Minnesota are experiencing large budget deficits (www.lacity.org/councilmte/budget); (<http://www.nydailynews.com/news/local/story/3590p-3254c.html>); (http://www.ci.chi.il.us/Mayor/2002Press/news_press_budgetcuts.html) Ventura: It’s the economy, Minnesota, excerpted from Governor Jesse Ventura’s State of the State speech in 2002, (http://news.minnesota.publicradio.org/features/200201/03_mccallum_ml_sos.sos.shtml) (accessed June 2002).

The report card for America’s infrastructure (ASCE 2005) found that the United States government has allocated less than the required funding for infrastructure improvement and development. Some cities and states still have access to enough funds to promote their projects, but it is not clear how long this availability will last.

4. *Lack of legislation:* According to 11% of the responses, one of the reasons for not using BOT is the unavailability of legislation to allow the agency to adopt this method. Studies

conducted by Bennett (1998) and Li et al. (2005) indicate that an enabling regulatory, legal, and political environment is the cornerstone of sustainable private sector participation in urban infrastructure services. In most instances, the municipal or state legislature has to discuss this issue at length before legislation is enacted that regulates the use of BOT or variations. Because this is a contentious issue that can be easily manipulated, politicians need to take calculated risks to support such legislation. In general, passing BOT legislation is a lengthy and laborious process.

5. *Negative attitude of the private sector:* Eight percent of the responses reveal that BOT projects are not appealing to the private sector. The involvement of the private sector in the development and financing of public facilities and services has increased substantially over the past decade (Li et al. 2005). However, for a private consortium, promoting a BOT project to the government, the road to tendering, negotiating, and winning the BOT contract is not easy (Ngee et al. 1997). The whole process of project development is complex, time consuming, and expensive. The financial risk is high, competition is keen, negotiations are extensive, and opportunity costs are considerable (Tiong 1996). Moreover, the government may make excessive demands during negotiation and is frequently indecisive in awarding the contract (Ngee et al. 1997). Those making BOT proposals must be willing to take calculated risks, be flexible in their attitudes and stance, and their proposals must be adaptable to changing circumstances and demands by the governments (Tiong 1996).

Financing of BOT projects is a primary responsibility of the sponsor and only in some cases is governmental aid contributed. Therefore, all the risks are undertaken by the sponsor, co-operators such as investors, insurance companies, and lenders. The number of the stakeholders involved, the complexity of relations between them, the conflicting interests, and the long period of the concession are the features that create serious challenges to the stakeholders of a BOT project (Xenidis and Angelides 2005).

Project sponsors face political, financial, construction, operational, and market risks when they undertake BOT projects (Schaufelberger and Wipadapisut 2003). Three of the major challenges facing project sponsors include accurately estimating project costs, accurately projecting revenues to be generated during the concession period, and selecting the most appropriate financing strategy. The respondents probably think that there are not many projects that would attract private sector involvement in the form of a BOT arrangement in the face of the many risks and the challenges involved.

Another reason for this finding may be that the private sector is not familiar enough with BOT and therefore does not even recognize the opportunity. The history of BOT indicates that BOT is commonplace in most developing countries which need foreign investors to pursue their large infrastructure projects, whereas BOT is not a delivery/financing system that is commonly used by United States government agencies. In the absence of successful past examples and with negative accounts of taxpayer resistance, it should be hard for investors to get into BOT arrangements. Indeed, a study conducted by Ahadzi and Bowles (2004) revealed that the private sectors' past experience in privately financed infrastructure projects directly influences the performance of these projects.

