Private Sector's Roles in Application of Private Finance Initiative to Highway Development in Japan

by

Takashi Imamura

B.Eng. Urban Engineering (1995)
The University of Tokyo

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Signature of Author _____
Department of Civil and Environmental Engineering
May 14th, 2002

Certified by _____
Fred Moavenzadeh
James Mason Crafts Professor of Engineering Systems
Department of Civil and Environmental Engineering
Thesis Supervisor

Accepted by _____
Oral Buyukozturk
Chairman, Departmental Committee on Graduate Studies

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ABSTRACT

The highway development program in Japan is currently at an important transition point. Necessary policy reforms, triggered by the public's increasing and intensifying criticisms, are under discussion. These criticisms are generally concerned with the financial difficulties in the program. Along with these policy reforms, the government should also consider applying Japanese Private Finance Initiative (or PFI) to highway infrastructure. Since its enactment in 1999, the governments have applied Japanese PFI in increasing number of occasions. However, primarily because of the difficulties for applying PFI to a large-scale infrastructure, they have not applied PFI in highways; PFI highway projects have not yet been realized in Japan, despite their potential advantages.

The analysis begins by reviewing how public-private partnerships (or PPP) work in highway projects, based on the worldwide observations and the specific experiences in the United States and the United Kingdom. The governments' original intent in organizing PPP in their highway development, and the effectiveness and difficulty of PPP implementation are examined. Also, the thesis discusses how PPP changes the work that private companies do on highway infrastructure projects.

Next, the thesis examines how the private companies must work with the government in PFI highway projects in Japan. What is the most important contribution? What is the most desirable working environment? The analyses of Japan's highway development program reveal that private companies must innovate their technology and manage risks efficiently to reduce the public expenditure. On the other hand, they need the government support in preliminary project planning and financial contributions.

Finally, the thesis introduces a new project planning method that construction companies can use to more effectively bid in PFI highway projects and thus increase their chances for selection. The study considers that the method should maximize Value for Money (or VFM) in PFI highway projects for the government, while maintaining debt repayment capacity of the project and reasonable profits for the operator companies. The method presents an improved approach to consider interrelationships among major cost items and project scheduling, and configure them to make the most of the companies' efforts in achieving the highest possible VFM in PFI highways.

Thesis Supervisor: Fred Moavenzadeh
Title: James Mason Crafts Professor of Engineering Systems
Department of Civil and Environmental Engineering

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I am dedicating this thesis to my wonderful wife, Shoko. Thank you for understanding and motivating me all the time until I could finally complete this thesis.

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Chapter 1. Introduction

1.1. Public-Private Partnerships in Japan's Highway Infrastructure

In Japan, the highway public corporations, under direct supervision of the national government, have developed integrated highway network throughout the nation since World War II. The initial condition of the highway infrastructure in the country was a significant lack of investment, because the government had focused their efforts to railroad and port infrastructure. Although the extensive highway development was initiated late compared to other developed countries, Japan has been successful in developing high standard and well-managed nationwide highway network in a remarkably short period.

The accelerated highway development has been made possible through virtually pure debt financing relying on toll collection. It is believed that the direct investment by the national government using tax money would have been unable to achieve the same result, given its capacity limitation and the variety of important objectives in the government. However, the accelerated highway investment has created a large amount of outstanding debts in the highway public corporations. Lately, many experts point out that the highway public corporations are facing with severe financial difficulties and policy reforms in highway development are necessary.

This kind of problem is not quit new in a global perspective, however. Many governments in the world have been experiencing fiscal problems in their highway development. Although there can be a number of possible measures to mitigate the problem, privatization schemes in some form are one of the most commonly followed paths. Further, among the various forms of privatization schemes, public-private partnerships (PPP) have been employed in a considerable number of occasions worldwide. Experiences are accumulated in many governments and the strengths and weaknesses of PPP in highway infrastructure are becoming gradually understood.

Japanese government, as well, launched Private Finance Initiative (PFI) in 1999, aiming at improving effectiveness and efficiency of public infrastructure services. The new policy can be thought of as an application of innovative methods that the world governments have

experimented in their public works procurement. Indeed, the concept of PFI was adopted from the United Kingdom, where the policy had originally been created and successfully implemented. Although Japanese PFI has seen increasing number of applications in building-type public projects by local governments, it has implemented in infrastructure projects by the national government in only few occasions. The highways, large-scale infrastructure under the responsibility of the national government, are not an exception.

However, given the potential advantages in various forms of PPP experienced in other countries, the application of PFI needs to be seriously sought in Japan as well. It will require changes in the mind-set of the government officials, because the application of PFI is likely to change the way they involve in highway projects. Also, it will require changes in the scope and arrangement of services that the private sector, particularly the construction companies, provide in public infrastructure procurement. Unless the private sector becomes sufficiently prepared to assume expanded responsibility under PFI, its implementation is not likely to proceed.

1.2. Objective of the Thesis

The ultimate objective of the thesis is to envisage a likely scenario of PFI application in Japan's highway development. The thesis primarily takes the viewpoint of the private sector, particularly of the construction companies. PFI aims at improving efficiency and effectiveness in the provision of public infrastructure services through the use of the private sector's technical and financial capability. Among the many private parties involved in PFI projects, the construction companies typically form an integral part of the participating teams. Therefore, the achievement of the goal in PFI depends on the construction companies' success in evolving their services in highway projects.

There are two important considerations in participating in PFI projects from the construction companies' point of view. They are the major areas of contributions that the public sector expects in inviting the construction companies in their highway development program and the policy environment where the construction companies are working under PFI arrangements. The construction companies must effectively direct their efforts according to the expectation from the public sector. Also, they need a workable environment, where their efforts are likely to result in reasonable profits. Focusing on these two aspects, the thesis tries to learn from the experiences in the world governments and apply them to the specific situations of highway

development in Japan.

1.3. Structure of the Thesis

The first half of the thesis (Chapter 2 thru Chapter 5) tries to draw lessons from the preceding experiences in the world governments that have invited private participation in their highway infrastructure. First, important issues regarding the fundamental benefits and difficulties in privatization policies are discussed. Next, the practical applications of the policies in the United States and the United Kingdom are studied.

The second half of the thesis (Chapter 6 and 7) tries to apply the lessons to the specific problems in Japan's highway development. First, the problem that Japan's highway development program has been facing is identified. Second, the lately developed policy framework of Japanese PFI is introduced. Third, the expected benefits for the government (and its agencies) responsible for the highway development are studied. Finally, the implications of PFI application to the private sector are discussed. The structure of the thesis appears in Figure 1-1.

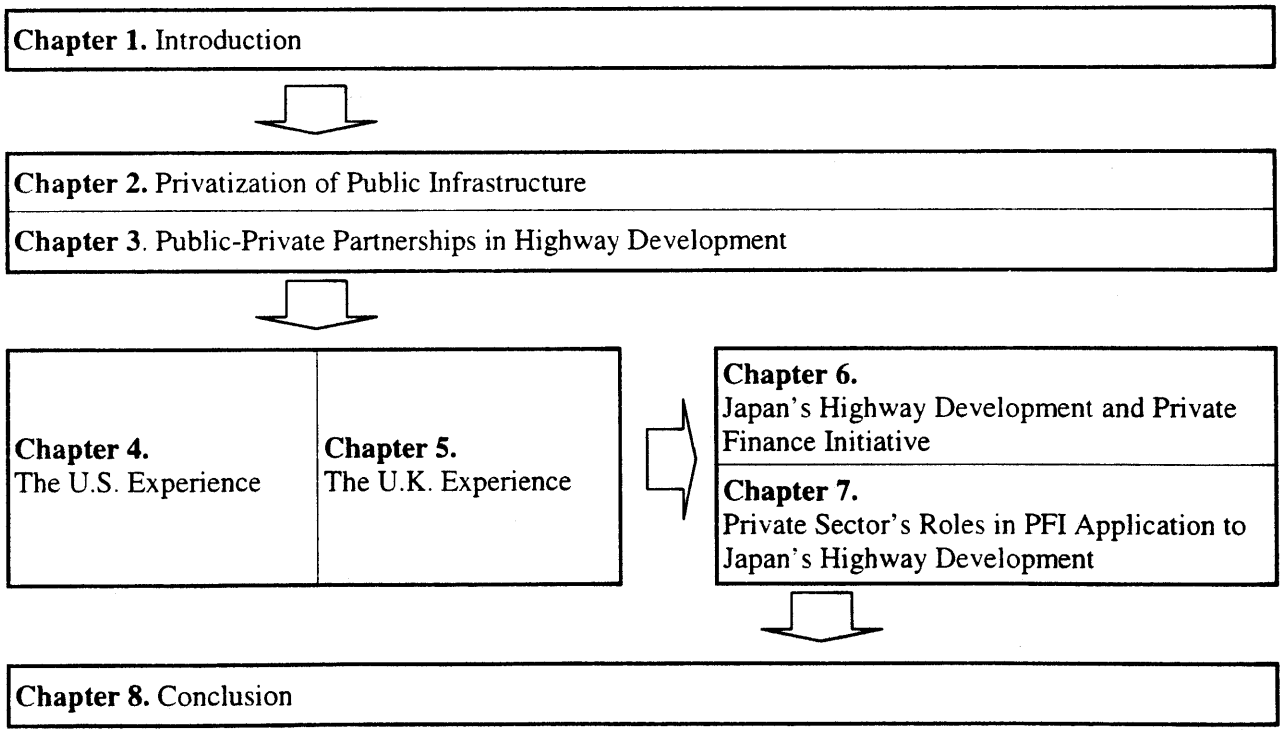


Figure 1-1 Structure of the Thesis

Chapter 1. Introduction: Chapter 1 introduces the research topic of the thesis and the background information to define the basic context where the topic is discussed.

Chapter 2.Privatization of Public Infrastructure: Chapter 2 outlines the various forms of private participation in infrastructure and the underlying reasons for the government to choose private solution in their public infrastructure development. The chapter also introduces public-private partnerships (PPP), the most widely employed form of private participation scheme in infrastructure. Their benefits and a range of organization options are discussed.

Chapter 3. Public-Private Partnerships in Highway Development: Chapter 3 focuses on PPP in a specific area of highway development. Economic nature of highway infrastructure investment, its viability and risk, is discussed to understand the issues that must be addressed in implementing PPP in highways. Also, the government arrangements of competition in PPP highway projects are given extended considerations, because competitive pressure is believed to be the only way to actually realize the potential efficiency in the private sector. The chapter also addresses the importance and practical methods of government regulations that are usually imposed on the private sector in PPP highways.

Chapter 4. The U.S. Experience: Chapter 4 introduces the experience in the federal and state governments of the United States in applying PPP to their highway projects. After the review of the historical background of the U.S. highway development, the recent problems that have led to application of PPP in this country are examined. After the case studies of early private highway projects, key findings are summarized about the strategy of the public sector in arranging PPP and the important contributions made from the private sector.

Chapter 5. The U.K. Experience: Chapter 5 introduces the experience in the national government of the United Kingdom in applying Private Finance Initiative (PFI), the U.K. version of PPP in infrastructure, to their highway development. Because Japan has lately launched PFI, the experience in the U.K. is particularly insightful to understand the possible improvements that PFI has to make in Japan's highway development. Also, this chapter and Chapter 4 are intended to facilitate a comparative study of the experiences in two countries (i.e., the U.S. and the U.K.). Differences in the ways that the governments in each country have arranged their PPP in highways and their influences to the environment where the private sector provides their improved services are the main lesson from the study.

Chapter 6. Japan's Highway Development and Private Finance Initiative: Chapter 6,

first, overviews Japan's highway development system: its historical background, the so far employed development strategies, and the current status and future prospects. The observation identifies the problems in the country's highway development program, which is now in its important transition point. The chapter, next, introduces Japanese PFI, which was launched in 1999 and has been employed in increasing number of projects by local governments. Its legal framework, the evaluation method for PFI projects, and macro analyses of early examples are presented. Finally, the chapter addresses the application of PFI to Japan's highway development. Its potential benefits are discussed, mainly from the public sector's point of view.

Chapter 7. Private Sector's Roles in PFI Application to Japan's Highway Development: Chapter 7 discusses the implications of PFI application to Japan's construction companies in the highway infrastructure market. The chapter analyzes the possible contributions that the construction companies can make in PFI highway projects. Having understood the various limitations imposed on them, a desirable framework in PFI applied to highways is discussed from the construction companies' point of view. Finally, a conceptual method for the construction companies to prepare a competitive and successful PFI proposal is proposed using an illustrative example.

Chapter 8. Conclusion: Chapter 8 concludes the discussions by summarizing important lessons learned from the study.

Chapter 2. Privatization of Public Infrastructure

An increasing number of governments around the world have been considering some sort of private participation in their infrastructure provisions. "Privatization" efforts by the government range from mere out-sourcing of the government activities to total denationalization of so far state-owned public service entities. Also, public-private partnerships, which locates somewhere in between this range, is becoming common as an innovative method for infrastructure provisions where the public and the private sector can combine their efforts for efficient infrastructure development by making use of their own strengths and supplementing the other's weaknesses.

In the first section of this chapter, a review is presented about the generic motives for the government to seek for privatization as a solution to the problems experienced in their infrastructure development programs. Next, it is followed by the presentation of general forms of privatization employed in the governments worldwide. Finally, in the last section, overall reviews and related discussions are provided for the public-private partnerships, the most commonly employed form of privatization in the field of infrastructure. They are focused on the benefits of the partnerships, the organization options, and the important issues in choosing one from the available options.

2.1. Government Motives for Privatization

When a government seeks to reform its so-far employed methods of public infrastructure provisions, it is because the government experiences some problems that cannot be properly handled under the current systems. If privatization is to be chosen in such a situation from broad range of policy reform options, the remedy that the government tries to achieve through the reform must match the kind of remedies that privatization could bring. In this section, the generic motives for the government to seek privatization solutions are examined. They are divided into fiscal restructuring, efficiency gains, and the other.

Fiscal Restructuring

First motive is that the government tries to achieve fiscal restructuring through privatization of its public infrastructure provisions. Due to growing oppositions against taxation, the governments in general are experiencing difficulties in raising tax rates higher than they currently are. Also, some governments are in effect reaching their borrowing capacity, which makes it difficult for them to obtain additional funds for infrastructure development through bonds or loans. While the monetary resources for the government is getting limited, their range of use is expanding. For a developed country, as the country's industry structure and population distribution change, the government must respond to various needs for public spending. For example, the public welfare has become one of the important issues under the aging populations experienced in most developed countries. The difficulties for the government to appropriately allocate its constrained monetary resources to wide range of uses are even intensified, when the government expenditures are under close scrutiny from the public that are now becoming more aware of the government accountability than before.

As a result, the monetary resources that can be allocated to infrastructure provisions are becoming scarce. On the other hands, the aging infrastructure in a developed country requires continuing and increasing investment for maintenance and rehabilitation. If the maintenance and rehabilitation is not made as needed, the infrastructure simply deteriorates. While maintenance and rehabilitation are gaining more attentions in overall infrastructure management programs, many countries still need to build new capacity to complete the nation's infrastructure networks. When most of the government fiscal resources are directed to maintenance and rehabilitation, little can be retained for the new capital investment.

Such problems as under-maintenance of existing facilities and inadequate funds for new capital investment may trigger the privatization decision by the government. In such a case, the specific goal of the government for privatization is to find additional funding for infrastructure that government cannot otherwise provide. In other words, the private sector is expected to bring additional source of money from the private capital markets to help the government fund their infrastructure investment.

Also, the privatization can provide additional revenue sources for the government. In a short term, the government may generate revenues by selling currently state-owned assets, by which it can repay a part of its borrowing. In a long term, the newly created infrastructure companies may become additional sources of taxes. Even if the financial burden for the government cannot be completely eliminated, privatization may reduce the government expenditures because of the efficiency in the private sector as discussed in the next section.

In developing countries, although their objective for privatization may not be defined as "fiscal restructuring," they have serious fiscal concerns in infrastructure development and have much to ask for privatization. Because they, as developing countries, are still in a severe lack of infrastructure, it is their urgent needs to build new infrastructure in order to accelerate economic development and thereby improve people's living standards. However, because the government fiscal capacity is often limited and their domestic capital market is yet to mature, the major objective of these governments is to attract new investment from foreign companies and/or multilateral banks such as the World Bank. Thus, they rely on privatization as a means to invite the foreign capital in-flow.

Efficiency Gains

In many occasions, it is argued that the public sector is inefficient. The poor performance of the public sector may appear in such observations as (1) inefficiency, overstaffing, and low productivity, (2) poor quality of goods and services, (3) unresponsiveness to the public, (4) obsolete practices or products, and little marketing capability, and (5) underutilized and under-performing assets. Proponents of this argument would point out that many government activities are performed by monopolies, which have little incentive to use resources efficiently or to use labor-saving practices, and suffer no penalty for poor performance. While private firms that perform poorly are taken over or go out of business, government

agencies that do poorly are immune to takeovers and even may be given bigger budgets under the name of an attempt to improve their performance. (Savas 2000)

Thus, it is believed that the private sector has a relative efficiency over the public sector. The efficiency gains through the use of private sector are the specific goal of the government for privatization in this context. By inviting private participation in infrastructure, it is expected that better quality of services at reduced costs could be provided to the public. Cost reductions may be realized directly in user charges or indirectly in tax levies.

Other Objectives

Additional support for privatization comes from commercial reasons. As privatization accompanies the need for the new funding sources, privatization may promote the development of capital markets (e.g., by creating and selling shares for the private companies). Also, since the market for the construction industry is generally shrinking in developed countries where the construction of the new infrastructure is mostly accomplished, the industry may see privatization as a new business opportunity. From the government's viewpoint, its objective would be defined as to support the country's stable economic growth or to stimulate its stagnant economy by creating new business opportunities.

Although they are out of the scope of discussion in this thesis, there are ideological reasons for privatization, where it is argued that the government intervention to the economy should be minimal and, therefore, the government should delegate the operations to the private sector where it is possible. Also, privatization may be the result of the political struggles among the various parties with different interests.

2.2. General Forms of Privatization

When privatization is chosen as a method of reforming public infrastructure provisions, there are still a number of possible arrangements. Indeed, the term "privatization" is a broad policy concept that includes these various kinds of arrangements. Any arrangement that transfers a part of the government responsibility in public service provision to the private sector can be considered as "privatization." Literatures dealing with this issue seem to agree (with some variations) on the following three basic forms of the private sector involvement in infrastructure provision: contracting out, denationalization, and public-private partnership. They are different in the scope of works delegated to the private sector, the ownership of physical assets, and the duration for which the arrangement lasts. Also important is the difference in risk allocation among the parties involved.

Contracting Out

The government can contract out to a private company the operation and maintenance of an existing project. In this type of privatization (sometimes called *alternative service delivery*), the government changes the way they provide the public infrastructure services by letting the private company serve the users on behalf of the government. In other words, the government, as a service provider, serves the users using the private company's efficient delivery capability. Strictly speaking, this category is further subdivided, by the payment mechanisms and resulting risk allocations, into *contracting* (the private delivers services to the users and collects fees from the government) and *franchising* (the private delivers services to, and collects fees from, the users).

The rationale for this type of private participation is presented by Liddle and summarized as follows. (Liddle 1993) For the goods or services in which exclusion of free riders are impossible, the government provision is the only possible option, because the private is unable to charge their costs to the users and cannot undertake the project by itself. However, the delivery of the goods or services can be independent from the provision thereof and the delivery method with the best efficiency should be chosen. If a private company offers the most efficient services, the government out-sources the service to the company.

While the service is arranged by the private sector, the government retains the overall responsibility for the provision of the public service. The government specifically decides the

scope of the contract. This is how the contracting out is different from generic public-private partnerships discussed later.

Denationalization

Denationalization, which is also called *divestiture*, entails the transfer of the ownership of an existing public service venture from the government to a private company. That is, the government actually sells existing facilities to the private company. It can take many forms — public offerings of shares, or private trade sales of assets themselves. Once a public service is denationalized, the created private company becomes responsible for the service provision to the users. Now the role of the government reduces (or changes) to the regulation of the public service provision by the private company.

Public-Private Partnerships

First of all, the term "Public-Private Partnerships" should be defined, because the term is somewhat ambiguous in its definition. While the public-private partnership could be broadly thought of as any arrangement where the public and private sectors cooperate to produce or deliver goods and services, it is specifically defined here as infrastructure projects where the private sector play an active role as a partner of the public sector.

In a public-private partnership, the government and the private company share the risks and responsibilities of a project that would otherwise have to be assumed fully by the government. Conceptually, the advantage of this form of privatization is as follows. The public and private sector have different criteria in evaluating the acceptability of a project: the private accepts a project if it is likely to make profit, while the public do so if the non-monetary and monetary benefits are greater than the costs. When each party cannot achieve its goal by itself, the public-private partnership can be effective.

The government may enter into a contract with the private sector to build a brand new infrastructure projects (i.e., a *greenfield projects* as called in some literatures). In practice, it can take a number of structures, which has varying degree of transfer of risks and responsibilities.[1] Build-Operate and Transfer (BOT) model and its variations are among the most common in this category. Under the generic BOT model, a private consortium receives a concession to finance,

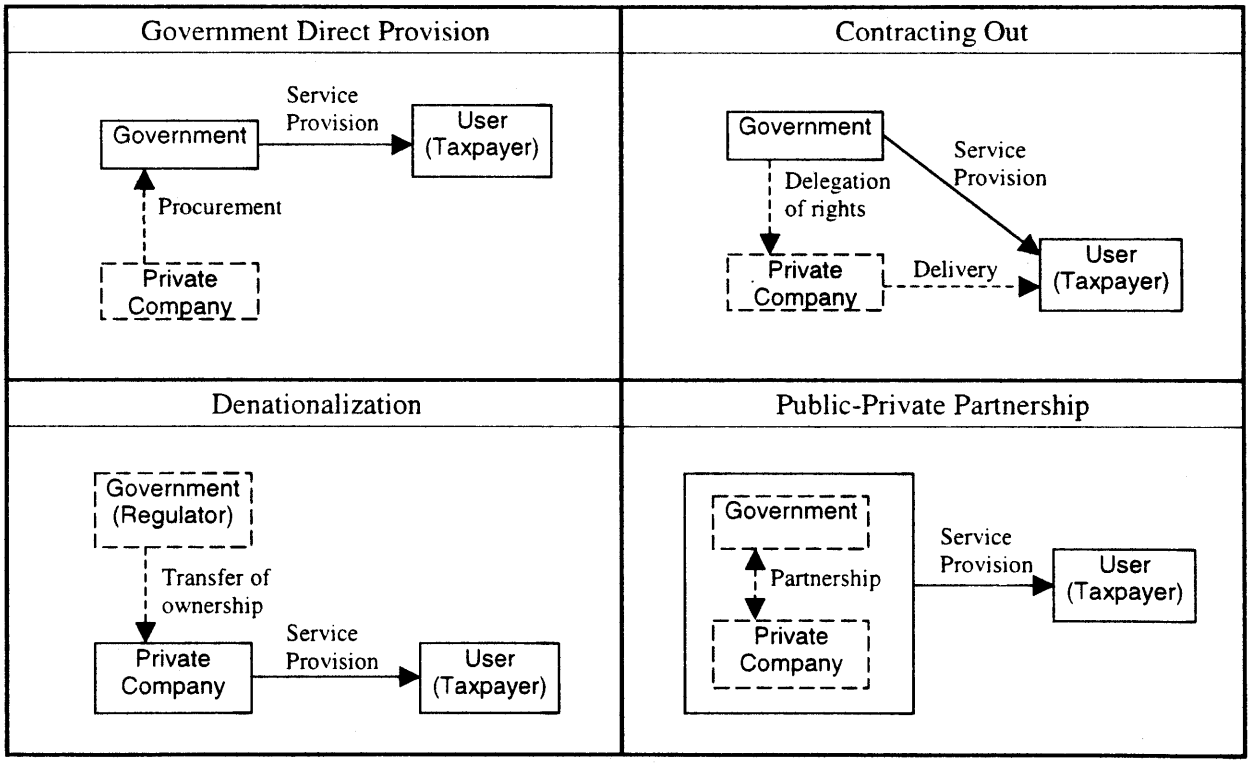
[1] Various forms of Public-Private Partnerships in infrastructure is presented in Section 2.3.2.

build, control and operate a facility for an agreed upon time, after which the facility is transferred back to the government. According to Estache, the relative importance of BOT types of projects is likely to further increase as a result of PFI in the U.K. Urban roads in the U.K. and Australia are increasingly being procured under the public-private partnerships. (Estache, et al. 2000a)

Summary

Although these different privatization schemes can take various forms of relationship among the government, the private company, and the users, they can be summarized in a simple graphical presentation as in Table 2-1.

Table 2-1 General Forms of Privatization



Selection of the form of privatization is greatly affected by the specific objective that the government tries to achieve in its policy reform. Also, the government may have to decide the priority in its objectives in selecting the form of privatization. For example, selling a monopoly government-owned enterprise intact to a single buyer in a competitive process will maximize the sales revenue but will not lead to greater efficiency from the public's point of view. On the other hand, if too much competition is introduced to the industry in order to ensure the efficiency gain,

the sales price would become lower, minimizing the fiscal restructuring benefit for the government. The sale of competitive business would attract much less interests from the private sector than the sale of intact monopoly, but the public would undoubtedly benefit through lower prices even though the government revenue from the sale would not be maximized.

More important, whichever form of privatization is chosen, competition is always a key element for the selected privatization scheme to succeed. It is the most important for the government to establish a competitive environment where the private sector is motivated to maximize the efficiency to seek their performance improvement. Although the general theory is that the private firms can do better than the public, it is true only when such an environment is ensured. This is especially important when the private operator is to undertake monopolistic services, where market pressure does not exist. The importance of competition and the role of government regulation are discussed in Section 3.2.

2.3. Public-Private Partnerships in Infrastructure

In the field of infrastructure provision, public-private partnerships are the most commonly employed form of privatization. As discussed in Chapter 4 and Chapter 5, the governments of the United States and the United Kingdom introduced public-private partnerships in their highway infrastructure development. Also, the Private Finance Initiative in Japan, one of the central topics of this thesis, is characterized as these partnerships. This section, focusing on public-private partnerships in infrastructure, presents further overviews for their benefits and organization options.

2.3.1. Benefits of Public-Private Partnerships in Infrastructure

The characteristics distinguishing the private sector from the public sector is that the private has a profit motive and is under a threat of bankruptcy. Public-private partnerships intend to improve the efficiency of public infrastructure development by bringing into infrastructure projects these private attributes that the governments in general do not hold. If structured properly, public-private partnerships would enable a number of benefits. The following bullets are drawn from Savas (2000) and enumerates the possible contribution of the private sector to better infrastructure development program:

1. It helps identify and develop new, innovatively designed, user-financed, profit-making facilities or existing facilities in need of rehabilitation, renovation, or expansion.
2. By involving private sponsors and experienced commercial lenders, it assures in-depth review of the technical and financial feasibility of the project.
3. It accesses private capital market to supplement or substitute for hard-to-get government resources. New capital comes from a large and previously untapped pool of investors interested in higher-risk, higher-return investments than traditional municipal funds: this can leverage limited public funds and may improve the government's credit rating.
4. It builds more quickly and more cost effectively than government usually can, and therefore satisfies public needs more quickly at lower cost. Construction is generally more rapid because private developers are more flexible and do not have to observe

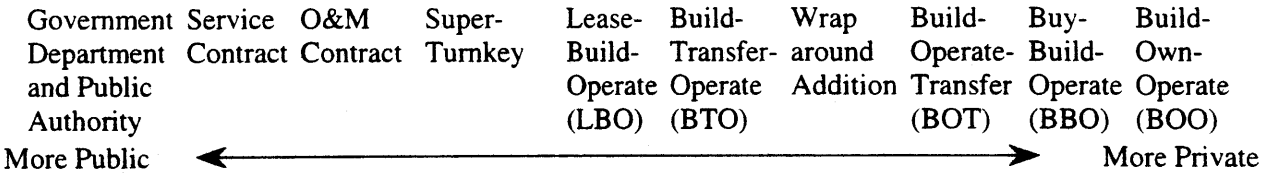
government procurement rules and bureaucratic constraints that delay planning and construction schedules.

5. It operates facilities more efficiently than government usually can, while complying with regulatory standards.
6. Taxpaying private firms provide a new source of tax revenue.
7. It accepts some risks that would otherwise have to be borne by the public sector alone.
8. It transfers technology and trains government personnel during the course of a project.
9. It establishes a private benchmark against which to measure the efficiency of similar projects and enhances public management of future projects.

Some of these benefits are interrelated. Also, they are greatly affected by how partnerships are arranged. For example, if the government regulation, a crucial component in these partnerships, is too detailed and too strict, the private sector may not be able to achieve technical innovation. On the other hand, too ambitious attempt to technical innovation, which utilizes premature technologies, would increase the risks and jeopardize the projects. The government and the private sector alike should be careful about the many trade-offs that the arrangement is to arise.

2.3.2. Organization Options in Public-Private Partnerships

Public-private partnerships for infrastructure take many forms. The principal models can be arranged in a spectrum, such as shown in Figure 2-1, ranging from fully public to almost fully private. Below provided are brief descriptions of the arrangements that are relevant in this thesis. (Savas 2000; Hakim, et al. 1996)



Source: Savas 2000 (arranged)

Figure 2-1 Spectrum of Public-Private Partnerships

Organization Options

1) Government Department and Public Authority

The traditional method of providing infrastructure-based services is directly through

government departments. The government, which owns the facility, is responsible for designing, financing, building, and operating it. Also, public authorities are common for power, water, transportation, and telecommunications services, which are being reformed by corporatization and commercialization. The intentions of such changes are to achieve efficiency and accountability and to have the entity act like a business rather than a political body. Regional transportation authorities exemplify this form.

2) Service Contract

Specific and limited-scope services associated with infrastructure may be contracted out to private firms. Examples are ticketing, cleaning, and food catering for railroads; meter reading, billing and collection for water; and cleaning and snow removal from public highways. The public retains overall responsibility for operation and maintenance of the system except for the particular contracted services, and it bears all of the commercial risk. It must finance fixed assets and provide working capital. Service contracts are generally for periods of less than five years.

3) Operations and Maintenance (O&M) Contract

A private partner operates and maintains a publicly owned facility under a management contract with the sponsoring government that owns the facility. This arrangement is similar to a service contract, but in this case the private partner has overall responsibility for operating and maintaining the physical facility.

Strictly speaking, this arrangement includes two different types of contract. One is a pure O&M contract, where the private operator is obliged to operate and maintain the facility "in a good condition" but the contract does not include additional investment obligation. The other is a general O&M contract, where the private sector assumes responsibility for additional investment listed in detail in the contract, as well as the responsibility for operation and maintenance of the facility. In the latter, the private sector is often entitled to collect revenues from the project in order to recoup the investment stipulated in the contract. In such a case, the private operator may assume the commercial risks regarding the revenues. Typical duration of the former type is short to medium (e.g., 2-5 years), while that of the latter is longer (e.g., 10-30 years).

4) Super-Turnkey Development

A private partner designs and constructs a facility to meet performance objectives defined by the public sector. Upon completion, the private sector is reimbursed by the public sector for construction and begins operating the facility under contract. Super-turnkey development may place some financial risk on the private sector, but private-sector investment is generally limited.

5) Lease-build-operate (LBO)

A private firm is given a long-term lease to develop (with its own funds) and operate an expanded facility. It recovers its investment plus a reasonable return over the term of the lease and pays a rental fee. Because the facility remains publicly owned, this arrangement avoids possible legal problems associated with private ownership of a facility.

6) Build-transfer-operate (BTO)

A private developer finances and builds a facility and, upon completion, transfers legal ownership to the sponsoring government. The government then leases the facility back to the developer under a long-term lease, during which the developer operates the facility and has the opportunity to recover his investment and earn a reasonable return from user charges and other commercial activities. The same issue of ownership as in the LBO approach applies.

7) Wraparound Addition

A private developer finances and constructs an addition to an existing public facility, and then operates the combined facility either for a fixed period or until he recovers costs plus a reasonable return on his invested capital.

8) Build-operate-transfer (BOT)

A private developer is awarded a franchise (concession) to finance, build, own, and operate a facility, and to collect user fees for a specified period, after which ownership of the facility is transferred to the public sector. This is perhaps the most common form of public-private partnership for building new infrastructure. In contrast to a sale or permanent concession, the government retains strategic control over the project.

9) Buy-build- operate (BBO)

An existing public facility is sold to a private partner who renovates or expands it and operates it in perpetuity under a franchise. This is equivalent to divesting a company, which then operates under a franchise.

10) Build-own-operate (BOO)

A private developer finances, builds, owns, and operates a facility in perpetuity under a franchise, subject to regulatory constraints on pricing and operations. The long-term property rights provide a significant financial incentive for capital investment in the facility.

Issues in Choosing the Option

The possible arrangements described above are summarized in Table 2-2. While it has been shown that the government has a broad range of options in inviting private participation in its infrastructure development, the government often seeks a more complicated approach combining these various types of arrangements. Also, the differences between some of these models may be subtle. More importantly, given the complicated nature of infrastructure projects and the various situations encountered by the government, there would be no single answer for the appropriate organization option. Nevertheless, some important points that characterize the arrangements can be drawn.

Scope of Delegated Responsibility

First, these arrangements can be distinguished by the scope of delegated responsibility. In the initial state of government direct provision, the private sector works under a direct supervision of the government. The contracts are closed for relatively small and segmented portion of the project. Simply stated, the private sector companies do what the government tells them to do.

In the next stage, the government delegates a wider scope of the project. The government defines general and functional requirements and the private sector decides the way to meet the requirements. While the government retains the overall responsibility for the project, the private sector is allowed to make day-to-day management decisions. The financing of the project is partly arranged by the private sector.

In the final stage, the government delegates all the components in a specific project to

the private sector. While the government is to establish overall development strategy for the infrastructure, most of the responsibilities at a project level are assumed by the private sector. The design, construction and operation are managed by the private sector that also arranges the financing of the project.

Compensation

As wider scope of responsibility is delegated to the private sector, the compensation mechanism becomes more complicated. When the scope is limited to a specific component of a project, the compensation is based on the work that the private sector does for the government. Simple design or construction works are paid for specific prices agreed upon in the contracts. Most O&M contracts and turnkeys are paid in a similar manner.

However, the compensation for a more integrated type of arrangement is more complicated. The government may compensate the service at a fee basis; alternatively, the private sector may be entitled to collect user fee directly from the users. The combination of both can be found. If all or a part of the compensation is to be from the user charges, the private sector often assumes the commercial risks regarding the actual demand as opposed to that projected. On the other hand, if the government is to guarantee, explicitly or implicitly, the demand volume, revenues and so on, significant contingent liabilities remain with the government.

Ownership

The ownership of the asset is another major consideration in public-private partnerships in infrastructure. Its major influences to the projects include tax treatment and tort liability. If the private sector owns the asset, it can depreciate the asset and reduce the taxable income base. In such capital-intensive services as highways, depreciation expenses make a huge difference in accounting for tax purposes. If the government owns the asset, the private sector may pay rental fee for operating the facility. In that case, while the rental fee is tax-deductible, it accompanies real annual cash flows and requires a different consideration from the case of depreciation.

