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Public private partnership in transit projects

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ABSTRACT

PUBLIC PRIVATE PARTNERSHIP IN TRANSIT PROJECTS

by

Rashmita DasChaudhuri

The government is cutting down government impediments and entering into the market. One of the outcomes has been the rise of Public-Private Partnerships (PPPs). There have been a lot of information and transaction cost problems in government institutions. These issues can be sorted and mitigated if the risk is shared with the private sector.

Until 1990, there had been a monopoly of the public sector developing transit projects. Now with the PPP concept, the transit projects are slowly moving into public private partnership agreements. This study tries to identify the various approaches of public private partnership delivery system. A few successful case studies are studied and analyzed to figure out which delivery system works well with smaller and bigger projects.

Issues are identified in this study by comparing some of the delivery approaches. Further studies of some of these issues are suggested to improve the project delivery system.

PUBLIC PRIVATE PARTNERSHIP IN TRANSIT PROJECTS

by
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I dedicate this thesis to my Father, Mr. S. Das Chaudhuri and my Mother, Late Mrs. Rupa Das Chaudhuri who have always stood by me and presented me an opportunity to pursue my dreams.

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LIST OF ACRONYMS

PPPs:	Public-Private Partnerships
BOT:	Build-Operate-Transfer
DBOM:	Design-Build-Operate-Maintain
DB:	Design-Build
BOO:	Build-Own-Operate
DBFOM:	Design-Build-Finance-Operate-Maintain
DBFO:	Design-Build-Finance-Operate
LRT:	Light Rail Transit
PSMC:	Performance Specified Maintenance Contracts
JD:	Joint Development
TOD:	Transit Oriented Development
FTA:	Federal Transit Admistration
FHWA:	Federal Highway Administration
RFP:	Request for Proposals
CDOT:	Colorado Department of Transportation
AASHTO:	American Association of State Highway and Transportation Officials
MTA:	Maryland Mass Transit Administration
WMATA:	Washington Metropolitan Area Transit Authority
ACTIA:	Alameda County Transportation Improvement Authority
ACCMA:	Alameda County Congestion Management Agency
MTC:	Metropolitan Transportation Commission
Caltrans:	California Department of Transportation
CTC:	California Transportation Commission
CPI:	Consumer Price Index

CHAPTER 1

INTRODUCTION

1.1 Concept: Public-Private Partnerships

Public-Private Partnerships (PPPs) are essentially a form of procurement where a single private entity, typically a consortium of private companies is responsible and financially liable for performing all or specific responsibilities of a project within a specified time period. Contrasting to the earlier practicesm that all the responsibilities of a project were separated and contracted separately, a PPP agreement aggregates two or more responsibilities like design, construction, and/or operation all together, and awards to a single contractor. The whole PPP system also might attract private capital through innovative approaches.

The public and private sectors are supposed to work hand in hand to help share information and resources which makes the project finished on time or earlier. Until 1990 there was a public monopoly for infrastructure projects, which has changed after the introduction of the public private partnership concept in the infrastructure development. The management of roads, bridges, and tunnels by the private sector started before they are allowed into managing public transit projects, such as Light Rail Transit (LRT) and Commuter Rails. Later the private sector also started developing transit corridors which in a way promoted real estate development in and around transit facilities. These real estate developments are known as “joint development” or “transit oriented development.” These kinds of projects require a lot of capital and innovative approaches can be used to attract private companies to finance such projects partially.

Innovative approaches can bring in additional capital. Operating revenues can be earned through the receipt of lease payments, access fees, and increased fare revenues. Bringing additional capital from the market helps in sharing of resources and also shares risks and rewards. The degree of resources shared or risk and rewards shared varies from project to project.

There are various kinds of public-private partnerships in transit projects. They can be of either lesser or greater private role.

Lesser Private Sector Role

Build-Operate-Transfer (BOT)

Design-Build-Operate-Maintain (DBOM) A

Design-Build (DB)

Greater Private Sector Role

Build-Own-Operate (BOO)

Design-Build-Finance-Operate-Maintain (DBFOM)

Design-Build-Finance-Operate (DBFO)

1.1.1 Lesser Private Sector Role

Design-Build-Operate-Maintain and Build-Operate-Transfer: Under a design-build-operate-maintain ("DBOM") or build-operate-transfer ("BOT") delivery transfer approach, the selected contractor or the private agency is responsible for the design, construction, operation, and maintenance of the project for a specified time period. The private agency has to go on a contract where the performance standards will be mentioned. They need to follow the project quality standards and design specifications

mentioned in the contract. Since the private agency is responsible for operation, and maintenance of the project, the project turns out to be of good quality.

Since 2000, three transit projects in the U.S. have been procured as DBOMs: NJ Transit Hudson-Bergen LRT MOS-1 and MOS-2 and JFK Air train.

Design-Build: In the design-build ("DB") delivery approach, the private agency or the contractor is responsible for the design and construction phase of the project. It is a fixed-fee contract. The private entity can be one private company or a consortium of private companies who are responsible for all the design and construction errors and specifications. If there is more than one contractor under one contract then they need to work together for better on-time performance. Bidding is done generally to select the contractors for this approach. The DB approach is mostly considered for the transit projects in the United States and the projects which considered DB approach have been successful overall.

Since 2000, many transit projects have been procured using a DB approach, including:

• Denver RTD Southeast Corridor LRT;

• South Florida Commuter Rail Upgrades;

• Minneapolis Hiawatha LRT;

• WMATA Largo Metrorail Extension; and

In addition there are two non-New Start fixed guide way projects with Federal interest that have been delivered using a DB approach: Portland MAX Airport Extension and JFK Air train.

1.1.2 Greater Private Sector Role

Build-Own-Operate (BOO): Under a build-own-operate approach, the private company is responsible for the maintenance of the contractor. Unlike other approaches, in a BOO approach, the private partner owns the project and is responsible for all operating revenue risk and any surplus revenues for the life of the project. They can innovate new strategies to improve the quality of the project overall.

Design-Build-Finance-Operate and Design-Build-Finance-Operate-Maintain: The design-build-finance-operate ("DBFO") and Design-Build-Finance-Operate-Maintenance ("DBFOM") delivery approaches are a variation of the Design-Build-Operate-Maintenance ("DBOM") approach which has been mentioned earlier in this project. In addition to the design, construction, and operation of the project, the private entity is also responsible for all or half of the project's financing. DBFO and DBFOM approaches are very similar to DBOM approach. The only addition is that it includes the transfer of the financial risks to the private entity during the contract period. Though the private sector finances partially, but the ownership rights of the project remain in the public sector. The private sector's debt is repaid by all or a portion of the revenue. Revenue is generally generated by the public sector through taxes or user fees. This revenue in turn repays all the debt of the private sector. One of the most successful projects with DBFO approach is BART Extension to San Francisco International Airport.

1.2 Need For The Study

The U. S. government has shifted from its monopoly of developing transit projects by the public sector to joint efforts by the private and public partners (PPP). One of the outcomes has been the rise of Public-Private Partnerships (PPPs) for public transit projects, which mitigated risk and share costs and benefits among all stakeholders..

This study tries to identify and evaluate various PPP approaches in delivering public transit projects via a number of case studies. A few case studies of the U. S. are examined and analyzed to identify which PPP approach worked well with various small and large projects with various legislation, financial, and institutional arrangements.

Various PPP approaches, such as Build-Operate-Transfer, Design-Build-Operate-Maintain (DBOM), or Design-Build (DB) have been implemented in the transit development processes. The study highlights the unique characteristics of each based on the magnitudes of private sector involvement, effects of risk mitigation, and results of cost and time reduction for the overall project. Recommendations are made in regards to the most applicable PPP approaches and their corresponding circumstances. Further studies of a few selected issues are suggested to improve the project delivery system.

1.3 Goal

To identify the project delivery approaches of public private partnership in transit projects and analyze the PPP impacts based on projects related criteria.

1.4 Objectives

- To understand the concept of public private partnership and its various forms.
- To review case studies to analyze the impact of public private partnership on the projects.
- To analyze innovations that impacted the projects.
- To evaluate various consequences of the selected project delivery approaches.

CHAPTER 2

LITERATURE REVIEW

Public-Private Partnership (PPP) projects can take a number of different forms. A literature review of these various forms is required to properly understand what kind of variations can be possible be it a long-term or short term contract.

The Federal Highway Administration (FHWA) has listed a number of variations of the Design-Build (DB) contract, such as: Build-Operate-Transfer (BOT); Design-Build-Operate-Maintain (DBOM); Design- Construct-Maintain (DCM); Design-Build-Finance-Operate (DBFO); Build-Own-Operate (BOO); Performance Specified Maintenance Contracts (PSMC) and Concessions.

Build-Operate-Transfer (BOT); Design-Build-Operate-Maintain (DBOM); Design-Construct-Maintain (DCM): In these approaches, the public sector sponsors the project The private sector receives revenues from the public sector through taxes and user fees. The private contractor is responsible for the design and construction, operations and maintenance of the project.

