Private Involvement in Delivery of Transportation Infrastructure: The State-of-the-Art in Transit System Turnkey Contracts

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Abstract

Turnkey procurement as applied to public transit systems represents a shift in the scope of private sector involvement in transportation infrastructure delivery. Turnkey is fundamentally a design-build contract between the owner/operator of the system and the turnkey contractor. The contractor is obligated to deliver a functional system for a fixed price. The owner communicates system requirements to potential contractors such as conceptual, preliminary designs and minimum performance criteria.

A turnkey approach to transit infrastructure development is beneficial to the public sector because in general it provides time and cost benefits, lower risk, and greater focus on the strategic goals of the project. So long as the public sector has developed solid pre-project work, turnkey procurement allows for early commencement of construction and thus earlier completion. The project will also cost less. By expanding the scope of a turnkey project to include operations and maintenance, a project owner may get a better long-term price when costs such as operations, capital replacement and ridership revenue is netted out from the original capital cost. Private contractors may also be able to bridge the loan gap as the public sector waits for the next set of funds from federal sources. Finally, because the public sector contracts out to "one vendor" for much of the design and most of the construction and operations, the owner/operator can spend more time focusing on and planning for the strategic goals of the project. In fact, the planning process solidifies, rather than weakens, public control over projects.

Five case studies, all applications of a turnkey-style strategy to rail transit system procurement, form the basis for qualitative analysis. The cases are: Docklands Light Rail (London, UK); Manchester Metrolink (Manchester, UK); STAR Transit (Kuala Lumpur, Malaysia); Hudson-Bergen Light Rail System (Jersey City, New Jersey); and Tren Urbano (San Juan, Puerto Rico). The most promising examples of turnkey procurement have been in foreign projects. Foreign project structures tend to be more aggressive than U.S. cases. Risk and reward allocations are still primarily tilted toward the public sector

in U.S. projects, while foreign projects assign more risk and reward to the private sector. This is partially because U.S. projects exhibit scaled-back scopes due to the lower market share of public transportation in the U.S.- thus the risks are much greater, and the private sector may be less willing to undertake these risks.

In the case of future projects which are developed in areas other than the United States, the future potential of continued private involvement is clear and not an issue. The private sector has already entered into projects at all levels, including equity investment and ridership risks. In the U.S., both examples studied are structured to permit future involvement, however the mode dominance of the automobile is hard to work around when calculating ridership. This will have an impact on the extent of turnkey procurement in future U.S. transit development projects.

Summary of Table of Contents of Thesis

Introduction

Summary

This thesis presents the issues involved in the still unfamiliar strategy of turnkey procurement; describes five cases in which the strategy has been or is being applied to rail transit system procurement (both overseas and within the U.S.); and draws qualitative conclusions about the issues based on the experiences of the projects examined.

The five case studies mentioned in the Abstract, all applications of a turnkey-style strategy to rail transit system procurement, form the data baseline for qualitative analysis. Special emphasis is given to the Tren Urbano system procurement currently in development in San Juan. This case study serves as documentation of the process of strategy development and implementation in the context of the joint University of Puerto Rico/MIT Tren Urbano research program.

Background

Fundamentally, this work is an analysis of new-start rail systems that make use of a flexible procurement strategy termed turnkey contracting. Because the potential benefits and pitfalls of this emerging model for private infrastructure delivery are so important, this study hopes to clarify the issues involved. First and foremost, the definition of turnkey must be clarified and integrated into the context of increased private involvement in infrastructure. Second, the issues involved in implementing turnkey must be enunciated. Third, the details of project structure and implementation emerging from recent turnkey projects must be documented. Fourth and finally, the project details must be examined for a preliminary evaluation of the benefits and liabilities of turnkey strategies.