6. *Resistance to change:* Seven percent of the responses indi-

cated that some government agencies may exhibit resistance to change in the context of adopting a new delivery/financing approach. The BOT method of project development may not be well understood and sometimes may not be well received by the government agencies handling it (Ngee et al. 1997). This is similar to Uhlik and Eller's (1999) finding that the reason why the design/build and construction management delivery systems are not used more often is simply because of the tendency to resist change. BOT and its variations redefine the role of government in procurement and capital programming. It compels the government to fulfill its obligations by focusing on its strengths as a policymaker, standard bearer, and regulatory agent, while inviting the private sector to contribute its capacity for innovation, specialized knowledge, and efficiency. Properly implemented, BOT and its variations may allow public owners to fashion strategies of infrastructure procurement that fulfill long-term public needs and objectives under public sector leadership (Miller et al. 2000). But the transition to a BOT system brings new challenges to public owners. Trying new delivery/financing methods may expose them to new and uncharted risks or may require new legal, financial, administrative, political, and technical arrangements to be made. Many public owners do not yet possess the required "institutional infrastructure" to deliver projects using these methods. Ahadzi and Bowles (2004) study shows that a public agency's past experience in BOT projects presumably reduces resistance to change and positively impacts the performance of these projects.

7. *Increase in public spending:* Increase in public spending provoked by BOT was a reason expressed in 4% of the responses for not using BOT. It is surprising to see that some respondents would think BOT would increase public spending instead of reducing it. Although these respondents indicated that increased public spending is a reason for not using BOT, some studies conducted on this issue revealed quite the opposite. The Massachusetts Taxpayers Foundation found in 1999 that the cost of transportation projects would leave precious few dollars for the long list of other pressing capital needs. A wide variety of important capital projects, such as college facilities, courthouse renovations, new libraries, and seaport improvements, would be sacrificed or delayed as a result. It was recommended that Massachusetts should take advantage of alternative project financing methods that offer the possibility of replacing the Commonwealth's limited capital resources by alternatives such as BOT, State's Capital Budget Reaching the Breaking Point, News release by the Massachusetts Taxpayers Foundation on January 11, 1999, (<http://www.masstaxpayers.org/data/pdf/reports/Capt99.pdf>) (accessed June 2002).
8. *Disinterest on the part of lending institutions:* Lending institutions not being interested in BOT ventures was mentioned in only 2% of the responses. Lending entities' decision to be involved in BOT arrangements would depend on the private sector's move to initiate such a venture in addition to the guarantees issued by the government. Indeed, a study by Li et al. (2005) revealed that government involvement by providing guarantees is critical for the success of a BOT project. It is therefore unlikely that this reason would prevent agencies from implementing the BOT delivery/financing method or its variations in their projects.
9. *Other reasons:* Seven percent of the responses mentioned reasons such as BOT never considered by the agency, BOT not considered to be within the mission of the agency, unfac-

miliarity with BOT, and no rational justification for the use of BOT.

Conclusions and Recommendations

Infrastructure is vital to the nation's production and distribution of economic output as well as to its citizens' overall quality of life. The cost of constructing, maintaining, and operating infrastructure projects is high. BOT has emerged as an option to build infrastructure with the financial help of the private sector when governments suffer from shortages in their budgets. BOT is a valid delivery/financing system, whereby a private sponsor finances the design, construction, maintenance, and operation of a public project for a specified concession period, at the end of which it transfers ownership to the government agency. Since the infrastructure in the United States is in need of large and immediate investments, and the funds provided by public agencies are not nearly sufficient to face such a challenge, there is an immediate need for exploring innovative financing models such as BOT that were successfully used by developing countries, which are faced by much the same problems as local, state, and federal agencies in the United States.

A questionnaire survey was conducted to determine to what extent large cities and state departments of transportation are

using BOT in their large projects, to investigate BOT practices, and the reasons why some government agencies avoid using BOT. It was found that the large majority (88%) of the government agencies surveyed were not able to justify the use of BOT because: (1) proven alternative methods of delivery/financing are available and used with reasonable success (31%); (2) political factors create obstacles (16%); (3) funds for most infrastructure projects are budgeted with no problem (14%); (4) proper legislation is not available (11%); (5) the private sector is not interested in BOT ventures (8%); and (6) resistance to change is a factor (7%). Seven government agencies (i.e., 12% of the remaining organizations that responded to the survey) who used some variation of BOT in various types of infrastructure projects, reported the reasons why they did so and pointed out the difficulties they encountered in the implementation process. But given the low number of respondents (only seven), it was not possible to draw generalized conclusions.