Design-Build-Finance-Operate (DBFO): In this variation, the private sector is not only responsible for design, construction and operation the project but also they finance the project partially or fully. The private sector earns revenue by the user fees or from the public sector in the form of tolls. Though the private sector funds a part of the project, the ownership still remains with the public agency.

Build-Own-Operate (BOO): This approach is not that popular with the transportation projects. In this case, the private sector develops, finances, designs, builds, owns,

operates, and maintains the project. Transit projects are public property and hence they cannot be owned by the private agency. Hence this approach is not that popular with the transit projects. The contractor is responsible for all the operating revenue risk, but retains all the surplus revenues.

Performance Specified Maintenance Contracts (PSMC): This type of contract pertains to the rehabilitation and maintenance of highways for a specified period.

Concessions: This variation on DB contracts allows the concessionaire to design, build, and operate a project with the right to receive revenues from operations and/or receive payments from the public agency. The debt of the contractor is anyway repaid by the revenue generated from operations through user fees. This contract variation has many of the characteristics of the DBOM contracts and typically the average contract period is between 15 and 30years. The use of concessions is very prevalent in some European countries, such as Portugal and France.

Teigen (2007) listed the following benefits resulting from PPPs:

• It is a mechanism that provides infrastructure on time and allows the public sector to spread the cost of the infrastructure over the life of the asset.

• Most PPP infrastructure projects are completed on-time or earlier. This is because the private sector needs the revenue to repay the capital costs which they have invested. Though this is applicable to only a few variations.

• The maintenance of the infrastructure is transferred to the private sector in some of the PPP approaches. This ensures that assets are adequately maintained. This also provides

an incentive to the private sector for long term quality standards as it will be responsible for operation and maintenance expenses over a long term period.

• The private sector is more customer-oriented because they rely on user fees for their revenue streams.

Teigen (2007) identified three stages in PPP model maturity measured in terms of the sophistication of the model adopted and the level of activity in the country (see Figure 2. 1).

Countries in Stage One of PPP Model Maturity have:

• developed dedicated units in agencies to deal with PPP projects,

• an established policy and legislative framework for PPPs,

• started to develop a central PPP policy unit to guide the implementation of PPP projects,

• developed deal structures,

• developed a public sector model to compare the PPP model to,

• begun to develop the market for PPP and attract private investors, and

• started to apply early lessons from the transportation sector to other sectors.

Countries in Stage Two of PPP Model Maturity, such as Portugal, New Zealand, Canada, France, and Italy, typically have :

• developed dedicated units in agencies to deal with PPP projects,

• begun to develop hybrid models for the development of PPPs,

• started to expand the market for PPP projects,

• leveraged new sources of funding from capital markets,

• used PPPs to initiate innovation in service delivery, and

• multiple PPP projects in various sectors of the economy.

Countries in Stage Three of PPP Model Maturity (e.g., Australia and the UK) have:

• adopted new innovative PPP models,

• applied creative and flexible approaches to the roles of the private and public sector in the delivery of PPP projects,

• adopted more sophisticated risk models,

• emphasized the total lifecycle of a PPP project,

• a sophisticated infrastructure market with access to pension and private equity funds,

• leveraged underutilized assets into financial assets, and

• developed the organizational and skill sets required in government to implement and support a greater role for PPPs.

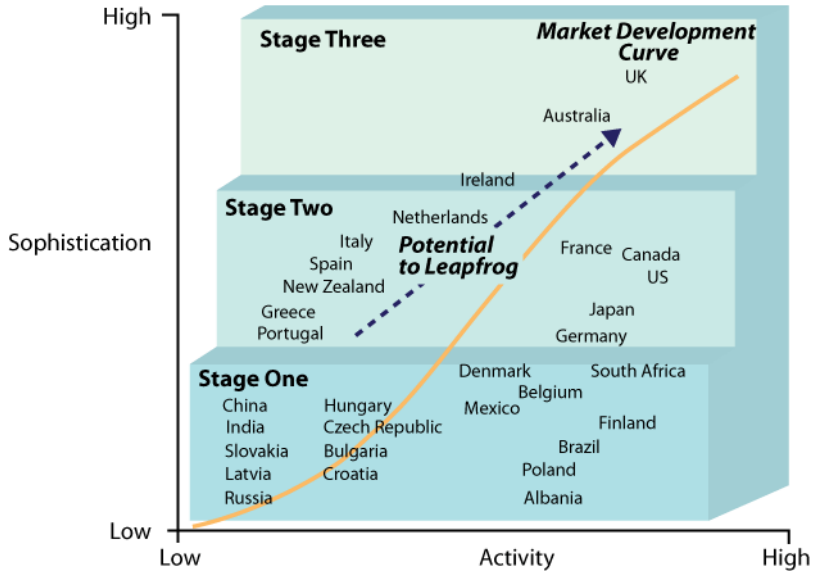

Figure 2.1 Public Private Partnership Maturity Model

The U.S. is considered to be in stage two of PPP model maturity, mainly because of the level of sophistication of the PPP agreements that are being entered into.

The literature study intends that there are various approaches that are not being used or cannot be used for transit projects specifically like Build-Own-Operate. Also, the maturity model shows, to reach the highest level of sophistication, a lot of creative and flexible approaches are required not only in the private sector but also in the public sector as well.

CHAPTER 3

CASE STUDIES

There have been a few transit projects throughout the United States that implemented PPP approaches. Out of which top five projects have been examined in this study.

3.1 The Transportation Expansion Project (T-REX)

It was the largest and the most successful transportation upgrade projects in Colorado, USA. Its main goal was to transform the way people in the metro Denver area commute.

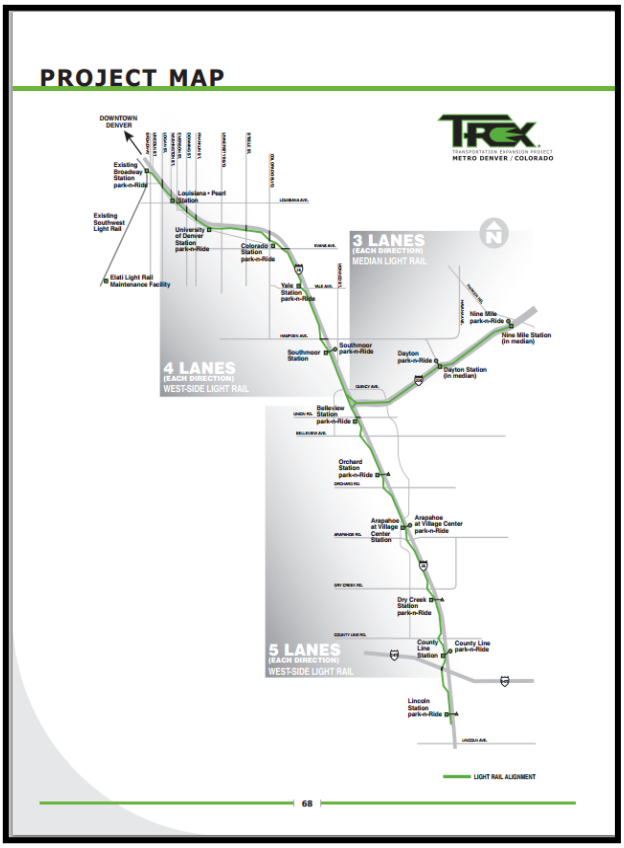

Figure 3-1 T-Rex Project Map

Source: T-Rex Transportation Expansion Project Metro Denver/Colorado, Project Fact Book, 1999-2006 .

According to the information mentioned in the Metro Denver Organization website, the T-REX project finished 3.2% under its $1.67B budget and 22 months ahead of schedule in 2006. It is an example of intergovernmental agency cooperation for transportation projects in North America and Worldwide. The T-REX corridor carries more than 280,000 vehicles per day and connects the two largest employment centers in the region: Downtown Denver and the Denver Tech Center.

3.1.1 Funding

According to the information gathered from department of transportation website of the Federal Highway Administration of Colorado, no new state, county, city, or gas taxes were used to fund the T-REX project. This was partially due to the Taxpayer Bill of Rights **(**TABOR) laws enacted in 1992, and the State Leadership's stance against levying additional taxes on its constituents. Instead, metropolitan areas that would potentially benefit from the expansion voted to approve an increase in property taxes which was required for the build out. In November 1999, voters in the affected municipalities approved two property-tax increases which later funded the transit portion of the project partially.

The total cost of the project was $1.67 billion. The design-build contract with the Southeast Corridor Constructors was worth $1.18 billion. The light rail component cost was about $879 million. The highway component cost $795 million and was funded with a combination of Highway Users Tax Fund dollars, Senate Bill 97-01 money and bonding/federal revenues.

Lots of real estate development was occurring along the corridor which coincided with this Southeast Corridor expansion project. The Southeast Corridor connects the two

major employment centers in the Denver metro area: the downtown Denver Central Business District, and the Southeast Business District. According to the Denver Regional Council of Governments (DRCOG), more than 180,000 people work in these two employment centers, and another 30,000 or so work along the corridor, include businesses along Colorado Boulevard, Evans Avenue, and University Boulevard. Forecasters expect downtown and the Denver Tech Center.