On the other hand, the owner of the asset has to assume the tort liability associated with the facility. If accidents are to occur on a highway, for instance, the owner is exposed to the risk of indemnifications resulting from lawsuits filed by the users involved in the accidents. In this regard, BTO approach, for example, may be preferred to a similar arrangement of BOT,

particularly in a litigious society such as the United States.[2] Under the BOT model, the private owner/operator may encounter liability issues during the long period of ownership. Then, the BOT operator has to prepare for such a contingent liability, typically by reserving special accounts for the purpose. The preparation costs, in turn, may somehow increase the user charges. Such incremental costs may be lower in the government than in the private sector, because the government owns and operates large number of similar facilities and could enjoy the risk diversification effects.

Duration of Arrangement

Duration of arrangement is usually decided as a consequence of other factors, but it is an essential consideration in a contract arrangement, particularly when the private sector makes significant amount of investment. Because the private sector has to repay all the debt raised for financing the design and construction works and it aims to make a reasonable profit out of the project, duration of arrangement is a key variant in privately financed infrastructure projects. As a result, if major investments by the private sector are needed, the concessions will require a long duration, perhaps more than 30 years. In contrast, if the public sector is responsible for major investment, the period can be as little as 5 to 15 years.

One relevant issue is an incentive given to the private sector as to proper maintenance of the facility until the end of the concession period. Infrastructure facilities require continuous investments that obviously cannot be predicted accurately years in advance, and some investments will have to be made near the end of the concession period when they cannot reasonably be amortized. The concessionaire may be tempted to practice "strategic maintenance," i.e., no or inadequate maintenance near the end of the concession period. For the purpose of faithful and fair treatment of maintenance obligations, incentives should be designed both to avoid strategic maintenance and to compensate the concessionaire for assets that have not been fully amortized. (Savas 2000)

[2] See Chapter 4 for a related discussion.

Table 2-2 Private Participation in Infrastructure

		Design	Construction	Operation	Financing	Ownership	Duration
Government Department and Public Authority		△	△				–
Service Contract				△			Short (<5 yrs)
O&M Contract	*Without* investment obligation			○			Short (<5 yrs)
	With investment obligation		○ (Repair)	○	○		Medium
Super-turnkey development		◎	◎	○	○		Medium
Lease-Build-Operate (LBO)		◎ (Extension)	◎ (Extension)	◎	◎		Medium - long
Build-Transfer-Operate (BTO)		◎	◎	◎	◎		Long
Wraparound Addition		◎ (Extension)	◎ (Extension)	◎	◎	◎	Medium - long
Build-Operate-Transfer (BOT)		◎	◎	◎	◎	◎	Long
Buy-Build- Operate (BBO)		◎ (Extension)	◎ (Extension)	◎	◎	◎	Infinite
Build-Own-Operate (BOO)		◎	◎	◎	◎	◎	Infinite

△: The private sector merely provides services that are procured by the government.

○: The private sector assumes some responsibility regarding the activity.

◎: The private sector assumes full (or most) responsibility regarding the activity.

Chapter 3. Public-Private Partnerships in Highway Development

In the previous chapter, three basic forms of privatization schemes and the underlying motives for the governments to seek for private participation in their infrastructure development are examined. Also, the public-private partnerships in infrastructure, their benefits and organization options, are introduced. This chapter, focusing on highway infrastructure development, reviews important issues raised in many countries experiencing the public-private partnerships in their highway (and transport) infrastructure development.

Important issues raised here are concerned with (1) the economic viability and risks, and (2) the regulatory environments for the privatized highway projects. While the former is the kind of attributes that are mostly determined by the nature of the project itself, the latter is that "artificially" given by the government. First, the fundamental economic strengths and weaknesses, and the inherent risks of the project are discussed. They are important in properly assigning the responsibilities to each party in the partnerships. Second, regulatory systems under which the privatization processes are carried out are reviewed. The systems are necessary in order that efficiency gains can be obtained through competitive pressures being placed on the private sector, and delivered to the public as originally intended in the public-private partnerships. Thorough understandings of these issues are crucial in the public and the private sector alike, in order for the partnerships to be financially viable and, at the same time, beneficial to the society.

3.1. Economic Viability and Risks

When a highway is to be financed and developed by the private sector, the government and the private sector alike should be careful about the economic viability and risks of the highway project. In order for the project to be successfully developed, its economic viability has to be sufficiently robust and the risks must be thoroughly understood and properly managed. If these conditions cannot be satisfactorily met solely by the private sector's efforts, supporting measures need to be provided by the public sector.

3.1.1. Economic Characteristics[3]

Economic characteristics of highway projects are largely attributable to their purpose and physical characteristics. These two aspects significantly affect the demand prospects and the development costs of the project.[4]

Purpose of a Highway

Congestion relievers are relatively short roads that are built to relieve congested traffic on existing routes often located in densely inhabited urban areas. The advantage of the congestion relievers is that they generally have strong traffic volumes from the early years because they serve already realized heavy traffic demand. The disadvantage is that they often suffer from high development costs because of costly land acquisitions and expensive amenities designed to ameliorate the objections of the built-up communities along the routes.

If these roads are to be developed under public-private partnerships, regulatory oversight on pricing decisions become particularly important, because the expensive development cost may require high toll rates. Also, if these roads are built to relieve the congestion on existing free roads, they face competition from the existing roads. In such cases, time-of-day and other variable pricing schemes may be effective, for heavy traffic demand is often concentrated at peak periods (i.e., the major diversion of traffic only occurs at peak periods when the free roads are congested).

Development roads link certain remote areas with urban centers or with major transport routes. They serve areas that are as yet not fully developed but are expected to grow rapidly in

[3] The examples of the projects with various economic characteristics, developed in the United States and the United Kingdom, are presented in the following two chapters.

[4] Most information in this subsection is drawn from Estache et al. (Estache, et al. 2000a)

the next decade or two. Accordingly, traffic volumes generally are not financially sufficient in the early years, and thus often require substantial public supports. However, these roads may enjoy relatively low construction costs per length when it travels through open community, and it is less likely to suffer from free-road competition.

Bridges and tunnels are typically very short, but very expensive to build per unit length, relative to overland roads. Nevertheless, they often have strong financial capacity because they tend to serve important links with high traffic volumes, particularly when they are built to relieve congestion on existing routes.

Physical Characteristics and Development Costs

A project's physical characteristics are the primary determinants of its development costs. Important aspects include whether the project is a new facility or an expansion of an existing road, the length, capacity and design, geographic aspects and toll collection mechanisms. New facilities are more costly per kilometer than expansions or rehabilitations. Moreover, expansion projects that involve pre-existing tolled facilities may be able to use the existing toll revenues to lower external financing requirements. Bridges and tunnels, because of their design requirements, tend to be much more expensive.

It is important to recognize that road capacity presents high levels of "indivisibility." In road, full capacity service is offered from the beginning, although the traffic demand builds up slowly. This means that the traffic revenue stream does not necessarily match the cost. While the debt repayment schedule starts right after the completion of the facility, the large revenue comes in the later period of operation. Some sort of government assistance may be needed to cover the difference in timing of cash flows.

Summary

Because the economic characteristics of highways are always unique for case-by-case, it is impossible to draw any definitive conclusion as to the economic viability of private highways. However, as a general remark, a qualitative and generalized analysis of economic viability of highways can be summarized as follows.

Table 3-1 Qualitative Analysis of Economic Viability of Highways

		Demand Prospects	Development Cost	Economic Viability
Congestion relievers	New	High	High	Medium-low
	Expansion		Medium	Medium
Development roads	New	Medium-low	Medium	Medium
	Expansion		Low	High-medium
Bridges and tunnels	New	High	High	Medium-low
	Expansion		Medium	Medium

3.1.2. Risks

In privatized highway projects, it is important to comprehensively identify the risks and properly manage them. In a sense, risks have to be avoided as much as possible so that they would not jeopardize the project. However, a more proactive attitude may be needed for risk management under public-private partnerships in infrastructure development. The ultimate goal of the public infrastructure development is to provide the public with quality infrastructure services at low costs. Because the risks are costly when they materialize, the risk minimization should always be among the considerations in public infrastructure procurements. Then, in order for the public-private partnerships to contribute to truly efficient and effective infrastructure provisions, earnest efforts are needed in addressing risk-minimization measures.

The general rule often found in literatures dealing with the risk management issues is that risks (and associated costs) are minimized when they are assigned to the party that can best bear them. Also, an additional notion would be that the risks are minimized when they are assigned to the party that is given proper incentives to manage them. In the initial state of government direct provision, the government assumes all the risks for the entire infrastructure development. Although the capability for risk management differs in each government, it is not true that the government is always the best entity to assume all those risks. Instead, successful projects have been characterized by a broad level of risk-sharing between the public and the private sectors. Generally, the private sector is better at managing commercial risks and responsibilities, such as those associated with construction, operation, and financing. In contrast, highway projects often depend on public participation in areas such as right-of-way acquisition, political risk, and in some cases, traffic and revenue risks. (Estache, et al. 2000b)

As a practical matter, the risk-sharing affects the project structure of private highways.

First, they affect the choice of the organization options, because each option accompanies different approach for risk-sharing. Second, because of the non-recourse or limited recourse nature of project financing, the risks assumed by the private operator affect the cost of capital. In this subsection, the major categories of risks that are relevant to private highway projects (mostly in a developed country) are introduced. Also, typical risk management measures taken for certain categories of risk are presented.[5]

Construction Phase Risks

Construction Risks

During this phase, the major risks are delays in completion and commencement of project cash flows; cost overruns with an increase in the capital needed to complete construction; and the insolvency or lack of experience of contractors or key suppliers. Delays in project completion can result in an increase in total costs through higher interest charges for construction financing. A common cause of cost overrun stems from design changes and unforeseen subsurface and/or weather conditions during the construction phase.

The private sector typically bears primary responsibility for such risks and may attempt to cover some of them through insurance. It is always sensible for developers to establish an escrow or contingency fund to cover cost overruns. Typically, cost overrun risks are shifted to contractors through a fixed-price and fixed-term contract, with incentives for earlier completion and cost reductions, and also with some penalties for severe disruptions. However, the public sector may also assume responsibility for risks under its control, such as completing complementary facilities (connecting roads or interchange) or allowing cost increases associated with major design changes. It is also common for governments to share cost in projects that face major construction uncertainty (e.g., highways through mountains).

Environmental and Land Risks

Highway projects can have a substantial environmental impact. Such projects frequently attract strong oppositions from community and environmental groups over issues of pollution, congestion, neglect of public transport and visual impact. Similarly, land acquisition can be a time-taking process, which may be a severe obstacle for timely completion of the project.

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[5] Most information in this subsection is adopted from Estache, et al. (Estache, et al, 2000a, b)

In general, the public sector often ends up assuming the responsibility for most of these risks since often it is easier for the public sector to take the responsibility for acquiring the rights-of-way, pay for them and contribute this asset to the project. Project sponsors often try to ensure that the government bears the risk of providing all necessary land within a given time frame or be liable for damages. Furthermore, the cost of land acquisition can become a major factor where land values have risen rapidly or are subject to speculative activity over which the private operator has no control.

Starting-up and Operation Phase Risks

Traffic Revenue Risks

Traffic and toll levels may not be sufficient to cover all costs, including construction, operation and maintenance. The risk arises when the actual traffic is smaller than projected in the traffic demand forecast. Then, the accuracy and reliability of the forecast is one of the major determinants of this type of risk.[6] Unlike project financing in other sectors, take-or-pay or fixed price contracts are typically not available in highway projects. The handling of traffic revenue risks ranges from full private sector assumption to government-provided traffic and/or revenue guarantees. To the extent that these risk are driven by country's overall economic conditions, there is a potential role for the government to play in risk-sharing.

Technology Risks

New technologies cannot be ignored since they can either significantly improve the profitability of a project or adversely affect any project that uses obsolete technology. For example, the automatic toll collection technology can reduce the costs and times for toll collection. It also provides a way to improve the credibility of traffic counts, which is particularly important when the government pays the shadow tolls[7] based on the actual traffic volumes.

Financial Risks: Interest Rates

Financial risks generally are the risks that project cash flows might be insufficient to cover debt services and then pay an adequate return on sponsor equity. In theory, financial risk is

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[6] The issues in traffic demand forecast are discussed in section 3.1.3.

[7] The shadow toll concept is briefly introduced in section 3.1.4 and its practical application in the United Kingdom is presented in Chapter 5.

best borne by the private sector, but in highway projects there is likely to be substantial government risk-sharing, such as revenue/debt guarantees or cash grants.

More specific, they refer to the risks that the debt financing may not be obtained for a sufficiently long term and at favorable and stable interest rates. Financing constraints, especially the lack of long-term debt capital, significantly hinder highway development, because highways are long-lived investments with high start-up costs. Often the available maturity of financing is of a term that is shorter than the period required to recoup the investment, creating a major refinancing risk that either renders the project nonviable or requires government guarantee of such a rollover.

Political Risk

Political risk concerns government actions that affect the ability for the private operations to generate sufficient earnings. Governments generally agree to compensate investors for political risks, although in practice, governments may tries to justify their actions to delay or prevent such payments. As a result, private investors generally have to assume the risks that are associated with dispute resolution and the ability to obtain compensation if the government should violate the concession agreement. The credibility of the government to uphold contractual obligations and their willingness and ability to provide compensation for political risks are key issues for the investors.

Other Risks

Force Majeure refers to risks that are beyond the control of both public and private partners, such as floods or earthquakes, which impair the project's ability to earn revenue. While some private insurance is becoming available for catastrophic risks, the public sector generally is faced with the need to restructure the project should such disasters occur. This may take the form of extending the contract term, or to provide additional financial support. The rule is that remedies in the event of force majeure should be stated in the contracts.

Tort Liability refers to liability for legal awards as a result of accidents or negligence on the highway. Because the owner of assets bears this liability, an appropriate contractual arrangement in a given circumstance should be selected.[8] If the private sector owns the facility, it bears this responsibility and typically tries to obtain private insurance coverage.

[8] See Section 2.3.2 for the discussions on the contractual arrangements and the ownership issue.

3.1.3. Demand Forecast

As already seen, traffic and revenue risks are among the most crucial types of risks in privatized highway projects. If the project is structured as a financially free standing project relying solely on the toll revenue or the compensation for the private sector is designed as a service fee paid by the government and linked to the actual traffic volumes, the traffic actually realized on the highway has a critical impact on the financial success of the project. The traffic revenue stream should be large and predictable enough in order for the private operator to repay the debt and obtain reasonable return for their equity contribution.

Although all the participants ideally would want to "know" the future traffic, they actually need to "guess" demand growth prospects at some point in advance of the start of operation. The forecast of traffic demand is the only available information at this point. However, the demand shortage problems in highway projects are mostly that the actual traffic demand is smaller than projected in the forecast. In other words, a failure in traffic demand forecast largely causes revenue shortage problems. Therefore, the nature of traffic demand forecast, particularly its pitfalls, should be understood.

Predicting traffic level is technically difficult, because (1) new projects are unable to rely on existing traffic volumes as the basis for demand forecasts; and (2) the traffic demand has great sensitivity to toll levels. The latter is especially important when the level of tolls, required to cover costs and provide financial returns, is far above existing toll level. Various aspects such as the market served, the number and quality of competitive alternative routes, and the highway's connections to the rest of the network affect traffic levels. (Estache, et al. 2000a)

In addition to these technical difficulties, there can be political or strategic biases for traffic forecasts from various interests of the players involved. For example, over-optimism is common for the government privatization teams focusing on convincing private operators of the value of their business and for potential operators who want to get the deal, knowing the possibility for renegotiation afterwards. (Estache, et al. 2000b) In addition, politicians want to look good during their tenure and support policies that maximize short-run fiscal payoffs and/or minimize toll rates. (Trujillo, et al. 2000)

In reality, forecast can turn out to be either too optimistic or too pessimistic. The following is adopted from Trujillo, et al. and explains the general experiences in highway projects, their background reasons, and the possible mitigation options. (Trujillo, et al. 2000)

An Over-optimistic Demand Forecast (Overestimation)

Observations

There is enough experience to argue that over-optimistic demand forecasting is common. Traffic forecasts that are incorrect by 20-60% compared with actual developments are common in large transport infrastructure projects around the world. The over-optimistic demand forecast arises, because one of the changes often brought by the private operators is the introduction of cost-reflecting prices and a switch from taxpayers to users for the responsibility to pay for the service. If the use of toll roads is deemed too expensive, users look for free alternative itineraries.

Indivisibility of investment in highway infrastructures often provides partial explanation for revealed over-optimistic demand forecasts, especially those experienced in the early years. Although it would make sense to follow a progressive or piecemal investment approach, the advice can be hard to follow because it is generally impossible for most of highway infrastructures to incorporate a flexible design for piecemal investment strategy to quickly adjust the capacity to future demand growth. Moreover, because of this nature of the investment process, most of these projects require some short-run excess capacity to be able to absorb the longer-run demand. A seemingly overoptimistic forecast may be nothing but a result of prudent long term planning.

Mitigation Options

If the actual demand falls below the forecast, there are several options to mitigate the problem, depending on the nature of contract in a specific project. The contract duration could be extended so that the total costs can be recovered through the extended operation. When the duration cannot be adjusted, the main option is to cut toll rate and subsidize the operator.

Price adjustments have their own problems, however. From an efficiency viewpoint, toll rates should be set at least to the short-run marginal cost. However, from a financial viewpoint, this is not good enough since it does not allow the recovery of the costs of capital and hence results in a deficit. On the other hand, trying to include investment amortization in the toll rate results in a demand inconsistent with the resulting toll level.

One option is to allow the use of two-part toll rates designed to allow the recovery of both operational and capital costs. The idea is to set a unit price equal to the short run marginal cost and at the same time to levy a fixed charge to recover the capital cost. In practice, this is

done through thinking of the infrastructure as a "club". That is, frequent users pay an annual fee and then pay the marginal cost every time they use the facility. Occasional users who are not members of the "club" end up paying a higher usage fee every time they use the facility.

Another option is to allow the operator to explore price discriminations between its user types, under which the prices are adjusted for different types of users according to their willingness-to-pay. This price discrimination, by exploiting the potential willingness-to-pay in some user types, would allow the recovery of a larger share of the investment than a flat fixed charge. The differentiation may be in car types, where trucks are charged more than autos. This also reflects the difference in costs that different types of users necessitate for the road operator. For example, heavy trucks need larger costs in construction and maintenance of the pavement and related structures of highways than autos. In addition, it may be useful to differentiate between a tourist and a commuter, where commuters are charged more than tourists.

The main problem with these solutions is in fact not technical but political. Which option should be used depends on the priority that the government places to each of its goals. First, if the earnest goal of the government is to minimize subsidies, it should not give up considering price discrimination. Second, if this does not work, subsidies are the most likely outcome. Finally, if this does not work or is not enough, an extension of the contract duration, or a slower investment requirement will generally be effective.

An Over-pessimistic Demand Forecast (Underestimation)

Observations

Although it is less common in the general context of transport privatization, undershooting demand does happen. The main outcome is a lack of capacity and hence congestion. Also, the private operator may receive excess profits from large traffic revenues that are not anticipated in the beginning. Underestimation arises for two main reasons: (i) privatization changes the perceived transport services, changing the nature of the demand, and (ii) the planners fail to recognize the network aspects of the demand. Experiences show that the main reason for the underestimation was that most policymakers were concerned that the potential passengers of the privatized services would be reluctant to pay for what they use to get for almost nothing.

In existence of multi-modal transport systems, there are also many instances in which

the demand for a specific mode is surprisingly stronger because the supply of another mode is deteriorating more severely or faster than expected. More generally, when a forecast at the project level does not take into account the interactions with a much wider transport network, it is easy to underestimate the derived demand stemming from the network characteristics of a transport system.

Mitigation Options

If demand is temporarily or occasionally stronger than expected but a long-term adjustment in capacity is not needed, the short-run solution, generally recommended by economists, is a temporary adjustment in toll rates. This means that prices have to increase to ensure that demand falls to meet the available supply (i.e., capacity) of infrastructure. The problem is more complex when recurrent or lasting congestion appears. One solution then is to set the toll equal to the long-run marginal cost plus a markup to reduce demand. The pricing solutions, however, can entail a political problem, because the increased toll rates obviously attract intense oppositions from the public.

A general solution is to avoid fixed term contracts with variable fares and to award variable term contracts with set fares or fares subject to minimal changes. Under a flexible duration contract, if the demand is stronger than expected, the contract duration is automatically shortened, preventing the private operator from making excess profits. After the shortened contract duration has been reached, capacity increase can be done under a new arrangement. Also, a quicker capacity adjustment can be obtained under the current contract, by changing the scope of work and, at the same time, the contract duration to accommodate the increased investment requirements.

3.1.4. Government Supports

Government supports, explicit or implicit, are crucial for public-private partnerships in highway projects. Most of highways have already been constructed in developed countries, leaving only a limited number of projects that are financially viable. The governments usually build the highways of higher priority, where the traffic demand is also high. Additionally, the remaining road segments with high demand potential are often located in already developed urban areas, making the development costs, including land acquisition and construction costs, unbearable for private companies.

Moreover, highway projects are subject to high degree of risks. As seen earlier, there are many kinds of risk to be taken care of, most of which would have significant adverse impacts on the project when they materialize. In particular, while the technique has rather been sophisticated, the traffic forecast is not always reliable, because of its technical difficulties and the strategic biases from the parties involved. Without accurate and reliable traffic forecasts, the revenue streams for the highway projects are inevitably uncertain. On the cost side, large-scale construction projects involve considerable level of uncertainties as well. Cost estimates are obtained from limited information about foreseeable conditions and even seemingly simple projects may suffer from unforeseen problems when they are actually undertaken.

Given the relatively weak economic potential and high level of risks, the private sector, in many cases, would not be able to assume the development responsibility all by itself. For successful and sustainable implementation of public-private partnerships, the government should remain in the projects as a co-financier. The financial commitment of the government helps ease the fund raising, even if it is only implicit and contingent. There are two main functions for the government supports in highway projects: (1) to reduce the financial burdens and risks for the private operators, and (2) to enhance or stabilize the revenue stream. If public financial support is needed and appropriate, a variety of mechanism are available. (Estache, et al. 2000a)

Government Supports to Reduce Financial Burdens and Risks

Equity Guarantees

A project is provided with the option to be bought out by the government at a price that guarantees a minimum return on equity. Although the liability is contingent, the government effectively assumes project risk and reduces the corresponding private sector incentives.

Debt Guarantees

The government will pay any shortfall related to principal and interest payments. The government may also guarantee any refinancing that is scheduled. This creates significant government exposure and reduces private sector incentives, although it may decrease the cost of capital and/or increase the amount of debt available to the project.

Grants/subsidies

They are contrary to equity and debt guarantees that create contingent liabilities for the

government. Alternatively, governments can furnish grants or subordinated loans at project inception, buying down the size of the project that needs private finance. Also, explicit subsidies can be given as part of the renegotiation process. In general, these grants or subsidies have no provision for repayment.

Subordinated Loans

Subordinated loans can fill a gap in the financing structure between senior debt and equity. They improve feasibility by increasing the debt service coverage ratio on senior debt and by reducing the need for private equity, which requires a higher return. However, because subordinated debt eventually requires repayment, which is attractive for the government, it does not improve project feasibility to the same degree as a similarly sized grant. Another alternative would be for the government to contribute financing that has characteristics of both debt and equity. One such instrument is a "*reverse convertible*" contribution that remains as equity unless the project is successful, at which point it converts to debt with repayment obligations.

Government Supports to Improve or Stabilize Revenue Streams

Minimum Traffic and Revenue Guarantees

They are a relatively common form of support for tolled highways, where the government compensates the concessionaire if traffic or revenue falls below a minimum threshold. They reduce government exposure while providing sufficient revenue coverage to support the debt component of the capital structure. Also, they help retain financial incentives in the project. If the government shares "downside risk" with the private sector, it is sensible to also consider seeking instruments that allow profit of the "upside."

Shadow Tolls[9]

They are a way of providing subsidies where the government contributes a specific payment to the concessionaire according to the traffic volumes. They can also be used as the primary payment mechanism from the government to the private operator for the highway projects where real tolls are not imposed for some reasons. Because they are paid over time, they may be less of a burden on the public budget. The drawback of shadow tolls is that they may not

[9] Shadow tolls have been introduced in highway projects in the United Kingdom, as a mechanism for payment on un-tolled highways and for contract management. (See Chapter 5)

provide investors with much protection from revenue risks.

Concession Extensions and Revenue Enhancements

They provide financial support that involves limited public sector risks, but do little to directly support or enhance private financing. First, a government can extend the concession term if revenues fall below a certain amount. Second, a government can restrict competition or allow the development of ancillary services by the concessionaire.

Summary

In general, the most advantageous types of support for the concessionaire are those which provide early funding streams (when toll revenues from the highway are low or nonexistent during the construction period) and which give guarantees for unexpected problems. The least significant are those that themselves are unpredictable, i.e., additional rights for development around the road. These various mechanisms of government support can also be used in combination when a single measure is not sufficient to make feasible a project with substantial revenue risk.

While the government supports are indispensable for many of privatized highway projects particularly in developed countries, care should be taken in order not to give the private operators excessive protections. It will reduce the private sector's incentive for higher efficiency. From the private sector's viewpoint, their contribution (and competitiveness) would be found in exploring the best solutions for a specific project that would reduce the needs for the government support. Innovation for revenue enhancing means and great cost savings should be employed. If these are not sufficiently done and the private sector continues to rely heavily on the government, the benefit of privatization efforts will be easily gone.

3.2. Competition and Government Regulation

The ultimate goal of the government regarding infrastructure provision should be that the public is provided good quality services at reasonably low costs. When public-private partnerships are employed in infrastructure provision, the policy should always address this goal. Efficiency gains have to be realized and delivered to the public through the partnerships. Competition and government regulation are the two essential elements to enable this.

It is the government's responsibility to ensure that these two elements are effectively placed on the private operation. This requirement significantly changes the government's role in infrastructure provision. Also, from the private sector's point of view, the elements largely decide their business environment under the new arrangement. Therefore, the important issues about these aspects of public-private partnerships must be thoroughly understood by the both parties involved.

3.2.1. Government's Role as a Competition Facilitator and a Regulator

The increasing private participation, by no means, relieves the government from its current responsibility for infrastructure provision. The government role remains in (1) defining overall policies and strategies for their infrastructure development programs, and (2) undertaking by itself many projects that are too risky to attract private investments. The public-private partnerships in infrastructure would be suitable for only limited number of projects.

Even in those occasions where public-private partnerships can be implemented, the government still has a considerable amount of tasks. Before inviting private participation, the government has to carefully select a project that is likely to fit for private operation. It needs to investigate the economic viability and inherent risks of the project. Once the project is chosen, the next important tasks of the government are to select the private operator through a fair and transparent procedure, and negotiate and sign the contract. After the contract is closed and the private operator embarks on the project, the government has to make sure that the obligations under the contract are actually fulfilled by the operator and the users are provided with good quality services at reasonable prices as predetermined in the contract.

What is important is that the role of the government changes under the public-private partnerships. The government's new role can be decomposed into two elements. The first is that of a competition facilitator, where the government establishes competitive environment in

infrastructure provisions so that the private participation can result in substantial efficiency gains that would have not been obtained in public direct provisions. The second is that of a regulator, where the government provides proper regulatory oversight so that the achieved efficiency gains can reach the public through improved service at reduced costs.

3.2.2. Competition for Efficiency Gain

Competition is one of the factors that most clearly distinguish the private sector from the public sector. In other words, the private sector is always under a competitive market pressure, while the government is usually not. In order for a private company to stay in business for long, it must keep its competitive edge in the industry. Efficiency improvement can never stop so that the company can continuously provide the customers with better services at lower prices. It must keep up with the technology advancement of other companies and also make great innovation by itself. Otherwise, the competitors would take up its share. Thus, the competitive pressure is the driving force that makes the private sector pursue efficiency gains. When the private sector is invited into infrastructure provision, the expectation is that the private sector under competitive pressure can bring efficiency improvements into the sector.

Introducing Competition in Infrastructure Monopoly

However, the initial conditions of infrastructure market in most countries are not with the competitive pressure. Instead, infrastructure often represents local monopolies or oligopolies, because most countries have tended to develop their infrastructure under strong public monopolies. Infrastructure has been provided by the public sector because of the economic and political reasons (e.g., scale economies, externalities, and national security). It is said to have the characteristics of natural monopoly mainly because of its scale economy. For example, duplicate highway networks serving a similar traffic demand would not be optimal from economic efficiency viewpoint, because the social benefit is not large enough to justify the unnecessarily large investment for the duplicated capacity.

Although the scale economy arguments are understandable to a certain extent, the original inefficiency problems in infrastructure provision are largely attributable to the existing monopoly. When the government provision of infrastructure (and related services) is inefficient, the reason is not the fact that the government runs the facility. Instead, the reason is that the government provides infrastructure services under monopoly and has little incentive for

efficiency improvement. Therefore, private involvement without simultaneous introduction of competition would not make great difference to the current problematic situation encountered by the government.

However, it is not always a good idea to make a competitive pressure as large as it could be. If competition is too intense, the financial stability and profitability of the project become too uncertain to attract large investment requiring long period for its recoupment. Care must be taken to manage the level of competition at a reasonable level.

Industry Restructuring

The competition can be introduced in privatized highway development through the following two stages: *industry restructuring* and *competitive bidding*. Industry restructuring is the first process where the government creates a competitive situation in the industry by reforming currently monopolistic infrastructure sector. Even in a monopolistic industry, there should be found a number of various sub-sectors, each of which covers different service region or different level of activity. In practice, restructuring generally implies some degree of unbundling of these activities performed in each sub-sector. Through unbundling process, the large monopoly is disintegrated into various small business units.

Unbundling can be horizontal, which enables comparisons, in terms of performance, of various companies delivering similar activities. In road sector, geographical separation of entire highway network is among this type of unbundling. In this case, unbundling would allow comparisons of similar business activities performed by separate public agencies (or private companies) in similar geographical conditions. This is *competition between markets* as opposed to *competition in the market*. Also, unbundling can also be vertical, where vertically related stages of production are separated. Among vertically separated business units, there may be some activities that could be outsourced. In contracting out some of the activities, *competition for the market* thorough auction may be realized.

However, unbundling has its limitation from the economic efficiency viewpoint. Unbundling stops at the level of activity that requires some type of material infrastructure (e.g. rail tracks and roads) that would make no sense to duplicate in a competitive environment. Moreover, too much unbundling can hurt, as it reduces the opportunity for risk hedging across activities with different risk profiles, or it reduces the opportunity to optimize economies of scale

and/or scope. Therefore, it is important to decide the extent to which a restructuring of the sector is needed and/or is possible to make the most of the opportunities offered by a reasonable degree of competition.

Further, the multiple objectives of the government may impose additional limitation on the level of unbundling. While the efficiency gains are the primary concern in introducing competition in infrastructure provision, the government may also want to achieve fiscal gains (short-term and long-term) from the privatization process. Indeed, privatization can provide the government with fiscal gains in three major ways: (i) sale or rental of assets; (ii) passing on the financing costs of operating and investing to the private operators; and (iii) subject the private operators to the standard tax demands, rather than formally or informally exempting them.

These gains are more easily achieved when the government imposes less competition for the operations to be privatized. For example, in selling or renting the public assets, the higher the retained degree of monopoly passed on by the government, the higher the willingness of private operators to pay for the right to run a service. In such cases, competition introduced through industry restructuring and associated efficiency gains are reduced. For the government, it is important to strike the balance between the initial desire to achieve efficiency gains and the additional one to achieve fiscal gains through the process.

Competitive Bidding

The second process for introducing competition in infrastructure is competitive bidding. As discussed above, although industry restructuring is quite important, its applicability and effectiveness is often limited due to economic efficiency concerns and multiplicity of the government objectives in privatization. This would be the case for the highway infrastructure as well because of its network aspects and large investment requirements. While ideally the competition should be *in the market*, if the remaining monopolistic nature in the market structure does not allow it, *competition for the market* can be designed to achieve many of the gains from competition. The practical method to realize it is the competitive bidding (or auction).

In order for a competitive bidding to lead to a fair and meaningful result, the bidding rules should be reasonable and fair. Since the award criteria chosen have a critical impact not only on the competition but also on the project itself, the government as well as the private sector should be careful about them. However, it is often difficult for governments to find "ideal" award

criteria, because of the complexity of infrastructure projects and the diversity of objectives that the governments have in the privatized highway project.

Award Criteria Used in Highway Project Auctions

Competitive bidding is not a new concept, of course; it has been conducted for innumerable construction projects. However, because competitive bidding for privatized infrastructure projects involve two factors of technical sophistication and financial robustness, the bid evaluation process and award criteria are much more complicated than those used in bidding for simple construction contracts. Most of the following discussion is adopted from World Bank studies (Estache, et al. 2000a; Engel, et al. 1997).

Two-stage Evaluation

In many cases, a two-stage evaluation process is used. In that process, technical proposals are evaluated separately from and prior to financial proposals. The bidders who pass the technical evaluation then submit their financial proposals, based on which the winning bidder is selected.

Technical Proposals

Technical evaluation helps examine the technical viability of proposals and thereby reduce the risk of project failure. However, technical evaluation may also have difficulties. First, because the evaluation committee often has considerable discretion and judgment, the overall transparency of the process may be reduced. It is always hard to quantify the relative superiority of proposals. Second, if market conditions significantly changes after the contract award, the technical aspects of the project may have to change accordingly. In that case, the initial bidder selection based on its technical proposal becomes meaningless.

As a partial solution for these drawbacks, the technical evaluation can be replaced by a kind of technical consultation. First, the government issues a preliminary set of technical standards to be achieved. Next, the prospective bidders prepare their own proposals and discuss them with the government. Through this process, the government modifies the original standard and finalizes the bidding package. Finally, financial proposals are requested for the same technical specifications and requirements, from which the winning bidder is selected. While it is desirable for the government because they now have some idea of best engineering solution to a

specific road project, it is doubtful whether the potential bidders do their best in the technical review stage. Without any kind of reward system, the bidders would have nothing to get from the contribution in this stage. However, if the government considers the bidder's contribution and tries to add some points for the final selection, the same problem about the fair and transparent evaluation arises.

Financial Proposals

After the technical evaluations come the financial proposals. While there are many different options for structuring financial proposals for road concessions, common options include (1) lowest toll level, (2) shortest duration of the concession, (3) highest payment to the government for existing infrastructure, and (4) lowest subsidy required from the government. Less common options include (5) the lowest income guarantee requested from the government, (6) the amount of new investment and/or its speed, and (7) some innovative ideas discussed later.

In early attempts for auction design, it had been tried to create complex multivariate criteria using weighted average of some of index just mentioned. However, because these criteria were considered unclear and even unfair, the governments started to use a single criterion. The followings are the basic models found in privatized highway concessions around the world.