There are several structural deficiencies in a segmented process. First, there are narrow performance incentives. The low-bid system for awarding construction contacts has proven to be a narrow scope of competition. The second shortcoming is public sector distraction. The segmented procurement process requires an owner who is intimately involved with each step of the process. The third deficiency is contentious and litigious influences. The adversarial posture of public owners is required in a segmented procurement system. The segmented process provides incentives to shift responsibility for problems to other parties. A final deficiency is defensive posturing. The risk and cost allocation of the segmented process also leads to a defensive posture in each participant. There are two ramifications of this defensive posture which are noteworthy: the problem of "overdesign" and the lack of incentives for innovation.

Table 2.3.2: Risk Allocation Implications of Turnkey

	Risk	Traditional Allocation	Change Under Turnkey
1.	Political	Owner	
2.	Funding	Owner	Shared (potentially)
3.	Financing	Owner	Shared (potentially)
4.	Right-of-way	Owner	
5.	Speculative Effort	Owner	Shared
6.	Bids Exceed Estimates	Owner	
7.	Geotechnical	Owner	Negotiable
8.	Hazardous Materials	Owner	Negotiable
9.	Underground Utilities	Owner	Negotiable
10.	Inflation	Owner prior to award, between stages	Full transfer to contractor
11.	Federal, State, Local Regulations	Regulatory changes only	Full compliance
12.	Design Integration, Coordination	Owner	Full transfer to contractor
13.	Changed Requirements	Owner	
14.	Construction Performance	Share	
15.	Subsystem Test	Contractor	
16.	System Integration	Owner	Full transfer to contractor
17.	Schedule Slippage	Negotiated	Full transfer to contractor
18.	Construction Safety	Contractor	
19.	Site Security	Contractor	
20.	Act of G-d	Contractor	
21.	Failure to Complete	Contractor	
22.	Seismic	Shared	
23.	Operating	Owner	Negotiable (Design-Build-Operate)
24.	Market (Ridership/Revenue)	Owner	Negotiable (Build-Operate-Transfer)

The Turnkey Model

Operations

While operational responsibilities fall outside the formal definition of a turnkey procurement strategy, the incorporation of operations and maintenance (O&M) has emerged as a primary benefit of the decision to go with turnkey. Life-cycle cost issues are at the core of this trend which considers the full impact of infrastructure investment over the duration of its useful life.

Perhaps the biggest advantage which might come from a turnkey-style project is the incorporation of the financial risk of meeting adequate ridership levels into the same package with design, construction and operation. Here the team is responsible for the total quality of the transit service.

Competition

Competition is generally held as the primary mechanism by which privatization has the greatest impact. Often the threat of competition is enough to exact efficiency gains from the public operators who had not previously faced competition. Turnkey reduces the scale of competition (the number of competitors) but increases the scope (quality) of competition.

Competition is fundamental to the achievement of turnkey's potential benefits. The scope of competition is a concept which captures the breadth of the single turnkey competition: proposers are bidding on more than the lowest price delivery of a commodity good. Significant effort must be put into the development of a bid for a turnkey proposal, and this level of effort is a good proxy measure for the scope of competition.

Financing

The implementation of a simple turnkey strategy has very little effect on the financial structure of the project or on the owner's financial responsibility. In short, the owner pays directly for the system, usually through monthly progress payments, while the private sector assumes new risks and responsibilities.

The Case Studies

Introduction

"Turnkey procurement" has been used to denote a wide range of contracting options in the field of transit development. Many diverse regions have had experience with some form of turnkey procurement for transit systems, and the diversity of these contractual relationships is an interesting testament to the flexibility and options which this type of scheme offers. This diversity is documented by a set of case studies which looks at the turnkey experience of the UK, Malaysia, and the United States. The description and analysis of these projects will also offer several lessons for those who will be involved in future efforts to design turnkey contract projects. The case studies are from more developed countries because there is a real choice of whether or not to use turnkey, as well as a choice on the part of the riders as to whether to take transit or use their cars.