3.1.2 Timeline

According to the T-Rex Transportation Expansion Project Metro Denver/Colorado, Project Fact Book, 1999-2006, a timeline of milestones related to the T-REX project is shown below :

Summer 1995: Major Investment Study (MIS) started by the Colorado Department of Transportation (CDOT)

Fall 1997: Denver Regional Council of Governments (DRCOG) adopted Major Investment Study (MIS) recommendations which resulted in the adoption of light rail in the Denver Regional Council of Government's fiscally constrained regional transportation plan (RTP).

November 1999: Voters approved two separate ballot initiatives that allowed for the issuance of bonds that funded T-REX.

December 1999: Final environmental impact statement (EIS) completed and design-build rules established by CDOT

July 2000: Project announced Shortlist of Proposers

March 2000: Record of Decision signed by the Federal Transit Administration (FTA) and Federal Highway Administration (FHWA) making T-REX eligible for federal funding.

November 2000: Full Funding Grant Agreement approved by FTA was signed.

Fall 1999 - May 2001: Design-build contractor procurement process started with the development of a Request for Proposals (RFP) and ended with the selection of Southeast Corridor Constructors (SECC), a joint venture between Kiewit Construction and Parsons Transportation Group, to design and build the $1.67 billion project.

June 2001- December 2003: Final design phase

June 2001 – September 2006: Construction of T-REX.

September 2006: Completion of all highway related construction for the corridor.

November 2006: Opening of the light rail portion of the corridor.

3.1.3 Project Concept

Environmental Impact Statement (EIS) and Planning Phase

A significant effort was made by the project team (RTD, CDOT, and the EIS consultant team) and the specific stakeholders and developed during the project planning phase. They conducted many workshops between the project team and property owners around some of the stations to discuss about development. Minimal changes were made to the EIS after receiving developer input. Participants in the workshop, listed many scopes for improvement in this phase of the project. One of the most striking points was the need to maximize environmental clearance in the EIS phase to preserve future flexibility. RTD and CDOT felt locked down the design prior to the release of the RFP for the design-build contractor. Despite the outreach made during the EIS process, participants felt the

need for more participation by the development community and adjacent property owners. The problem was RTD and CDOT could not force the stakeholders to the table but the local jurisdictions could have, to encourage more early collaboration. If the local jurisdictions had prepared and used land-use plans for the station areas, those would have been useful in the EIS. Absence of required plans and the lack of initiation of a public planning process by the local jurisdiction, the project team made the error of developing Transit Oriented Development (TOD) concepts without coordinating well with all the local landowners.

Contractor Solicitation and Request for Proposals (RFP) Phase

One of the criteria of RFP evaluation was to understand TOD. RTD had limited part-time TOD staff which resulted in a limited specific language included in the RFP related to TOD. There was a limited TOD experience regionally in Denver which failed to draw a specific direction for how to address TOD in the RFP.

About the Design-Build approach, one respondent from the workshops conducted pointed out, “Design-build can work, but the degree of complexity with specific sites may warrant extracting them from the design-build contract and handled separately” (September 2007, T-REX Transit Oriented Development Lessons Learned Report, Regional Transportation District). The feasibility of this option depends on whether the federal government funds acquisition or not and the timing of any joint development so that revenue can be generated from parking. If the recommendation of the respondent is considered, it will bring problems because construction costs may become higher in this situation because individual stations would have to bid out separately from the design-build contract.

Final Design Phase

The project team clearly stated the expectations for responsibility for design changes, which rested with the local jurisdiction and/or the developer. Considering the cost implications, participants also mentioned the project team and SECC demonstrated flexibility in making changes to improve TOD at various sites. Local jurisdictions became much more active during this phase of the project. The plan for Village Center at Arapahoe Station was a good example of this newfound motivation. Participants felt a critical improvement at this phase would be good with extensive community involvement mainly where TOD was being considered. On the other hand, participants felt that decision-making power was unclear at this phase. Agreements made between the developer and contractors were not always acceptable to local jurisdictions.

To address this issue, clear and frequent communication amongst stakeholders was required and also communication of the decision making authority and roles in the TOD process was necessary while involving the public when appropriate. One more problem this phase of the project suffered was the absence of a full-time TOD expert on RTD's project staff.

Construction Phase

There was generally good coordination between the project team and SECC during the construction phase. There was a timely resolution of challenges which prevented unresolved problems from dragging on. But participants identified a need for more transparency in the change order process. They suggested that details of change orders should be such that there is a common understanding of how costs were developed which will make it easier to reconcile discrepancies in change order costs. They also felt that

local jurisdictions and RTD need to consider the land-use impact on the project. T-REX staff felt they were uncomfortable in being caught in the middle of negotiations between the developer and local jurisdictions. They recommended using checklists for property owners for regulations, easements, etc.

Information Sharing

The co-location of the project owners and the design-build contractor helped in sharing information. Participants said the minutes of the technical meetings were very useful. They also appreciated the quality of public presentations. Participants mentioned there was good coordination between land-use planning in station areas of the City and County of Denver and preparation of the EIS. They also complemented the project team for being transparent. The key opportunity identified for this related to planning. Participants said the local jurisdictions must take responsibility for land-use planning and RTD must be willing to advise local jurisdictions about the interface with the project process. Stations located at jurisdictional borders, such as Dayton, were identified as a special problem. These situations required an improved level of coordination.

Entity Roles

T-REX experience provided an excellent foundation for the Fast Track program. It was critical for all stakeholders to develop a team mentality to address various challenges and opportunities. The need for designated TOD representatives for each entity with the authority / budget was identified as a necessary improvement that should be made to the process. Participants stated that the RFP should be specific in defining roles for the contractor and project owner in TOD implementation. The local jurisdictions should have

a stronger planning role, and be more supportive of development. Local elected officials should be made aware of this issue.

The T-REX project has been a very successful project. It was completed ahead of schedule and within budget with relatively minimal disruption to the neighborhoods within the corridor. Considering TOD standpoint, T-REX had some success, but many important lessons have been learnt that can be applied to other future Fast Tracks corridors to build and improve upon the TOD process.

3.2 The Portland Max Airport Extension

The Portland MAX Red Line Airport Extension is a 5.5-mile extension of the regional light rail system from the Gateway Transit Center to Portland International Airport in Portland, Oregon. The route crosses a mixed-use development which is the Portland International Center. It is located between I-205 and the airport and runs beside the main airport access road to the airport passenger terminal. The extension project includes three other stations between the Gateway Transit Center and PDX, two of which serve a 120-acre development, Cascade Station. The Portland MAX Airport Extension project was developed as a public-private partnership with an innovative approach between a joint venture of Bechtel Enterprises and Trammell Crow Company, the City of Portland, acting through the Portland Development Commission, Tri-Met, and the Port of Portland. Metropolitan Area Express opened the first segment of the MAX light rail system in 1986 with one 15-mile line between downtown Portland and Gresham in the east of the metropolitan area and two years later opened the 18-mile west side extension from downtown Portland to the cities of Beaverton and Hillsboro. In 1997 Bechtel Enterprises

(Bechtel) approached the Port of Portland and Tri Met for a public-private partnership with a proposal to construct a 5.5-mile extension of the MAX system. There was an innovative approach to the PPP agreement. It provided Bechtel Enterprises with development rights to the land adjacent to the airport in return for covering some of the construction costs of the light rail extension. By this, the public costs which were involved in developing the airport link were reduced by about 23 percent. The project was completed many years earlier than had been planned. This extension was thought of and was included in the transportation plans in its first segment but it was not expected that funding will be available until 2010.

Bechtel proposed for a a Design Build public private partnership approach but was providing private sector funding forthe quarterr of the project's cost in return for a contract to design and also to build the extension and development rights of the project. The contract was to build the extension and development rights of a 120-acre site which is located near the airport on the MAX airport extension. After getting the development rights, Bechtel also got the approval to construct a mixed-use development. The project's primary goal was to create a major employment center on the east side of the city because it was in close proximity to major transportation infrastructure.

Figure 3.2 **Airport MAX Route and Cascade**
Source: Tri-Met, "Airport MAX", January 2000.

3.2.1 Funding

The city of Portland, TriMet, Port of Portland and Bechtel funded the project with 18.9%, 35.7%, 22.4% and 23.1% respectively.

The total development costs for the Red Line Airport extension was $128.8 million which includes engineering and construction costs. There has been confusion whether there was a slight increase in the total costs towards the end of the project.

The Red Line Airport extension was funded partially by local funds and partially by Bechtel Enterprises, as shown in Table 3.1. No direct funds from the federal government were used in the project, which simplified approval process and allowed rapid decision-making.

Table 3.1 Funding Sources

	Amount $(m)			
Funding Source	Preliminary Engineering	Construction	Total	Percent
City of Portland	0.5	23.8	24.3	18.9%
TriMet	0.5	45.5	46.0	35.7%
Port of Portland	0.5	28.3	28.8	22.4%
Bechtel	1.5	28.2	29.7	23.1%
Total	**3.0**	**125.8**	**128.8**	**100.0%**

Source: PB Consult, Airport Max: A Case Study, April 2009.