The Minimum Toll

The term of the franchise is specified and the contract is awarded to the bidder with the lowest toll. This system has an important problem, because the tolls are decided by the scale of investment and not by the traffic demand. If tolls are set to cover the total costs, high tolls result when traffic volume is low and low tolls result when traffic is high.

The Shortest Term

The tolls are specified and the contract is awarded to the bidder asking for the shortest term. If tolls are not specified and the bidders are allowed to include them in the proposals, the problem similar to that in the minimum toll auction will arise.

From the experiences in the two models above, it was realized that the tolls should not be decided exclusively from the total cost coverage and therefore are not suitable for the award criteria. Accordingly, in the next models, the tolls and the durations of franchise are predetermined and other criteria are employed.

The Minimum Amount of Required Government Investment

Under this system, the bidder estimates how much government investment is required in order that the project can be financially viable, for the traffic forecast, the tolls and the franchise duration given beforehand. The bidder with the minimum investment requirement from government is selected as the winning bidder. The government investment can be a direct subsidy that serves to "buy down" the size of the project and reduce the financial risk exposure of the private company. Alternatively, the government can pay the concessionaire through "shadow tolls" over the life of the project, which is the method established in British DBFO (Design-Build-Finance-Operate) highway projects.[10]

The Minimum toll, Within a Band Set by the Government

In these minimum toll auctions, a band could be set, within which the bidder can propose its toll level. The floor of the band is set sufficiently high to guarantee a minimum revenue stream to the concessionaire. In addition, the duration of the contract is fixed in the bidding documents. Setting this minimum toll level and the duration of the contract effectively puts a floor on the expected earnings of the concession company.

One common characteristic of the four systems above is that they fix the contract duration in the beginning. The main defect of fixed term mechanisms is that they create unnecessary risk for the operator. The risk is concerned about the uncertainty of future traffic. In the bidding, the bidders would first estimate the total costs of the project (construction, operation and so on). Then, they would calculate the toll (or the franchise term) required to cover the cost and make reasonable profit, using the specified franchise term (or toll). In doing so, they have to rely on the traffic forecast. In a competitive situation, it is no wonder that the bidders tend to be optimistic about the traffic forecast and thus expose themselves to the traffic risk. The successful bidder faces significant losses if traffic turns out to be considerably below expectations. Financial stability of the concessionaire, a pre-requisite for uninterrupted infrastructure services, is important for the government as well. On the other hand, if the traffic is substantially higher than expected, the government may want to expand the capacity of the highway under the control of the concessionaire. In that case, the fixed term mechanisms do not give any guidance for settlement.

[10] The bid evaluation method employed in the U.K. DBFO highway projects is discussed in Chapter 5.

LVPR: The Lowest Present Value of Revenue

This idea is a latest example of innovative award criteria, pioneered by Chile. In this system, the bidding variable is the present value of revenue throughout the life of the concession that firms are willing to accept to undertake the project. The firm that bids the lowest present value of revenue (LVPR) wins. The duration of the concession is then flexible and depends on the effective traffic levels encountered. Once the concessionaire has received the amount (in present value terms) that he bid, the concession ends, and the infrastructure reverts to public ownership.

The LVPR method can effectively address the problems in fixed-term contracts. If real traffic levels are lower than expected, the duration of the concession is extended automatically, while if traffic is higher than expected, the opposite occurs. Therefore, income uncertainty due to traffic variations is largely removed of the operator. In addition, the LPVR auction reduces potential conflicts related to the unexpected early termination of a concession. In such a case, the operator receives the difference between what he originally bid and what he has already earned.

However, the LVPR mechanism also has its drawbacks. It may lower the incentive of concessionaires to make demand-enhancing investments such as quality improvement. The increase in demand from these expenditures results in an earlier termination of the contract, with little benefit to the concessionaire. Perhaps a more important difficulty is that the LPVR auction does not resolve possible cash flow problems that a private operator may face when traffic levels drop.

Government Concern and Award Criteria

As seen in the sample mechanisms shown above, there are various models of award criteria experimented by the governments to find better ones. However, it is important to note that each of them has its advantages and drawbacks and none is always superior to the others. What is also important is that the variety of award criteria is also a result of varying objectives in the government. (Estache 1999) Therefore, the award criteria chosen can be seen as an indicator of the government concern in privatized highway projects.

If the government are most obviously concerned for the users and want to decrease the toll rates through privatization, they will generally opt for awarding the contracts to the bidder with the lowest tolls. On the other hand, governments with some political concern will set the

tolls and investment obligations and award the contract to the bidder offering to run the business for the shortest duration. When fiscal concerns dominate, the auctions can be organized to award the contract to the bidder who is willing to pay the most to the government for the right to provide the service. In some cases, when demand for the service is not strong enough, obtaining the best fiscal impact may be through choosing the bidder that asks for the smallest subsidy.

3.2.3. Government Regulation for Real Public Benefit

Once the efficiency gains are achieved through introduction of competition, they should then reach the users (or the taxpayers) through improved quality at reduced cost. However, because the private sector does not necessarily follow this step, government regulations are usually required. The government regulations include price regulation and quality regulations (e.g., technical quality, service quality, safety, and environmental quality regulations). Because the privatized highway services almost inevitably retain a certain degree of monopoly, the price should be regulated so that the users are not exploited by abusive pricing. Also, several crucial aspects of infrastructure projects, such as safety, service quality and environmental mitigation, are not directly achieved by the competition. Instead, the cutbacks of these quality aspects may be used as an easy way for cost reduction. At the same time, these regulations should be straightforward and prearranged at the time of contract agreements, because too much discretion given to the regulator may become a potential source of political or regulatory risks for the private sector, which increases the overall level of risk and, in turn, raises the cost of capital.

Price Regulation[11]

Price regulation aims at preventing monopolistic infrastructure operators from charging excessively high prices on the users, by which the companies make unreasonably high profits. There are several forms of regulatory systems employed in a broad range of public service industries around the world.

Rate-of-Return Regulation

One of the price regulation systems is rate-of-return regulation. This is the traditional system for price regulation broadly applied to infrastructure services such as telecommunications,

[11] Practical applications of price regulation mechanisms in highway projects developed by the United States and the United Kingdom governments are discussed in Chapter 4 and Chapter 5, respectively.

power, and, transportation. Under pure rate-of-return regulation, the prices of the services provided are adjusted so that the company can earn a specified rate-of-return. The price can be adjusted upward if the company starts making a lower rate of return, and also it will be adjusted downward if the company makes a higher rate. In other words, a private company is guaranteed a rate of return on capital that is agreed upon in the contract.

Under this system, the guaranteed rate of return is set at the level of reasonable profit for the private operator to earn in the project. Because the fundamental goal of price regulation is to prevent private companies from making excessive profit by exploiting the users, it seems that this system is able to directly address the goal of regulation. Also, because the company is placed on less risky situation than under other regulation systems, the cost of capital should be lowered for them and thus the price could be reduced.

However, there are two major drawbacks in this approach. The first is that rate-of-return regulation does not give a sufficient incentive to private companies to reduce costs or improve efficiency. Even if a private company is inefficient and its operation cost is unnecessarily high, the company is still allowed and guaranteed to earn a predetermined rate-of-return. If that is the case, the company will not attempt to reduce its cost. The second drawback is that rate-of-return regulation encourages over-capitalization by companies. Because the allowable profits are directly linked to the size of the capital base, the companies regulated under rate-of-return systems tend to make capital investments for excessive and unnecessarily large capacity.

Price-Cap Regulation

Another system is price-cap regulation. Because it is believed to give companies stronger incentives for efficiency than rate-of-return regulation, price-cap is replacing rate-of-return regulation and becoming increasingly common (Alexander et al. 1997). Under pure price-cap regulation, the prices for the services provided are preset over several years in advance. The prices are given in pre-established formulae where the price bases are to decline annually reflecting the company's expected cost reduction and, at the same time, they are adjusted each year by the rate of inflation plus or minus some other factors. Because the formulae do not account for the company's profit, the company is at a risk that it may not obtain desired profits if it fails to achieve the cost reduction. On the other hand, the company is given an opportunity for an extra profit larger than a fair profit considered in the regulated prices, because the cost savings larger than expected would go to the company. This feature of price-cap regulation (i.e., threats

of lower profits and rewards for higher profits) gives private companies a strong incentive for efficiency improvement.

An outstanding example of price cap system is *RPI – X*, introduced in the United Kingdom. When utility privatizations were carried out in the country, this formula is used to decide the price-setting rule in gas and electricity. *RPI* is the Retail Price Index and *X* (efficiency factor) represents the expected annual gain in the utility's efficiency. In water, the rule is *RPI + K*, where *K* represents both expected productivity gains and a permitted annual increase in the real price of water to allow for quality improvements. Based on these formulae, utility companies are permitted to increase their prices according to the change in the consumer price index (i.e., inflation rates) plus or minus a specified amount. Also, price-caps have been used in the United States to adjust the prices charged by the long-distance telephone company AT&T since 1989. (Alexander et al. 1996; Alexander, et al. 1997)

However, there are some drawbacks in price caps, too. Because the company is to seek for cost reduction, there is a chance of quality cut-down. Performance oversight by some sort of authority will be necessary. More importantly, because the price-setting formula is mostly based on the inflation rate, the companies are exposed to all cost changes beyond the range of inflation. When the cost changes occur as an overall market movement (e.g., oil price) and such changes are not fully reflected in the inflation rate, a company has no adjustment on prices. Then, the companies under price-cap regulation are subject to great risks and may raise their cost of capital. This, in turn, will have to be reflected in the price setting and the price will increase.

Recognizing the fact that certain cost elements are beyond the control of regulated companies and expose them to high risk without giving proper incentives, most price-cap regimes allow some cost pass-through. Most of the U.K. RPI – X formulae mentioned above allow for certain uncontrollable cost elements to be passed through to customers. (Alexander et al. 1996) If certain cost changes beyond the company's control occur, these mechanisms (*price-caps with cost pass through*) automatically allow the company to pass the costs on to customers without any permission in the periodic price review. Thus, the risks borne by investors are reduced and the cost of capital of the company should be accordingly lowered. At the same time, as long as the uncontrollable cost elements are correctly and specifically identified, the company still is given the efficiency incentive as in the original price cap.

Hybrid Systems

There are hybrid systems, combining the price regulation systems (purely on rate-of-return or price-cap) described above. They are intended to complement the drawbacks of each of these pure systems. Because of the relative superiority of the hybrid systems, they are becoming common in many countries.

Revenue-cap and Price/revenue Cap Regulations

One of them is the idea of *revenue-cap* regulation. Under revenue-cap regulation, a ceiling is imposed on the total income of companies, instead of on the price the companies charge for a unit of sales. This system is suitable for companies with high fixed costs, such as electricity companies, and reduces the risk exposure of them. If these companies are regulated under price-cap regulation, it faces high degree of risk from demand fluctuations. The lower demand significantly reduces the revenue (based on fixed prices), while it does not affect the cost (based on fixed investment) so much.

While there are several possible variations of revenue-cap regulation, a hybrid *price/revenue cap* regulation is one of them. In industries with a relatively high level of marginal costs, a hybrid price/revenue cap should be used rather than a pure revenue cap. If a pure revenue cap is used for these industries, a demand increase will raise costs while the revenue increase is restrained. By introducing the hybrid approach, the regulation can mimic the balance between fixed and variable costs in the industry, so that the companies are given the correct incentives to promote sales and is not exposed to excessive risks from demand fluctuations.

In the U.K., where pure price-cap regulations have generally been the preferred regulation systems, these hybrid approaches are now taken in the electricity industry. This has generally been achieved in conjunction with the existing price caps rather than by replacing them altogether. Northern Ireland Electricity was privatized in June 1993 with a revenue-cap rather than a price-cap formula, while hybrid price/revenue caps have been introduced for the regional electric companies (RECs) in England and Wales. This was due partly to arguments concerning the level of fixed costs in the industry, which the companies claim were not recouped through the existing fixed charges to customers, and also to correct a perverse incentive effect of the pure price-cap system. When company's income is linked to the number of units sold while costs are mainly fixed, the companies have no incentive to encourage the efficient use of electricity. In fact, companies would gain by encouraging customers to waste power, in conflict with the energy-

efficiency measures that they are supposed to encourage. (Alexander et al. 1996)

Price-cap/rate-of-return Regulation

Most regulatory systems do not purely rely on either rate-of-return or price-cap. Instead, they are often implicitly a hybrid of them. The length of time that elapses between price reviews and the degree of automatic cost pass-through would decide the relative appearance of the system. When the price-cap system is to be imposed, the initial price level is decided based on the past history of the company's rate-of-return, so that the price is set at a reasonable level. More important, the regulated prices require periodic reviews in order to ensure that the predetermined prices were appropriate. In these reviews, the company's rate-of-return would be one of the most important benchmarks to judge the effectiveness of the price regulation. Thus, if the review cycle is frequent, price-cap is so greatly affected by rate-of-return that there would be no practical difference that clearly separates two regulatory systems. Also, if the degree of automatic cost pass-through under price-cap regulation is high, the majority of cost elements are covered by the pass-through, making the regulatory system similar to that of rate-of-return.

Besides, there are also explicit hybrid price-cap/rate-of-return regulations. Such schemes may place a floor and a ceiling on the rate of return that may be earned by a regulated company, in addition to direct price regulations. Alternatively, a less extreme system might allow all profits to be kept in a band around the 'target' rate of return, while any further gain or loss relative to this level is shared between the company and its customers.

Table 3-2 An Example of Sliding-Scale Regulation

Rate of return, R (%)	Adjustment to revenues
Over 15	Revenues adjusted down by $\frac{1}{2}(R - 15)$
Between 13 and 15	No adjustment
Under 13	Revenues adjusted up by $\frac{1}{2}(13 - R)$

Source: Laffont and Tirole (1993), A Theory of Incentives in Procurement and Regulation, MIT Press, as cited in Alexander et al. (1996)

An example (shown in Table 3-2) is the sliding-scale regulation system governing the New York Telephone Company established in 1986, which is operated according to the following rules. Under the scheme, full cost-efficiency incentives are retained in the intermediate band of 13-15 percent as any profit changes are passed through to the company in full. In the higher and lower bands, incentives are weakened as 50 percent of any gain or loss accrues to customers: this is the cost of avoiding excessive profits on the upside and excessive risk to the company on the

downside. Incentives are stronger than under pure rate-of-return regulation but still weaker than under price-cap system. (Alexander et al. 1996).

Summary

The price regulation started with rate-of-return regulation. When the drawbacks of the system were widely noticed, price-cap regulation was introduced as a more powerful regulatory system. Now the regulators are looking to some kind of intermediate systems.

The issue has been a trade-off between incentives for efficiency and the degree of risk exposure. The rate-of-return regulation exposes companies to little risk, but, at the same time, lacks incentive or pressure on the companies to improve efficiency. On the other hand, the price-cap gives companies strong incentive to improve efficiency, while it places the companies in risky situations. The hybrid systems are intended to coordinate the trade-off, minimizing the risk exposure while maintaining the efficiency incentives. In this sense, any regulation system, when encountered, should not be understood separately from the other various types of systems. Rather, it should be located on the spectrum of systems, each of which has different extent of efficiency incentive and risk exposure, relative to the other.

Regulators should have solid understanding of the impact that the price regulation system selected would have to the success of privatized infrastructure projects. Also, the prospective private companies should also be careful about the risks that the price regulation would impose on themselves and the incentives that they are given under the system.

Quality Regulations

There are many quality aspects that require government regulations. They include technical quality, service quality, safety, and environmental quality. General considerations in these aspects are presented in Estache, et al. and summarized as follows. (Estache, et al., 2000a)

Technical Quality

During the design and construction phases, technical matters such as pavement materials, thickness, and construction techniques must be specified in the contracts and monitored by regulatory agencies, since these aspects largely determine the facility's performance and future maintenance and investment needs. After the highway is opened for public use, the focus of quality regulations shift to making sure that the assets are properly maintained, pre-established

performance standards are achieved, and additional investments are made as specified. It is also necessary to make sure that the private operator reserves sufficient funds for maintenance and repair of assets. This can be particularly problematic in the later years of the contract term, where incentives to properly maintain the equipment and facilities are lower.

What is important is that these quality standards have to be agreed upon by the both parties and specified in the formal agreements. The quality regulation is based on whether these performance standards are actually met by the private sector. If actual performance is below the standard, the contract should specify the nature and type of penalties to be imposed and/or the nature and timing of investment to be undertaken. Again, the rule is that the service quality standards must be specified in the contract.

Service Quality

The regulation should cover not only the technical (or physical) quality of the highway but also the quality of services provided by the private operator. The performance standards regarding service quality should include, for example, (1) lane availability and shutdowns, (2) traffic volume and average speeds, (3) toll queue performance (waiting times and availability), (4) capacity, speed and visibility in bad weather conditions, (5) access conditions and bottlenecks, (6) response times and service aspects of emergency vehicles (if such services are under the responsibility of the private operator).

Safety

Safety assurance, while important, requires somewhat complicated treatment in regulation of privatized highway projects. Safety is not only a function of the physical characteristics of the road, but also the quality and operation of the vehicles using the road. In particular, speeding, unsafe driving practices, and poor vehicle inspection practices can lead to accidents. Therefore, performance standards should be designed to help evaluate whether safety problems are the result of the facility or from traffic enforcement shortcomings. For example, if average speeds are above the statutory limit, this may indicate insufficient law enforcement.

The facility, which is under direct control of the private operator, must be designed to handle the anticipated traffic volume with mixed car types under a variety of operating conditions. The technical qualities, such as capacity, design speed, grades, roughness, signaling, lighting and emergency services, are the examples of safety factors that should be built into the

performance standards.

Environmental Quality

As for the construction (and rehabilitation) of the highway under public-private partnerships, the importance of environmental mitigation should be appreciated as in the conventional projects. If construction companies are in the concessionaire, they should be familiar with relevant environmental aspects, such as noise, vibration and wasted materials, and required mitigation measures for them.

What are more important in the context of public-private partnerships in highways would be the environmental mitigations taken during the planning and design phase. The road alignment decision should reflect geographic characteristics of the region where the road is located. The physical design of the road should take into account the material used for the pavement, noise barriers and so on.

Chapter 4. The U.S. Experience[12]

In the last two chapters, major discussion points regarding public-private partnerships in infrastructure are summarized in order to understand the important issues that the prospective participants, the public or the private, in such partnerships must keep in their minds. However, more focused discussions within a country-specific context would be necessary in order to understand how the partnerships can be successfully implemented in actual situations of infrastructure development.

In this and the subsequent chapters, insightful examples of public-private partnerships applied to highway development in two countries are introduced. The countries are the United States and the United Kingdom. This chapter discusses the U.S. experience, followed by the next chapter discussing the U.K. experience. The chapters review their historical backgrounds in highway development, the overall policy changes regarding the implementation of public-private partnerships, and the milestone projects under the partnerships. Through these overviews and some comparisons of the two experiences, important lessons are drawn.

The studies reveal that the governments in two countries have implemented the public-private partnerships with somewhat different objectives under their own arrangements to specifically address their historically rooted problems in highway development. On the private sector's side, the different expectations of the governments in public-private partnerships led to different changes in the industry. The differences in the nature and depth of private involvement required under the established systems also have affected the relative effectiveness of the contributions made by the private sector.

[12] Most information in this section was drawn from Levy 1996, Gómez-Ibáñez 1993, and World Bank 1999.

4.1. History of Highway Development in the United States

4.1.1. Overview

Although the United States has a vast and heavily used multi-modal network of transport infrastructure, public investment priorities for land transport during the twenties century focused almost exclusively on roads and highways. As a result, the country is now highly dependent on motorized vehicles, particularly for passenger transport. More than 95 percent of motorized land-based passenger trips in the country are by private car or truck on public roads. There are approximately 3.9 million miles (or 6.3 million kilometers) of public roads in the U.S., of which nearly 53,000 miles (or 85,000 kilometers) are urban and rural express highways (World Bank 1999).

In the U.S., the road sector is one of a few fields of public infrastructure provision where the governments directly provide services using their own funds[13]. Unlike many other countries, the U.S. has relied on regulated private provision in most public services, such as railways, electricity and telecommunications. Accordingly, when the initial debates about the reform of the public services began, the discussion focused on the need to introduce more competition in the industries. The U.S. governments, in trying to do so, reduced or eliminated restrictions to entry (such as entry licenses) and on operating rights, in addition to eliminating strict price and quality controls (Estache 1999). "Deregulation" rather than "privatization" would be appropriate to call the U.S. reform in public services. In the road sector, however, a different approach has been taken since late 1700s.

4.1.2. America's 200-year History in Highway Development

Late 1700s: the Birth of Highways

While almost all of the U.S. highway system is now owned and operated by the public sector, and most of it has been financed with motor fuel taxes or similar excises rather than tolls, privately financed toll roads are not without historical precedent. Indeed, the concept of the toll road in the U.S. dates back to the late 1700s. As early as 1792, the Philadelphia and Lancaster Turnpike was constructed in Pennsylvania, starting the history of highway development in the

[13] Water supply and wastewater treatment would be among other examples.

country. From this time on, the private toll road was the dominant form of land transportation in the U.S., and approximately 15,000 miles (or 24,000 kilometers) of toll roads had been built by the middle of the 1800s (Levy 1996).

Many of these roads were constructed with some federal assistance in the form of land grants or subsidies, while others were built by wealthy businessmen. Although the federal government itself was also engaged in road constructions during that time, these roads were usually not built as competitors to the private turnpike systems but rather as compliments or supplements that connected the various private efforts into a more comprehensive and integrated network.

Late 1800s: Temporary Halt of Highway Development

However, during the later part of the nineteenth century, development of alternative modes of transportation was also underway. The boom in private turnpike construction and public road building was halted by the emergence of the railroad and, to a somewhat lesser extent, of canals. It was not until the commercial production of the internal combustion engine at the end of the century that the interests in building a nationwide highway system were revived.

Early 1900s: Revival of Highway Development

As a result of pro-highway initiatives led by various interests, a national highway policy was established in the Federal Highway Acts of 1916 and 1921. The concept behind the acts was that a comprehensive nationwide highway system could best be achieved through federal coordination. By the 1920s, a Federal Bureau of Public Roads was in place, and limited federal assistance for road construction, mainly in rural areas, was provided. Also, a federal standard for road construction was established, dictating the specifications to be followed by the states seeking federal aid in developing their highway systems. However, tolls were prohibited on highways built with federal aid, exclusive of high-cost bridges or tunnels, reflecting the federal officials' view that the reliance on private toll roads in the nineteenth century had been a major obstacle to the development of a national highway network at that time.

Despite the slowly expanding federal role, state and local governments still remained largely responsible for road construction and finance decisions. The federal role was limited to providing financial aid and design standards for the highway constructed by the states. Moreover, the federal aids were small in terms of amount of investment, since state and local expenditures

still outweighed by far the federal assistance. During the 1920s, an increasing number of states began to levy taxes on gasoline as their source of funding highway construction and maintenance. In many states, the new gas taxes were earmarked to paying for highway expenses only. Nevertheless, through the 1930s the states generally followed the federal lead in that it used tolls to finance only very special and high-cost links, mainly tunnels and bridges.

However, since the states were mainly responsible for highway decisions, they could experiment with alternative methods of financing their road networks, and many different patterns eventually developed. Several major highways were built or planned in the following two decades using toll revenue to pay for construction and operating costs. Connecticut's Merrit Parkway, opened in 1937, was the first auto-only toll road, while the Pennsylvania Turnpike, opened in 1940, was the first high-performance road designed to serve trucks as well as automobiles. Interestingly, 1940 was also the year in which the first Los Angeles freeway (the Arroyo Seco) was built. By the early 1940s, successful models, thus, existed of both tolled and un-tolled (i.e., tax-financed) highways; the toll roads were on the East Coast and the gas-tax-financed freeways were on the West Coast.

Mid 1900s: Federal-Aid Highways

World War II further promoted the awareness of the need for a high-speed, national highway system linking strategic parts of the country together for passenger, freight, and military travel. Development of a truly comprehensive national system of high-performance roads obviously necessitated a compromise or reconciliation of these different regional financial strategies.

The Federal-Aid Highway Act of 1956 chose tax-finance for national highways development. The act provided funding for the construction of an Interstate and Defense Highway System of 41,000 miles (or 66,000 kilometers)[14]. 90 percent of the construction cost was to come from the federal fund tapped from a federal gas tax and increased federal excise taxes on motor vehicles and parts.

Following the example of many states, a companion act, the Highway Revenue Act of 1956, created the Highway Trust Fund whereby proceeds from a federal tax on gasoline and motor vehicle parts would be deposited for the sole use in highway construction. Prior to the

[14] Later it was increased to 43,000 miles (or 69,000 kilometers).

Fund, the federal money necessary to pay for the Federal-Aid Highway Program came from the Treasury's general funds. The Fund increased user taxes and established new ones, and all the revenues now would be credited to the Fund, which would be dedicated to finance a larger highway program.

Tolls were expressly forbidden on the new interstate highway system except for 2,447 miles (or 3,900 kilometers) of toll expressways in operation (or almost completed) at that time. Several factors led to the decision to finance the interstate system with gas taxes rather than tolls. Tolls were generally opposed by several interests promoting the automobile and trucking, who argued that the combination of tolls and existing gas taxes would be especially unfair to motorists using tolled facilities since they would, in effect, be paying twice. In addition, it was recognized that it would be difficult to finance a transcontinental expressway system through tolls alone.

Not surprisingly, the establishment of the federal grant system of 90-10, 90 percent federal participation to 10 percent state participation, dramatically discouraged the construction of toll roads. Additionally, some states removed existing tolls to comply with a federal requirement, which would make states eligible for federal funds for reconstruction and widening. While slightly more than 3,000 miles (or 4,800 kilometers) of toll roads had been opened by 1960, from 1906 to 1980 only about 1,500 more miles (or 2,400 kilometers) of toll road were built. By contrast, the construction of un-tolled expressways was accelerated rapidly through the 1960s and the 1970s, only slowing in the 1980s as the interstate system was nearing completion. (Gómez-Ibáñez 1993)

In the 1966, the Federal Government's various transportation-related agencies were merged into the United States Department of Transportation (USDOT). One year late, in 1967, the Federal Highway Administration (FHWA) came into existence to administer the nation's federal highway system. Each of the 50 state governments also established their own state-level Department of Transportation (DOT).

By 1989 the United States had built 54,145 miles (or about 87,000 kilometers) of limited-access expressways with four or more lanes, and most of this mileage was un-tolled. The interstate system and its connecting roads accounted for 44,759 miles (or about 72,000 kilometers), of which only 2,695 miles (or about 4,300 kilometers), mainly the core of the pre-1956 toll road network, were tolled, accounting for only 6 percent of total length of interstate

system. (Gómez-Ibáñez 1993)

4.1.3. Revived Interests in Private Toll Roads

Pilot Toll Road Program

By the 1980s, as the interstate era was coming to an end, needs for new arrangements for developing the nation's highway system were being brought to the attentions of government officials, especially at the state level. While 90-10 funds could still be used for the widening or rebuilding of the interstate system, Congress had agreed to only minor expansions of the eligible interstate route network. In the meanwhile, the constructed stocks of highway facilities were aging, which required increasing amount of maintenance. The costs for just maintaining them outrun the funds available from traditional sources, such as the gasoline taxes, and left few resources for building new capacity.

Federal and state gas tax increases covered part of the funding shortfall during the 1980s. However, the gas tax increases were not sufficient to cover the high cost of new construction and of rehabilitation and repair of the rapidly deteriorating roads and bridges. Additionally, the need to reconstruct and repair neglected, aging highways, bridges, and tunnels was only one of the many demands being placed upon overburdened federal and state treasuries. Thus, finding innovative methods of providing funds for new highway construction became a necessity.

Budgetary pressure revived state governments' interests in toll roads. In 1984, Virginia opened the first new toll road in the U.S in nearly a decade, the 13-mile Dulles Toll Road serving a rapidly growing western suburb of Washington, D.C. Several other states followed the lead. After the completion of individual toll roads, several states (and one territory) passed legislation to allow increased private sector participation, before any action took place at the federal level. These jurisdictions include: Virginia (1988)[15], California (1989)[16], Missouri (1990), Puerto Rico (1990), Arizona (1991), Florida (1991), and Texas (1991). (World Bank 1999)

The state governments' interests in toll roads urged the federal government to reconsider the prohibition of tolling on the federal-aid highways. In 1987, Congress authorized a pilot program under which up to 35 percent federal aid would be available to construct toll roads in nine interested states (California, Colorado, Delaware, Florida, Georgia, Pennsylvania, South

[15] The Highway Corporation Act of 1988, as discussed later.

[16] The Assembly Bill 680 of 1989, as discussed later.

Carolina, Texas, and West Virginia). However, only new or substantially improved roads in a non-interstate system would be eligible as demonstration projects and the state's apportionments of non-interstate federal highway aid would not be increased. Nevertheless, by the end of 1990, three of the states had already started their toll road projects under the program.

ISTEA

In December 1991, the federal government enacted the Intermodal Surface Transportation Efficiency Act (ISTEA). The law essentially extended the pilot program to all 50 states. It granted state and local governments more flexibility in raising new capital for highway investments. First, it expanded the projects eligibility for the federal aid so that the state could use the federal fund to build new toll roads, although tolls were still forbidden on the interstate system. Second, more importantly, it accelerated the process of creating public-private partnerships for the construction of much-needed roads and bridges. Thus, ISTEA enabled the revival of private toll road development, an idea neglected since the early nineteenth century.

Expanded Project Eligibility

ISTEA did not change the form of federal aid, but did change how it was administered. It expanded toll facility eligibility for federal aid in a variety of activities including (Levy 1996):

1. Initial construction of toll facilities (except for on the interstates),
2. "Four Rs" (resurfacing, restoring, rehabilitation, and reconstructing) work on toll facilities,
3. Reconstruction or replacement of free bridges or tunnels and conversions to toll facilities,
4. Reconstruction of free highways (except interstates) to convert to toll status, and
5. Preliminary studies to determine the feasibility of the above works.

For the non-interstate highway systems, states can now use federal highway funds to pay 50 percent of the cost of building a toll road, public or private, provided that the facility is new or substantially improved. A 50-percent subsidy would significantly increase the number of situations where toll roads are financially viable. However, because the federal government would provide no special toll road funds above and beyond each state's normal apportionment of federal highway aid, the use of federal aid for a toll road will come at the expense of its use for other road projects. Congress left the decision to the state governments.

Because the funds can be either loaned or granted to toll projects, the funds are not

returned to the federal government, and ISTEA allows federal aid funds to be recycled. If the funds are loaned, the repayments (including interests) are made to the sponsoring state, where they remain to be used for other transportation projects. These repayments can then be used to fund other transport projects, free of the federal requirements that originally accompanied the federal aid funds. Also, tolls do not have to be removed once the state has recovered the costs.

ISTEA requires 30 years to repay loans obligated with federal aid highway funds. Typically, a private toll road project would require 20 to 40 years to repay debts and achieve the developer's required return on investment. In the pioneering non-ISTEA projects discussed later, California has stipulated a term of 35 years, while Virginia has allowed the Dulles Greenway 40 years.

Public-Private Partnerships

One of the most intriguing innovations in ISTEA would be acceleration of public-private partnerships. ISTEA allows the mixed use of federal, state, and private-sector funds and the responsibility sharing between the public and private sector. Both sectors are allowed to participate in the design, financing, construction, and operation of new highway facilities and in the repair and expansion of existing facilities.

Such partnerships in the U.S. have typically been reached between a state government and a private consortium. Their primary intentions have been:

- to provide each entity with the ability to carry out the functions that each is best suited to pursue;
- to provide a balance between the equity and decision-making responsibilities of the public sector, and the market-driven, competitive efficiencies of the private sector; and
- to increase the general welfare for society through the provision of highway facilities, relative to what is possible through existing institutional arrangements.

4.2. Modern Proposals for Private Highways

In the late 1980s, there were two states that pioneered the modern efforts for private toll roads: Virginia and California. The Virginia road proposal, the earliest, was led by a strong private initiative, while in California the state organized a competition to award up to four demonstration projects of private toll roads.

4.2.1. Dulles Greenway

Background

In 1962, as the existing facilities of the National Airport were reaching their capacity, the new Dulles International Airport was built in rural Loudon County, 25 miles (or 40 kilometers) northwest of central Washington, D.C., serving the Washington D.C. area as well as the adjacent Virginia and Maryland countryside. In order to provide travelers fast access to the new airport, a 12-mile (or 19-kilometer) un-tolled expressway was built to connect the airport with the Washington Beltway, I-495. The Dulles Access Road was designed and built so that only the airport visitors could use it. No interchanges were built on the freeway to prevent its being congested by local traffic.

The Dulles Corridor in Fairfax County, the area along the Access Road, became increasingly developed in the following years. As a result, the need for developing a new highway serving local traffic became a serious concern. However, faced with the increasing costs for all forms of infrastructure for their rapidly expanding communities, Fairfax County officials had no reliable option other than charging tolls on a new highway. Thus, in the 1970s, the Virginia Department of Transportation (VDOT) initiated development of a toll road to service the Corridor.[17] Construction was completed in 1984. The Dulles Toll Road, as it was called, was the first toll highway in the state[18], and it soon became a heavily traveled and profitable facility.

In 1986, a proposal was submitted from a group of private entrepreneurs, later organized as the Toll Road Corporation of Virginia (TRCV), to develop a 14-mile (or about 22-kilometer)

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[17] The Dulles Corridor right-of-way was leased from the federal government, which had purchased it whey they had built the original un-tolled Dulles Access Road, anticipating the future rise of needs for another road.

[18] The Dulles Toll Road was also the first new toll road in the U.S. in nearly a decade at that time and stimulated the private toll road legislations that were to occur from the late 1980s.

toll road extending the existing state-owned Dulles Toll Road from Dulles International Airport to Leesburg, Virginia. Combined with the existing highway, the private road would provide a limited-access route through the Loudon–Fairfax County corridor, rapidly developing western suburbs of the Washington, D.C. Eventually, the proposers convinced the Virginia Assembly to pass the legislation authorizing private toll roads in the state.

Highway Corporation Act of 1988

It was in early 1988 that the privatization legislation, the Highway Corporation Act, was enacted, which established the legal ground for a private toll road development in the state. It provided the guidelines that would be applicable for any public-private partnerships in transportation projects in Virginia. It covered such information as submitting applications, obtaining a certificate of authority, dealing with eminent domain issues, and other issues regarding the responsibilities of the government and the private operator.

First, the Act defined the process where the public-private partnerships would be employed in transportation projects. When an application is filed by a private developer to develop a transportation project under public-private partnerships, the state Board of Transportation has the authority to approve or deny application for a certificate. The Board approves the project and its interconnections, if there is a public need for the project and if the project is compatible with the existing road network. Once the project is approved, the Board enters into a comprehensive agreement with the operator, which will include reviews of all plans, specifications, and proposed maintenance practices, and other relevant issues.