This study shows the division of responsibility between the vendor and the owner by the following generic table:

Table 3.2.1: Division of Responsibility, Generic Turnkey Project

	Turnkey	Owner
Planning		
System		•
Project		•
Design		
5%		•
30%	•	
60%	•	
100%	•	
Build		
Civil	•	
Systems	•	
Maintenance		•
Operations		•

Docklands Light Railway Case Study

The Docklands Light Railway (DLR) was developed as a strategic investment in a real estate redevelopment program. The decision to use a turnkey procurement strategy was a response to a very firm offer of capital support from the national government and a need to convince private developers of the near term availability of access to this vast area of prime real estate. The project included a design-build contract. This shift allowed for more control over the contract in light of the fixed funding guarantee. The bidders were competing to deliver a fully operational, automatic light rail system which met the specified carrying capacity.

The contract centered on four specifications: performance, technical, specified contract drawings, and design concept drawings. When the turnkey bids were solicited, the system was very well described in terms of technology, alignment, and performance.

The DLR entered revenue service on the date originally specified with no cost overrun. This is perhaps the most significant impact of the decision to employ a turnkey scheme. The fate of this system and its expansions is mostly a result of the huge potential of the site of the Docklands.

Manchester Metrolink Case Study

The Manchester Metrolink project was successful in rebuilding two commuter rail lines for modern light rail operations. The structure of this project was a full concession agreement with the private sector taking the ridership risk. This contract was a 15 year concession including design, construction, and operations and maintenance. Ownership of the facility remained with the public sector. The political climate at the time was one of emphasis on private sector development and operation. Indeed, the final approval for a central government grant was subject to the participation of private-sector capital in the project.

Within the constraints of performance criteria and preordained alignment, the Public Transit Executive Agency (PTE) allowed a significant amount of design innovation on the part of the bidders.

From the point of view of turnkey procurement structure, the Manchester Metrolink has been a success. The private sector has, in effect, contributed to the capital cost of the new system. Ridership risk has been transferred to the private operator, thus providing the incentive to operate efficiently and attract ridership through effective marketing and an innovative fare structure.

Kuala Lumpur STAR Light Rail System

The Sistem Transit Aliran Ringan (STAR) light rail system is a joint venture between European engineers and system suppliers and Malaysian investors. STAR, the owner/operator, has signed a split-turnkey construction and system supply contract with the European firms which are equity investors in the project. Due to dire congestion, the decision was made to convert some old rail lines for transit use. Local parties formed STAR, an operating venture, which was awarded the concession contract. The concession agreement enables Phase I of the project to be build and operated by STAR for 60 years. STAR is responsible for all aspects of the system development, including the arrangements for financing. The project is breaking new financial ground in that the financing is based on non-recourse debt without a government revenue guarantee.

The government is intimately involved in the structure of the deal but not in the often-assumed role of bearer of ridership risk. The project is not financed on the basis of government revenue guarantees. This is new ground for infrastructure projects in the region and is testament to local confidence in solid growth forecasts for the Malaysian economy.

Hudson-Bergen Light Rail Case Study

The Hudson-Bergen Waterfront Light Rail is a new rail system for New Jersey's waterfront corridor. A turnkey plus operations contract will soon be signed for design, construction, and 15 years of operations and maintenance. A single contract will be signed for the development and operation of the system. The winning consortium will take the 30% plans which are considered a part of the bid documents and develop the final plans. This same group will construct the system and be responsible for 15 years of operation and maintenance.

Service requirements relate much more to the operation that the design of the system. In fact, the contractor will have incentives for exemplary service in addition to penalties for deficient service. In exchange, NJ Transit (the owner) has explicitly sheltered the contractor from any revenue risk. The contractor was chosen based on a life-cycle cost evaluation, another benefit of turnkey contracts. The winning contractor will also be expected to provide a "bridge loan" to allow construction to outpace the fixed funding amount. While it is important to reassure the potential bidder in this situation, it is highly beneficial because it allows construction to continue along without waiting for monies to come through.

Tren Urbano Case Study

Tren Urbano is a grade-separated, high platform rail transit system currently in development in the San Juan Region of Puerto Rico. The structure of the procurement of Tren Urbano has evolved into a split/hybrid turnkey arrangement termed the Systems and Test Track Turnkey (ST^3) strategy. One turnkey contract will be signed for a fixed-price delivery of the cars, systems, central operations center (including the maintenance yards and shops, and five years of operations and maintenance of the system.