The City of Portland contributed $23.8 million for the construction of the 2.9-mile segment from the Gateway Transit Center along the I-205 right-of-way. The City used tax increment financing for construction of the segment which was within the Airport Way Urban Renewal Area. It issued bonds to generate the funds. Tax revenues were incurred from increased land values of parcels within the URA. The revenues were used to pay the interest on the bonds and clear the debt. TriMet contributed $45.5 million of

the construction costs. Tri Met was also responsible for the development of the 2.9-mile segment of the rail corridor.

The Port of Portland contributed $28.8 million which is 22.4% of the total project cost from the airport PFC revenue. The financial relationship between these local funding bodies was complex.

Initial construction cost of the Airport MAX extension was funded by Tri-Met using proceeds from tax-exempt bonds issued to finance the Gateway segment of the extension which was supposed to be funded by Bechtel. Bechtel later repaid $28.2 million as an assignment fee for the development rights at Cascade Station.

3.2.2 Timeline

According to a Case study report by PB Consultant in 2009, the timeline of the project is stated below.

September 1997: Bechtel approaches Portland with an unsolicited public-private partnership proposal.

December 1997: The City Council authorized the PDC to undertake a preliminary engineering study for the light rail extension with Tri Met and Port of Portland.

1998: Public entities secure approvals from their respective boards

1999: Construction started in 1999.

2001: Airport Max began operation. Tri Met opened the MAX Red Line to serve Portland International Airport (PDX).

3.2.3 Project Concept

Innovative approach of the PPP Agreement

Bechtel Enterprises were provided with development rights to the land adjacent to the airport in return for covering some of the construction costs of the light rail extension. The question remains how much a private developer will pay for the development rights to the area of Cascade Station if this had been a separate transaction not related to the construction of the airport extension. At the time of the agreement, Bechtel Enterprises believed that it was more advantageous to undertake the Cascade Station development in conjunction with the construction of the light rail extension to the airport than to pursue the development of the Cascade Station as a separate project. Some studies have argued that Bechtel Enterprises pursued the project as a PPP in order to avoid a competitive bidding process for the development rights to the area of Cascade Station.

When private sector funds public infrastructure, a question remains whether the overall costs to society of using private funds to develop public infrastructure are reduced or increased compared to funding these projects entirely from public sources. While private sector funding is often viewed as “free money” by the agencies sponsoring a particular project because these funds does not come from constrained budgets but have to be repaid in some way or other. This makes it difficult to understand whether this particular PPP approach has long-term public interest or is a way for the private company to make money. However, with growing public interest these questions become increasingly important.

MAX Airport Extension provides an excellent example of a Design-Build PPP project where there is an advantage of private sector funding for airport ground access

project, as well as the difficulty of knowing whether this approach is really of public interest.

Many elements of advanced planning made this project possible. Plans for this transit line were made public before designing so Bechtel Enterprises were aware of them and offered its proposal accordingly. The unsolicited proposal of design-build method of project delivery and also providing the development rights of Cascade Station to Bechtel saved time in building Airport Max.

In general if the private company has faith in the public administration, it will partner with the public sector. It was unclear in this project whether Bechtel's innovative approach to this DB planning paid-off financially for them or not. Well whatever may be the reasons for Bechtel to approach with an unsolicited proposal, the public got a new rail line ten years ahead of schedule.

In Portland, the local bodies have significant control over development. Development rights within Portland are very valuable. Hence, it played an important role in making this project successful. However, Bechtel's financial return on this project is unclear, since the financial status of the private entity is not made public. So the question remains whether it was a bad decision for the company in the real estate end or did it expect losses to be covered through its construction costs. One of the other lessons that is learnt is that it is a challenge to maintain transparency in the whole process. It is tough to involve the public in negotiations with the private sector. In this project Bechtel had an unsolicited bid without any competitive bidding process. Therefore public was involved after most of the designs were made.

In April 2009 a detailed case study was done by PB Consult on the development and financing of the Airport Red Line extension for the AASHTO (American Association of State Highway and Transportation Officials) Center for Excellence in Project Finance. Many information about this case study are drawn from that study.

3.3 WMATA Largo Metrorail Extension

The Maryland Mass Transit Administration (MTA) and the Washington Metropolitan Area Transit Authority (WMATA) are the lead agencies of the WMATA Largo Metrorail Extension project. It is a 3.1-mile heavy rail extension of WMATA Metro's Blue Line. The project aimed at extending the Blue Line from its terminus at the Addison Road-Seat Pleasant Station to Largo Town Center, located just beyond the Capital Beltway in Prince George's County, Maryland. The project includes tunnel and surface segments. The project also includes two new stations at Morgan Boulevard and Largo Town Center; also purchase of 14 heavy rail vehicles. All the stations provide a total of 2,700 park-and-ride spaces and bus bays. The project also provides direct walking access to a new Boulevard Cap Center retail development. It gives walking access and shuttle bus service to the sports complex at FedEx Field.

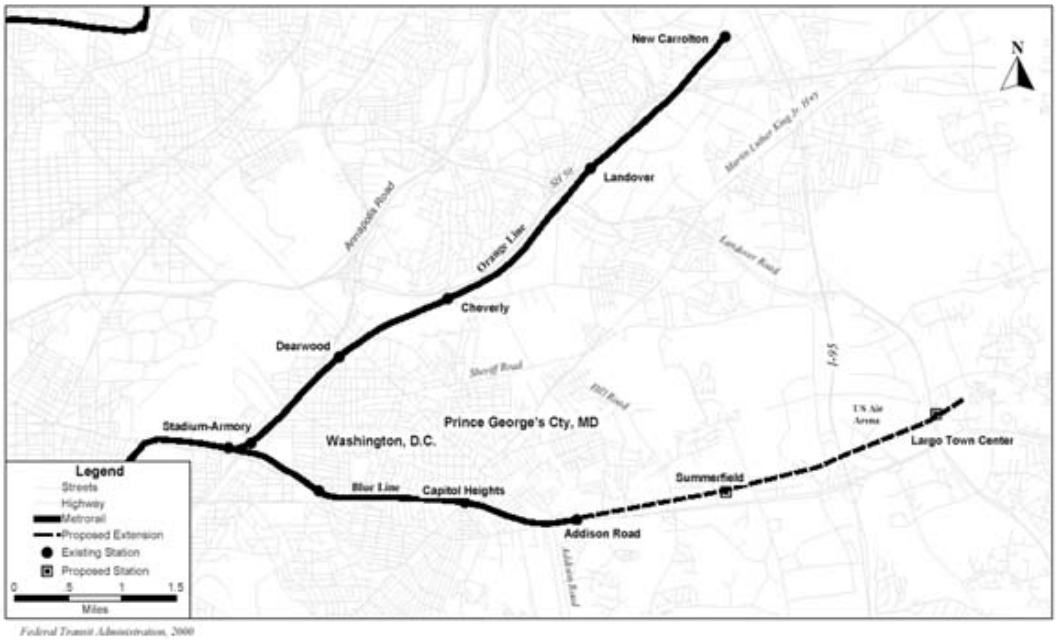

Figure 3.3 WMATA Largo Metrorail Extension Map

Source: www.ft.dot.gov (accessed on 10/15/13)

3.3.1 Funding

The total capital cost of the project is $607.20 million.

Table 3.2 Funding sources

Source of Funds	**Total Funding ($million)**
Federal:	$364.30
Local:	$69.30
State:	$173.60
Total	**$607.20**

3.3.2 Timeline

According to a study done by Washington DC Metropolitan Area on the Largo Metrorail Extension in 2007, the timeline of the project is stated below:

July 1997: Preliminary engineering for the Largo Metrorail Extension was initiated

April 2000: Completion of preliminary engineering.

October 1996: A Draft Environmental Impact Statement (EIS) was made.

December 1999: Final EIS was completed.

February 2000: Federal Transit Administration (FTA) issued a Record of Decision for the Largo Metrorail Extension

July 2000: Approved the project into final design.

December 2000: WMATA and FTA entered into a Fully Funded Grant Agreement (FFGA).

May 26, 2000: The non-Federal share for the original FFGA project was provided by the State of Maryland through a funding agreement with WMATA.

March 2001: WMATA went for a Design-Build Public Private Partnership

October 2002: The final contract was initiated for the stations and parking facilities.

September 2002: An additional $13.60 million was authorized by Prince George's County and the Maryland Department of Transportation to add a parking structure at the Largo Station and a day care center at the Morgan Boulevard Station.

September 2002: The WMATA Board approved $9.00 million.

December 2004: Revenue operations started.

July 2006: FFGA was amended to add $173.30 million for additional rail cars and traction power upgrades to support eight-car train operations on the Blue and Orange lines.