Second, the Act set forth the power of the State Corporation Commission. Under the Act, the Commission, not VDOT, was (1) granted the authority to regulate the applicant as a public service corporation, (2) charged with the responsibility of supervising and controlling the operator in its performance, (3) assigned the responsibility of approving or revising the toll rate charges requested by the operator. Initial toll rates would be approved if they appeared reasonable in relation to the benefits received and appeared not to discourage use of the roadway. In revising them, a reasonable rate of return to the operator would be examined by the Commission.

Finally, the private operator would be given the authority to operate the roadway, collect tolls, and use any revenue net of operational expenses to repay debt obligations incurred during

construction. Financing of the project was to be at the discretion of the operator; repayment would be effected by the collection of tolls, and the state would have no responsibility to assume any financial obligations of the operator. In operating the roadway, the operator may:

- classify traffic according to reasonable categories for the assessment of tolls,
- set and enforce maximum and minimum speed limits, and exclude undesirable vehicles or cargoes from using the roadway, with the consent of the Department, and
- establish commuter lanes for use during the day or any part of the day, with the consent of the Department.

The power of eminent domain was not to be used by a project's proposer for the acquisition of land for the project, although the Virginia legislature allowed local governments to exercise eminent domain on behalf of a private road.

Project Proposal

With the passage of the Highway Corporation Act of 1988, the legal framework for the proposed private toll road, the Dulles Toll Road extension, was established. An application was officially submitted from the proposer. The proposed 14-mile toll road extension, later referred to as the Dulles Greenway, was a 4-lane limited-access highway within a 250-foot (or about 76-meter) right-of-way. An 88-foot (or about 27-meter) median was left open in order to accommodate a future addition of two lanes and even a mass transit development. Along the route, nine interchanges were to be built; seven of them were to be constructed initially and the remaining two would be added when traffic reached a certain level.

Also, it would employ an Automatic Vehicle Identification (AVI) system to collect tolls without making the drivers come to a complete stop and thereby to offer a faster travel along the road. The AVI in the Dulles Greenway has its specific problem. Because the Dulles Greenway would extend the existing Dulles Toll Road, the AVI system should be able to handle the tolls on the existing road as well. For the existing road users, certain lanes would be available to accept cash and coins in the conventional manner. For the Greenway AVI users, both tolls would be debited to their accounts; a portion were to be payable to the Greenway and a portion to VDOT.

Project Development

VDOT began to hold public hearings on the proposed 14-mile toll road in the spring of 1988. In 1989, the state Board of Transportation approved an application for the Dulles Toll

Road extension submitted by the proposer, a purely private undertaking – the first of its kind under the new state law.

The project would be developed by the Toll Road Corporation of Virginia (TRCV), a special purpose company formed for this project. The driving force behind TRCV was Lochnau Limited, a family-owned investment company of the Bryant family. At this time, Keiwit Eastern Company, a division of Peter Kiewit Sons of Omaha, Nebraska, was proposed as the general contractor[19]. Also, Autostrade International S.p.A. (Rome, Italy) became a general partner in the Greenway corporate entity, and would employ an AVI system on the road. The total cost was estimated at $326 million and the state allowed the period of 40 years for the concession, after which the service responsibility would revert to the state.

As mentioned, the tariff proposed by the operator was subject to state regulation. Virginia adopted conventional rate-of-return regulation by the State Corporation Commission that was also regulating electricity, telephone, gas, and other utility rates. State regulators considered a reasonable rate of return for the Dulles Greenway investors as beginning at 30 percent and reduced to between 14 and 15 percent once toll revenues exceeded debt services, which would remain at that level until the end of the contract period.

To ease the financing of the project, TRCV, the entity that had originally obtained a certificate of authority from Virginia, decided to change its legal structure from a corporation to a limited partnership. The new entity, the Toll Road Investors Partnership II (TRIP II), succeeded the certificate from the TRCV upon approval from the state.

Long-term financing in the amount of $202 million was provided by a consortium of 10 leading institutions. Also, many of the owners of property along the right-of-way donated their land to TRIP II with the expectation that value of other portions of their properties would increase substantially. However, the acquisition of right-of-way, closely linked to securing equity and debt financing, was still a difficult and time-consuming process for the Greenway.

Originally, the developer was to have obtained all necessary rights-of-way by January 1993. However, negotiations with some landowners were unsuccessful. In the meanwhile, the original contractor, Keiwit Eastern, had become concerned about the risk of the project, with the schedules being pushed back. Eventually, the concern resulted in their withdrawal from the project and the step-in of Brown and Root Inc., one of the world's top design and construction

[19] Keiwit later withdrew from the project, as mentioned shortly.

firms based in Texas, to the project as an alternative general contractor for a $145 fixed-fee contract and also as an equity investor. Following several times of extension authorized by the state Commission, all the arrangement of necessary right-of-way was settled by late September 1993, after which financing was completed in no time. The construction commenced on September 29, a day early from the state Commission's designated deadline.

Once the construction had started, it was kept at a fast pace. As of September 1994 the project was ahead of schedule; half the work activity had been completed in the first 11 months of the 30-month project schedule. As of April 1995, it was 7 months ahead of schedule. One reason for the fast progress was the lack of bureaucratic procedures that would have been required in a public project, according to Charles Williams, the then CEO of TRIP II (Levy 1996). On September 30, 1995, the Dulles Greenway was opened to traffic. It was 2 years and 1 day after construction commenced, and 6 months ahead of the original schedule but with moderate cost overruns.

Despite the quick start, the project suffered cash flow problems from the beginning of operation. By the end of year one, the traffic level was just over 8,000 vehicles per day with the introductory fare of $1.75, as opposed to the forecast traffic of 35,000 paying $2.00. It turned out that the traffic forecasts did not accurately address the elasticity of traffic demand to toll rates. Apparently, motorists were turned back by the charge that was more than double the rate of the existing Dulles Toll Road. Indeed, when the scheduled toll increase was foregone and an "emergency" toll reduction to $0.90 was introduced in March 1996, the traffic increased to nearly 15,000 vehicles per day (World Bank 1999).

Since then the toll has been raised again to $1.15 and the ridership has grown at a steady rate to about 35,000 trips per day at present. While sufficient to cover operating costs, the current revenues were still only about half of what would be needed to cover debt payments. The project company was in default from July 1996. The TRIP II partnership proposed a comprehensive financial restructuring plan that was reviewed by the Commission. As of April 2000, TRIP II announced that it was successful in refinancing its debt by making the most of financial advantage allowed under the revised public-private partnerships legislation in the state.

4.2.2. California's AB680 Projects

Assembly Bill 680 of 1989

Assembly Bill 680 (1989) authorized the California Department of Transportation (Caltrans) to enter into franchise agreements with private entities for design, construction and operation of up to four demonstration transport projects, at least one of which had to be located in northern California and one in southern California. The eligible projects include toll transport facilities such as highways, bridges, tunnels, monorails, and light rail projects.

Investors would be granted a franchise period for up to 35 years to operate the transport facilities to recoup their investment and earn reasonable profits through toll collection and land development revenue. In addition, the Build, Transfer, Operate (BTO) concept was preferred over a Build, Operate, Transfer (BOT) concept primarily because of the liability issue. The state recognized that it would be prohibitively expensive for a private developer or consortium to carry enough insurance to cover tort liability issues such as highway accidents and related property damage.

Projects and Developers Selection

A two-stage process was employed to select the demonstration projects and private developers. The first phase was to pre-qualify prospective developers, and the second phase was to review and select the projects from the proposals submitted by the pre-qualified proposers.

In November 1989, Caltrans issued the request for qualification (RFQ), to which 13 teams responded. The respondent's qualification would be evaluated according to the weighted criteria shown in Table 4-1 (Levy 1996).

Table 4-1 Pre-qualifying Criteria Used in AB680 Projects

Items	Weight
Experience of the principal organization and consortium members	30 %
Record of financial strength to commit to a major project	30 %
Ability to work cooperatively with a broad range of government agencies	20 %
Individual qualifications of key project team personnel	10 %
Organizational and management approach of the group	5 %
Familiarity and experience with automated traffic operations	5 %

Source: Levy 1996

The selection of pre-qualified groups would be accomplished by February 1990. According to previously established milestones, the submission of the developer's conceptual

proposals was scheduled between July1 and October 1, 1990.

In March 1990, Caltrans issued the brochure, *Guidelines for Conceptual Project Proposal.* The state had not identified any specific projects; however, a proposed project would not be selected unless a free transport facility existed as an option for those who would not choose to use the toll facility. The important components of the conceptual proposal guidelines included:

1. *A Concept Report*, a report describing the proposal in detail and containing at the minimum: (1) the location and limits of the project, (2) a clear statement of the transportation services provided, (3) a discussion of engineering concepts including, the estimated average daily traffic for both the first year of operation and 20 years, the interchange location and type, the toll collection concept and so on, (4) a brief description of the right-of-way requirements, and (5) capital cost estimates.
2. *A Preliminary Environmental Evaluation*, where the proposer describes how the proposal furthers California's environmental policies, and discusses how the proposal treats physical issues such as air, noise, solid waste and so on.
3. *The Financial Plan*, a statement of opinion from the pre-qualified financial consultant along with a financial plan of sufficient detail to demonstrate a reasonable basis for project funding.
4. *A Schedule for Development*, a schedule listing the dates on which some important milestones are to be met. The starting date in the schedule is to be the date when the proposer is notified by Caltrans that the proposal has been selected as one of the initial four.
5. *State Services Required*, any optional, reimbursable services that the state has to provide under separate contract such as highway maintenance and highway patrol services.

Proposals were submitted from 8 pre-qualified developers. Caltrans established an elaborate scheme for judging the proposals to avoid complaints of favoritism or political influence. The weighted criteria, shown in Table 4-2, were used in selecting the four demonstration projects from the proposals submitted (Levy 1996). By September 1990, Caltrans experts had ranked the proposals on those criteria and selected the four demonstration projects, which included three from southern California and one from northern California. Four other

proposals were held in reserve in case any of the four elected projects could not be completed.

Table 4-2 Proposal Evaluation Criteria Used in AB680 Projects

Items	Points
Transportation service provided	20 points
Degree to which proposal encourages economic prosperity	10 points
Degree of local support for the project	15 points
Relative ease of proposal implementation	15 points
Experience/expertise of sponsors and support team	15 points
Degree to which proposal supports state's environmental quality and energy conservation goal	10 points
Degree to which non-toll revenues support proposal costs	5 points
Degree of technical innovation displayed in proposal	10 points
Degree of proposal's support for achieving the civil rights objectives of the state	10 points
Highest achievable score	*110 points*

Source: Levy 1996

Four Projects Selected by Caltrans

Project No.1: State Route 57 (Orange County)

This project would construct an 11.7-mile (or 19-kilometer), 4-lane limited access toll road that would extend Route 57 from its present termination point near the Anaheim Stadium, connecting on to the San Diego Freeway, and then turning slightly eastward to connect to Route 73 near the John Wayne Airport.

To ease the right-of-way acquisition, the road would be constructed over a channel of the Santa Ana River, a partially concrete-lined river that is usually dry and serves primarily for flood control, being programmed by the U.S. Corps of Engineers. The passenger-car-only facility was named the Santa Ana Viaduct Express (or SAVE). Tolls would vary by time of day, an innovative feature Caltrans liked, and would range from $5 for each car in the rush hour to $1 for each car in the late evening. The consortium organized by H. Ross Perot, Jr., the Dallas real estate developer, estimated that it could be built at a cost of $700 million.

Caltrans ranked the proposal highly because it would complete the missing portion of an Orange County north to south highway system and would relieve congestion on parallel freeways and local streets. The project was strongly supported by Orange County officials, who alone among California's counties had actively encouraged local AB680 projects and who regarded SR-57 as one of their top priorities.

Project No.2: State Road 125 (San Diego County)

This project would construct an initial 4-lane, limited-access toll road that would extend SR-125 in eastern San Diego County and run 9.5 miles (or 15 kilometers) from State Route 905 (SR905) near the Mexican border (Otay Mesa) northward to San Miguel Road (near the State Route 54). It would serve growing residential communities in the eastern end of the county as well as the increasing international truck traffic to and from the Mexican plants just the other side of the border. Expansion to 10 lanes would be possible if traffic warrants this. There is also a provision for future high-occupancy-vehicle (HOV) lanes and a fixed-rail system.

The proposal was from a consortium led by Parsons Brinckerhoff, a giant transportation and environmental planning firm. The project would cost $411 million and would be financed by a combination of toll revenues, contributions of land by local real estate developers, and possibly from local communities along the route.

Project No.3: State Road 91 (Orange County)

The project would construct a 10-mile (or 16-kilometer), 4-lane toll road located completely within the median of the existing SR-91 between State Route 55 in Orange County and the Riverside County line. The SR-91 connects rapidly growing residential areas of western Riverside and San Bernardino counties with the major employment centers in Orange and Los Angeles counties. Because there were no convenient alternate routes to serve this commuter traffic, the excising 8-lane freeway was heavily congested. The project would relieve congestion of the existing freeway by converting its open median into two new "express" travel lanes in each direction.

The project was proposed by a group, later organized as the California Private Transportation Company (CPTC). The development costs of $130 million would be privately financed and paid entirely from tolls. Orange County had originally planned to build high-occupancy-vehicle (HOV) lanes in the median, and CPTC proposed that the lanes be privately built instead and financed by opening them to toll-paying single-occupant vehicles (SOVs). HOV would still be allowed to use the lanes, and those with three or more persons would travel free. Tolls would vary by time of day, with an expected rate of 20 cents for each vehicle-mile during rush hours. To facilitate this, the express lanes would be equipped with AVI systems that would require the state to establish a procedure for drivers to obtain the necessary transponders and deposit money on account.

Project No.4: Mid-State Tollway (Alameda and Contra Costa Counties)

The project would construct a new 85-mile (or 137-kilometer), 5-lane toll road from I-680 at Sunol in the South San Francisco Bay area to I-80 near Vacaville. This highway would not only relieve congestion at the I-680 corridor, but also provide an alternate route for commercial traffic around the Bay Area for freight moving to and from Silicon Valley.

This highway would be built in two phases. The first phase, costing around $600 million, would be the 40-mile section from Sunol to SR-4 near Antioch and would provide a high-performance alternative to congested local roads for the developing areas of eastern Contra Costa County and northern Alamada County. The second stage, also costing around $600 million, would be an extension from Antioch to I-80 near Vacaville, including two high-span bridges over the San Joaquin Delta and the Sacramento River. The extension would open up areas of largely agricultural central Solano County and provide an alternative route between the Sacramento area and South San Francisco Bay.

The final project, proposed by a consortium led by the Parsons Corporation (still another large construction and engineering company), was ranked sixth, but was included because it was the highest-ranking project in northern California. Caltrans evaluators were attracted to the Mid-state because it would pass through a poorly served and developing area of the state, but they were concerned about potential environmental problems, about the difficulties of assembling land and securing support from a lot of communities along the right-of-way, and the plans for the second stage were highly speculative.

Caltrans and the four winning consortia negotiated franchise agreements during 1990. By January 1991, all the projects had reached agreements. Specific items in the agreements included the maximum rates of return that the developers could earn and zoning restrictions where Caltrans promised not to build competing transportation facilities around the projects.

Table 4-3 Four Projects Selected by Caltrans

	No.1	No.2	No.3	No.4
Project	State Route 57 (SR57) (Santa Ana Viaduct Express)	State Road 125 (SR125) (San Miguel Mountain Parkway)	State Road 91 (SR91) (SR91 Median Improvement)	Interstate 80 Route (I-80) (Mid-State Tollway)
Consortium	The National Toll Road Authority Corporation (the Perot Group)	California Transportation Ventures Inc. (CTV)	California Private Transportation Corporation (CPTC)	California Toll Road Company L.P. (CTRC)
Cost	$700 million	$400 million	$125 million	$1.2 billion (all phases)
Completion Date	Mid-1997	December 1995	Late 1994	January 1997

Source: Levy 1996

In regulating the rate-of-return on investment, Caltrans selected an innovative one-time contractual approach, setting the maximum allowable rate-of-return in each project. The private operators are free to set their own toll rates so long as they stay within the ceiling returns set out in their franchise agreement. Caltrans conducted a study to determine what might be a reasonable rate of return based on the investment required and the risk associated with that investment. Such factors as right-of-way, local policy uncertainty, environmental mitigation risk, predictability of traffic counts and design/construction risks were taken into consideration. Based on the study, they arrived at the rate-of-return ceilings for each project as tabulated in Table 4-4.

Table 4-4 Maximum Allowed Rates-of-return on Investment

Project	SR57	SR125	SR91	Mid-State
Rate of return (%)	20.25	18.5	17	21.25

Source: Levy 1996

Project Development

While the developers targeted one project completion in 1994, another in 1995, and two in 1997, many suffered from obstacles that had been unanticipated or severer than anticipated. Currently, only SR-91 project has been completed and opened to traffic, while other three projects are either moving forward with a significant delay (SR-125), temporarily suspended (SR-57), or terminated (Mid-state).

State Route 57

The project was halted partly due to the Orange County bankruptcy. The granting of a right-of-way agreement over a flood control channel, encompassing about 75 percent of the entire project's alignment, required a $24 million preliminary environmental study. The cost of this study was to have been split between the private developer and the County. When the financial crisis arose in the County, their $12 million dollar payment was put on hold. Caltrans has received a request that the required date for commencement of construction be extended to January 11, 2007. This request is currently under review. (Caltrans)

State Road 125

The project is now developed by California Transportation Ventures, Inc. (CTV). The principal companies involved in CTV are Parsons Brinckerhoff Infrastructure Development Company, Inc., and Egis Projects, a French toll road development company. While CTV's initial proposal indicated that, based on their preliminary study, they had optimistic prospects in respect to environmental protection issues, the project, in reality, was subject to a great degree of controversy from the beginning. Citizen reaction against the program was intense, and many residents and neighborhood organizations opposed to the various routings proposed by CTV.

In order to find the most environmentally desirable approach, CTV had to engage in detailed environmental studies. Given the strong public oppositions, the alignment had to obtain consents from local citizen activity groups. CTV presented a number of alternative routings on a meeting, attracted many opinions, and rearranged the routings for a next meeting. After several iterations of this process, final environmental approval for the project was finally received in June 2000. Construction was expected to commence in late 2001. The project is now moving forward using a design-build approach. Once a contractor is selected, the design-build contract signed, and the project financial plan finalized, work will begin on the 34-month design, right-of-way and construction phase. (Caltrans)

State Road 91

The SR-91 project, initially scheduled for a late-1993/early-1994 completion, actually entered construction phase in July 1993 and opened to the public use in December 1995. This project was developed by California Private Transportation Company (CPTC), a limited partnership formed by: (1) subsidiaries of Peter Kiewit Sons', Inc., (2) Compagnie Financiere et

Industrielle des Autoroutes (Cofiroute), a French toll road company, and (3) Granite Construction Inc. Prior to opening to traffic, CPTC formally transferred ownership of the facility to the State, after which Caltrans leased back the facility to CPTC for a 35-year operating period (i.e., BTO approach).

The CTPC partners put up $19 million of sponsor equity. The Orange County contributed $7 million in a form of subordinated debt. Kiewit Diversified Group, in addition, underwrote a $35 million institutional debt, which they would sell as market conditions allowed. Three banks, Citicorp USA, Banque National de Paris, and Societe Generale, loaned the group $65 million on a 14-year variable rate basis to round out the financial arrangements.

The California Highway Patrol (CHP) is responsible for providing police services at CPTC's expense. Maintenance and operational costs for the facility are also the responsibility of CPTC. The private development of SR-91 not only have brought cost savings to the state by providing $130 million value of capital asset, but also will save another $120 million in CHP, operations and maintenance expenses over the 35-year franchise period (Caltrans).

In addition to the cost saving benefits, the project has realized significant innovation in toll collection concepts. First, the facility is the world's first fully automated toll road utilizing electronic transponders to collect tolls. With the AVI system consisting of a windshield-mounted transponder and roadside antennas, there will be no need to stop at entrance and exit booths.

Second, more significantly, it is also the nation's first toll road to employ variable congestion pricing, which is an innovative idea by itself and also demonstrates an effective use of AVI electric toll collection systems. Toll rates for the express lanes average $1.75; they rise during peak hours ($3.20) and lower during off-peak hours ($0.60). The variable congestion pricing helps travel speeds remain stable at all times, with higher tolls limiting the in-flow of motorists during peak period, but with lower tolls encouraging motorists to enter the Express Lanes during off-peak period. Their easy-to-read overhead signs to display the toll charges assist motorists in making their decision as to which roadway to use. Thus, the SR91 Express Lane has given drivers a choice: Drive on the freeway portion of the highway and be subjected to the potential delays, or drive on the express lanes paying a demand-sensitive toll.

Unlike traffic on the Dulles Greenway, a development road project, the SR-91 Express Lanes could rely on the established traffic records on existing SR 91. Indeed, the highway has attracted substantial use from the outset. Daily usage varies depending on congestion in the

adjacent free lanes, but averaged just over 20,000 vehicles per day upon startup, increasing to about 35,000 vehicles per day at present (World Bank 1999).

By March 1996, toll revenues for the facility had reached a level sufficient to cover operating expenses, and by June 1998 it was taking in enough revenues to meet debt payments as well. However, in order to achieve a cash-positive position, CPTC had to raise tolls beyond what was initially anticipated, and also exercise a contract clause that allows them to charge half-price fares for high occupancy vehicles (HOVs) that had formerly been able to travel for free.

Mid-State Tollway

While the Mid-state Tollway was initially planed to be an 85-mile, $1.2 billion program, the scope was substantially reduced to about 40-mile, $600 million, initial 4-lane (ultimate 6-lane) toll road. The Solano County portion was deleted from the project, leaving the section from Route 680 near Sunol to Route 4 near Antioch. Despite the scale-down, the work in the project was further suspended due to serious political opposition, and the franchise terminated on January 1, 2001 (Caltrans).

4.2.3. Other Proposals

Other toll road initiatives currently being implemented throughout the U.S. are briefly summarized in Table 4-5. States passing public-private partnership legislation since 1991 have had the advantage of being able to incorporate the Federal ISTEA provisions into their regulations. Washington (1993), Minnesota (1993), Delaware (1995), South Carolina (1995), and Oregon (1995) may be included in this "second generation" of state-level public-private highway legislation. Virginia (1995), Washington (1995), and Arizona (1996) have also revised their earlier legislation.

Table 4-5 Ongoing Toll Facility (Road, Bridge and Tunnel) Developments in the U.S.

State	Toll Facility Name	Estimated Cost (US$)	Contract Type*	Lead Public Agency
California	Foothill/Eastern	1,500	Turnkey	TCA
California	San Joaquin Hills	1,400	Turnkey	TCA
Colorado	E-470 Beltway	380	Turnkey	E-470 Hwy Auth.
Florida	Osceola Parkway	150	Turnkey	Osceola County
Florida	Orlando Southern Connector	153	Joint Devl Agr.	FDOT
Massachusetts	Route 3 Upgrade	200	DBOM	Mass. Hwy Dept
New Jersey	Atlantic City - Brigantine	405	Turnkey	NJDOT
Ohio	Regional Expressway	100	Mgmt Contract	Butler County
Oregon	Newberg - Dundee Bypass	n/a	BOT/BTO	ODOT
Rhode Island	I-195 Rebuild	225	Concession	RIDOT
South Carolina	Greenville Southern Connector	191	3 Joint Devl Agr.	special agency
Texas	Camino Expressway	80	BOT/BTO	TXDOT
Virginia	Rt. 168 Chesapeake Expressway	110	DBOM	VDOT
Virginia	I-185 Connector	302	Concession	CTB
Virginia	Route 28 Upgrade	138	Turnkey	VDOT
Florida	Midpoint Bridge	195.2	Turnkey	Lee County
Missouri	Lake of the Ozarks Bridge	40	BOT/BTO	MO Hwy Comm.
North Dakota	Fargo-Moorhead Bridge	1.6	Concession	City of Fargo
South Carolina	Charleston Toll Bridge	90	Concession	SCDOT
Washington	Tacoma Narrows Bridge	800	BOT/BTO	WSDOT
Virginia	Hampton Roads Tunnel upgrade	600	Concession	CTB

* The "contract types" represent how each of the public sector project sponsors have characterized the intended nature of private sector involvement. The terms are intended to be indicative, not definitive.

Source: Public Works Financing, "1998 International Major Projects Survey," October 1998, as cited in World Bank (1999)

4.3. Key Findings in the U.S. Experience [20]

4.3.1. Driving Force Behind the Implementation of Public-Private Partnerships

In the U.S., private participation in highway development has been mainly driven by the financial problem faced by the governments. Since early 1900s, most length of the highways had been developed by state governments using the federal aid. As much as 90 percent of initial investment costs were provided from the aid, which relied primarily on taxes imposed on gasoline and other items related to the automobiles. Tolls were prohibited for federally aided highways. When it was realized that the taxes were not sufficient to cover the new construction costs and the maintenance costs of aging highways, tolls were brought back to the attentions of the government officials.

Along with the revival of the toll concept, the monetary resources of the private sector attracted their attentions, too. Indeed, the U.S. has the history of toll roads developed by the private sector before the federal highway era. The federal government, moved by state pressures, resumed the development of private toll roads by extending project eligibility for the federal aid program. Following a pilot program, ISTEA has opened the road sector, which was funded and managed by the public for a long period, to the private sector. State governments have followed the federal lead and passed legislation to allow the private participation in their road development.

4.3.2. Project and Operator Selection

In the U.S., the private sector has taken initiatives in implementing the private toll road development. The Dulles Greenway was initially conceived by the private entrepreneurs. They suggested the idea to the state government and the government, in turn, responded by passing the legislation necessary for such a deal. Under the newly created law, the private proposer formally filed an application for the project, which was then approved by the government. Instead of an open bidding, the project was authorized by the state utility commission after a review. In this regard, the Dulles Greenway is more like a private venture regulated by the government, such as

[20] It is intended that this section be contrasted with the key findings in the U.K. experience. (See section 5.5)

electricity and telecommunications in the U.S.

In California's approach, which has now become a model of innovative highway procurements throughout the country, the private sector's initiative in project selection was almost similarly large as in Virginia's case. In the AB680 projects, the private sector identified highway projects from a commercial point of view. The state then selected four projects that would meet its objective in the road program and offer large benefit of private participation. Specifically, in the second phase of the two-stage bidding, the proposals were evaluated by a kind of scoring system provided by the government. However, California's approach is different from that of Virginia in that the state organized a formal competition. The pre-qualification process reduced the number of bidders in the proposal phase to eight, minimizing the costs for the private companies to prepare the proposal while keeping competitive pressures on the bidders.

4.3.3. Government Controls Over Project Execution

The U.S. governments have taken positions to create an environment where profit-seeking private companies can engage in road operation business under the government regulation. Indeed, the governments' political and legal support in the passage of necessary legislations would be the most significant in what they have done for the public-private partnerships in the U.S. highways. Presumably, the governments' belief in market economy and the outstanding private interests in such deals have made this approach preferred.

The governments regulate the profits and performance of the company, as they do for the public utility companies. Both Virginia and California have employed rate-of-return regulations, which are conventional form of price regulation for utility companies in the U.S. Compared to toll rate regulation (i.e., price-cap regulation), rate-of-return regulation gives less incentive for the operator to reduce costs, although it would attract more interests from the private sector because profitability is their primary concern.[21]

There is a difference in the way the regulation affects the toll settings in two states. In Virginia, the state's public utility commission reviews the rate-of-return every time a toll increase is requested, so that the increased toll will not make an extra profit for the operator; in California, the private operator is free to set their own tolls as long as their earned rate-of-return is within the ceiling specified in the contract. The California's one-time contractual approach seems to be a

[21] The advantages and disadvantages in the price regulation methods are discussed in Section 3.2.3.

simpler and superior system that can avoid time-consuming and potentially controversial review processes.

The other roles for the governments would include the supports for the private operator in such issues as tort liability and right-of-way acquisition. In a litigious country like the U.S., tort liability is particularly an important issue. In California's SR91, a Build-Transfer-Operate (or BTO) arrangement was chosen so that the state could own the facility and assume the tort liability. If the operator had been asked to assume the risk, it would have raised the operator's cost of capital and, at the same time, the toll rates.

As for the government support in land acquisition, the Virginia legislature allowed local governments to exercise the power of eminent domain on behalf of a private road operator and the California legislature allowed Caltrans to do so, although neither Virginia nor California gave the operator the power to acquire right-of-way with eminent domain. However, in practice, it would not be so easy even for the government to actually exercise eminent domain. Further, right-of-way acquisition is a more complicated issue involving environmental scrutiny, especially for a development road. The governments assigned the work of environmental clearance to the operator and SR-125 in California suffered substantial delay because of the environmental actions.

4.3.4. Private Contributions

From the U.S. experience, it is learned that there have been substantial contributions brought by the private sector involvement in highway development programs. Also, it is found that these contributions are largely dependent on the design of public-private partnerships furnished by the governments. The private sector's contributions and its limitations in three areas of technical innovation, risk sharing, and financial contribution, are discussed.

Technical Innovation

The governments of both Virginia and California did not identify the project by themselves. Instead, the project identifications were assigned to the private sector. The private sector was to obtain right-of-way (without the authority of eminent domain) and environmental permit as well. However, it has turned out that this approach placed significant level of planning risk on the private sector. The environmental issue has become a cause of delay in SR125 project; SR57 is now suspended partly because of the right-of-way issue; and the franchise for

the Mid-state Tollway is terminated due to serious political oppositions. One could argue that the state governments should have assumed the responsibility for conducting environmental studies and winning local permissions, since raising the capital needed for a project with largely uncertain outcomes is quite costly for the private operator.

Nevertheless, Virginia and California's strategies have given the private sector the flexibility and incentive to develop new ideas. By allowing the private sector to identify the project, these states unlocked the full potential for innovative project ideas. For example, three of the four proposals in California's AB680 had been rejected, neglected, or overlooked by public highway authorities. The extension of SR-57 had been abandoned by Caltrans as too expensive in the 1970s, the southern segment of SR-125 was on state and county plan but was not to have been built for at least 10 or 20 years, while the Mid-state alignment had not even occurred to public officials. (Gómez-Ibáñez 1993)

The design and operating plans have brought innovative ideas as well. In SR-91, the idea is employed for the first time in the U.S. that toll-paying SOVs use special HOV lanes. This concept not only provides a means of financing HOV lanes but also exploits the often under-used capacity of these facilities. Varying toll rates with time-of-day or congestion, a key element in the plans for the two congestion-relieving roads (SR-57 and SR-91), is another idea being pioneered by these private projects.

In the projects that have been opened to traffic (i.e., the Dulles Greenway and SR91), electric toll collection systems were introduced. While intelligent transportation systems (or ITS) are becoming more and more common in highways worldwide, the profit-sensitive private projects would accelerate the use of ITS. Because electric toll collection systems can reduce the number of employees and costs of operating tollbooths, lifecycle cost approach adopted by private operators will favor these systems.

Risk Sharing

The risks inherent in the projects are mostly assumed by the private sector, with an exception of tort liability assumed by the government. As mentioned, planning risk is assumed by the private sector. Design and construction risks are also assumed by the private sector, as usual in this kind of arrangements. This would be potentially a significant time and cost saving especially in the U.S. construction industry, where the claims about changes and differing site

conditions are frequently filed from the contractors, which may result in costly and time-consuming litigations.

Since it is the private sector to identify the opportunity for road projects, traffic risk is naturally born by the private sector alone. While consistent with the basic concept of private toll roads in the U.S., it has proven to be the kind of risk that cannot be well controlled by the private. Dulles Greenway has faced significant traffic shortfall and the financial viability of the project has seriously been damaged. Caltrans was aware of the traffic risk on the private operators and promised that no competing road would be built within a zone specified in the contract.

The five cases studied here rely primarily on toll revenues to cover costs. They vary, though, in their dependence. The difference is closely related to the types of the projects. The two California roads (SR-57 and SR-91) are congestion relievers that would serve already built-up and congested areas. The remaining three projects (Dulles Greenway in Virginia, and Mid-state and SR-125 in California) are development roads, which serve areas that are not yet fully developed but are expected to grow rapidly in the next few decades.[22]

The congestion relievers by definition serve already congested corridors, which makes sufficient traffic revenue reasonably predictable. Accordingly, developers of the two congestion relievers claim that tolls will cover all construction and operating costs. However, in actuality, both SR-57 and SR-91 are gifted rather unusual situations, where much of their right-of-way is provided without charge by state authorities (air right over the Santa Ana flood channel for SR-57 and land in the median of the existing expressway for SR-91). For a more general case, the least-cost alignments usually will have already been exploited by public authorities, leaving private developers only the most difficult and costly alternatives (for example, tunnels, cut-and-cover, or viaducts).

By contrast, developers of the three development roads argue that tolls alone are insufficient and that local government and landowner contributions will be necessary to cover 20 to 30 percent of costs (Gómez-Ibáñez 1993). While development roads, in general, cost less than congestion relievers, the three development roads still are dependent on these contributions from outside. However, given the uniqueness of the two congestion relievers that are free from the general difficulties in the same kind of road projects, development roads may have a slightly

[22] The basic categories of highway projects based on their purposes, and the advantages and disadvantages of each category from economic viability point of view are summarized in Section 3.1.1.

better chance of being privately developed than congestion relievers.

In order for congestion relievers and, to somewhat lesser extent, development roads to be successfully developed as private projects in a larger number of occasions, the purchase of rights of way and other supports by the government may be necessary, in general. In particular, in a highly developed country like the U.S., finding a project where toll revenues will cover most, if not all, construction and operating costs is a serious problem, given the extensive lengths of high-performance expressways already built in the country.

Financial Contribution

Financial contributions of the private sector are significant as well. The developers provide the total costs for developments of all the five projects through their own equity contribution and the debt raised from the capital market. Indeed, the state legislations expressly stated that no financial contribution is to be made by the state government. The governments have obtained at least the physical asset and also the associated services (as long as they are not to be disrupted for some reasons) for practically free, in exchange for the franchises to collect tolls directly from users. Given the economic benefits for the local communities confirmed by the state governments, the projects significantly reduced the financial burden for the states to provide their necessary infrastructure services.

Important financial issues include tax code's treatment of public borrowing versus private borrowing. In short, bonds for municipal (public) purposes are tax exempt at the federal level. In addition, municipal bonds may have credit backing or enhancement through a tax-supported public entity, providing up to a 2-3 percent advantage by financing via tax-exempt means. By contrast, current regulations treat private toll roads as taxable corporations. (World Bank 1999)

Leaving it aside whether this differentiating treatment is reasonable, the differences in accounting practices between the public and the private are one of the important issues in comparing the privately financed projects with those funded publicly. Fundamental cost savings to society rather than transferred from one part of society to another should be sought. A private road would be less costly to society as a whole only if it requires fewer physical resources, services, or amenities to build or operate than a comparable public road. For example, it represents real cost saving if the project requires less right-of-way, concrete, or labor to build

because of more efficient design. Also, if the private project can open the road sooner by starting construction earlier and building it faster, this advantage would represent a real saving to society, because it would reduce the construction finance costs while offering the society earlier realization of the benefits from the road.