The goal- to design, construct and operate Tren Urbano in an efficient and effective manner- points directly to the issue of the procurement structure. The turnkey strategy accelerates development and enables the early commencement schedule. The design-build civil sections were bid separately. The main driver for using the turnkey approach was to accelerate the start and completion of construction (mainly a political motivation). The split/hybrid turnkey scheme used was structured to address certain issues such as the difference in cultures between the systems suppliers and civil construction organizations.

The contract terms with pre-negotiated to be signed with the winner. This innovative technique secured the terms of the contract in an open forum before the winner was announced. The scope of the ST^3 contract represents a conscious reduction in responsibility on the part of the systems provider (as compared with a single turnkey-style procurement).

The allocation of risk in Tren Urbano leans heavily to the side of the government. This is to keep relatively more owner control. The fundamental risk which the ST^3 contractor assumes is the schedule and cost of the entire system, within the constraints imposed on it by the other segment contractor's schedule.

Conclusions and Results

There are a number of points made in the conclusion section of the thesis. Qualitative conclusions are drawn on the following subjects: U.S. versus foreign experience; time and schedule savings; public and private roles; the impact of life-cycle incentives; and turnkey as the first step to more private involvement.

In terms of United States versus foreign experience, one trend that was evident in the case studies is that foreign examples of turnkey-style project structures are more aggressive than U.S. cases. Risk and reward allocations are still primarily tilted toward the public sector in U.S. projects, while foreign projects assign more risk and reward to the private sector. One reason cited for this is that the market share of public transportation in the U.S. is an order of magnitude lower than that of foreign regions, and thus the risks are much higher in U.S. projects. In many cases, U.S. transit systems are developed as a policy decision (not necessarily to maximize ridership), so the private assumptions of risks would be an impossibility.

Estimates of the time and cost benefits of turnkey procurement are appropriately vague: 10-25 percent cost savings for design and construction bundled; 10-40 percent in cost

savings in private operation; up to 40 percent less time from preliminary engineering to completion. In almost every case studied, the most important benefit of a turnkey strategy was that it gave more control to the government in developing a more advantageous cost structure and schedule. Another benefit of turnkey was that of early commencement of construction. This was useful in many cases, particularly in the Tren Urbano project where the current administration had political motivations (an upcoming election) to get the system in place quickly. In the case of the Docklands, alacrity of progress attracted redevelopment sites to the area by exuding confidence.

Public and private roles are also analyzed as a result of the case studies. In all cases, the public sector had a large role in preparing a solid pre-project development effort. The planning process which has been undertaken by the public sector early in the pre-project stage has solidified, rather than weakened, public control over projects. Perhaps the most important role for the public sector is as bearer of political risk. In addition, public investment, particularly for capital intense projects such as rail, still rely on financial help from the public sector. Private involvement mainly came in as "non-traditional" owners took a fresh look at new procurement methods.

One issue which must be considered separately from the general cost savings of turnkey is the impact that life-cycle incentives have in generating private sector efficiencies. By expanding the scope of a turnkey project to include operations and maintenance, a project owner may get a better long-term price when costs such as operations, capital replacement and ridership revenue is netted out from the original capital cost.

In the case of future projects which are developed in areas other than the United States, the future potential of continued private involvement is clear and not an issue. The private sector has already entered into projects at all levels, including equity investment and ridership risks. The more tricky question is private sector investment in transit projects in the United States. Both examples from the United States are structured to permit future involvement. However, the prospects for future U.S. rail transit projects to be formulated around a strategy of private real estate financed development ("super-turnkey") do not seem bright. The mode dominance of the automobile is hard to work around when calculating ridership and the added value of rail access for commercial and residential real estate values.

The turnkey model is most applicable in cases where the government knows what it wants, and goes to the vendor and contractor community to buy it. The private role is to effectively deliver a rail system which meets the performance criteria specified in the political and regulatory process. If the public sector is to move toward the role of strategic policy formulation and control of infrastructure development from a higher level, then the flexible tools like turnkey procurement must be available to the decision makers.

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