3.3.3 Project Concept

Much information about this project concept has been taken from a study by Washington DC Metropolitan Area on the Largo Metrorail Extension in 2007. They stated the final cost of the **Largo Metrorail Extension** project were approximately $1 million less than what WMATA had budgeted for them. The design-build contractor used a jet van tunnel ventilation system in the project which saved approximately $10 million over the vent shafts. The cost got directly saved here. Hence, innovations in project design resulted in savings. The size of the project was such that it was expected to have 15 to 20 contractors and might have applied Desin-Bid-Build approach. Instead the number of contractors reporting to WMATA went down to 3 contractors. Therefore it reduced the complexity and cost of managing the project and procuring contractors. WMATA originally projected overhead cost savings related to a shortened project timeframe versus commodities-related cost savings. Later the overhead cost savings did not impact the project much given its completion before the recent sharp increases in key construction commodities. The jet van tunnel ventilation system that has been used in the project was found to be easier to maintain and more efficient to operate, though special equipment was required to maintain them. The design-build contractor suggested the tunnel ventilation changes to WMATA for the **Largo Metrorail Extension project** which improved a project by applying a construction technique that is both higher quality and cost effective.

3.4 BART Oakland Airport Connector

The **BART Oakland Airport Connector** project has been a public private partnership with Design-Build-Finance-Operate-Maintain approach between Bay Area Rapid Transit (BART), the Federal Transit Administration, the Alameda County Transportation Improvement Authority (ACTIA), the Alameda County Congestion Management Agency (ACCMA), the Metropolitan Transportation Commission (MTC), California Department of Transportation (Caltrans), the California Transportation Commission (CTC), the City of Oakland and the Port of Oakland. The concept of an improved transit link between Oakland International Airport (OAK) and the BART system has been discussed and various feasibility and environmental studies have been undertaken since the early 1970s. There are existing transportation constraints in the Bay Area, increased growth at OAK, anticipated future public and private development, and related congestion along roadways. Thus there was an urgent need for the Oakland Airport Connector (OAC).

Transit services to OAK include Air BART, Alameda-Contra Costa Transit District (AC Transit) buses, taxis and airport shuttles. All these transit services provide various levels of service. The traffic congestion, the crowd during Oakland Coliseum events raises concerns for air passengers and that resulted in use of transit services to access OAK. Since there are no fixed travel times for Air BART between the Coliseum/Oakland Airport BART Station and OAK and also the wait times vary for Air BART at the station and at the airport purchasing tickets at the Coliseum/Oakland Airport BART Station and OAK becomes confusing and inconvenient for passengers which results in additional loss of time and frustration for travelers. Hence there was a need for a connector. This 3.2-mile connector was proposed as a transit alternative to driving

individual automobiles and the overall airport traffic will benefit by reducing the number of cars on the road.

Figure 3.4 BART Oakland Airport Connector

Source: www.bart.gov (accessed on 10/15/13)

OAK has been the largest aviation project and completed a $350 million Terminal Improvement Program. The program started in April 2004. A 20-year Master Plan was prepared by The Port of Oakland, owner and operator of OAK in cooperation with airport, government and community stakeholders. The plan demarcated land use for airport facilities like passenger terminal, cargo, and airport services, airfield and aircraft apron, and public access using expanded roadways and ground transportation alternatives, such as the OAC. BART staff studied the impact of the project in details. The results show that the OAC project will create more than 2,500 jobs.

According to a paper, "Job Impacts of Spending on Public Transportation," prepared by the Economic Development Research Group for the American Public Transportation Association (APTA), every $1 billion in transportation capital investments supports 24,000 direct, indirect and induced jobs. Using this formula the OAC project figured out more than 7,000 direct, indirect and induced jobs will be created from this project.

3.4.1 Funding

The total project budget for the OAC project is approximately $484 million. In July 2010 project funding partners developed a funding plan to address the loss of $70 million in previously anticipated federal stimulus funds, and are in the process of being considered by the various agency boards. The loss of stimulus funding is primarily offset by $35 million from new sources, better bid pricing than anticipated and increased debt financing. The funding plan is within the borrowing limits established by the BART Board of Directors in May 2009.

Table 3.3 Funding sources ($ millions)

Local	**274.5**
State	**78.9**
Federal	**25.0**
Debt draws	**105.7**
Total sources of funds	**484.1**

3.4.2 Timeline

1970: Phase I Transit Access Feasibility Study completed.

1975: Phase II Oakland Airport Transit Access Project completed.

1980: Oakland Airport Transit Connector Working Paper Preliminary Design and Engineering Phase completed.

1981: Oakland Airport Transit Connector Draft Environmental Impact Statement (EIS) completed.

1993: Project Update Report for the Oakland Airport Intermodal Connector Project completed.

November 7, 2000: Alameda County provided funding for a series of transportation-related projects, including the Oakland Airport Connector.

March 28, 2002: The BART Board of Directors certified the Final Environmental Impact Report (EIR) and approved the BART link to Oakland International Airport via elevated Automated Guide way Transit (AGT) system.

May 2009: BART issued an RFP/RFQ for Design-Build Operate Maintain (DBOM) contract.

December 10, 2009: The BART Board of Directors authorized the Notice of Intent to award the Oakland Airport Connector DBOM contract to Flatiron/Parsons with a Joint Venture.

September 16, 2010: The BART Board of Directors reaffirmed the authorization of the contract for the project.

3.4.3 Project Concept

An Automated Guide way Transit (AGT) system has been used in the OAC project. The AGT system operates within their own guide ways. They have stations physically integrated with the Coliseum/Oakland Airport BART Station and the airport terminal. This system does not require a vehicle operator which in turn reduces the cost. Selection of the specific technology has been a part of the design-build procurement process.

From the Coliseum/Oakland Airport BART Station to Doolittle Drive, the alignment will proceed in the median of Hegenberger Road. South of Doolittle Drive on Oakland International Airport, it will run between Airport Drive to the west and the Lew F. Galbraith Municipal Golf Course to the east. The AGT vehicles operate in an elevated guide way, to separate itself from other vehicular traffic. Since the AGT system is a driver less system, it is better to separate it from the general vehicular traffic and provide

an exclusive right of way. The **BART Oakland Airport Connector** project had been partially funded by the private. A DBFO delivery approach added an estimated $30 to $40 million to the cost of the concession over a 30 to 40 year term. If a DBOM delivery approach was applied, then the state had to fund the whole project, but in this case the state was running short of money. So private financing became necessary. The BART **Oakland Airport Connector** project would not be possible without using a DBFO structure because of the poor economic climate; a major amount of state funding for the project would not have been available before several years. Only because of the advantage of the DBFO approach of getting funds from the private agency, BART is using a PPP structure for its **Oakland Airport Connector** project. Under the proposed DBFO structure for the project, the private agent finances half of the project's capital cost. The debt service would be repaid from fare revenue which will be generated by the project's operation. One major reason BART selected a DBFO project delivery approach for the **Oakland Airport Connector** project is because it would build a high-quality system. The private agency will develop a high-quality system because it is responsible for capital reinvestment. It is also responsible for system turnover costs over the 35-year span of the O&M contract. The project will also benefit from the efficiencies created by direct operation and maintenance by the private agency.

3.5 Hudson-Bergen LRT MOS-1 & MOS-2

The **Hudson–Bergen Light Rail (HBLR)** is a 20.6-mile long light rail service that runs as the north-south transit connector within the Hudson County communities of Bayonne, Jersey City, Hoboken, Weehawken, Union City, and North Bergen with 23 stops along 3

services. In 1996, HBLR project evolved as a public-private partnership project with Washington Group International with a Design-Build- Operate - Maintain contract. The timeframe was 15 years. Washington Group International was awarded the $1.1 billion contract to a team led by URS. The team was known as 21st Century Rail and were contracted to design and construct the system, procure the equipment, and operate and maintain the line. The project scope was increased later which resulted in increase of the cost to $1.9 billion contract including 20 years of operations and maintenance. The Hudson-Bergen LRT is the first Design-Build-Operate-Maintain transit project in the U.S. and was the first such contract awarded to a single contractor. The Hudson-Bergen LRT project brought in developments in the areas across the line. Commercial and residential developments are the major land use developments that took place near the Hudson River waterfront. Many abandoned industrial neighborhoods turned into thriving communities. The whole route was developed in multiple phases. It was a product of intensive planning, public participation and political cooperation. Being the first DBOM transit project, HBLR is a testament to the value of investment in new transportation infrastructure.