The public's tax-exempt status is not the fundamental cost savings of this kind. Depreciation tax-shield, while important, is not of this kind, either. Moreover, the often-claimed governments' advantage of lower financing cost is also misleading. It would be true that the government as an owner of large number of road projects can diversify the risks in each project and minimize the total risk with a portfolio effect. However, in comparison of a specific project, the same risk is to be assumed by the public and the private sector alike. Then, if the government raises financing at a lower cost for the same project, relying on the sovereign authority backed by the taxes, the government just shifts part of the risks from investors and motorists to federal and state taxpayers. In other words, the government in effect would be asking taxpayers to make a risky equity investment in the project but not compensating them for the risks they were assuming.[23]

[23] The example of cost comparison between the public and private financing options, conducted in the Dulles Greenway project by the state commission, is presented in Gómez-Ibáñez (1993).

Chapter 5. The U.K. Experience

In this and the previous chapters, insightful examples of public-private partnerships applied to highway development in two countries are introduced. The countries are the United States and the United Kingdom. This chapter discusses the U.K. experience, following the last chapter discussing the U.S. experience. The chapters review their historical backgrounds in highway development, the overall policy changes regarding the implementation of public-private partnerships, and the milestone projects under the partnerships. Through these overviews and some comparisons of the two experiences, important lessons are drawn.

Firstly, the experiences presented in these two chapters are generally informative for the countries that are faced with the needs of reforming their infrastructure provisions and conceiving public-private partnerships in the range of possible solutions. Also, the U.K. experience presented in this chapter provides important background information regarding Japanese government's attempt at introducing Private Finance Initiative in their infrastructure development. Because the government has adopted the concept from the U.K., the understanding of the original is quite important to discuss the current efforts of Japanese government.

5.1. Private Finance Initiative

In the late 1970s, the then Thatchar government initiated the series of administrative reform with the aim of achieving "a small government." First, the U.K. government divested many of its nation-owned companies, primarily forced by its fiscal concern[24]. Divested companies included the British Telecom, the British Gas and so on. Second, the government decided to isolate its operating activities from its central role of policy-making. The agencies were created as independent, financially freestanding entities, which have become responsible for the separated operating activities. Among them is Highways Agency, which was established in 1994 as an executive agency of the Department of Transport, and has become responsible for maintenance, operation and improvement of the highway network in England.

Another important restructuring was sought in the public infrastructure provision, where interests were increasing in the private financing of infrastructure investment. In the U.K., as with many other countries around the world, infrastructure had mostly been provided under the responsibility of the public sector since the Second World War. In 1981, the so-called "Ryrie Rules" was published and set forth the basic legal and regulatory framework for private participation in infrastructure in this country. Its principal conclusions were that the use of private funding should be governed by two basic principles (HM Treasury 1995):

- in order for privately funded solutions to be implemented, it must be tested against publicly funded alternatives and shown to be more cost-effective; and
- public expenditure would be reduced by the amount of private funding obtained.

The rules (in particular, the second bullet above) were criticized for being too restrictive and giving pubic bodies no strong incentive to seek private funded solutions. Consequently, it was announced in 1989 that the Treasury would no longer require full reductions in public expenditure to offset privately funded projects, mitigating bureaucratic oppositions against the original rules. Despite the reluctant attitudes in the government officials, the rules boosted some projects developed with private funding, paving the road toward future implementation of PFI. The examples are the early BOT-type road projects, which are discussed later.

Finally, in 1992, the Private Finance Initiative (PFI)[25] was launched under the next

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[24] About the primary reasons underlying various forms of privatization, see Chapter 2.

[25] While PFI, when introduced in Japan, was often confused with privately financed delivery methods such as BOT (Build-Operate-Transfer) and its variants, it is a more broad term representing one of

Major government, solidifying the administrative reform in public infrastructure provision. PFI is an overall government policy aiming at promoting the private sector's involvement and thereby improving the taxpayers' "value for money" in the U.K.'s infrastructure and public services. It was intended to foster higher quality and more cost-effective public services through the use of managerial skills and technical expertise in the private sector. Also, the financial resources of the government were to be leveraged by those of the private sector, assisting the government efforts of fiscal restructuring.

So far PFI has proven to be successful and grown to have a share of roughly 15 percent of the total pubic infrastructure investments in the U.K. (Nishino 2001). Within the Central Government, PFI has been used in areas as varied as bridges and highways, prisons, health facilities, railways and public transport, information technology services, water supply and wastewater treatment, power generation and distribution, equipment, and accommodation. There is also considered to be significant scope for application of PFI in local governments (World Bank 1999).

The UK's road sector also has carefully applied PFI to their highway investments. As described shortly, their first experience was the introduction of BOT-type toll road concepts in three bridges and one road in 1980s. After that, when the PFI was formalized at the national policy level, the road sector responded by embarking on their experimental efforts in the first eight DBFO trunk road projects. So far, 20 road projects, in relation to PFI, have been put forward in one form or another. The projects are shown in Table 5-1.

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government policy options for privatization. Among the three forms of generic privatization policy discussed in section 2.2, PFI can be thought equivalent to the public-private partnerships, which include various contract arrangements (e.g., BOT, DBFO).

Table 5-1 Status of the First PFI Road Projects in the U.K. (as of 1998)

No.	Project Name	Length (km/mile)	Value (£ million)	Status
BOT-type				
1	Dartford River Crossing	2.8/1.8	180	In operation (1991)
2	Skye Bridge in Scotland	2.5/1.6	23.6	In operation (1995)
3	Second Severn River Crossing	5.0/3.1	331	In operation (1996)
4	Birmingham Northern Relief Road	48/30	450	Under construction [a]
Tranche 1				
5	A69 Newcastle to Carlisle	84/52	9.4	Under construction
6	M1-A1 Motorway Link, Leeds	29/18	214	Under construction
7	A1(M) Alcombury to Peterborough	21/13	128	Under construction
8	A417/A419 Swindon to Glousester	51/32	49	Under construction
Tranche 1A				
9	A50/A564 Stoke to Derby link	56/35	20.6	Under construction
10	A30/A35 Exeter to Bere Regis	101/63	75.7	Under construction
11	M40 junctions 1-15	122/76	37.1	Under construction
12	A168/A19 Dishforth to Tyme Tunnel	117/73	29.4	Under construction
Projects announced				
13	A6/A43 South Midlands Network	249/155	116	Pending
14	A65(M6) Cumbria to Bradford	105/65	104	Pending
15	A21/A27 Weald and Downland	116/72	142	Pending
16	A36/A303 Wessex Link	200/124	105	Pending (partly cancelled)
17	A13 Thames Gateway	37/23	146	Call for proposals
18	A40 West London Approach	24/15	75	Cancelled
19	M6 junction44 to Guardshill [b]	10/6	42.3	Under construction
20	M6 DBFO in Scotland	92/57	214	Under construction

a) The status is updated as of March 2002.

b) This project is being procured by the Scottish Office. on behalf of the Highways Agency, as part of the M6 DBFO project (No.20).

Source: World Bank 1999; NAO 1999; Highways Agency 1997;Infrastructure Journal 2000

5.2. Four BOT Toll Road Projects: Precursors to PFI

The UK's transportation infrastructure is extensive and highly developed, although increasingly aging and in need of rehabilitation. The country's highway network totals nearly 400,000 kilometers, of which more than 3,200 kilometers are motorways (express highways, nearly all of which are toll-free). The country is also served by 17,500 kilometers of railways, providing extensive urban and intercity passenger transport, as well as a growing share of freight traffic. (World Bank 1999)

Virtually all the British motorways currently in operation have been funded from Central Government sources. Due to legal restrictions and strong public resistance, direct tolls have so far been charged only in a few occasions. The exceptions are the four BOT-type toll road projects detailed in this section.

The four projects preceded the full-dress implementation of PFI. The projects are: (1) the Dartford River Crossing, (2) the Skye Bridge, (3) the Second Severn River Crossing, and (4) the Birmingham Northern Relief Road. The first three are directly tolled bridges and now open to the public use; the last one is the country's first tolled overland road and planned to be opened by 2004. They were unique and innovative in the U.K. highway development history. Firstly, they were arranged as BOT-type projects, where the private consortiums raised the financing of the projects through the capital market. Secondly, the raised funds were to be repaid thorough the toll revenues, although tolled highways had not been common in the U.K. highways, as explained. The following introduces the four projects.[26]

Dartford River Crossing (Queen Elizabeth II Bridge)

The Dartford River Crossing (or, the Queen Elizabeth II Bridge) is located about 26 kilometers east of London and serves as the third crossing over the Dartford River, carrying M25 motorway traffic between Dartford in Kent and Thurrock in Essex. The first Dartford River crossing is a 2-lane tunnel that opened in 1963; the second is also a tunnel completed in 1980. While these two tunnels initially had sufficient capacities, a significant traffic growth was anticipated because of the completion of the M-25 London Orbital Motorway planned in 1986. The need for a third Dartford River crossing became apparent.

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[26] Most information about the four BOT-type road projects is adopted from World Bank (1999) and Levy (1996).

It was about this time that the government began to consider private-sector involvement in its highway construction. The construction division of Trafalgar House (now Kværner PLC), an international diversified business group based in London, saw an opportunity to create a project. It was envisioned that this project could be financed from toll income derived from its operation over 20-year period. Impressed by the scheme proposed by Trafalgar House, the Department of Transport proceeded to a bidding process. Out of eight consortiums that submitted proposals (five bridge schemes and three tunnels), Trafalgar House, the original proposer, was awarded the contract in September 1986.

The concession agreement provided for the operator the right to purchase the lease of the two existing tunnels for a sum approximating £43 million, build a new cable-stayed bridge, and operate all three crossings for a maximum period of 20 years. All land and property for the project were to be acquired by the Secretary of State (using eminent domain if it became necessary), and then leased to the concessionaire.

The 2,872-meter bridge is composed of three components: (1) an 812-meter cable-stayed bridge with a 450-meter main span, (2) a 1,052-meter approach road on the Essex side, and (3) a 1,008-meter approach road on the Kent side. Trafalgar House Construction (Europe) Ltd. was responsible for the design and construction of the foundations and substructure of the Third Dartford Crossing. Construction works on the bridge began in August 1988 and the bridge opened in October 1991, on time and on budget.

The debt of £166.5 million borrowed for the development of this bridge is repaid through toll revenues. In toll collection, the project utilizes an electronic toll collection system to speed the flow of cars and trucks. The bridge has 8 lanes, 4 northbound and 4 southbound. There are 14 tollbooths at the northern approach to the bridge and 13 booths at the southern approach. 9 booths in each direction are manned and all lanes are equipped with an automatic vehicle identification (AVI) system known as DART-Tag, which has proven to be very effective to date.

As of mid 1995, there were 146,000 vehicles using the crossing in both directions, increasing about 7 percent annually. The operator projected that revenue in the year 2000 would be £75 million, and with operation and maintenance of £15 million, profits should be in the £60 million range. Based on this projection, it was expected that the bridge would be paid for in 12 years – 8 years less than the maximum period of 20 years. At that time, operation and toll collection activities will revert to the government, although the operator is allowed to continue

with the concession for an additional 12 months to build up a fund for maintenance purposes. (Levy 1996)

Skye Bridge

The Skye Bridge links the Isle of Skye, 2.5 kilometers off the northwest coast of Scotland, to the mainland, taking the route on two small islands off the mainland. The completed bridge comprises (1) the main bridge of 570 meters, which crosses a 400-meter wide navigation channel between Skye and the larger of two small islands, (2) a viaduct between the smaller of these islands and the mainland, and (3) approach roads on both sides.

The island had long been served by ferries, but increasing traffic volumes led to considerable delays at peak times, especially during the summers, due to capacity constraints on the ferries. Two British construction companies, Trafalgar House and Morrison Construction, suggested to the government that construction of a privately funded bridge was feasible. Convinced by the suggestion, in 1989 the Scottish Office announced a competition for the concession of construction and operation of the Skye Bridge as a toll facility, for a period not to exceed 27 years[27]. The tolls for each category of vehicle were not to exceed the current charge for the ferry, and were to be pegged to the Retail Price Index (RPI) over the life of the concession. Ten pre-qualification submissions were received from six groups.

In February 1990, three of the pre-qualifiers were selected to submit detailed proposals for the design, financing, construction, and operation of the bridge. Finally, in December 1991, contract was awarded for the Sky Bridge Tolls Ltd. (now, Skye Bridge Ltd.), the special purpose company owned by the Miller-Dywidag consortium[28].

Financial closure was achieved in January 1992. The funding package was made up of £15 million of senior debt to be paid back over a 14-year term and £10 million of index-linked subordinated debt over a 20-year term. There was nominal equity of only £1,000. Underpinning the cash flows was a traffic forecast prepared by the consortium's consultants, which demonstrated that future toll revenue should be sufficient to repay the debt within the life of the concession. Construction commenced in June 1992 and was completed in the summer of 1995,

[27] The concession will ends, if the net present value of accumulated revenues collected total £23.64 million before maximum concession period of 27 years is reached. (NAO 1997)

[28] The members of the consortium are (a) a joint venture between Miller Civil Engineering Ltd and Dyckerhoff & Widmann AG (known as Miller-Dywidag) and (b) Bank of America International Financial Corp. (NAO 1997)

followed by the bridge officially opened to traffic in October 1995 (World Bank 1999; Levy 1996).

Second Severn Crossing

The Second Severn Crossing is the 5-kilometer bridge newly built over the Severn River between England and Wales. It is located around 5 kilometers downstream of the original 30-year-old suspension bridge. The new crossing comprises two 2-kilometer long approach bridges and a 900-meter cable-stayed bridge with a 456-meter main span.

Having studied the problems of serious congestion plaguing the existing bridge since 1984, the Department of Transport announced in 1986 its intention to build a second bridge. In 1989, the department announced to seek DBFO schemes applied to the second bridge that it had been planning, and subsequently invited four groups to present bids. The Severn River Crossing PLC (public limited company) was selected as the successful bidder and signed the agreement with the government in 1990. After eight years of design, planning, and official reviews, the Severn Bridges Act was enacted in February 1992, establishing the legal framework for the development of a second toll bridge crossing over the Severn River. Thus, the 30-year concession period began.

This project, as with the two bridges already described, is to be paid for through the tolls collected from the users. It uses an electronic toll collection system. As with the Dartford Crossing project, revenue collection rights to the existing bridge crossing were granted to the bridge developer to cover losses during the construction period and any revenue gap after opening, and to mitigate risks associated with future traffic revenues. As an incentive for investors to participate in the project, toll rates on the existing bridge were allowed to increase as high as 6 percent above the inflation rate during construction of the new bridge. Upon completion, toll increases were limited to the rate of inflation (RPI). The new bridge was completed on time and within budget, and was opened to traffic on June 5, 1996. (World Bank 1999; Levy 1996)

Birmingham Northern Relief Road

The Birmingham Northern Relief Road (BNRR) is a 43-kilometer dual 3-lane tolled motorway, running parallel to congested section of M6. Because the existing M6, the free motorway through Birmingham, England, had been experiencing serious congestion problem,

the idea was conceived to build a bypass route to avoid the congestion and to give easy access from West Midland industrial and residential areas to local trunk roads. It represents the first *overland* toll road in the U.K., and is the largest new road proposed in the current roads program.

The consultation process for BNRR began in 1984. In 1986, the Department of Transport announced a preferred routing from M56 at Featherstone to M6 near Coleshill. While the new bypass road was originally conceived as a publicly funded highway, it was later identified as a potential PFI project. In 1989, the Secretary of State of Transport announced a private-sector competition to design, build, finance, and operate BNRR. In the same year, pre-qualifying bids were invited and subsequently submitted, from which a short list of three was prepared in 1990. In 1991, the government announced that Midland Expressway Ltd. (MEL) had won the final competition. MEL is a joint venture company formed by Trafalgar House (now Kværner PLC) and Autostrada, an Italian road operator. Both sponsors owned an equal share (50 percent each) of the joint venture. The DBFO contract signed in 1992 granted MEL the right to design, build, finance, and operate BNRR for a period of 53 years, commencing at the start of construction. The concession agreement allows for a 3-year construction and a 50-year operating period.

Initially the timetable for a construction start was set for 1995, including approximately one-year allowance for MEL to finish the environmental studies and obtain the necessary permits. However, the commencement of construction was advanced to 1997 primarily because of strong environmental movements. The project was consistently and vocally opposed by environmental groups, who had accused it of: (1) cutting a huge swathe through the green belt, (2) encouraging extra car traffic on the existing local road network, (3) potentially acting as a catalyst for further, unwanted development, and (4) lacking overall social-economic justification that should have normally been examined thorough a cost-benefit analysis.

The controversy continued and the project could not make it for the once extended construction commencement in 1997. In 1999, Kvaerner sold their stake to Macquarie Infrastructure, an investment fund managed by Macquarie Bank. Although they tried to retain the construction contract, it was unsuccessful and MEL opted for re-tendering.

In September 2000, more than 10 years after it was initially proposed, the deal has finally reached financial close. Financial close also marked a further change in ownership of MEL, with Macquarie Infrastructure Group purchasing a further 25 percent from Autostrada and

securing an option to acquire the remaining 25 percent in 5 years. CAMBBA Construction Group, a joint venture comprised of Carillion, Alfred McAlpine, Balfour Beatty and AMEC, was awarded the design and construction contract. Preliminary work has started and the consortium is on target to deliver the project within the projected time frame of 3 years and 4 months.

Being the UK's first ever toll road, BNRR is obviously subject to significant financial risks, particularly traffic risk. However, the stretch of M6 in question is so congested that it is believed that a diversion of only 10 to 15 percent would be sufficient to service the debts. In addition, MEL has a 53-year concession and absolute power to change toll rates at their discretion.

An "open" tolling system was proposed in which vehicles are stopped only once when they exit. These tollbooths would be equipped with both manual and automatic collection device (AVI). By 2004, motorists traveling around Birmingham will have a tolled alternative to the highly congested M6 section. (World Bank 1999; Levy 1996; Project Finance 2001a, b)

5.3. DBFO: PFI in Road Sector

5.3.1. PFI Concept Introduced in Road Sector

It was while the four BOT-type toll road projects were being developed that the U.K. government launched PFI in their public infrastructure procurement. In the meantime, the discussion continued about the application of PFI in the road sector. The Department of Transport announced in November 1992 that private sector companies might be invited to bid for Design, Build, Finance and Operate (DBFO) road contracts. The application of the PFI to road programs was set out in two consultation documents – the Department of Transport's Green Paper, "Paying for Better Motorways" (1993) and "Design, Build, Finance and Operate Concessions for Trunk Roads and Motorways"(1994). The Department carried out further detailed consultation with a number of potential participants in Spring 1994. The Agency formally announced its use of PFI to procure a road service on parts of the motorway and trunk road network in August 1994. (Highways Agency 1997)

DBFO conceived by the Department represented the specific delivery method to apply the PFI concepts to the highway projects. Traditionally, infrastructure procurement had been viewed as asset procurement; decisions relating to provision, production, and financing of assets as well as the operation and maintenance of the services had been undertaken by the public sector. Assets had been procured from private sector contractor whose responsibilities had been limited to the construction of the assets, and the risks associated with operation of the facility had remained with the public sector. However, the PFI approach was intended to shift the focus of government agencies away from the procurement of assets and instead towards the purchase of services associated with those assets. Ideally, the level of payment by the public sector is to be based on the performance of the private sector operator against contractually agreed levels of service. The DBFO contracts were designed to apply these concepts underlying PFI into the field of highway development in the U.K., as explained in the next section.

5.3.2. Objective and Scope of DBFO Roads

The overall objectives of the Highways Agency, on behalf of the U.K. government, for DBFO toll road projects are:

- to ensure that the new roads will be designed and built, and the new roads and the existing roads will be maintained and operated safely and satisfactorily so as to minimize any adverse impact on the environment and maximize benefit to road users;
- to maximize value for money, i.e., to minimize the financial contribution required from the public sector; and
- to foster the development of a private sector road-operating industry in the U.K.

As for the objective of maximizing value for money (i.e., the second bullet above), the government believes that the objective will be achieved through:

a) promoting innovation, not only in technical and operational aspects, but also in financial and commercial arrangements; and

b) allocating risks appropriately between the public sector and the private sector.

To realize these objectives, the responsibilities for a private operator under DBFO contracts include:

- design and construction of the new road or the upgrade of existing roads according to the specifications;
- operation and maintenance of the new or upgraded road as well as the relevant segments of existing roads; and
- financing of the capital, operational and maintenance costs of the roads.

The main benefit of DBFO is that, by transferring to the private sector the responsibilities listed above, the private sector will consider its obligations as a whole, over the life of the contract, taking full account of the risks inherent at each stage of the project. For example, there is a direct relationship between the way a project is designed and constructed and its operational costs over the whole life cycle. The private sector chooses how to provide the service to the level specified by the Agency. For this purpose, the specification is intended to be primarily on output (i.e., the level of service), as discussed later. Also, proper risk allocation between the public and the private sector should lead to a lower life-cycle cost for the government.

The responsibilities for private operators under DBFO contracts are similar to those under BOT contracts, such as the ones explained before. The difference is that under a DBFO arrangement the concessionaire, in return for its responsibilities, receives a payment from the

government according to the use made of the road. Under the proposed payment mechanism, so called "shadow tolls" as opposed to real tolls, the government, instead of road users, makes the payment based on the number of vehicle-kilometers traveled by road users. These payments come from the government's general funding sources that may or may not be related to the road users, allowing the government to use multiple sources of revenues.

The use of shadow tolls, one of the unique and interesting characteristics of the UK's DBFO road projects, has significantly affected the structure of DBFO projects. It has played an important role in deciding the level of traffic risk transferred from the public sector to the private. Accordingly, it has formed one of the central issues in negotiations between the government and the private bidders in selecting the winning bidder and finalizing the DBFO contracts. Also, it has served as the tools for contract management in various aspects, as discussed later.

5.4. First DBFO Road Projects

5.4.1. Project Selection

Once the decision had been made to implement DBFO scheme in the road sector, the Highways Agency started identifying specific road sections that would meet the government's overall objectives in PFI described above and, at the same time, be likely to attract sufficient interests from the private sector. The Agency took a step-wise method to introduce DBFO contracts in their road service procurements. They deliberately selected several projects with different scale and characteristics, and grouped them into a "tranche." Tranche 1 and 1A were established, each of which included four projects, totaling eight first DBFO road projects. They have already closed the DBFO contracts in the eight projects, about which the procurement process and learned lessons have been widely publicized. Their intention is that these lessons are to be reflected in the next DBFO road projects.

In addition to the general objectives in PFI, the Highways Agency had a specific objective for their work in the first eight road projects. The additional objective was to test the enthusiasm of the market for DBFO roads contracts across a range of different project types. In particular, Tranche 1 was declared to be experimental from the outset; as such the relative priority of projects in the trunk road program was not the main issue in the selection of the trial projects. Accordingly, the Agency had the following considerations in choosing the projects.

- The projects should have differing size and complexity, involving different mixes of new construction and maintenance.
- The projects should have passed through the necessary stages that require substantial design and planning (e.g., Public Inquiries) and in an advanced stage of development, so that they would not contain great uncertainty of statutory risk, and progress reasonably quickly.

The following brief descriptions of each of four projects in Tranche 1 are adopted from the report published by the National Audit Office (NAO 1998). They include the varying range of projects and very well reflect the experimental nature of the Tranche 1. For all the projects, the contract term is 30 years.

M1-A1 (Yorkshire) Link

The project builds a new motorway between the M1/M62 (south of Leeds) and the A1

and the A64 (east of Leeds). It also includes the operation and maintenance of the route. It will provide a strategic route for traffic bypassing Leeds and will remove congested traffic from existing roads to the east and south. The major construction works in this project are:

- construction of new dual 3-lane motorway between the M1 at Belle Isle and the A1 at Hook Moor,
- widening of M62 to 4 lanes in each direction between Junctions 28 (Tingley Junction) and 29 (Lofthouse Interchange),
- widening of M1 to 5 lanes in each direction between Lofthouse Interchange and a new interchange at Belle Isle, and
- widening of A1 to a dual 4-lane motorway between Hook Moor and Bramham.

Total 30 kilometers of new road construction and 22 kilometers of widening works are the most capital-intensive of the four projects in the tranche.

A1(M) Motorway Alconbury to Peterborough

The project forms a part of the proposed upgrading of the existing A1 between London and Newcastle to motorway standard. It upgrades the section between Alconbury and Peterborough. The private operator builds a new motorway-standard highway along the existing trunk road, after which it operates and maintains the new road. During the construction, the operator is responsible for the operation and maintenance of the existing A1, which will be de-trunked and transferred to the local highway authority, Cambridgeshire County Council. The new construction of total 21-kilometer motorway is the second most capital-intensive of the four projects in the tranche.

A419/A417 Swindon to Gloucester

The project forms a strategic route between Junction 15 of the M4 near Swindon and the M5 near Gloucester. It includes the following major construction works:

- new construction of the A419 Latton Bypass (6 kilometers),
- new construction of the A419/A417 Cirencester and Stratton Bypass (10 kilometers), and
- improvement of the A417 North of Stratton to Nettleton Improvement (9 kilometers).

The private operator is to operate and maintain the existing trunk road sections, as well

as these new or improved road sections. This total 52-kilometer road project is relatively operation-focused, because the new/improved construction section only shares a half of the total length for overall operation and maintenance responsibility.

A69 Carlisle-Newcastle DBFO Road

The A69 is the principal east west all weather route serving the north of England and has been designated a part of the Trans-European Road Network. The project is mostly operation and maintenance of 84-kilometer existing trunk road. The only construction work included in the project is that of a single carriageway, Haltwhistle Bypass, to relieve the existing A69 at Haltwhistle of through traffic. The new bypass is only 3.2 kilometers in length and was completed as early as just over 1 year after the contract close.

5.4.2. Contract

Overview

The DBFO contract is the principal legal relationship between the project company and the Agency. In each case, the winning consortium formed a special purpose vehicle company by the time of contract award, which has entered into the DBFO contract with the Secretary of State. On the other hand, although the Secretary of State is the counter-party to the DBFO contract, the Highways Agency has been given executive responsibility for its administration.

In order to leave sufficient rooms for the private sector's innovation, the specifications for the DBFO road projects were kept minimal and intended to be output service specifications. A part of such output specification was the *core requirements*, which consisted of only the fundamental requirements for design, construction, operation and maintenance of the project roads. Also, so-called *illustrative requirements* were provided with the Invitation to Tender. They were the government engineers' own design proposals and served as a benchmark for evaluation. The illustrative requirements were not mandatory and bidders were encouraged to make alternative proposals. Also, long-term contract duration of 30 years was intended to induce technical innovations from a life-cycle approach to design, build, operate and maintain the project roads.

As mentioned, the DBFO contract period is for 30 years from the commencement date. Because financing for this type of project generally has a maximum repayment period of around

20 years, the selected duration of 30 years would allow the private operator to apply a similar timescale on its debt repayment schedule. Also, the private sector was allowed a buffer period after the anticipated debt repayment date so that it could produce sufficient profit out of its initial investment in case the traffic revenue might be less than anticipated. . In addition, since 30 years was beyond the currently available range of conventional debt, financial innovation was expected in the use of alternative sources of funding and the possibility of re-financing after the completion of construction.

The most important goal in DBFO road projects is "to achieve higher Value for Money" in highway service provisions. Value for Money, in turn, is obtained (or measured) with reduced public expenditure and risk transfer. Therefore, the understanding of the arrangements of service fee payment and risk transfer is indispensable in this scheme.

Payment Method: Shadow Tolls

In compliance with the principle underlying PFI, the payment in the DBFO roads is made for the road service provided (i.e., the use of the road), rather than the road asset itself. Accordingly, the payments to operators are based primarily on the amount of traffic that travels on the operators' roads during the contract periods. While the service fees could be collected through tolls from the road users, the tolls have not been widely accepted in the U.K. (with several exceptions already introduced). Therefore, the concept of "shadow tolls" is used, under which the government pays the private operators an amount that is based on the number and type of vehicles using the road, with adjustments made for lane closure and safety performance.

Structure

The payment of the shadow tolls is based on the following three criteria:

1) Usage

The actual level of road usage forms the basis of the shadow tolls. The level of usage is simply measured by a unit of vehicle-kilometer (i.e., number of vehicles multiplied by length of roads traveled). By multiplying this figure by the toll rates, the shadow toll payments are determined. The toll rates, in turn, are proposed by the operator and fixed in the contract upon mutual agreement.

The toll rates consist of two dimensions. First, they are established for each of two categories of vehicles: long vehicles and short vehicles. Ideally, the categories should be based

on the weight of the vehicles. Because heavier vehicles require thicker pavement and more frequent maintenance and thereby make the road project costlier, they should be charged more than the other vehicles. However, since there is no available technology of differentiating between the weights of vehicles, vehicle length was used as a proxy for weight.

Second, the toll rates for each class of vehicle were to be split into 2 to 4 shadow toll bands, with selection allowed for the bidders. In other words, the bidders were asked to bid both the parameters of traffic levels to form the 2 to 4 bands and the toll rates associated to each band. While the bidders were allowed considerable flexibility within that structure, there was one important restriction; the top band must have the toll rates set at zero, in order to ensure that the maximum liability of the government under a DBFO contract is capped.

2) Availability of service

Some PFI schemes in other sectors use the availability for use of the asset as payment bases. While this type of payment was not emphasized in the first DBFO road projects, a similar approach was taken with a limited scope[29]. The payment represents the cost for keeping the service available on the existing road sections and should be close to the cost of operation and maintenance for the existing road.

In the case of the M1-A1 project, the payment profile over the life of the contract was modified to mirror more the operator's costs rather than the service being provided. This project involved new construction for virtually all length of the road. Because there was no payment for a service provided on existing roads, the financial burden of the operator was relatively large. In addition, the debt service schedule following the large capital investments would not match the gradual growth of shadow toll revenues, because the large portion of debt repayment was, as usual, scheduled in earlier time. The Highway Agency agreed to an additional method for mitigating the risk borne by the private sector. This would be achieved by weighting the Agency's payments to the operator towards the beginning of the contract period using "sculpting factors", thus matching the revenue to the debt repayment schedule.

Hypothetical example is as follows. First, no payment is to be made until the road is officially open to traffic. Once the most of construction is finished and the road is open for traffic, the operator receives 80 percent of the full level of traffic payment. When all the construction

[29] A possible use of this type of payment mechanism with a wider scope is being considered by the Highways Agency for future DBFO road projects based in urban areas, for example the A13 project.

works are completed, the operator receives more than full of the usage payment based on the actual traffic level. When the debt is fully repaid, the toll payments step down again to the level that covers both the operating and maintenance costs and the return on equity.

3) Performance

There are two aspects in performance payments: safety performance payments and lane closure charges. Safety performance payment is introduced to encourage the private operator to actively seek safety improvements, one of the Agency's key objectives in the DBFO roads. If a safety improvement scheme is proposed by the operator and are agreed by the Agency, the private operator constructs and pays for the scheme, and is compensated by receiving 25 percent of the economic value of each personal injury accident avoided in the following 5-year period. Accidents avoided are determined by comparing the actual statistics with data over the 3 years prior to the implementation of the scheme.

In addition, disturbance and delay caused by lane closure is a significant performance issue to both the Agency and the road user. A deduction is made from the payment when lanes are closed. The size of the deduction is dependent on the number of lanes closed, the duration of closure, the expected traffic at the time of closure (which encourages scheduled closure for maintenance at off-peak times) and the economic value of user delay. Lane closure charges are only made for closures within the control of the private operator, for example no deduction is made for those required by the police (in the case of accidents and emergencies) or utilities.

Future Introduction of Real Tolls

Shadow toll payments were originally intended as a precursor to the introduction of real (or user paid) tolls. For the first eight DBFO contracts, the money raised by these real tolls, when imposed, will not go to the operators, but to the Government who will continue to pay shadow tolls to the operators. However, the introduction of user paid tolls may lead to some traffic diverting onto other alternative non-tolled roads, which will adversely affect the road operator's income. Traffic forecasts made by both the Highways Agency and the operators have not made allowances for such impacts. In order to address the possibility of real tolls introduction, the contract clauses allow for shadow tolls to be re-based to compensate the operator for the effects of any reduction in traffic. These payments under the contract will be adjusted to reflect the actual changes in traffic over a 3-year period.

Risk Transfer

The risk transferred from the government to the private operator is paid great attention in PFI. Indeed, it is believed that the value for money, the most important measurement of the success of PFI, is achieved by the two components of cost reduction and risk transfer, as mentioned. The DBFO road projects, accordingly, transferred risks to the private sector, where appropriate.

Project risks should be transferred to the private sector if, and only to the extent that, the private sector is better able to manage such risk than the public sector. The private sector is thought to be better able to manage certain risks. Under a PFI contract, the private sector will generally be asked to take the following risks (Highways Agency 1997):

- construction and operational cost overruns;
- delay in delivery of the service;
- design of the underlying asset not delivering the agreed service; and
- changes of law, including tax law changes, which impose additional or increased costs on the operator (other than any change of law which discriminates against private sector operators).

DBFO contracts follow the conventions in PFI, and are, in general, structured to leave these risks with the private operators. The allocation of risk that may be unique to DBFO contracts includes the following.

a) Traffic Risk[30]

Because the shadow tolls are linked to the actual traffic and not to the forecast traffic, the actual traffic level observed on the roads affects both the operators' revenue and the government's expenditure. By using the shadow tolls, the government intended to share the traffic risk with the operators. Accordingly, the traffic forecast has become one of the most important works for both the bidders and the government.

The traffic forecast on which the bidder's shadow toll proposal was based was assigned to the bidders. Bidders were given the Highways Agency's historical traffic flow data for the existing road. Also, the high and low growth projections were provided for the sections of new road to be constructed. This information provided the basis for further traffic forecasting to be undertaken by the bidders.

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[30] The technical and strategic difficulties in traffic demand forecast are discussed in section 3.1.3.

What the bidders were provided was not all the government had. The Highways Agency had its own updated traffic forecasts for the project roads, which were kept confidential in order to encourage the bidders to form their own view of traffic growth. The updated forecasts were based on traffic models constructed for the initial investment decision for individual road schemes within the DBFO project. Also, the Agency developed a probability distribution for traffic based on analysis of actual traffic against traffic forecasts for a large number of different schemes. These updated forecasts were used during evaluation to calculate how much risk each bidder's payment structure would place on its revenue stream.

The traffic forecast was a strategic issue as well as a technical issue for a private bidder. Because the bidders set the bands and tolls from their own assessment of traffic levels, the traffic forecast conducted by the bidders had a critical impact on their shadow toll proposal. This, in turn, becomes the major determinant of the winning bidder selection, for the NPV of the shadow toll payment was used as the primary bid evaluation criteria. If the estimates of capital, operation and maintenance costs were fixed, a bidder whose forecast was relatively optimistic would set lower rates, assuming relatively high traffic risk. On the contrary, a bidder whose forecast was relatively pessimistic would set higher rates, assuming relatively low traffic risk. Because the lower bid is more attractive from the government's point of view, the bid evaluation method, in effect, encourages an optimistic traffic forecast. In order that this aspect of shadow toll proposal would not too seriously distort a fair competition, the government claims that it was careful enough to test the bidders' assumptions about traffic forecasts against a variety of scenarios to check whether bids were likely to be sustainable.