Given the increased demand for public facilities and the lack of funds to maintain, repair, and replenish the existing facilities, public agencies should rethink and reassess their needs, and learn from what national and/or international agencies have achieved by utilizing BOT. They could help the public and the private sector to understand that BOT is often a feasible alternative to existing delivery/financing methods and overcome political barriers to pass appropriate legislation.

Appendix

*Illinois Institute of Technology
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Construction Engineering and Management Program*

Questionnaire Survey on Build-Operate-Transfer (BOT) Delivery/Financing Method

BOT is a kind of public-private partnership whereby a governmental agency enters into an agreement with a private entity to finance, build, own, operate a public facility for a certain period of time (concession period) then transfer the ownership to the governmental agency. During this period the private entity sells the facility's product to the customers or collects user charges until it recoups its investment and makes a reasonable profit.

- Is your regional office using the Build-Operate-Transfer method of delivery/financing in its large projects?
 - ☐ Yes.
 - ☐ No.
 If yes, please continue.
If no, go to question No.7.
- What are the reasons why your office uses the BOT delivery/financing method?
 - ☐ To overcome budget deficits
 - ☐ To reduce spending
 - ☐ To test a new idea
 - ☐ To overcome the deficiencies of existing delivery/financing methods
 - ☐ To obtain advanced technology
 - ☐ To create more jobs
 - ☐ To increase tax income
 - ☐ The private sector pushes for BOT
 - ☐ Others, please specify
 - 1.
 - 2.
 - 3.
- What are the difficulties your office encounters when using the BOT delivery/financing method?
 - ☐ Citizens' opposition
 - ☐ Legal obstructions
 - ☐ Hesitance by private sector
 - ☐ Reluctance by lenders
 - ☐ Conflict of interest with other
 - ☐ Others, please specify
 - 1.
 - 2.
 - 3.
- What types of financing does the private entity use to finance your BOT projects?
 - ☐ Loans
 - ☐ Equity
 - ☐ Subordinate loans
 - ☐ Others, please specify
 - 1.
 - 2.
 - 3.

- What types of BOT project is your office involved in?
 - ☐ Clean up projects
 - ☐ Waste treatment projects
 - ☐ Water treatment projects
 - ☐ Others, please specify
 - 1.
 - 2.
 - 3.
- In addition to BOT, which one(s) of the following delivery/financing methods does your office use in carrying out large projects?
 - ☐ Build-Own-Operate (the private entity possesses the ownership and does not transfer it to the government)
 - ☐ Build-Transfer-Operate (transfer of the ownership to the government takes place before operation starts by the private entity)
 - ☐ Build-Lease-Transfer (the private entity leases the project to the government until it recoups its investment before transferring the ownership of the project to the government)
 - ☐ Build-Operate and Renewal (it is a BOT but the private entity has the right to renew the concession period)
 - ☐ Build-Lease-Own (the private entity possesses the ownership; it leases the facility to the government for a long-lasting operation.)
 - ☐ None of the above
- Why are some regional offices not using the BOT delivery/financing method or its variations?
 - ☐ Political considerations create obstacles
 - ☐ Public owner has enough funds for its projects
 - ☐ Availability of other methods of delivery/financing such as Design Build (DB), Construction Management (CM), Construction by Force Account (CF), Design Manage (DM), and Super Turnkey (STKY)
 - ☐ Private sector is not interested in such ventures
 - ☐ Lending institutions are not interested in such ventures
 - ☐ Public owner's resistance to change
 - ☐ BOT causes increases in public spending
 - ☐ Others, please specify
 - 1.
 - 2.
 - 3.

**** Thank you ****

Please return the questionnaire to
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