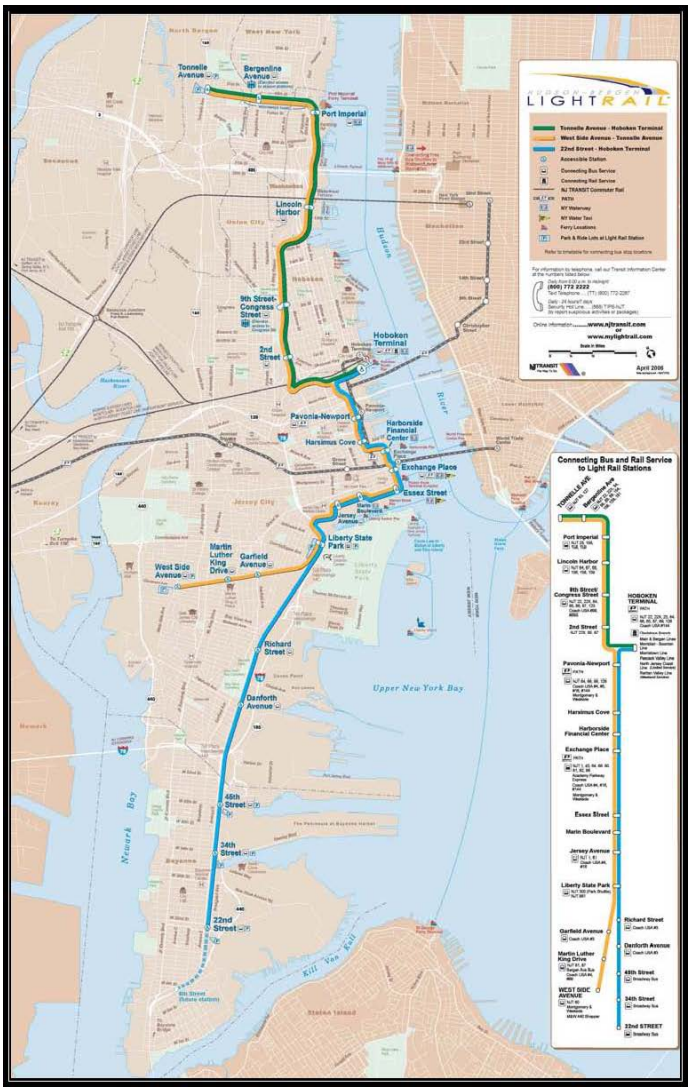

Figure 3.5 HBLR Route

Source:http://www.city-data.com/forum/general-u-s/952256-public-transportation-maps.html (accessed on 10/15/13)

HBLR linkages are linked to multiple connections. New transportation options have been opened up because of such connections. The HBLR provides connections to the PATH service into New York City and Newark, suburban commuter rail at Hoboken. It also provides ferry service at many points, bus stops at most stations. The current HBLR fleet consists of 53 low-floor electric light rail cars.

3.5.1 Funding

Table 3.4 Funding sources

First Segment cost:	$990 million
Federal Transportation Administration **New Jersey Transportation Trust Fund**	$600 million $390 million
Second Segment:	$1.2 billion
Federal Transportation Administration. **New Jersey Transportation Trust Fund.**	$500 million $700 million

Fare box is recovered by NJ TRANSIT. Ridership and Marketing promotions are the responsibilities of Agency Operator responsible for all maintenance and personnel costs. NJ TRANSIT pays an annual fee to the Operator.

3.5.2 Timeline

February 1996: Technical Proposals were made.

June 1996: Priced Proposals were made.

July 1996: Board authorized the proposals.

September 1996: Contract Signed**.**

November 1996: Notice to Proceed.

April 15, 2000: The first section opened from 34th Street to Exchange Place.

November 18, 2000: The light rail is extended north to Newport.

September 29, 2002: The light rail is extended north to Hoboken Terminal.

November 15, 2003: The light rail is extended south to 22nd Street.

September 7, 2004: The light rail is extended north to Lincoln Harbor.

October 29, 2005: The light rail is extended north to Port Imperial.

February 25, 2006: The line is extended to Tonnelle Avenue in North Bergen.

January 31, 2011: The light rail is extended south to 8th Street in Bayonne.

3.5.3 Project Concept

By applying a PPP, many of the risks associated with developing and operating a project can be shared with the private sector. Risk sharing can provide incentives to improve the quality, cost effectiveness, or timeliness of a project. As one project sponsor observed, under a design-bid build approach contractors would sit back and leave it to the sponsor to resolve design problems. On the other hand, with design-build, the contractor team members must implement what they themselves design, and will come to the plate much faster to make sure the design works than under design-bid-build. One of the primary reasons the public sector is interested in using PPPs is to achieve time savings in the total development process through concurrent performance of certain activities whose results are not mutually dependent, efficient use of resources, and related cost savings. PPPs can also expedite the application of advanced technology. Thus, private developers seek to "fast-track" design and construction, proceeding with certain elements of the construction work while design is still ongoing on others, and involving the construction firm in design reviews to avoid delays associated with design defects affecting project construction. Time savings can also lower the cost of the project by avoiding large increases in material costs due to price inflation. The Hudson Bergen Light Rail project advanced by at least one and possibly two years by using a DBOM delivery approach versus design-bid-build. NJ Transit discovered that when the concessionaire did more

design itself instead of subcontracting design, the agency obtained superior results because there was better coordination between the prime contractor and the operator. The design of the Hudson-Bergen LRT MOS-1 was by a sub-contractor, which created coordination and communication issues between the project's designer and operator. The lead for the DB consortium designed Hudson-Bergen LRT MOS-2 directly, and was more responsive to civil and system's needs, which achieved a better product easily.

Lower indirect costs include avoided costs attributable to the selection of a PPP. Indirect cost savings also result from the transfer of risk of operating and maintenance cost increases to a consortium. NJ Transit will pay the Hudson-Bergen Light Rail project's DBOM consortium a guaranteed price in 1996 dollars for the operation and maintenance of the line, subject to increases in the consumer price index (CPI) and other inflation indices for selected operating costs, including electricity. This insulates the agency from growth in operating costs for reasons other than inflation, and provides the operating consortium incentive to keep a lid on O&M cost escalation. For Hudson Bergen Light Rail project, the sponsoring agency was able to increase both ridership and revenues by bringing the projects online for revenue service earlier than using a more traditional project delivery approach. This benefits both the sponsoring transit agencies and their patrons. The major social welfare benefit of PPPs is their ability to expedite the delivery of transit facilities and services and to reduce capital and operating costs so that these benefits can be generated in a timelier manner at the same or lower overall costs.

NJ Transit discovered that its DBOM contract for the **Hudson-Bergen LRT** project did not adequately address the quality of service to the traveling public. While the consortium received a penalty or bonus for on-time performance, there were no

incentives for station cleanliness or notification of customers of changes in service or other announcements, which became an issue. This experience highlights the need for detailed performance standards and proper incentives for performance.

The project has improved mobility and connectivity in northern New Jersey and has spurred significant economic development in the communities served by the line.

CHAPTER 4

ANALYSIS

The analysis has been done based on the PPP impacts of various factors like project cost, project timeframe, direct and indirect costs, capacity building, project quality, funding sources and revenue of the selected transit project case studies reviewed in this study so far.

As shown in Table 4.1 , **Denver T-REX Southeast Corridor LRT, Portland MAX Airport Extension and WMATA Largo Metrorail Extension** projects followed a Design-Build approach of project delivery ranging from total project cost of $128.8 million to $1.67 billion and all the projects have been successful. This indicates that the DB approach can be applied to projects of various sizes. All these three projects were completed within or under budget as compared to **BART Oakland Airport Connector and Hudson-Bergen LRT MOS-1 & MOS-2** which followed a DBFO and DBOM approach respectively. Both these projects went above the estimated project cost due to private financing. Hence according to these case studies, Design-Build approach tries to complete the project within budget.

All the three approaches of public private partnership studied through these case studies show that they all have been completed before the estimated timeframe because they followed the public private partnership approach for project delivery.

Table 4.1 Analysis of PPP Impacts on Selected Transit Project Case Studies

	Denver T-REX Southeast Corridor LRT	**Portland MAX Airport Extension**	**WMATA Largo Metrorail Extension**	**BART Oakland Airport Connector**	**Hudson-Bergen LRT MOS-1 & MOS-2**
Type of PPP Approach	DB	DB with innovative approach.	DB	DBFO	DBOM
Project Cost	$1.67 Billion Project completed within budget.	$128.8 Million Completed within budget.	$607.2 Million Completed $1M under budget.	$484.1 Million Slightly higher cost for private financing.	$1.9 Billion Insulated from capital & O&M cost overruns through risk transfer
Project Timeframe	22 months ahead of schedule	3 years saved. Construction ended 9 weeks early.	2 years saved.	Project may otherwise never occur without DBFO.	2 years saved.
Direct and Indirect Costs	Estimated building materials cost savings.	$10-15M in building material cost savings.	Overhead cost savings from fewer contractors. Cost-effective Design lead to life cycle cost savings.	Reduced estimated cost for O&M.	Transfer of operating and maintenance to the private sector saves the overall cost.
Capacity Building	Absence of required plans and lack of the public planning process made an error of TOD. Limited staff with TOD	Complex financial relationships between local funding bodies. Lack of public participation An unsolicited project proposal by private agency made this project	N/A	N/A	N/A

	knowledge.	successful.			
Project Quality	Meets agency's usual design standards.	Meets agency's usual design standards.	Innovative design leading to higher quality product.	DBFO provided incentive to build higher quality project.	O&M portion of DBOM provides incentives for quality product. Inadequate quality of service to the traveling public.
Funding Sources	Increased property taxes, Highway Users Tax Fund Dollars, Senate Bill 97-01money, bonding/ federal revenues.	Up-front private funding of $28M, 23% of project cost. Also funded by the City of Portland, Tri-Met and Port of Portland.	Federal, state and local funds	Up-front private funding for 50% of project capital cost. Also local, state, federal funds and debt draw.	Federal Transportation Administration, New Jersey Transportation Trust Fund
Revenue	N/A	Private agency's financial return is unclear.	N/A	Repayment of debt service from fare revenue.	The sponsoring agency was able to increase revenues by bringing the project online for revenue service.