Nevertheless, the actual traffic may be larger or smaller than forecast. If the actual traffic turns out to be significantly larger than forecast, the government is exposed to the risk of shadow toll payment that is larger than expected. Should such an event occur, the private operator would make excessive revenue, which is not desirable from the public point of view. To limit the government exposure to unexpectedly high traffic volume and the possible excessive profit on the operator, the shadow tolls in the top traffic band had to be set at zero, thereby capping the maximum liability of the government under the DBFO contract.

If the actual traffic turns out to be significantly smaller than forecast, the economic viability of the project is seriously damaged. Because the shadow tolls are functions of the actual traffic volume, the revenue stream is largely lowered. On the other hand, the cost side is

relatively unchanged, because the most of the cost components are sunk in that the repayment of debt borrowed for the initial investment is the dominating item. Moreover, there is no practical scope for the private operators to encourage traffic growth.[31] Therefore, the shadow toll mechanism places a financial risk on the private sector that they are no better placed to manage than the public sector. Because of this structure of traffic risk allocation, most bidders chose a 4-band shadow toll structure with the lowest band within which the toll rates are set at a level necessary to cover debt service requirements (but not an equity return), representing a cautious view of traffic on the operators' side. (Highways Agency 1997)

b) Protestor Risk

The increase in direct adverse action to delay construction of new roads has placed extra cost on the Highways Agency. Although this risk was not considered significant for some of the projects, it was considered to be more serious on others, where the private sector could not easily accept the risk in full. However, the Agency tried and has transferred responsibility for dealing with protester action to the winning bidders as much as possible.

Bidders were asked to price the risk-sharing options involving different levels of risk transfer – risk transferred, shared and retained by the Agency. The end result of negotiations was generally a risk-sharing arrangement with much of the risk transferred to the operator, the degree of which was specific for each project.

c) Latent Defect Risk

Where a DBFO project requires the private operator to take over operation of an existing length of road, bidders had to understand the state of the road and related structures. Their technical advisers carried out investigations but there may remain problems that could not be detected (i.e., "latent defects"). Bidders were asked to bid on the same three risk-sharing options as with in protestor action. The experiences suggest that bidders were generally prepared to take a large share of latent defect risk, because the bidders often involved engineering and construction professionals who were technically sophisticated enough to analyze the risk.

[31] Also, it would not be economically and environmentally reasonable to encourage unnecessary traffic in order to enhance the financial viability of road projects.

5.4.3. Operator Selection Process

Project Approval

Before the projects were selected as DBFO projects, the Agency had successfully justified the economic value of the roads through cost-benefit analyses. The employed analysis method is applicable to road schemes to ensure that the economic value of the road including intangible benefit is larger than the total development costs. DBFO scheme was expected to reduce the total costs for the government and therefore believed to further magnify the benefits relative to the costs, if successfully implemented.

As mentioned earlier, because the first eight DBFO projects (Tranche 1 and 1A) were intended to be path finding projects for PFI in road sector, full statutory approval had been gained for all road schemes before contract award. This meant that the outline design had been put to a Public Inquiry and fixed in statutory Orders that were necessary to construct the schemes and acquire the necessary land. Accordingly, the private operators was not asked to take planning responsibility and associated risk, while such a responsibility might have enhanced the scope of innovation by involving the private operator in the earlier stage of projects. However, it was believed that although the outline design was fixed, there was still scope for innovation and cost savings in preparing the detailed design.

Official Announcement

Once identified, the candidates DBFO projects were announced publicly. In the case of tranche 1 projects, the Secretary of States for Transport, in December 1993, announced the first DBFO roads contracts were to be let within 18 months. In August 1994, the Department of Transport advertised the competition for the first tranche of four contracts in the Official Journal of the European Communities, inviting international competitors. Information and pre-qualification procedures setting out the project details, timings and procedures were also made available to prospective bidders. Those seeking to pre-qualify were invited to indicate their interest in bidding for one or more of the four projects (NAO 1998).

Pre-qualification

For each project, the Agency received responses from, on average, eight interested consortia. Because it was thought that it would be impractical to negotiate in detail with that

number of consortia and few consortia would want to proceed with only a 1 in 8 chance of being successful, a pre-qualification process took place to reduce the numbers. The Agency's view was that four was the optimum number of bidders to promote a healthy competition and to give those chosen a sufficient chance of success to ensure their commitment to a long and expensive procurement process. The criteria were that the bidders had (1) a technical, financial and economic track record in designing, planning, construction, maintenance and financing of roads and other DBFO-type projects, and (2) the skills and capability to fulfill the requirements of these projects. The relative weightings for the assessment criteria varied for each of the projects reflecting their different characteristics. The weightings were not made available to those seeking to pre-qualify. (Highways Agency 1997) In the case of the Tranche 1, pre-qualification submissions were received from 17 consortia, comprising some 70 individual companies. Through the pre-qualification process, 12 consortia were selected to proceed to the next stage of tendering (NAO 1998).

Invitation to Tender (ITT)

Once the pre-qualified bidders were selected, the Agency issued the Tender documents, including (1) the model contract, (2) more detail on the road schemes in each project and any existing road, (3) the core requirements for both construction, and operation and maintenance phases, (4) the payment structure and details of what had to be bid in relation to it, (5) the contents list for the standard bid which had to be returned by each bidder, (6) areas where variation from the standard bid would be considered; and (7) the criteria by which the bids would be evaluated. The bidders were asked to return their bids by a set date.

Standard bids were required:

- to meet a specified quality threshold for all aspects of the output specification;
- to meet specific and detailed core requirements covering safety, legal obligations, standard of highway service, maintenance and environmental objectives, and so on;
- to demonstrate bidders' willingness to both assume sufficient risk, and accept responsibility for design, construction, maintenance and financing;
- to include proposals for the two risks of protester action and latent defects;
- to be on the basis of a 30-year contract life; and

- to be based upon shadow toll payments on 2 classes of vehicle (heavy goods vehicles and all others).

The Agency also invited consortia to submit variant bids to the standard requirements that would offer different ways of meeting the Agency's requirements and provide scope for innovation. A number of bidders submitted variant bids. The Agency chose an evaluation bid from each bidder based on the lowest priced, financially robust offer that satisfied the Agency's technical requirements.

In the case of Tranche 1, 4 consortia were invited to bid for each project, as mentioned. Having been ranked initially on the basis of a simple scoring system, other factors came into play to determine which consortia were invited to bid for which project. The ability to build and finance the project was a major determinant in the selection. No consortium was invited to bid for more than 2 projects and, where possible, the tender lists reflected the preferences expressed by the qualified consortia. Also, to the extent permitted by the procurement regulations, the Agency wished to spread the work around to sustain private sector interest and thus assist in meeting the objective of creating a private-sector road-operating industry. For the 3 of 4 projects, all the 4 consortia responded to the invitation, while, in the M1-A1 project, Hochtief withdrew citing other commitments, leaving 3 bidders (NAO 1998).

Short Listing

After the bids were received, the Highways Agency clarified the contents of the bids and evaluated them. The negotiations with bidders were held as needed. On the basis of the interim evaluations, the Agency established a short-list. In the case of Tranche 1, 2 bidders were short-listed on three projects, while 3 bidders were short-listed for the A1(M) project as the second and third placed bids were particularly close (NAO 1998).

In evaluating the bids, first it was examined whether the bids met the required technical standards. For the bids that cleared this evaluation, the primary criteria were the expected discounted cost of shadow toll payments and specific values assigned to transferred risks. As a third criterion, the sensitivity of shadow toll payments to changes in traffic volumes was also considered only when 2 or more bids were very close after the 2 criteria had been considered.

The expected NPV of shadow toll payments is compared with the estimated public expenditure under the traditional procurement, adjusted by the value of risk transfer. If the

former is smaller than the latter, DBFO projects are considered to have value for money, thereby justifying the implementation of PFI scheme in the specific roads. The bids are compared with each other in the size of value for money that they offer.

The basis of the estimated public expenditure under the conventional procurement is a Public Sector Comparator[32]. While it represents the total life-cycle costs of the project under the conventional procurement, it was necessary to attribute a figure to the risks that had previously been taken by the government and now would be transferred to the private sector, so that a Public Sector Comparator would facilitate an equal-footed comparison.

In addition, there was a unique and interesting method of risk pricing, which is worth mentioning here. As explained above, two risks of protester action and latent defects were among the risks shared in the DBFO road projects, for which specific bids were invited. Bidders were asked to price the 3 options involving different levels of risk transfer – risk transferred, shared and retained by the Agency. The prices are taken into account for in the bid evaluation process.

Contract Close

Then, the Agency invited best and final offers from the short-listed bidders, which were evaluated against the same criteria as initial bids. On the basis of these evaluations, a preferred bidder was provisionally appointed for each project. In each case, the preferred bidder was the consortium whose bid had the lowest net present value at the short-listing stage.

After selection, negotiations proceeded with the preferred bidder and its financiers to finalize the terms of the DBFO contract (between the Agency and the preferred bidder) and the Direct Agreement (between the Agency and the financiers). During this process, the reserve bidder on each project was invited to leave its bid on the table, maintaining competitive pressure in the negotiation with the preferred bidder. At this stage, the preferred bidders had to obtain committed funding and to finalize any specified contractual issues with the Agency before it could be actually considered preferred bidder. To save bidding costs, only the preferred bidder (and not the reserve bidder) was required to secure committed funding at the next stage.

The sources of finance for DBFO projects are equity and debt. For the first DBFO road projects, all pure equity contribution has come from project sponsors. However, some quasi-

[32] The general method of calculating the public sector comparator (including accounting of risk transfer) has been introduced to Japanese PFI and is explained thoroughly in section 6.2.3.

equity, in the form of subordinated debt, has been contributed by third party investors. In future, equity may come from investment funds that have been set up to provide equity for PFI projects.

Debt finance has been raised through commercial bank debt, funding from the European Investment Bank (EIB) and the proceeds of a bond issue. The bank facilities provided have had a repayment period ranging from 15 to 20 years. The facilities are "limited recourse", as the debt is serviced out of cash flow generated by the project road and the banks look only to the assets of their borrower, the private operator.

The preferred bidders for each of the projects were awarded the contracts without significant movement in terms, and contracts were signed in 1996, about 2 years after the official announcement in December 1993 (NAO 1998). The projects included in the first two tranches and the winning consortia are shown in Table 5-2.

Table 5-2 First DBFO Projects

	Miles	Value (£m)	Winning consortia
Tranche 1			
A69 Newcastle to Carlisle	52	9.4	Roadlink (Henry Boot, Christiani & Nielsen, Cogefarimpresit, Morrison Construction, Pell Frischmann and ASTM-SINA)
M1-A1 Motorway Link, Leeds	18	214	Yorkshire Link (Trafalgar House and Balfour Beatty)
A1(M) Alconbury to Peterborough	13	128	RMG (Amec, Alfred McAlpine, Brown & Root and Dragados)
A417/A419 Swindon to Gloucester	32	49	RMG (Amec, Alfred McAlpine, Brown & Root and Dragados)
Tranche 1A			
A50/A564 Stoke to Derby Link	35	20.6	Connect (Balfour Beatty, WS Atkins ad Philipp Holzmann)
A30/A35 Exeter to Bere Regis	63	75.7	Connect (Balfour Beatty, WS Atkins and Philipp Holzmann)
M40 Junctions 1-15	76	37.1	UK Highways (Hyder, John Laing, Tarmac, Caisse des depots et consignations and Transroute)
A168/A19 Dishforth to Tyne Tunnel	73	29.4	Autolink (Amey, Sir Robert McAlpine and Taylor Woodrow)

Source: Highways Agency 1997

5.4.4. Contract Management

Design and Construction

During the design and construction phases of the contracts, the Agent from the Department of Transport, on behalf of Highways Agency, monitored the design, construction, testing, commissioning, completion and operation of the new sections of road. Although it has not been the case in the first DBFO projects, should anything not be in accordance with the contract, the Agents can require remedial action. If this is not carried out satisfactorily, they can put the work required out to tender, and recover the cost from the operator.

In the design phase, because the private operators prepared the detailed designs for the new road under the DBFO contracts, the changes proposed by the operators' designers had to be reviewed by the Agents. They could refuse a plan, if it failed to meet both safety standards and the requirements detailed in the contract. As for the construction, the Agents had full right of access not only to the operators' Quality Assurance systems, but also to both their on-site records and the sites themselves. Because construction risk rests entirely with the private sector under the DBFO contracts, the government recognized that it would be inappropriate to set up their own quality assurance or oversee construction in the same way as in the traditional procurement. Therefore, the monitoring conducted in the DBFO projects implied a lower degree of involvement than the traditional procurement.

Operation

Once the construction is completed and the road opens to the public use, the Department, by appointing their Representatives, monitors the operation and maintenance so that the private operator actually performs complying with the contract.

The DBFO contracts include a penalty points system for minor contract breaches. If the private operator fails to perform the operation and maintenance as specified in the contract, the Representatives award the appropriate number of penalty points specified in the contracts. Once a set number has been accumulated, the Highways Agency can require increased monitoring at the operator's expense. If penalty points are further accumulated beyond the threshold within specified periods, the Agency can terminate the contract without compensation. The penalty points system therefore acts as an incentive for the operator to minimize such breaches and also

acts as a warning to the shareholders and lending institutions.

Another item of operation monitoring includes the accuracy of the traffic count. Because the shadow toll payments are based upon the vehicle-kilometers, the accurate payments depend on the accuracy of traffic measurement. In addition to the audits of traffic flows carried out by the operators, the Agency may also independently verify the counts by themselves. Accuracy must be within certain parameters[33], and noted deviations cause re-adjustment to the payments made to the operators.

Change Mechanism

Over the long life of the DBFO contract, there will be changes in circumstances existing at the start of the contract. Because such changes are basically unforeseeable, it would be reasonable for the contract to include a mechanism that adjusts the service requirements agreed upon now. Among the parties involved, the Highways Agency (or the government) has the major concern in this regard, because it retains responsibility for strategic management of the whole network. Therefore, the Agency needs to retain the right to change the service specification after the contract closing. However, from the private operators' viewpoint, such change orders accompany additional costs that are not anticipated at the beginning. If there were no adjustment for the payments, the private operator could not accommodate the changes.

As a solution, the DBFO contracts specify (1) scope for possible changes requested by the Agency, and (2) the method of adjusting the payment mechanism. As for the scope, the Agency can ask changes to the agreed specification of the design, construction or operation and maintenance of the project. Also, the Agency can add new works that are not in the original contract, such as widening or new bypasses. When the additional works become necessary, the Agency can either (a) instruct the operator to incorporate any such new works into the project or (b) let the new works through competitive tendering. Although the second option, letting a new player involved in the operating toll roads, may seem impractical or inefficient at a first glance, it would be necessary in order for the Agency to negotiate reasonable compensations with the private operator even when the first option is preferred.

When a change has been proposed and mutually agreed, the adjustment is made

[33] In the case of Tranche 1, the accuracy required initially were that traffic counts must be within 3 percent by direction, 5 percent by lane. These parameters were to be (and actually were) improved to 1 percent by direction and 3 percent by lane in 1999 (NAO 1998).

according to the method specified in the contracts. The idea is that the private operator is compensated for the cost increase or the traffic revenue decrease, so that their financial position is the same as before the accommodated changes. There are two basic methods for this adjustment: an adjustment of toll levels or a one-time payment. The mechanism distinguishes between minor and major changes and assigns the second method to minor changes while reserving the first method to major changes. The Agency's view is that it would be impractical and insensible if the toll revels had to be revised every time a minor change is proposed.

The mechanism works as follows. When a change is made, its effect in costs or revenues is estimated. Normally, such an effect is incremental and accumulated in the operator's account. In most cases, the cumulative costs incurred by the operator are offset by the one-time compensation from the government, unless they reach a certain amount within a certain period, both of which are specified in the contract. Once the threshold is reached, the toll level is revised so that the NPV of the project is unchanged. The change mechanism is also applicable to the treatment of safety improvements suggested by the operator, as referred to in the previous section.

Asset Take-over

During the 30-year life of the DBFO contracts, the private operators have the right of access to the road and underlying land, while the legal ownership belongs to the government. At the end of the contract term, the road and all the related facilities are to be handed over without cost to the Highways Agency. As stated in the contracts, the road should be returned in a fit condition for service so that it will not require major capital maintenance immediately after the contract expiration. To ensure this, the contacts include specific clauses regarding asset conditions at the time of hand-back. A required residual life is specified for each element of the project road. The DBFO contracts in Tranche 1 stated, for example, at least 85 percent of the road pavement should have a 10-year residual life on hand-back (NAO 1998).

Despite the specific contract clauses, the government still holds the risk that the private operators may fail to fulfill their contract obligation regarding the asset transfer. As a remedy, several measures are in place. First, 5 years prior to hand-back, the Agency and the operator will carry out detailed inspections of the roads and main structures. Necessary repair works are noted, against which the operator should take proper actions before the expiration. Second, starting at the same time (i.e., 5 years prior to hand-back), the Agency can withhold the payments that are

due to the private operator, and deposit them up to an amount equal to 40 percent of the costs for agreed repair works. Third, the joint inspection of all the project road facilities takes place once again 18 months before the expiration. This is to ensure that the previously agreed works have been actually carried out and to examine the need for any additional works. Finally, when the asset is transferred back from the private operator to the Agency at the contract expiration, the final inspection of the asset conditions is carried out. The Agency will apply the reserved fund to complete any repair work if the operator fails to meet the hand-back criteria. Any money remaining in the reserve account is returned to the operator.

While these measures will serve as an incentive mechanism for the operators to properly carry out the repair works, the Agency still retains the risk that, at the expiration, the funds retained are not sufficient to cover the cost of remedial works that have not been carried out (although the private operator would remain liable for the balance of the cost).

Termination

There are procedures for dealing with fundamental breaches of the contract, which may lead to termination of the contract. Breaches can be divided into three categories: those caused by the operators, those caused by the Agency, and those caused by external factors.

Fundamental breaches by the operators include: (1) insolvency, (2) the accumulation of a certain number of penalty points explained above, or (3) serious breach of contract obligations (e.g., failure to deliver a completed road by a certain date). If either of these events has occurred, the Agency has a range of remedies of increasing severity. The remedies include: (1) the right to suspend payment to the operator, (2) the right to call for the operator to present a program for remedy, and (3) the right to terminate the DBFO contract without compensation.

Fundamental breaches may be caused by the Agency. It may be, for example, failure to make payments for the service provided or failure to issue the certificate of commencement within a specified period. If the Agency fails to meet their contract obligations, the operator is allowed to terminate the contract and receive full compensation. The DBFO contracts specify the calculation of such compensation so that it can repay the debt borrowed by the operator to finance the project and also compensate the equity providers.

In addition, the termination may become necessary beyond the control of the both parties involved in the contract. Such a situation includes the occurrence of force majeure. If

there is a continuing force majeure event (e.g., war) that significantly affects either party's performance of its contract obligation, either party has the right to terminate the contract. In that situation, the risk is shared between the Agency and the operator; although the debt repayment is covered by the Agency, no compensation is payable to reflect lost equity.

5.4.5. Results

Overall, the first eight DBFO contracts have delivered value for money. Cost savings (compared with the public sector comparator) have ranged from marginal to substantial; for Tranche 1 and 1A DBFO contracts, the average cost saving is 15 percent. (Highways Agency 1997) DBFO contracts have accelerated the introduction of cost efficiencies, innovative techniques and lifecycle cost analysis into the design, construction, and operation of the roads.

More detailed results are made available for the first four projects in Tranche 1[34],where the government believes that they have achieved better value for money thorough introduction of the DBFO schemes. As seen in Table 5-3, three of the four projects have achieved good value for money in that they reduced the expected government expenditure expressed in NPV terms. Exception is the A69 project. But, assessing the winning bid on the project, the Agency identified two main arguments to justify proceeding with this project as a DBFO scheme: firstly, it enabled to obtain an estimate of the risk premium on roads as bidders bid for differing levels of risk transfer, which is important for long-term bench-marking; and secondly, the public sector comparator does not fully recognize the value of residual risk transfer, such as that relating to legislative change, and non-quantifiable benefits, such as helping to foster a private sector road operating industry (NAO 1998).

The expected NPV of shadow tolls for the M1-A1 is over 30 percent lower than the public sector comparator; the A1(M) is around 25 percent lower. These two projects involved the highest proportions of road construction compared with operation and maintenance among the four Tranche 1 projects. The other two projects, which involve higher proportions of operation and maintenance, show much lower savings. The A419/417 has about 10-percent cost savings while the A69 has about 10-percent cost increase. This suggests that the construction element of DBFO roads offers the greatest scope for innovation. The tendency that more capital-intensive projects have higher value for money has also been confirmed in the four projects in Tranche 1A

[34] The brief descriptions of the four projects are found in section 5.4.1.

(NAO 1998).

Table 5-3 Summary of the First Four DBFO Road Projects

	The M1-A1 (Yorkshire) Link	The A1(M) Motorway Alconbury to Peterborough	The A419/A417 Swindon to Gloucester	The A69 Carlisle-Newcastle DBFO project road
Type of road	Ranges from 2 to 5 lane dual carriageways	All motorway	Single and dual carriageway	Single and dual carriageway
Length of road	Totals 30 kilometers plus 22 kilometers side roads	21 kilometers of motorway	52 kilometers	84.3 kilometers with new Bypass of 3.2 kilometers
Expected NPV of shadow tolls *	£232 million	£154 million	£112 million	£62 million
Public sector comparator *	£344 million	£204 million	£123 million	£57 million

Note: These values are net of Value Added Taxes.

(Source: NAO 1998)

5.5. Key Findings in the U.K. Experience[35]

5.5.1. Driving Force Behind the Implementation of Public-Private Partnerships

In the U.K., the DBFO toll roads were born as an application of PFI, a national policy for the government fiscal restructuring. While more drastic restructuring measures (e.g., de-nationalization of public-owned companies) were sought in other fields of public services, the road sector was not fit for the same strategy. One reason would be the reluctance or difficulty in imposing of tolls on highways. While true in general, four BOT-type projects were implemented using real tolls. They served as the precursors to the DBFO roads, where the basic structure in BOT arrangements was succeeded with one important modification about the payment mechanism. Even with government payment for the highway services, the total government expenditures have been reduced. Although incremental, the fiscal restructuring effect was the primary goal for the government in the PFI highway projects.

5.5.2. Project and Operator Selection

Apparently, the U.K. government has remained more active in their private-financed highway development than the U.S. government. Competitive biddings were conducted for the franchises of BOT-type projects. While some of them were initiated by the private proposals, the government organized the project as a public works assisted by the private sector, instead of a regulated private venture (as observed in the U.S.).

This government attitude was further strengthened in the DBFO roads, where the government selected, from their road program, the projects that seemed to be appropriate for DBFO schemes. Moreover, the government commitment for the scheme was seen in their attempt to create the environment where the scheme would work best. In the first four DBFO projects, varied range of projects was included; three new construction projects and one mostly operation-related project were included. Competitive bidding with two-stage evaluation was conducted for the DBFO contracts. As with California's AB680 in the U.S., four (or three) groups were selected in pre-qualification in order to keep the bidding cost minimal and

[35] It is intended that this section be contrasted with the key findings in the U.S. experience. (See Section 4.3)

competitive pressure in place. In the second stage, the government evaluated the total cost savings that they would achieve in PFI. The achievements are measured with an single, aggregate figure of Value for Money.

Value for Money is a single index incorporating all the effects from three elements of (1) technical innovation through integrated procurement of design, construction and operation, (2) risk sharing, and (3) financial innovation. The idea is that the sum of reduced capital and operational costs and increased private financing costs under DBFO is compared to the sum of total public expenditure under the conventional procurement and the monetary value of risk that can be transferred under DBFO. Under the method, while cost reduction through technical innovation forms the basis of comparisons, proper adjustments are also made on other factors. The relatively high financing costs for the private sector are, at least in theory, offset by the transferred risk that should have otherwise been born by the government (or the taxpayers). Quantified in monetary terms, it would be more straightforward than the scoring system used in California.

5.5.3. Government Controls Over Project Execution

In the U.K., the government has always tried to take the lead in implementing pubic-private partnerships in highways. While some of the BOT-type projects were initially proposed by the private sector, the government arranged competitions for the projects, as it would have done in conventional procurements. Moreover, in DBFO road projects, it was expressly recognized that the new scheme would be simply an alternative method for public works procurement of the government. The emphasis on the government responsibility for overall highway development has been far greater in the U.K. than in the U.S.

The U.K. government is monitoring the privately operated projects closely and retains control over the private company using the shadow toll payments as their channel of supervision. Such monitoring covers the asset conditions, safety aspects, and service levels, for instance. Also, they are deeply concerned about the asset conditions at hand-back and incorporated maintenance enforcement mechanism in the contract, reflecting their going concern in highway management. In addition, the government retains the right to change the contract, as needed, with equitable adjustment. Future introduction of real tolls is among the possible changes during the contract term, the treatment of which is specified in the contract.

The introduction of shadow toll turns out to be more than a mere avoidance of real toll imposition, which has been largely unapproved by the public. Instead, it serves as the price at which the government, on behalf of the people, purchases the services from the operator. The simple rule is that the payment is reduced if the services are unsatisfactory. Also, excessive profits for the private operator are prevented by capping the maximum revenue in-flow possible from the shadow toll.

5.5.4. Private Contributions

As is the case in the U.S., the U.K. experience also suggests that the private sector involvement brought significant benefits for the government but it might be partly limited by the design of contractual arrangements. The private sector's contributions and its limitations in three areas of technical innovation, risk sharing, and financial contribution, are presented.

Technical Innovation

As explained earlier, the bidders for the DBFO road projects were allowed to propose changes to existing design, subject to the review by the Agency. Some bidders seized the opportunity and proposed numerous departures from the Agency's illustrative requirements and existing design. Some bidders also applied value-engineering techniques throughout the procurement process to reduce construction costs by optimizing the Agency's design. Also, some bidders proposed variant bids that sought to provide good value for money in ways that somewhat departed from the standard bids. As long as they conformed to the Agency's core requirement, the Agency permitted for them to be used as the evaluated bids.

In the BOT-type projects, the private sector's technical capabilities were exploited to a somewhat larger extent than in the DBFO road projects. The outline designs are proposed by the private bidders in the Dartford River Crossing project, resulting in the cable-stayed bridge scheme selected out of eight proposals including five bridge and three tunnel proposals. Also, the request for proposal for the Skye Bridge asked the bidders to select the most desirable route based on their engineering judgments. In addition, electric toll collection systems are introduced in three of the four toll road projects (the Dartford River Crossing, the Second Severn Crossing, and the Birmingham Northern Relief Road).

The BOT-type toll road projects suggest that broader scope of innovation can be derived from larger flexibility allowed to the bidders' discretion in relation to the outline designs of the

projects. In this regard, the scope of innovation might have been limited in the DBFO roads, where the outline designs had already been fixed by the government. The Highways Agency's core requirements, derived from the project plans and orders following public inquiries, were largely binding and had limited flexibility in design elements. For example, the changes to any existing design could not require any change to the land required for construction, as the acquisition of land remained the responsibility and risk of the Agency.[36]

However, this was not because the government did not acknowledge the importance of flexibility for innovations. Instead, the government, knowing the limitation that it would place on the scope of innovation, chose the projects that had obtained development permits and necessary rights-of-way so that the projects would progress reasonably quickly. Moreover, the extent of core technical requirements was minimized as much as possible and the resulted cost savings suggest that there were still scope of innovation.

The discussion of scope for innovation should cover the issue of planning risks, as was in the U.S. experience. If the private sector is to be invited in outline design proposals, they must assume some planning risk that they are committed to provide an asset, which, as a result of the planning approval process, may never obtain approval or may have to be delivered in a substantially different form or much later than anticipated. The resources committed in the planning process may become wasted. Indeed, some private sector contractors have expressed unwillingness to become involved and do not want to bear such risk, according to Highways Agency (Highways Agency 1997).

Some of the BOT-type toll road projects, which allowed the private sector larger flexibility in design, have experienced lengthy design, official review, and legislative approval periods. Although the extensive review process may allow for a rigorous assessment of cost and traffic forecasts, these delays may reduce investor's interest and confidence in the projects. In addition, as witnessed with respect to the Birmingham Northern Relief Road, environmental and community issues should ideally be addressed from the start. This process may involve issues that are most appropriately addressed between the government and its citizens, well before the private sector is introduced. (World Bank 1999)

Nevertheless, the government believes that further scope of innovation is the key for the

[36] The private operators could acquire additional land, through negotiation with private landowners, to reduce construction costs by design changes, though.

success of future PFI projects. As the Highways Agency itself is now using value engineering as part of its design criteria, savings delivered by the private sector (solely from detailed design and value engineering techniques) may reduce in the future, necessitating more innovation brought from the future PFI (Highways Agency 1997). It is more likely that there will be cost saving in operation if the private sector has designed the asset they are going to operate.

Accordingly, some of the DBFO projects announced introduce the concept of planning risk and will test the proportion that this will deliver better value for money. Some small schemes, where the capital needs are small and moderate delays in planning phase can be accommodated, are enlisted as the prospective PFI projects, before the statutory process have not started. For larger schemes, the model procurement tested in the first eight project will continue to be applied, at least for the time being, where the statutory process have almost been completed (Highways Agency 1997).

Risk Sharing

In the U.K. BOT-type projects, most of risks are born by the private operator. Because their revenue sources are the tolls collected from the drivers, traffic risk is the most important among them. In the Dartford River Crossing and the Second Severn Crossing, the operating rights of existing crossings were leased to the private sector, in order to enhance the stability of traffic revenue, especially during the construction of the new crossings.

While the designs were furnished by the private sector, the planning risks were not significant in the three bridge projects. The government provided the approaching roads, eliminating the right-of-way acquisition needs in the roadside from the private sector. However, the Birmingham Northern Relief Road was an exception, where the private operator suffered from extensive project suspension due to intense controversy over environmental issues.

Since the DBFO road projects had already obtained regulatory clearances, the planning risk was not an issue. Important areas where risks were shared included traffic risk, protester action risk, and latent defect risk. The amount of risk transferred to the private sector were measured in a monetary term and evaluated in the bid selection.

Again, traffic risk is the most crucial issue for DBFO road projects that is beyond the private sector's control. This risk is shared between the government and the private sector, with the use of shadow toll payment mechanism. The shadow toll payments, structured in two to four

bands with different rate settings, helped mitigate the traffic risk born by the private sector in case the traffic is far less than anticipated. While this mechanism places much risk on the government, the toll rate set at zero in the highest traffic band capped the maximum liability for the government.

For the risks of protestor action and latent defect, specific pricing for each risk was asked in the bids, by which the Agency succeeded in transferring considerable level of risk to the private operator, leading to a reduced public expenditure expected over the 30-year lives of the projects.

Financial Contribution

In the BOT-type projects, all the capital cost (exclusive of the right-of-way acquisition especially for the approach roads in the bridge projects) is provided by the private sector and is to be recouped from the toll revenues. The governments have obtained their necessary road infrastructure services at a significant discount, although this was largely made possible with the exceptional imposition of real tolls.

Because of the shadow toll payments, the government expenditures were not completely eliminated in the DBFO contracts, a compromise partly necessitated from the political concern on the government about the real toll imposition. Yet, the total government expenditures, including the risk costs, were substantially reduced. As mentioned earlier, the cost savings of 15 percent on average for the first eight projects or as high as over 30 percent on an individual project were reported. Also, the financing arranged by the private sector helped lighten the government borrowing burdens.

Additionally, financial innovation to reduce the financing costs was among the focus of efforts by the bidders. As mentioned, the value for money, the most important evaluation criterion in the PFI projects, is achieved by offsetting the financing costs incurred by the private operator with the innovations in various forms. Because the financing costs for the private companies are, in general, higher than those for the government, it is crucial to minimize them for PFI to result in better value for money.

One good example was the portfolio approach of the Road Management Group (RMG). In October 1995, the RMG was selected as the preferred bidder on two of four projects in Tranche 1: (1) the A1(M) between Alconbury and Peterborough and, (2) the A419/A417 between

Swindon and Gloucester. The financial commitment was required in the final negotiation stage. The financing for the two road projects was raised through Road Management Consolidates PLC (RMC), a newly created special-purpose financing vehicle (wholly controlled by RMG) that provided funds to the individual RMS companies through back-to-back on-loans. In March 1996, Lehman Brothers and SBC Warburg underwrote a £165 million, 25-year, fixed rate bond issue to partially fund the two projects, and arrange a £111million 25-year European Investment Bank (EIB) loan facility to provide the remainder of the required senior debt financing. The DBFO contracts were awarded to two subsidiaries of RMC; Road Management Services (Petersborough) Limited for the A1(M), and Road Management Services (Gloucester) Limited for the A419/A417.

This structure brought a number of benefits. First, it allowed cross-application of dividends so each project could support the other. Second, it also enabled projected interest coverage levels to be tighter than they could have otherwise been, thus lowering total financing costs. Third, combining two different roads diversified the lenders' risks. Fourth, it eliminated the need for two separate financing structures, minimizing the duplication of documentation and negotiation with financing parties. This kind of approach may provide a foundation for a project company to grow into a large operating company, capable of performing more pooled financing and eventually able to raise funds on its own based on the combined financial strength of its entire portfolio of projects. (World Bank 1999)

In the BOT-type projects, innovative idea was conceived in the Dartford Bridge and the Second Severn Crossing. By using revenues from existing crossings to mitigate start-up risks of the new projects, the private companies were able to successfully develop the projects despite having extremely high debt-to-equity ratios. This approach is termed "pinpoint equity," a technique that may be used to relieve equity investors from the problem of slow returns on their investment through dividends. This technique may also potentially lower the cost of capital (because of the stable revenues from the existing project), in turn lowering the toll rate and/or shortening the duration required to pay off the project debt. (World Bank 1999)

Chapter 6. Japan's Highway Development and Private Finance Initiative

In Japan, the highway development program that has been employed for about a half century is now at its important transition point. Although the program has been effective in developing extensive length of highway network in a remarkably short period, it has created large level of debt obligations in the highway public corporations. The debt financing strategy of the public corporations, relying on toll revenue collection, was born from the necessity for accelerating the nation's highway development within limited funding capacity of the national government. However, as Japan's economic growth has become stable, its highway development strategy has to be re-adjusted so that the current financial problems of the highway public corporations can be mitigated.

As seen in Chapter 4 and Chapter 5, the governments in the U.S. and the U.K. have started organizing public-private partnerships in their highway development programs. Benefits have been identified in those cases, with difficulties for successful implementation. Japanese government also has initiated PFI in 1999, as an improved method for public infrastructure procurement. Although the scheme has been employed in increasing number of occasions ever since, the highway infrastructure has so far been out of the scope of PFI application. Because the highway development in the future must be more efficient than that of today, the potential benefits of PFI should not be overlooked.