For **Denver T-REX Southeast Corridor LRT, Portland MAX Airport Extension** projects, the estimated building material costs got saved. For **WMATA Largo Metrorail Extension** project, reduction of estimated contractors from 15-20 to 3 contractors simplified WMATA's Largo Metrorail Extension project management and reduced the cost and complexity of managing the project and procuring contractors. Also, the jet van tunnel ventilation system that has been used in the project was found to be easier to maintain and more efficient to operate. Thus there were substantial cost savings.

In Design Build projects, it is seen that because the projects were completed before time, the cost of managing the project and contractors got reduced. Hence the overall cost got reduced. For **BART Oakland Airport Connector and Hudson-Bergen LRT MOS-1 & MOS-2** projects, transfer of operating and maintenance to the private sector saved the overall cost. Therefore, for DBOM projects, since the responsibility of many of the risks and cost associated with developing and operating a project is with the private sector, the risks get shared. This in turn makes the project cost effective.

The **Denver T-REX Southeast Corridor LRT** project felt the need for more participation by the development community and adjacent property owners. The problem was the local jurisdictions did not encourage early collaboration. If the local jurisdictions had prepared and used land-use plans for the station areas, those would have been useful. Absence of these plans and the lack of initiation of a public planning process by the local jurisdiction, the project team made the error of developing Transit Oriented Development (TOD) concepts without coordinating well with all the local landowners. Also there were limited staffs with TOD knowledge. The **Portland MAX Airport Extension** project had a unique unsolicited proposal of design-build method of project delivery and also providing the development rights of Cascade Station to Bechtel. This project also had lack of public participation during the design phase. It can be inferred that in a public private partnership approach, when the responsibility of designing and building is with the private sector, the local jurisdictions have to take the initiative to collaborate the public with the private sector before the start of the design phase.

For **WMATA Largo Metrorail Extension** project innovative design leads to higher quality project. This is the only Design – Build project that has a good project

quality because of its innovative design. For the DBFO and DBOM projects, operation and maintenance portion provide incentives for quality production.

The **Portland MAX Airport Extension** project followed a Design-Build approach but had an innovative approach. It had an up-front private funding for 23% of the project capital cost which made the project happen. The **BART Oakland Airport Connector** project had an up-front private funding for 50% of the project capital cost because it followed a DBFO approach. The project went into a public private partnership only because it was receiving 50% private funding because the state was not able to collect that amount and would have to wait for a long time. Hence, it implies that due to the lack of state funds, funds have been taken from the private sector which resulted in reducing the timeframe. Though it is still unclear whether the private sector benefits from the project or not.

In the **Hudson-Bergen LRT MOS-1 & MOS-2** projects, the sponsoring agency were able to increase revenues by bringing the project online for revenue service. Revenue information for most of the projects mainly the ones funded partially by the private sector are unclear because the financial information is not made public.

CHAPTER 5

EVALUATION OF THE PPP APPROACHES

After comparing all the 3 types of Public Private Partnership approaches that has been widely practiced throughout the country, it is seen that Design-Build-Operate-Maintain, Design-Build-Finance-Operate and Design-Build is the most successful approaches. Based on project size and cost, schedule, risk management and allocation, capacity building, lifecycle issues and construction claims all the three project delivery approaches have been evaluated.

5.1 Project Size and Cost

Project size reflects the dollar value and physical dimensions of the transit corridor. This issue represents several aspects of project cost like ability to handle budget restrictions, early and precise cost estimation, and consistent control of project costs.

The design build approach has been shown to work on projects of all sizes varying from **Portland MAX Airport Extension** project with $128.8 million to **Denver T-REX Southeast Corridor LRT** project with $1.67 billion. It has been noted that DB can facilitate better management of small projects due to the single source of responsibility like for **Portland MAX Airport Extension** project. As projects grow in size, there can be large peaks in owner staffing requirements with DB. Also the number of contractors increases which increases the cost and complexity of managing the project and procuring contractors.

Design Build Finance Operate approach can work well on small to medium sized projects because the project is partially funded by the private sector. According to the **BART Oakland Airport Connector** project, it is not clear whether they earned enough revenue or not. So, bigger the project, larger would be the amount share of the private company.

DBOM is appropriate for large projects. Similar to DB, can facilitate better management of large projects due to the single source of responsibility. DBOM is not appropriate for smaller projects due to the overhead costs (e.g., for maintenance, etc.) as seen in the **Hudson-Bergen LRT MOS-1 & MOS-2** projects. There is a disadvantage of DBOM approach. The private sector is provided with a fixed cost for design, construction, and maintenance very early in the process. Due to the large amount of risk being taken by the DBOM provider, costs may be higher if the providers are not given opportunities to find efficiencies. DBOM pricing may be harder to negotiate due to the complexity and time frame of maintenance contracts.

5.2 Schedule

This factor shows two aspects of project schedule and includes both the ability to shorten the schedule and the opportunity to control and prevent time growth.

The design build approach provides a single point of responsibility (DB contractor) for schedule control. If the project is bigger, the number of contractors might increase as in the case of **Portland MAX Airport Extension** project. Each contractor is responsible for schedule control. It gives early schedule certainty.

Design Build Finance Operate approach also has a single point of responsibility. DBFO has also been good for small to medium sized projects and hence will have less number of contractors who are responsible for schedule control.

DBOM approach also provides a single point of responsibility (DB contractor) for schedule control. And also gives early scheduled certainty. One of the DBOM projects, **Hudson-Bergen LRT MOS-1 & MOS-2** projects provides the least schedule growth. It facilitates the start-up process due to a single point of responsibility for design, construction, and operation. Rapid schedule will require owner effort in design and construction reviews.

5.3 Risk Management and Allocation

The issue details methods to cope with project uncertainties that are inherent to each delivery method. Each project delivery method has inherent risk-allocation characteristics. The overarching goal should be to select the project delivery method with the best ability to assign project risks to the parties in the best position to manage them.

For Design Build approach, the private sector has the single point of responsibility for risk management in design and construction. The design - builder owns risk for design errors and omissions. The owner may lose some ability to participate in the risk management process. Risks are allocated through conceptual design and performance specifications. Like for the **Denver T-REX Southeast Corridor** project, there was a lack of the public planning process, hence they made an

error of developing TOD with staffs having limited knowledge of TOD which resulted in errors in the RFP.

Design Build Finance Operate approach has a single point of responsibility for risk management in design, construction and operate. The design - builder owns risk for design and construction errors and omissions. The owner may lose some ability to participate in the risk management process for design, construction and operation. Risks are allocated through conceptual design and performance specifications for design, construction and operation.

In DBOM approach, the private sector has a single point of responsibility for risk allocation in design, construction, operation, and maintenance. Constructor owns risk for design errors and omissions in construction, operations and maintenance. The owner may lose some ability to participate in the risk management process for design, construction, operation, and maintenance. Risks must be allocated through conceptual design and performance specifications for design, construction, operation, and maintenance.

5.4 Capacity Building

Each project delivery method has some inherent abilities to include these features in accordance with the owner's needs. The level of experience of an owner's staff can affect the success of an alternative delivery method application. The total number of required owner's employees for each delivery method is one measure of the extent of owner involvement. Another important measure for the owners is the variation in the number of staff required throughout the project development process. This issue regards the owner's

requirement to furnish a highly capable staff to complete the duties it must undertake in each delivery method. Agency goals define project success. The extent to which these goals align with the inherent attributes of each project delivery method has a significant bearing on the delivery method selected. The owner's ability to control the details of design and construction varies with each project delivery method. Each delivery method can facilitate agreements with third parties, such as political entities, utilities, railroads, etc. in a different manner. The extent to which designers or constructors can facilitate third-party agreements is the basis for the advantages and disadvantages of each delivery method.

In the Design Build approach, an owner can use some Leadership in Energy & Environmental Design (LEED) certification elements to select constructor. Single point of responsibility is provided for LEED certification in design and construction. Agencies can take advantage of the sole point of responsibility for design and construction to leverage their experience. DB can greatly reduce the number of required owner staff. The design and construction reviews can be done in shorter periods of time. The owners are able to rely on one source of responsibility for both design and construction as it has been done for **Denver T-REX Southeast Corridor LRT** and **Portland MAX Airport Extension** projects. The best-value design-builder selection aligns the team with the project goals.

The owner may not be involved in all LEED decisions. The agencies may not have experience authoring DB RFPs as it happened to **Denver T-REX Southeast Corridor LRT** project. Lack of knowledge in conducting procurements and also administering DB contracts, particularly in the area of design review and administration

and also lack of TOD concepts created problems. DB necessitates experienced staff to manage design and construction under one contract. Fewer owner staff is needed but experienced staff is required. DB is an alternative delivery method and it is advisable to have a staff with DB oversight experience. Owners need capabilities to develop procurement documents and performance criteria. The owners also need to have the capabilities of reviewing design under a DB contract. To ensure success, agencies must completely understand goals prior to awarding the DB contract.