In this chapter, first, Japan's highway development, its historical background and its current status and future prospects, is reviewed. Next, Japanese PFI, its legal framework and early examples, is introduced. Finally, the implication of PFI to the highway development is discussed.

6.1. Highway Development in Japan

Japan has the world's most highly developed multimodal transport system. The country's road and rail networks total more than 1 million kilometers and 23,000 kilometers, respectively. The total road length includes about 12,000 kilometers of high-standard trunk roads (mostly toll roads), and more than 700 kilometers of tolled urban expressways. The country's rail system includes extensive urban commuter railways, as well as a 2,000 kilometers network of high-speed *Shinkansen* ("bullet train") network. The highway system, while it competes with railways for transport customers, handles about 66 percent of all passenger trips in terms of passenger-kilometers and 53 percent of all land-based freight traffic in terms of ton-kilometers, as of 1995. (World Bank 1999)

Although the achievement of Japanese government in developing advanced highway network in quite a short time should be highly appreciated, the current situation is that it is becoming uncertain that the past practices can be continued in the future. In this section, brief introductions of Japan's highway development from historical and institutional viewpoint are presented, followed by a specific example of financial analyses for Japan Highway Public Corporation (JHPC).

6.1.1. Modern Highway Development in Japan

Historical Background

Historically, Japan's road network for modern automobiles had long been in a poor condition. In Meiji Era (1868-1912), the government had prioritized the development of railways (a technology imported from Europe in the beginning of the era) and seaports. The result was a terrible lack of road improvement. As cited by the Ministry of Land, Infrastructure and Transport (MLIT), when he was invited by Japanese government to conduct research for the Meishin Expressway in 1956, Ralph J. Watkins reported: "the roads of Japan are incredibly bad. No other industrial nation has so completely neglected its highway system." (MLIT Toll Road Website)

In the early 1950s, as the Japan's economy was overcoming the devastation after World War II, the government set the road development as one of their priorities to support the future economic growth of the country. In 1952, the "Road Law" was enacted, establishing the overall framework for the nation's much-needed road infrastructure. It defined the categories of roads

(i.e., high-performance roads, national roads, and prefectural and municipal roads), assigned the development and management responsibilities of the roads in each category to specific government bodies at national and local levels, and set forth the legal procedures for construction, operation, and decommissioning of the roads. So far, it has served as the basic law that governs all the activities regarding the road infrastructure.

In the same year, the Law Concerning Special Measures for Highway Construction of 1952 was also enacted. The Law initiated modern highway development in Japan. Toll collection was allowed on the highways. Also, it was determined that the highways would be built by using a government's debt facility, Treasury Investment and Loans (TILs, described later), which would be redeemed through the toll revenues. In the early stages, the Ministry of Construction (now MLIT mentioned above) directly undertook construction of toll roads.

However, the funding capacity for overall road development was still limited. A partial remedy was achieved by the enactment of the Law Concerning Temporary Measures for Road Development Funding of 1953, where the gasoline tax levied by the national government was earmarked to the specific use in road development.[37] The rationale behind this was the beneficiary-payment principle, where the car owners who almost necessarily drive on roads should pay for the road improvements. While the new tax revenues under the Law helped increase the government subsidies for highway construction, the earmarked taxes were mainly directed to construction of non-tolled roads at national, prefectural, and municipal levels, where toll financing was, by definition, impossible. The highways were practically left with debt financing option, but TILs were still insufficient.

It was recognized that faster highway development would be only possible by finding other sources for construction financing. Additionally, the need for a special organization to provide the integrated construction and management of toll roads was recognized, because of the observed disjointed development caused by lack of overall project coordination. Consequently, the aforementioned Law Concerning Special Measures for Highway Construction was expanded in 1956, where the Japan Highway Public Corporation (JHPC), a state-owned entity, was created in order to efficiently undertake national toll road development. All toll road projects previously under the national and local governments were transferred to JHPC. The Law also allowed JHPC

[37] The Law was upgraded in 1958 into the Law Concerning Urgent Measures for Road Development. Also, other exercise taxes related to the automobile uses, at the national and local government level, have later been included in the earmarked tax sources.

to use private financing for their road development. Today's financing structure for highway development was basically established at this time.

While Japan's national expressways had almost exclusively been constructed and operated by JHPC for two years after its establishment, there was growing traffic demand in rapidly urbanizing metropolitan areas. In order to address these area-specific concerns, regional public corporations were also established, which are as tabulated below.

Table 6-1 Regional Highway Public Corporations

Organization	Year Established	Development Responsibility
Metropolitan Expressway Public Corporation (MEPC)	1959	Urban expressways in metropolitan Tokyo-Yokohama
Hanshin Expressway Public Corporation (HEPC)	1962	Urban expressways in metropolitan Osaka-Kobe
Honshu-Shikoku Bridge Authority (HSBA)	1970	Connecting bridges between the Shikoku Island and the mainland
Local public corporations	1970 –	Local routes at the prefectural level

Source: World Bank 1999

National Highway Network

Japan's national highway program was first established in the National Highway Law of 1957 and the National Development Arterial Expressway Construction Law of 1957. These laws specified individual routes with particularly high priorities and initiated the construction of these routes. However, it was not until the National Development Arterial Expressway Construction Law was expanded in 1966 that truly comprehensive guidelines for highway network development in the country were provided. The 1966 Law called for the construction of 7,600 kilometers of national expressways. Planning principles targeted by the Law were primarily characterized by the goals of providing equal opportunity for road users to access national expressways, as well as reducing regional disparities in competitive conditions. It was conceived that the completed network would enable the majority of households in the country to access the highways within a two-hour drive.

The Law was further expanded in 1987. The 1987 Law authorized the construction of 14,000 kilometers of national expressways. This target was set based on the criterion that the completed network would enable the majority of households in the country to access the highways within a one-hour drive. It is reported that setting goals in terms of the coverage of expressways across the nation was effective in fostering political acceptance and building

consensus (World Bank 1999).

The targeted and completed lengths of national highway system appear in the latest 5-year Road Improvement and Management Program[38], the government's overall road investment plan over the next 5 years. Of 14,000 kilometers of total targeted length for national expressways, responsibility for 11,520 kilometers has been assigned to JHPC, which had constructed and opened about 6,400 kilometers as of 1998. Urban expressways are planned to be of 1,000-kilometer in length, of which about 580 kilometers had been completed and opened to traffic.

Table 6-2 Japan's Highway Development: Plan and Current Status

		Planned	Completed (1998)	Responsible Agency
High Performance National Expressway	**Total**	**14,000**	**7,265**	
	Highway	11,520	6,395	JHPC
	Honshu-Shikoku Bridges	180	147	HSBA
	Other Toll Road	2300	723	
Urban Expressway	**Total**	**1,000**	**577**	
	Tokyo Metropolitan Area	N/A	248	MEPC
	Osaka Metropolitan Area	N/A	221	HEPC
	Other Areas	N/A	108	

Source: MLIT Road Program Website

6.1.2. Highway Public Corporations

As explained, there are four highway public corporations in Japan (i.e., JHPC, MEPC, HEPC, and HSBA), each of which has been serving different geographical areas. While they have been successful in quickly developing the high standard and well-managed highway infrastructure throughout the nation, their financial conditions are lately becoming sore. As the governments' general policy for the economic development, relying on public works procurements as economic stimuli, has getting criticized, their explicit and implicit subsidies for the public corporations are similarly brought under intense discussions. This is particularly the case in the current Koizumi restructuring. In this section, the financing strategy that the public corporations have so far employed is examined.

[38] This is the fourteenth of its series, with the first one established in 1954.

Financing Sources

Treasury Investment and Loans (TILs)

Toll road projects undertaken by Public Corporations have mainly been financed with the following two types of government guaranteed bonds provided through TILs.

(i) *Government Acceptance Bonds*: These bonds are purchased by the Ministry of Finance and the Ministry of Posts and Telecommunications with funds from sources such as postal savings accounts, employee pension funds, national pension funds, and postal life insurance premiums.

(ii) *Government Guaranteed Bonds*: These bonds are purchased by private financial institutions with the government guarantees.

Government Contribution and Support

The national government also provides direct financial support for the public corporations. The support takes the form of equity capital (for all the public corporations) and subsidies (for JHPC). The latter is provided so that the overall financing costs can be kept at predetermined levels, thereby reducing JHPC's risk from interest rate fluctuations. The predetermined rates[39] are set so that the higher interest payment would not escalate the toll rate charged on the road users. The amount of subsidy is decided as the difference between the actual interest payments accrued for JHPC and the predetermined maximum financing costs.

Because the urban expressways of MEPC and HEPC serve the Tokyo and Osaka metropolitan areas, respectively, the two public corporations receive equity contribution from prefectural and municipal governments as well. For example, MEPC receives equities from Tokyo Metropolis, Kanagawa Prefecture, Saitama Prefecture, Chiba Prefecture, and Yokohama and Kawasaki Cities, all of which are located in the service area of MEPC expressways..

Overall Budget Distributions

The budgets of the highway public corporations are as shown in the Table 6-3. It appears that TILs share the large part of their budgets. About 40 to 60 percent of revenues come from TILs. Also, a relatively small amount of funds are raised through the issuance of bonds

[39] For example, in recent years (1994-97), the maximum overall financing costs to be borne by JHPC have been 4.6 percent for profitable routes and 3.0 percent for unprofitable routes (World Bank 1999).

without government guarantees, as well as bonds in foreign financial markets – both backed by the credit of the public corporations. The total borrowing accounts for about 55 to 85 percent. As described, Japan's highway development strategy is that construction funds are obtained from various kinds of debts and are to be repaid through the toll collections. Although the strategy has accelerated toll road development in the country, it is becoming obvious that the amounts of debt for the public corporations are too large to be repaid, at least in the reasonably foreseeable future. The current financial distress of the public corporations is discussed later.

Table 6-3 Budgets of the Highway Public Corporations in Fiscal 1997

(Unit: billion yen)

Budget Category	JHPC		MEPC		HEPC		HSBA	
		%		%		%		%
Equity capital (national government)	137	2.6	25	3.1	39	5.4	43	6.0
Equity capital (local governments)	-	-	25	3.1	39	5.4	22	3.1
Subsidy for interest payments	113	2.1	-	-	-	-	-	-
Treasury Investment and Loans (TILs)	2,190	41.1	400	49.7	416	58.0	310	43.5
Other bonds and loans	674	12.6	51	6.3	42	5.9	278	39.0
Toll and other revenues	2,208	41.4	278	34.5	177	24.7	58	8.1
Other sources	6	0.1	26	3.2	4	0.6	2	0.3
Total	5,329	100	805	100	718	100	711	100

Note: The total amount may not match the sum of the distributions due to rounding error.

Source: Conference of Public Road Users *(Zenkoku Doro Riyosha Kaigi)*, Road Administration *(Doro Gyosei)*: Fiscal 1997, January 1998, as cited in World Bank 1999.

"Toll Revenue Pooling" System: Cross Subsidies for Network Expansion

In relation to the financing of highway development in Japan, there are two unique strategies employed by the highway public corporations: *toll revenue pooling system* and *redemption principle*. Because they are the critical factors governing the toll rate settings and the financial conditions of the highway public corporations, explanations and discussions of the systems are presented in this and the following subsections.

First one is the toll revenue pooling system. Although the toll rates had initially been set individually on route-by-route basis so that the toll revenue would be sufficient to recoup the costs of each individual route, a toll revenue pooling system was adopted in 1972 for the entire national expressway system. Under the system, tolls are set at equal levels for all of the routes and segments within a pool so that the total toll revenue would be sufficient to recover the total cost for the highways in the pool. Therefore, the actual costs or traffic levels on the individual

routes do not directly affect the toll rates. In other words, financial viability is achieved for the entire network, not for individual routes or segments. Thus, the pooling system is thought of as a form of cross-subsidization, where profitable routes subsidize unprofitable ones.

The rationale behind this system includes the following: (i) the cross-subsidization would help facilitate easier network expansion; (ii) the national and urban expressways would bring the most benefits if implemented as integrated and complete networks; (iii) the financial viability of certain routes would improve with the opening of connecting routes; and (iv) toll rates set at equal level throughout the regions would avoid possible controversy over the differentiated toll rates for basically the same services provided. (World Bank 1999)

The government generally acknowledges that the cross-subsidization achieved with the pooling system has contributed greatly to nationwide network expansion. The government set a goal to build a nationwide expressway network that included routes running through rural areas and/or areas with terrain where road construction would be expensive. The goal could not have been effectively pursued without the pooling system, because the routes with small traffic demand (or high construction costs) but with social economic needs would have been simply unviable if financed separately.

"Redemption Principle"

The so-called redemption principle is the second. The principle is specified in the toll road legislations as a major condition for setting toll rates. The toll rates are set so as to cover the total development costs (i.e., construction, right-of-way acquisition, operation and maintenance, and interest costs) within a specified period (i.e., a redemption period). In this equation, the redemption period greatly affects the annual cost level that must be covered by the toll revenue: for example, a shorter period would accelerate the debt repayment schedule, increase the annual payment and thus increase the toll revenue needed. The redemption period is set in order for the resulting toll rates to be reasonable given the economic benefits of the road services provided on the highways. In 1994, the original 30-year redemption period for the national expressway network was extended to 40 years in order to minimize toll rate increases (World Bank 1999).

According to the principle, tolls are to be removed upon completion of the redemption. However, there are arguments that the toll should remain imposed. The underlying reasons include: (i) the continuation of operation and maintenance costs; (ii) the possible need for costly

widening and environmental improvements in the future; (iii) the desirability of maintaining high-speed service by charging tolls (for the entire road network); and (iv) the possibility of further upgrading of toll concepts into congestion pricing (for the most efficient use of limited highway facilities in heavily traveled routes).

Current Status of Highway Public Corporations

As mentioned earlier, the operation of highway public corporations is currently one of the central discussion points in Japan's administration reforms. The discussion is in part general where it is claimed that almost all the government activities currently are not efficient enough and they need to be streamlined. In this regard, many public corporations, most of which are related to construction and financing activities, have been criticized and determined to be merged with others or be terminated. Apparently, reduction of overall government expenditure and underlying tax levy are the main focus in discussions of this kind.

In a sense, this increased criticism reflects the fact that Japan's economic growth has shifted from a rapid one during the past few decades to a moderate one, as many developed countries have experienced. Indeed, the development of infrastructure was generally accepted by the public during the 1960s to 1980s, when Japan's overall economic growth was excellent. However, triggered by the current stagnant economy since 1992, largely because of the after-effects of over-investment during the late 1980s, the public awareness about the government efficiency has become more active than before. Even after the current economic recession is overcome, the role of the government and the public corporations will not be the same as present.

In addition, there are discussions specific to the highway public corporations. The two financing strategies just described are central to these discussions. While they have contributed to the accelerated development of much-needed highway network in the country, now it is often claimed that they are no longer justifiable in the future. Firstly, because Japan has achieved most of the highly demanded (and therefore profitable) routes, the highways to be developed in the future would generally be the ones that are not so profitable. Because, with the toll pooling system, these unprofitable routes are to be cross-subsidized by the already completed profitable routes, issue is raised on equity among the road users in various regions. It is often pointed that the route selection is subject to political biases where the politicians, trying to attract more votes from the local supporters, attempt to induce more road investments in their election districts.

Unfortunately, the truth is that the current road development program with the toll pooling system is insensitive to profitability of each individual route. As such, the road selection often lacks justifiable economic grounds and is vulnerable to this kind of criticism.

Secondly, the future road selection also affects the redemption principle. In the future, the newly built roads will inevitably be those with less traffic and/or higher development costs. If these less profitable roads are included, the redemption schedule will be adversely affected. The new roads will increase the total amount to be redeemed without adding balanced revenue resources. In order to keep the toll rates at current levels, the redemption period may have to be extended. In other cases, the redemption may not be completed within currently specified period and portion of debts in the highway public corporations may remain outstanding at the end of current redemption period.

To make matters worse, the same kind of problem has already been observed in several occasions. JHPC (and local public corporations) develop stand-alone toll roads as well as national highways in the revenue pool. These toll roads are planned individually and do not necessarily form part of the nationwide network.[40] Although these roads are simply treated in the same way as the many toll road projects elsewhere, in the context of Japan's highway development system they can be thought of as a tiny revenue pool that are governed by the same redemption principles as the entire national network. As the redemption principle projects for the future removal of tolls on the national highway network, the 61 stand-alone toll roads across the country, totaling 568 kilometers, have been made toll-free as of 1999 (World Bank 1999). However, more than half of them could not redeem all the costs incurred and relied on the compensation from JHPC (Kato, et al. 2001). JHPC treats their individual toll roads as a whole and internally cross-subsidize the compensation from reserve accounts created with profits in other roads. But such a remedy will not be reliable when all the toll roads are finished and the redemption turns out to be unachieved.

Another occasion is the case of HSBA (i.e., Honshu-Shikoku Bridge Authority). When the Authority completed almost all the planned lengths on the three routes connecting the Shikoku Island with the mainland in 1999, it became apparent that the total amount of debt raised by the Authority was so large that the interest charges cannot be covered with the net

[40] In recent years, the pooling system has also been applied among stand-alone toll roads in Tokyo metropolitan area (e.g., in Kanagawa and Chiba Prefectures, near Tokyo).

operating gains of the Authority. For example, the income statement in fiscal 2000 revealed that the interest charges of ¥138 billion exceeded the net operating gains of ¥62 billion, resulting in the loss of ¥76 billion. As of the end of fiscal 2000, the accumulated loss was as large as ¥999 billion, most of which seemingly had been covered by the government subsidies and additional borrowings. Although a certain level of losses in early years had been anticipated from the outset, the actual losses exceeded it. The reason is that the current traffic revenue has been lower than expected; the operating revenue in fiscal 2000 was ¥87 billion, much less than the anticipated ¥131 billion (www.hsba.go.jp).

One urgent issue is how the unprofitable operation of HSBA can be treated in restructuring of the highway public corporations. While de-nationalization of the highway public corporations are under consideration, the financial condition of HSBA seems hardly suitable for that kind of schemes. More importantly, these observations in HSBA as well as in JHPC's stand-alone toll roads have sent discouraging signals on the general strategies of toll pooling and redemption principle in the highway public corporations. In these occasions, it has turned out that the traffic forecast is not always reliable and the indebtedness of the public corporations is unbearably large. It is thought that their financial strategy cannot properly address the possible future financial distress and it may have been used to differ the appearance of the problem, instead (Kato, et al. 2001). The need is recognized to closely investigate the reality of the so-claimed "well functioning" operation of the highway public corporations.

6.1.3. Japan Highway Public Corporation

Review of the Past Financial Records

Overview

Established in 1956, the Japan Highway Public Corporation (JHPC) is the executive authority for Japan's highway development and management. It is the largest of the four highway public corporations in terms of the annual budget and the total highway length. In fiscal 2000, its budget totals about 5.4 trillion yen. Its responsibility includes the construction, repair, and maintenance of national expressways, collection of tolls, and operation of highway-related service facilities. At the end of fiscal 2000, it has constructed and owns about 7,700 kilometers of high-performance, access-controlled toll highways running throughout the nation.

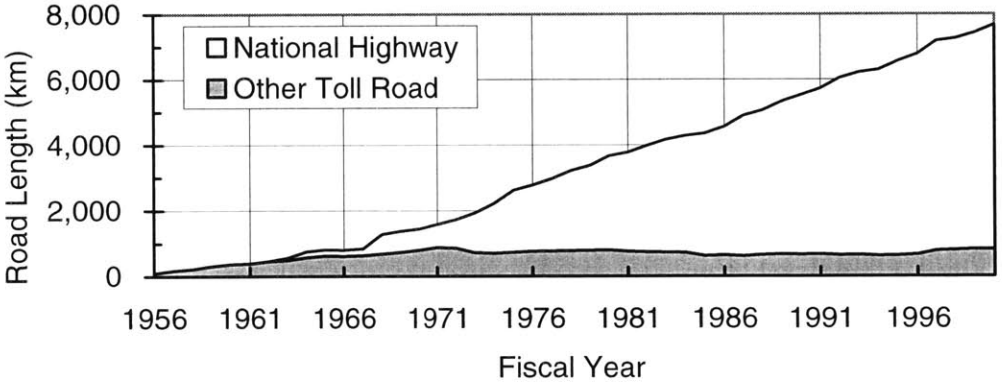
As mentioned, the initial condition of highway development was a significant lack of improvement, compared to other developed countries. In order to catch up with the preceding countries, Japanese government accelerated the construction of its highway network. Figure 6-1 and Figure 6-2 demonstrate that Japan's highway has been rapidly expanded after 1970s. While it was quite an achievement, the accelerated construction resulted in the current high level of debt outstanding in JHPC.

Table 6-4 Summary of Annual Budget for JHPC in Fiscal 2000

(Unit: billion yen)

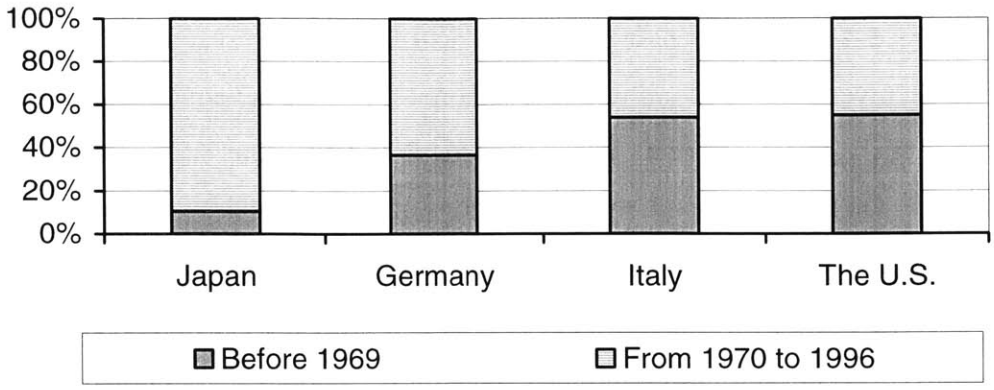
Revenues		Expenses	
Toll and other revenues	2,129	Construction	1,283
Government equity	207	Repair	174
Government subsidy	104	Maintenance and overhead	352
Road bonds	1,305	Non-operating costs	3,347
Other bonds and loans	1,635	Other expenses	266
Other sources	41		
Total	**5,422**	**Total**	**5,422**

Note: The total amount may not match the sum of the distributions due to rounding error.
Source: JHPC Year Book (2001)



Source: JHPC Year Book (2001)

Figure 6-1 Highway Development History of JHPC

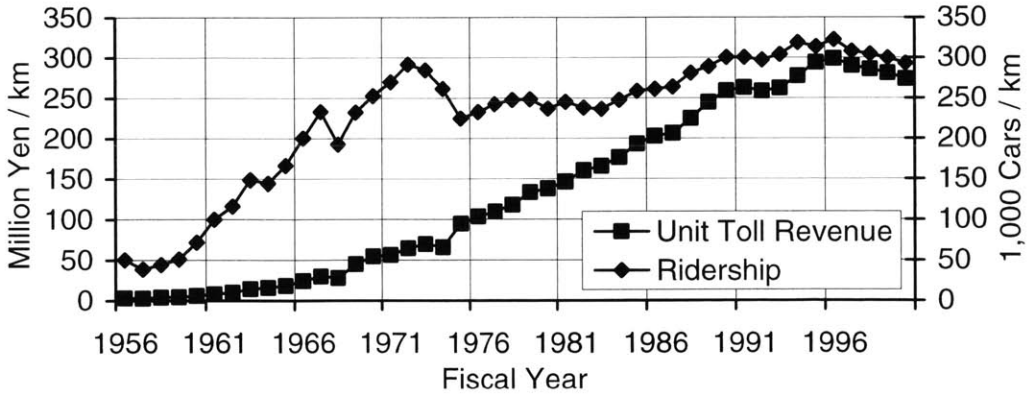


Source: MLIT Toll Road Website

Figure 6-2 Distribution of Achieved Highway Extension throughout the Time: An International Comparison

Trend of Traffic Demand

As the conceived highway network has been completed, the locations of newly built roads, in general, have shifted from heavily traveled corridors to relatively lightly traveled ones. Figure 6-3 shows the past trends of the traffic demands. While the unit toll revenue (total toll revenue divided by total highway length) increased gradually until the early 1990s, it has declined since 1996. On the other hand, average ridership (total counts of cars divided by total highway length) had grown rapidly during the 1950s and 1960s, whereas the growth was decelerated after 1970s. Also, the ridership has declined since 1996, as with the unit toll revenue. The current decline of overall traffic demand may be partly due to the country's stagnant economy, but the past trend since the late 1970s suggests that the traffic growth is likely to be modest in the future.

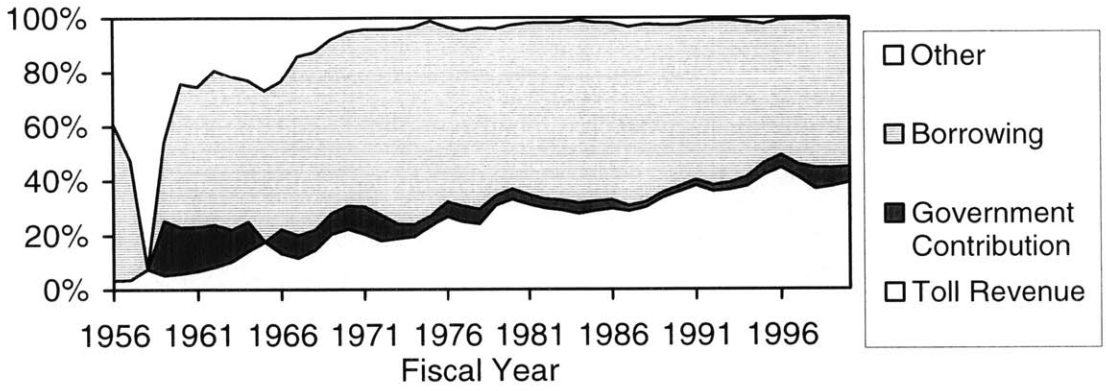


Source: JHPC Year Book (2001)

Figure 6-3 Past Trend of Traffic Demand

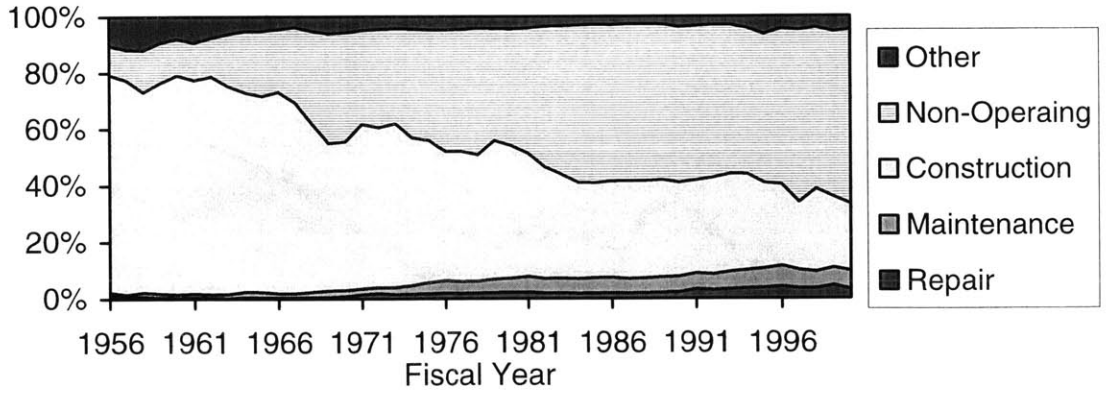
Trend of Revenues and Expenses

The Figure 6-4 shows the past records of distributions in revenue sources of JHPC. Although the traffic revenue has becoming to share more of the total revenues, the change is slow. JHPC has continuously relied on debts and government contributions at a similar proportion throughout the time. On the other hand, the distributions of expenses (shown in Figure 6-5) have greatly been changing. Significantly, the non-operating costs (mostly debt service costs) have replaced large part of share of the construction expenses. From the figure, it is seen that the financing costs have been becoming more and more dominating an expense item in the JHPC's budget structure.



Source: JHPC Year Book (2001)

Figure 6-4 Distributions of Revenue Sources of JHPC



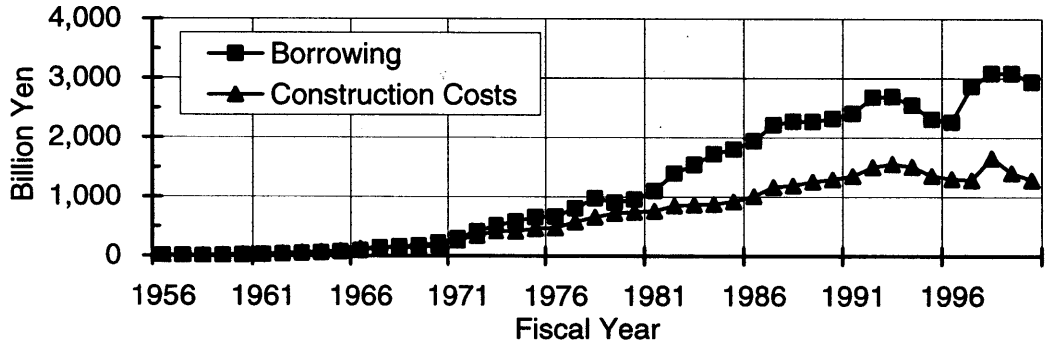
Source: JHPC Year Book (2001)

Figure 6-5 Distributions of Expense Items of JHPC

It is interesting to see a more drastic transition of budget structure in JHPC's highway development. The Figure 6-6 shows the past records of their borrowing and construction costs.

While, in principle, the borrowing is to be made to finance the construction of national highway infrastructure, the actual amount of debt raised annually has exceeded the construction investments since around 1970. Moreover, the disparity has generally been getting larger as time goes on.

Seen with the expense distribution chart shown in Figure 6-5, it seems that these annual borrowing amounts that exceed the construction costs are mostly used for the non-operating expenses (i.e., debt service expenses for interests and principal repayments). A rough statement would be that a considerable part of JHPC's efforts is currently directed to a refinancing of their debts. In turn, the accumulation of the outstanding debts has presumably been caused by the rapid extension of highway network. Stated simply, the pace of highway extension has been so aggressive that the debt has increased faster than the build-up of traffic revenue base.



Source: JHPC Year Book (2001)

Figure 6-6 Trend of Borrowing Amounts and Construction Costs in JHPC

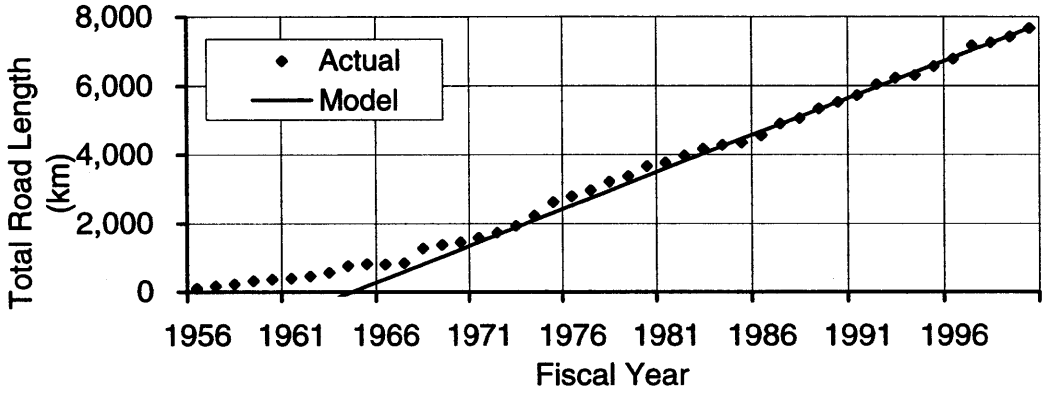
Financial Projection of JHPC: Base Case

From the overview of the financial records of JHPC, it has been found that the future traffic demand may not be so hopeful. Also, the level of borrowing in JHPC is so large that the current operating revenue alone may not be sufficient to cover the debt service costs. Then, it becomes doubtful that the redemption period, currently proposed to end in fiscal 2044, will be actually met. In this section, the future financial projection of JHPC is conducted and the robustness of the estimates is examined.[41]

[41] The conducted financial projection is intended to be illustrative and the obtained results do not necessarily reflect the actual financial condition of JHPC. It is presented here for a sole purpose of identifying the key issues for JHPC's sustainable highway developments and the possible areas of private contributions in the future.

Assumptions 1: Highway Development Plan

As of 2000, JHPC owns 6,851 kilometers of high-performance toll roads and 824 kilometers of standard toll roads. The length of annual construction of the high-performance toll roads is assumed to be 214.6 kilometers per year, from the arithmetic average of the past 10 years. The construction stops when the total length reaches 11,520 kilometers of currently planned highway network. The length of standard toll roads is assumed to remain the same and be included in the total highway length for simplicity.



Source: JHPC Year Book (2001)

Figure 6-7 Highway Construction Pace

Assumptions 2: Revenues

a) Toll Revenues

From a regression analysis based on the actual data of the past 30 years, the unit toll revenue (i.e., toll revenue from unit length (one kilometer) of the highways) is presented as in the following equation:

$$p(t) = -17.7328 + 9.02717 \times 10^{-3} \times t$$

, where p(t): unit toll revenue (billion yen/km), and

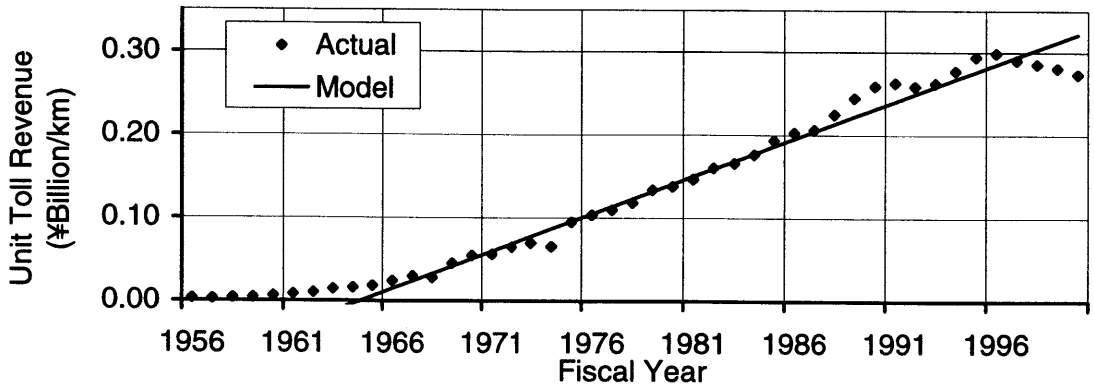
t: year.