In Design Build Finance Operate approach, the owner can use some LEED certification elements to select constructor. In addition to having a single point of responsibility provided for LEED certification in design and construction, many LEED principles are in alignment with the constructor's motivation to minimize operating costs. Similar to DB, agencies can take advantage of the sole point of contact for design, construction, and operation to leverage their experience. Similar to DB, DBFO can greatly reduce the number of required owner staff. Design and construction reviews can be done in shorter periods of time. The owners are able to rely on one source of responsibility for design, construction and operations. In addition to the DB advantages, DBFO allows owners to include operational goals in the contract. But on the other hand, the owner may not be involved in all LEED decisions. Agencies may not have experience authoring DBFO RFPs and conducting procurements though nothing as such has been seen in the **BART Oakland Airport Connector** projects. Agencies may not have experience administering DBFO contracts, particularly in the area of design review and administration. DBFO necessitates the most experienced staff to manage design, construction, and operation under one contract. DBFO can create large peaks in owner

staffing needs during procurement and design review due to the inclusion of operational and financial issues involved in the process. While fewer owner staff is needed, more experienced staff is required. Similar to DB, DBFO is an alternative delivery method and it is advisable to have staff members with DBFO oversight experience. The owners will need capabilities to develop procurement documents and performance criteria. The owners will also need capabilities to analyze complex financial proposals. Similar to DB, agencies must completely understand goals prior to awarding the DBFO contract.

In DBOM approach, the owner can use some LEED certification elements to select constructor. In addition to having a single point of responsibility provided for LEED certification in design and construction, many LEED principles are in alignment with the constructor's motivation to minimize operating costs. Similar to DB, agencies can take advantage of the sole point of contact for design, construction, and maintenance to leverage their experience. Similar to DB, DBOM can greatly reduce the number of required owner staff. Design and construction reviews can be done in shorter periods of time. The owners are able to rely on one source of responsibility for design, construction, operations, and maintenance. In addition to the DB advantages, DBOM allows owners to include lifecycle and maintenance goals in the contract. But on the other hand, the owner may not be involved in all LEED decisions. Agencies may not have experience authoring DBOM RFPs and conducting procurements though nothing as such has been seen in the **Hudson-Bergen LRT MOS-1 & MOS-2** projects. Agencies may not have experience administering DBOM contracts, particularly in the area of design review and administration. DBOM necessitates the most experienced staff to manage design, construction, and maintenance under one contract. DBOM can create large peaks in

owner staffing needs during procurement and design review due to the inclusion of maintenance and financial issues involved in the process. While fewer owner staff is needed, more experienced staff is required. Similar to DB, DBOM is an alternative delivery method and it is advisable to have staff members with DBOM oversight experience. The owners will need capabilities to develop procurement documents and performance criteria. The owners will also need capabilities to analyze complex financial proposals. Similar to DB, agencies must completely understand goals prior to awarding the DBOM contract.

5.5 Lifecycle Issues

Delivery methods can influence costs in the operation and maintenance phase. This issue focuses on the opportunities or barriers that each delivery method provides with regard to life cycle costs. There can be advantages and disadvantages to each delivery method with regard to how maintainability is achieved. This issue describes these advantages and disadvantages as they relate to the owner's ability to specify the quality and ease of maintenance. Sustainable design is becoming ever more important in achieving overall sustainability goals for projects. The effect of delivery method in facilitating the process of implementing sustainability issues in the design is the focus of this issue.

In the Design Build approach, the agency can use performance criteria to set lifecycle performance standards and rely on design-builder innovation to achieve these standards. For **WMATA Largo Metrorail Extension** project innovative design lead to higher quality project and lifecycle cost savings. The agency can emphasize sustainable design and construction issues through performance criteria and best value award factors. Integration of the design and construction team can enhance constructability of designs.

If lifecycle performance criteria are not well understood at the procurement stage, they will not be incorporated into the DB contract. If sustainable design issues are not well understood at the procurement stage, they will not be incorporated into the DB contract. If sustainable construction issues are not well understood at the procurement stage, they will not be incorporated into the DB contract.

In DBFO approach, the design-builder is responsible for operations in the DBFO contract and will be highly motivated to provide optimal lifecycle designs. The agency can use performance criteria to set lifecycle performance standards and rely on design-builder innovation to achieve these standards. The design-builder is responsible for operations in the DBFO contract and will be highly motivated to provide optimal lifecycle designs. The agency can emphasize operations issues through performance criteria and best value award factors. The agency can emphasize sustainable design issues through performance criteria and best value award factors. Integration of the design and construction team can enhance constructability of designs. The agency does not have complete control over all life cycle issues that are not included as performance criteria in the contract. If sustainable construction issues are not well understood at the procurement stage, they will not be incorporated into the DBFO contract.

In DBOM approach, the design-builder is responsible for maintenance in the DBOM contract and will be highly motivated to provide optimal lifecycle designs. The agency can use performance criteria to set lifecycle performance standards and rely on design-builder innovation to achieve these standards. The design-builder is responsible for maintenance in the DBOM contract and will be highly motivated to provide optimal lifecycle designs. The agency can emphasize maintainability issues through performance

criteria and best value award factors. The agency can emphasize sustainable design issues through performance criteria and best value award factors. Integration of the design and construction team can enhance constructability of designs. The agency does not have complete control over all life cycle issues that are not included as performance criteria in the contract. If sustainable construction issues are not well understood at the procurement stage, they will not be incorporated into the DBOM contract.

5.6 Construction Claims

The effect of each delivery method in exposing the agency to potential conflicts and claims is addressed under this issue. The extent to which a delivery method can prevent adversarial relationships on the project team varies depending upon the nature of the project and the owner's experience with the delivery methods.

In the Design- Build approach, the single source for design and construction eliminates claims for design errors or omissions from the agency's perspective. Inclusion of the designer and constructor on the same team can lessen adversarial relationships which have been seen in the **Denver T-REX Southeast Corridor LRT** and **Portland MAX Airport Extension** projects. There is potential for claims with regard to scope definition if the form of the DB contract is not well understood. Due to the loss of control over the details of design, DB requires a high level of trust between the owner and design-builder. Without this trust, design-build can become adversarial.

DBFO has similar advantages to DB and additionally eliminates claims regarding operating performance due to the integration of the operator. Inclusion of the designer, constructor, and operator contractor on the same team can lessen adversarial

relationships which have been seen in **BART Oakland Airport Connector** project. There is potential for claims with regard to scope definition if the form of the DBFO contract is not well understood. Similar to DB, DBFO delivery requires a high level of trust to succeed.

DBOM has similar advantages to DB and additionally eliminates claims regarding operating performance due to the integration of the operator. Inclusion of the designer, constructor, and maintenance contractor on the same team can lessen adversarial relationships which have been seen for **Hudson-Bergen LRT MOS-1 & MOS-2** projects. There is potential for claims with regard to scope definition if the form of the DBOM contract is not well understood. Similar to DB, DBOM delivery requires a high level of trust to succeed.

CHAPTER 6

CONCLUSION

6.1 Lessons Learnt

DBOM approach allows the private company to focus the project team towards the lifecycle of the project considering designing, building, operating and maintaining the whole project. DBOM approach tends to deliver a better quality project because the project team in order to increase their revenue and profitability decreases Operation & Maintenance costs. The transit project can be designed and constructed with operating performance rather than initial cost in mind. Increased integration of the project team can foster collaboration among architects, engineers, constructors and operators, facilitating a high performing project team. Also public participation with the project team should be initiated and encouraged by the local jurisdiction for better design and on-time performance. Systems can be right sized when they are designed with reliable O&M procedures in mind. This approach eliminates claims regarding operating performance due to the integration of the operator. The private company is responsible for maintenance in the DBOM contract and will be highly motivated to provide optimal lifecycle designs. DBOM allows owners to include lifecycle and maintenance goals in the contract. The transfer of design liability lessens the need for agency control over design and maintenance decisions.

The DBFO approach is generally taken up if the state does not have enough funds to fund the project. Well, it is unclear whether the private agency is financially

successful or not because the financial information of the private agencies are not made public.

The DBOM delivery method provides a single source for design, construction, operation and maintenance that proves to be the tool for facilitating high performance project teams to deliver high performance. Though DBOM approach seems to be the better PPP approach but it is not meant for smaller projects due to the overhead cost.

By all other means Design –Build approach is taken up mostly for public private partnership of transit projects because they are applicable for projects of various sizes. Also, private sector funding is not required in this approach, so the private agency does not have to worry about revenue generation and can concentrate only on design and construction issues.

6.2 Further Studies

Considering all the three project delivery approaches, it can be seen that Design – Build-Finance- Operate can provide a very high quality project but not many projects have taken up this approach. Also, financial status of the private agency is a very important entity in this approach. This has been unclear even after studying the project that followed DBFO approach. Further studies can be done to understand whether DBFO brings financial profitability of the private agency or not. If it does, then how can the DBFO approach of project delivery can be made popular among the local and state bodies to use this approach for their future transit projects.

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