The equation yields unit toll revenue of about 330.6 million yen per kilometer in fiscal 2001 increasing about 9 million yen per kilometer annually. Toll Revenue is obtained by applying this unit toll revenue to the following equation:

$$P(t) = p(t) \times L(t)$$

, where P(t): toll revenue (billion yen), and

L(t): total highway length at year t.



Source: JHPC Year Book (2001)

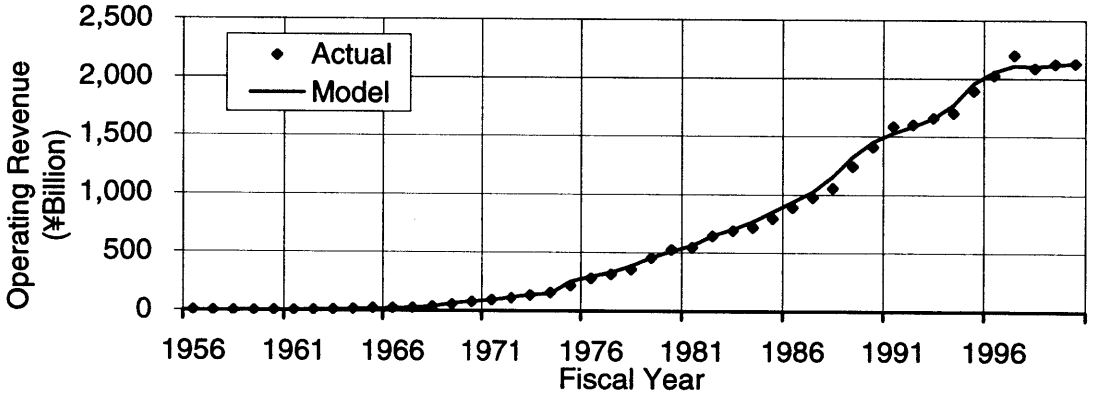
Figure 6-8 Unit Toll Revenue

b) Operating Revenues

The total operating revenue (i.e., toll revenue plus other operating revenues) is obtained from the following equation. The factor is the arithmetic average of the ratio of the total operating revenue to the toll revenue over the past 10 years:

$$O(t) = P(t) \times 1.015$$

, where O(t): total operating revenue (billion yen).



Source: JHPC Year Book (2001)

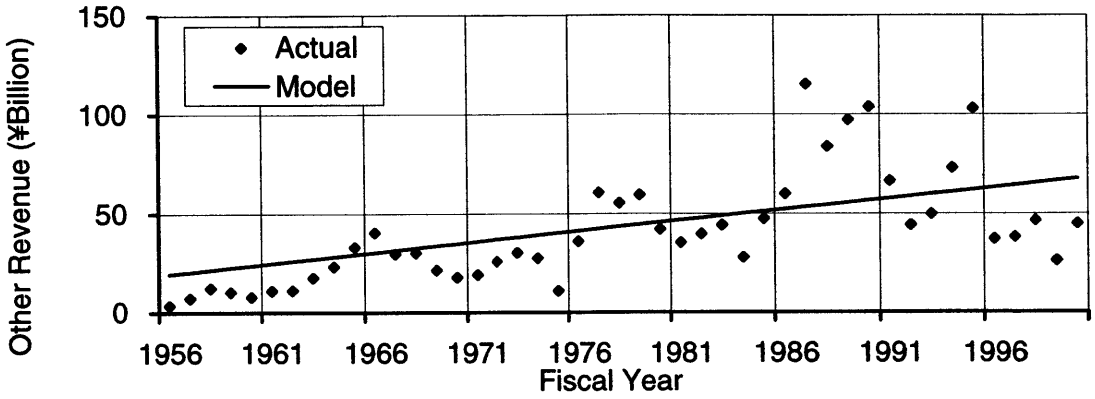
Figure 6-9 Operating Revenues

c) Other Miscellaneous Revenues

From a regression analysis based on the actual data of the past 30 years, the other miscellaneous revenues are obtained as in the following equation. The equation yields other miscellaneous revenue of about 68.7 billion yen in fiscal 2001 increasing about 1.1 billion yen annually.

$$OR(t) = -2.12402 \times 10^{3} + 1.09580 \times t$$

, where OR(t): other miscellaneous revenues (billion yen).



Source: JHPC Year Book (2001)

Figure 6-10Other Revenues

d) Total Revenue

Thus, the total revenue is obtained as follows:

$$R(t) = O(t) + OR(t)$$

, where R(t): total revenue (billion yen).

Assumptions 3: Expenses

a) Construction Cost

From a regression analysis based on the actual data of the past 30 years (exclusive of three points of abnormally high costs), the unit construction cost (i.e., unit cost of new construction for 1-kilometer highway) is presented as in the following equation:

$$c(t) = -3.24005 \times 10^{2} + 1.65548 \times 10^{-1} \times t$$

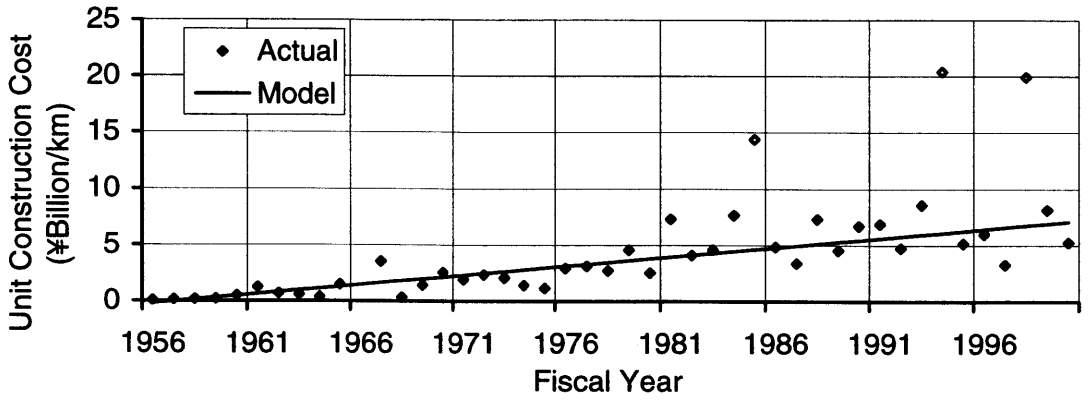
, where c(t): unit construction cost (billion yen/km).

The equation yields unit construction cost of about 7.3 billion yen per kilometer in fiscal 2001 increasing about 166 million yen per kilometer annually. Construction cost is obtained by applying this unit cost to the following equation:

$$C(t) = c(t) \times \Delta L(t)$$

, where C(t): construction cost (billion yen), and

$\Delta L(t)$: length of highway newly constructed in year t (km).



Source: JHPC Year Book (2001)

Figure 6-11Unit Construction Cost

b) Repair Cost

From a regression analysis based on the actual data of the past 30 years, the unit repair cost (i.e., unit cost of repair works for 1-kilometer highway) is presented as in the following equation:

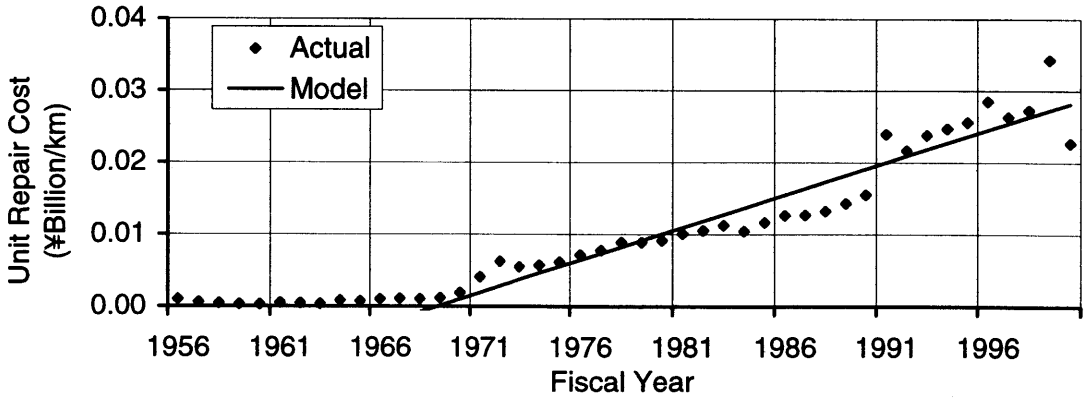
$$r(t) = -1.78155 + 9.04848 \times 10^{-4} \times t$$

, where r(t): unit repair cost (billion yen/km).

The equation yields unit repair cost of about 29.1 million yen per kilometer in fiscal 2001 increasing about 0.9 million yen per kilometer annually. Repair cost is obtained by applying this unit cost to the following equation:

$$Rp(t) = r(t) \times L(t)$$

, where Rp(t): repair cost (billion yen).



Source: JHPC Year Book (2001)

Figure 6-12Unit Repair Cost

c) Maintenance and Overhead Cost

From a regression analysis based on the actual data of the past 30 years, the unit maintenance and overhead cost (i.e., unit cost of maintenance works and overhead cost for 1-kilometer highway) is presented as in the following equation:

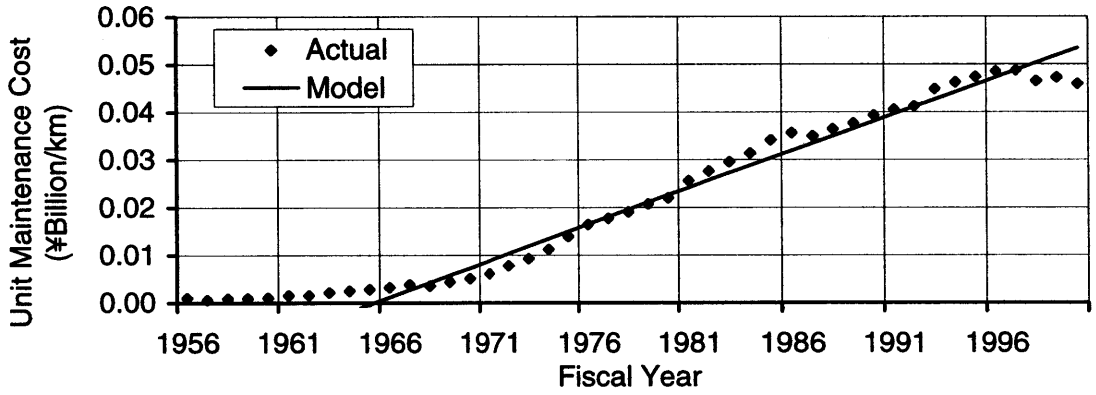
$$m(t) = -3.02229 + 1.53785 \times 10^{-3} \times t$$

, where m(t): unit maintenance and overhead cost (billion yen/km).

The equation yields unit maintenance and overhead cost of about 54.9 million yen per kilometer in fiscal 2001 increasing about 1.5 million yen per kilometer annually. Maintenance and overhead cost is obtained by applying this unit cost to the following equation:

$$M(t) = m(t) \times L(t)$$

, where M(t): maintenance and overhead cost (billion yen).



Source: JHPC Year Book (2001)

Figure 6-13Unit Maintenance and Overhead Cost

e) Other Miscellaneous Expenses

From a regression analysis based on the actual data of the past 30 years, the other miscellaneous expenses are obtained as in the following equation. The equation yields other expense of about 251.1 billion yen in fiscal 2001 increasing about 8.6 billion yen annually.

$$OE(t) = -1.69396 \times 10^{4} + 8.59103 \times t$$

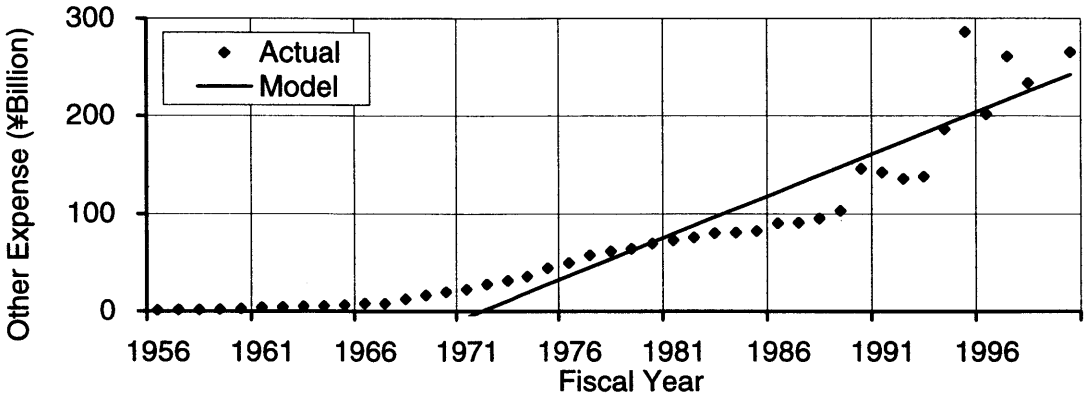
, where OE(t): other miscellaneous revenues (billion yen).

f) Total Expenses

Thus, the total expenses are obtained as follows.

$$E(t) = C(t) + Rp(t) + M(t) + OE(t)$$

, where E(t): total expenses(billion yen).



Source: JHPC Year Book (2001)

Figure 6-14Other Expenses

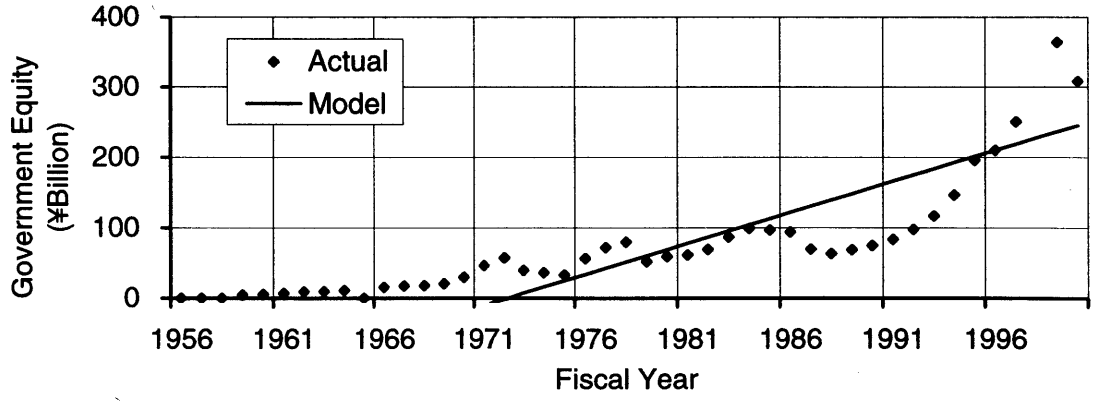
Assumptions 4: Financing

a) Government Equity

From a regression analysis based on the actual data of the past 30 years, the government equity contribution is obtained as in the following equation. The equation yields government contribution of about 254 billion yen in fiscal 2001 increasing about 9 billion yen annually. For the future projection, the assumption is that as long as JHPC continues to construct new highways, the government contributes equities according to the equation; however, no equity is contributed once new constructions are finished.

$$G(t) = -1.73844 \times 10^4 + 8.81479 \times t$$

, where G(t): government equity contribution (billion yen).



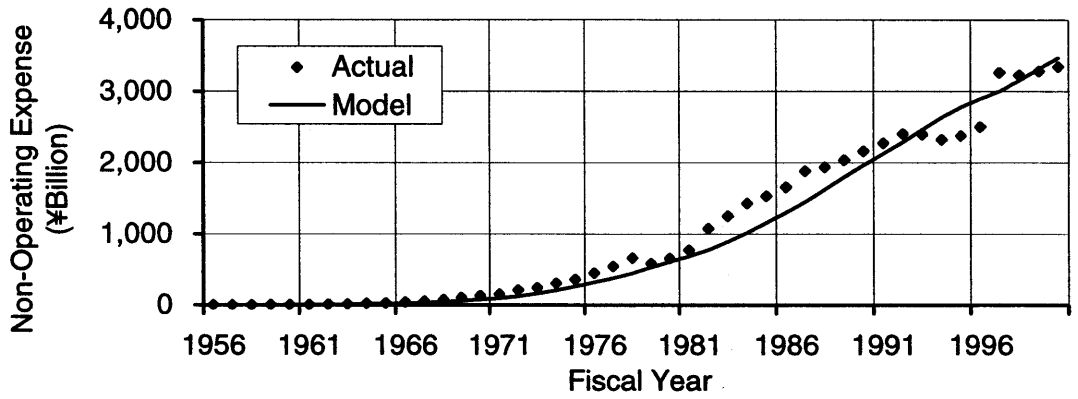
Source: JHPC Year Book (2001)

Figure 6-15Government Equity Contribution

b) Debt Service

It is assumed that the principals be repaid with equal amount of annual installment over 20 years after they are initially borrowed. From this assumption, the outstanding debt amount at the end of year 2000 is obtained as ¥26,762 billion, which is close to the actual ¥25,638 billion. It is also assumed that the overall interest rate charged on the debt be 5 percent. Non-operating expenses (or NOE(t)) are obtained in the following equation and demonstrates sufficiently good matching to the actual data.

NOE(t) = Principal Repayments + Interests



Source: JHPC Year Book (2001)

Figure 6-16Non-Operating Expenses

c) New Borrowing

When the operating expenses and non-operating expenses cannot be covered with the revenue and government equity, new debt is to be raised. If the new borrowing (or B(t)) is necessary, the amount is decided in the following equation.

$$B(t) = \{E(t) + NOE(t)\} - \{R(t) + G(t)\}$$

Result in the Base Case

The constructed model is as summarized in Table 6-5. From this model, the financial projection of JHPC is obtained for the next 50 years. This is such a long-term that the accuracy of the projection is inevitably uncertain. When one considers that JHPC's operation has only 45 years, the projection may seem even less meaningful. However, the model is necessary because the discussions of JHPC reform are centered on JHPC's argument that they will have redeemed all the bonds by year 2044 (i.e., 44 years after the start of projection). The obtained result has

confirmed the JHPC's estimate with reasonable accuracy; the redemption is achieved at year 2041, a slightly (4 years or about 10 percent) shorter than the official estimate.

Table 6-5 Model Summary

Category	Item	Assumption	Remark
Highway Development Plan	**Target Length**	10,520 km	Current Plan
	Total Highway Length at year t	L(t)	
	Annual Construction	$\Delta L(t) = 214.6$ km/year	Arithmetic Mean of the past 10 years
Revenues	**Operating Revenues**	$O(t) = P(t) \times 1.015$	Arithmetic Mean of the past 10 years
	Toll Revenue	$P(t) = p(t) \times L(t)$	
	Unit Toll Revenue	$p(t) = -17.7328 + 9.02717 \times 10^{-3} \times t$	Regression from the past 30 years
	Other Miscellaneous Revenues	$OR(t) = -2.12402 \times 10^{3} + 1.09580 \times t$	Regression from the past 30 years
	Total Revenue	$R(t) = O(t) + OR(t)$	
Expenses	**Construction Cost**	$C(t) = c(t) \times \Delta L(t)$	
	Unit Construction Cost	$c(t) = -3.24005 \times 10^{2} + 1.65548 \times 10^{-1} \times t$	Regression from the past 30 years
	Repair Cost	$Rp(t) = r(t) \times L(t)$	
	Unit Repair Cost	$r(t) = -1.78155 + 9.04848 \times 10^{-4} \times t$	Regression from the past 30 years
	Maintenance Cost	$M(t) = m(t) \times L(t)$	
	Unit Maintenance Cost	$m(t) = -3.02229 + 1.53785 \times 10^{-3} \times t$	Regression from the past 30 years
	Other Miscellaneous Expenses	$OE(t) = -1.69396 \times 10^{4} + 8.59103 \times t$	Regression from the past 30 years
	Total Expenses	$E(t) = C(t) + Rp(t) + M(t) + OE(t)$	
Financing	**Government Equity**	$G(t) = -1.73844 \times 10^{4} + 8.81479 \times t$	Regression from the past 30 years Provided during construction
	Overall Interest **Rate**	5 %	
	Repayment Period	20 years	Equal amount of annual installment
	Non-Operating Expenses	NOE(t) = Principal Repayments + Interests	
	Annual Borrowing	$B(t) = \{E(t) + NOE(t)\} - \{R(t) + G(t)\}$	

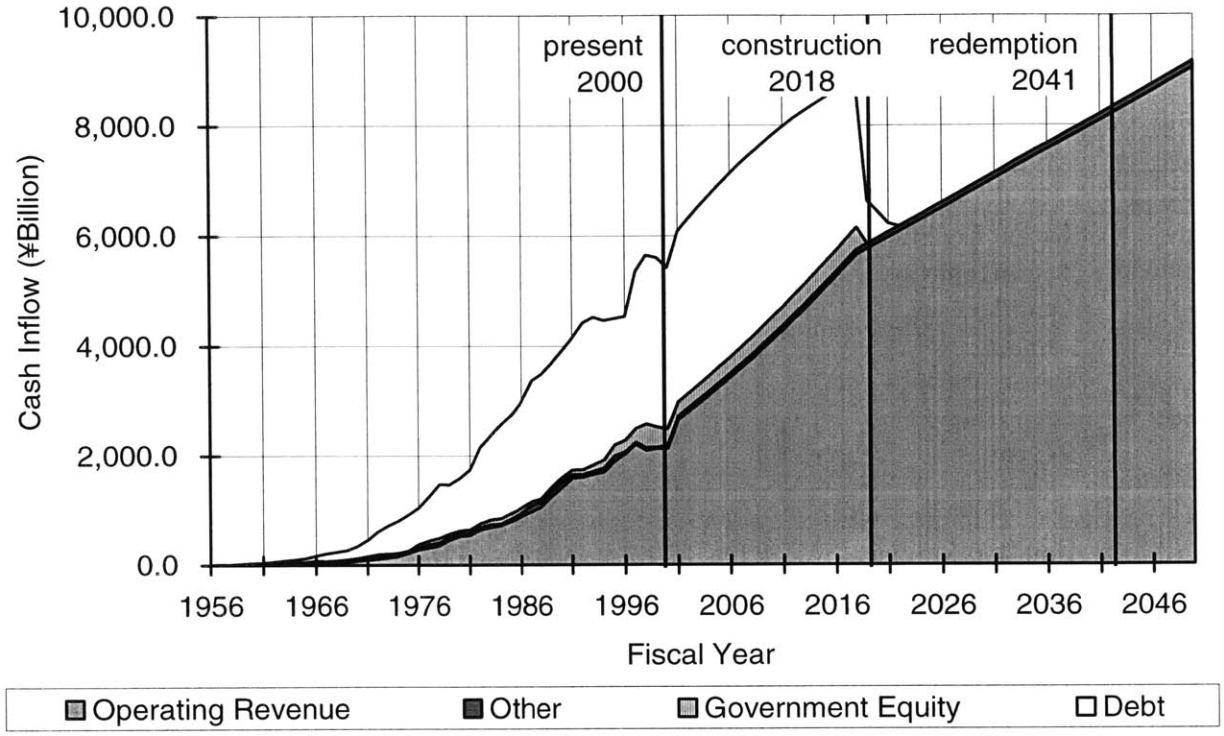


Figure 6-17JHPC Financial Projection (Revenues)

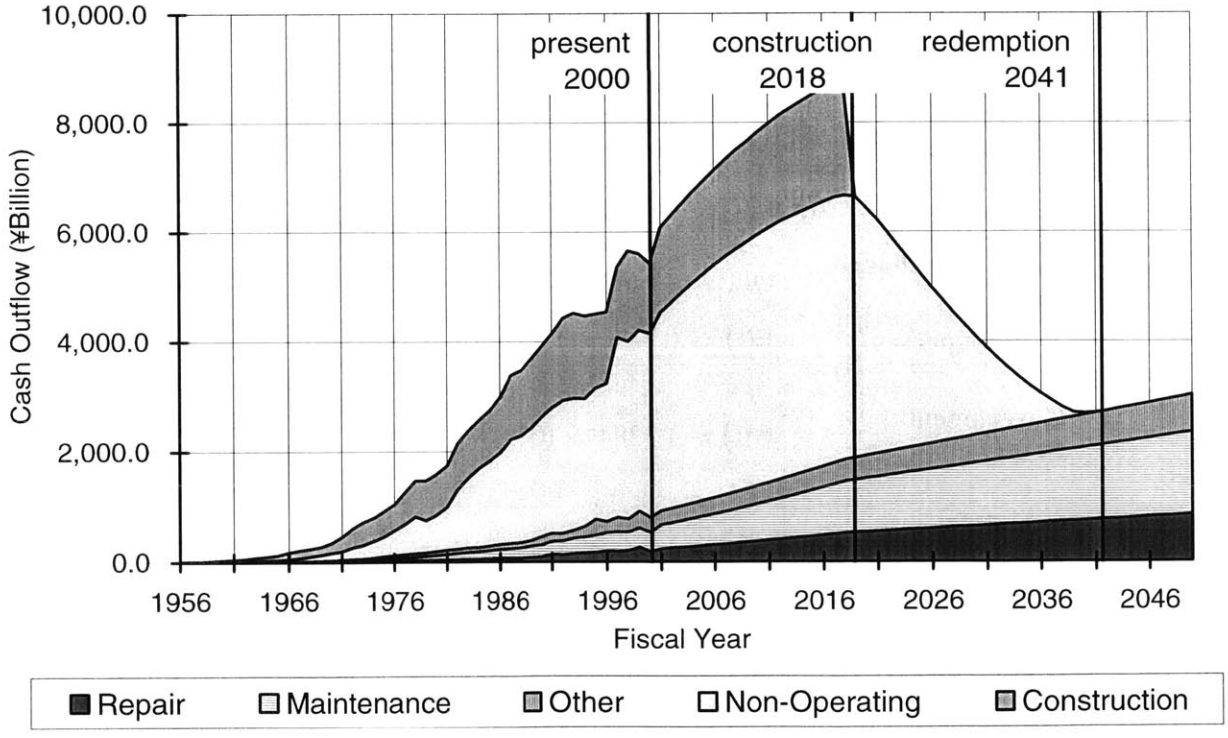


Figure 6-18JHPC Financial Projection (Expenses)

Table 6-6 JHPC Financial Data (Billion Yen)

	Revenues					Expenses					
	Operating Revenue	Government Equity	Debt	Other	Total	Construction	Repair	Maintenance	Non-Operating	Other	Total
1956	0.3	0	5.0	3.4	8.7	6.7	0.1	0.1	0.9	0.9	8.7
1957	0.5	0	6.0	7.2	14	10	0.1	0.1	1.5	1.6	14
1958	1.0	0	0	12	13	10	0.1	0.2	2.0	1.6	13
1959	1.2	4.5	6.5	10	23	17	0.1	0.3	3.2	2.1	23
1960	1.9	5.5	17	7.9	32	25	0.1	0.4	4.2	2.6	32
1961	2.9	7.0	22	11	43	32	0.2	0.6	5.7	4.0	43
1962	4.8	9.0	33	11	58	45	0.2	0.7	8.0	4.4	58
1963	8.4	10	46	18	81	59	0.2	1.2	15	5.0	81
1964	14	11	52	23	100	71	0.6	1.9	22	5.3	100
1965	22	0	68	33	123	85	0.6	2.3	29	6.4	123
1966	23	15	94	40	172	123	0.8	2.6	38	7.8	172
1967	24	17	138	30	209	141	0.9	3.2	56	8.1	209
1968	35	18	157	30	240	142	1.3	4.5	79	13	240
1969	56	21	174	21	271	142	1.6	6.0	106	17	271
1970	76	30	219	18	342	180	2.7	7.4	132	20	342
1971	93	46	298	19	456	265	6.5	10	153	23	456
1972	109	58	415	26	608	344	11	14	212	28	608
1973	135	39	515	30	720	417	11	18	243	31	720
1974	155	36	579	27	798	416	13	25	309	36	798
1975	216	33	658	11	918	461	16	36	360	44	918
1976	279	56	669	36	1,040	476	20	46	449	50	1,040
1977	314	72	807	61	1,253	577	23	53	543	57	1,253
1978	356	80	980	55	1,471	658	29	61	663	61	1,471
1979	455	52	902	60	1,469	720	30	70	585	64	1,469
1980	527	59	955	42	1,584	740	34	81	660	70	1,584
1981	546	61	1,102	35	1,744	760	38	96	777	73	1,744
1982	645	69	1,399	40	2,153	849	42	110	1,077	76	2,153
1983	691	87	1,545	44	2,367	864	47	123	1,253	80	2,367
1984	719	99	1,723	28	2,568	875	45	134	1,434	81	2,568
1985	794	97	1,799	47	2,737	920	51	148	1,536	82	2,737
1986	889	94	1,940	60	2,982	1,013	58	162	1,659	90	2,982
1987	974	70	2,215	115	3,374	1,167	62	171	1,883	91	3,374
1988	1,054	63	2,274	84	3,475	1,191	67	184	1,937	95	3,475
1989	1,241	69	2,270	97	3,677	1,260	76	201	2,036	103	3,677
1990	1,409	75	2,321	104	3,909	1,298	86	217	2,161	146	3,909
1991	1,584	83	2,408	66	4,142	1,355	137	232	2,275	142	4,142
1992	1,603	97	2,682	44	4,427	1,508	131	249	2,404	136	4,427
1993	1,661	117	2,694	50	4,521	1,561	148	279	2,396	138	4,521
1994	1,700	146	2,547	73	4,466	1,510	156	291	2,323	186	4,466
1995	1,892	196	2,310	103	4,500	1,359	168	311	2,376	286	4,500

Source: JHPC Year Book (2001)

Table 6-7 JHPC Financial Data *Continued* (Billion Yen)

	Revenues					Expenses					
	Operating Revenue	Government Equity	Debt	Other	Total	Construction	Repair	Maintenance	Non-Operating	Other	Total
1996	2,027	210	2,261	37	4,534	1,306	193	329	2,505	202	4,534
1997	2,202	251	2,864	38	5,355	1,287	189	350	3,268	261	5,355
1998	2,090	434	3,084	47	5,654	1,656	198	338	3,229	234	5,654
1999	2,126	364	3,088	26	5,605	1,408	255	351	3,285	306	5,605
2000	2,129	308	2,940	45	5,422	1,283	174	352	3,347	266	5,422

Source: JHPC Year Book (2001)

Table 6-8 JHPC Financial Projection (Billion Yen)

	Revenues					Expenses					
	Operating Revenue	Government Equity	Debt	Other	Total	Construction	Repair	Maintenance	Non-Operating	Other	Total
2001	2,646	254	3,114	69	6,082	1,557	229	434	3,611	251	6,082
2002	2,792	263	3,182	70	6,307	1,593	243	458	3,754	260	6,307
2003	2,942	272	3,235	71	6,520	1,628	257	483	3,884	268	6,520
2004	3,096	280	3,278	72	6,727	1,664	271	508	4,007	277	6,727
2005	3,254	289	3,309	73	6,926	1,700	286	535	4,121	285	6,926
2006	3,416	298	3,334	74	7,122	1,735	301	561	4,231	294	7,122
2007	3,582	307	3,346	75	7,311	1,771	316	589	4,332	303	7,311
2008	3,752	316	3,340	76	7,484	1,806	332	617	4,417	311	7,484
2009	3,926	324	3,325	77	7,652	1,842	349	646	4,496	320	7,652
2010	4,103	333	3,303	79	7,818	1,877	365	676	4,571	328	7,818
2011	4,285	342	3,270	80	7,977	1,913	382	706	4,639	337	7,977
2012	4,470	351	3,224	81	8,127	1,948	400	737	4,696	346	8,127
2013	4,660	360	3,156	82	8,257	1,984	418	768	4,733	354	8,257
2014	4,853	369	3,075	83	8,380	2,019	436	800	4,762	363	8,380
2015	5,051	377	2,990	84	8,502	2,055	454	833	4,788	371	8,502
2016	5,252	386	2,904	85	8,627	2,090	473	867	4,816	380	8,627
2017	5,457	395	2,807	86	8,745	2,126	493	901	4,837	389	8,745
2018	5,657	404	2,493	87	8,641	1,982	512	934	4,816	397	8,641
2019	5,763	0	782	88	6,633	0	522	952	4,753	406	6,633
2020	5,868	0	479	89	6,437	0	533	970	4,520	414	6,437
2021	5,974	0	159	91	6,223	0	543	987	4,270	423	6,223
2022	6,079	0	0	92	6,171	0	554	1,005	3,985	431	5,975
2023	6,185	0	0	93	6,278	0	564	1,023	3,688	440	5,715
2024	6,290	0	0	94	6,384	0	574	1,041	3,397	449	5,461
2025	6,396	0	0	95	6,491	0	585	1,058	3,112	457	5,212
2026	6,501	0	0	96	6,598	0	595	1,076	2,833	466	4,970
2027	6,607	0	0	97	6,704	0	606	1,094	2,562	474	4,735
2028	6,713	0	0	98	6,811	0	616	1,111	2,298	483	4,508
2029	6,818	0	0	99	6,917	0	627	1,129	2,042	492	4,290
2030	6,924	0	0	100	7,024	0	637	1,147	1,796	500	4,080

Table 6-9 JHPC Financial Projection *Continued* (Billion Yen)

	Revenues					Expenses					
	Operating Revenue	Government Equity	Debt	Other	Total	Construction	Repair	Maintenance	Non-Operating	Other	Total
2031	7,029	0	0	102	7,131	0	647	1,165	1,559	509	3,880
2032	7,135	0	0	103	7,237	0	658	1,182	1,333	517	3,690
2033	7,240	0	0	104	7,344	0	668	1,200	1,116	526	3,510
2034	7,346	0	0	105	7,450	0	679	1,218	911	535	3,342
2035	7,451	0	0	106	7,557	0	689	1,235	718	543	3,186
2036	7,557	0	0	107	7,664	0	699	1,253	537	552	3,042
2037	7,662	0	0	108	7,770	0	710	1,271	368	560	2,909
2038	7,768	0	0	109	7,877	0	720	1,289	211	569	2,789
2039	7,873	0	0	110	7,984	0	731	1,306	76	578	2,691
2040	7,979	0	0	111	8,090	0	741	1,324	34	586	2,685
2041	8,084	0	0	112	8,197	0	752	1,342	8.3	595	2,696
2042	8,190	0	0	114	8,303	0	762	1,359	0	603	2,725
2043	8,295	0	0	115	8,410	0	772	1,377	0	612	2,761
2044	8,401	0	0	116	8,517	0	783	1,395	0	620	2,798
2045	8,506	0	0	117	8,623	0	793	1,413	0	629	2,835
2046	8,612	0	0	118	8,730	0	804	1,430	0	638	2,872
2047	8,717	0	0	119	8,836	0	814	1,448	0	646	2,908
2048	8,823	0	0	120	8,943	0	825	1,466	0	655	2,945
2049	8,928	0	0	121	9,050	0	835	1,483	0	663	2,982
2050	9,034	0	0	122	9,156	0	845	1,501	0	672	3,019

Sensitivity Analysis

The financial projection conducted above is based on the assumptions that the past records of JHPC are to be maintained in the future. However, it is uncertain if the assumptions necessarily hold over the long-term of 50 years. As is always the case in this kind of projection, the sensitivity analysis is indispensable. Accordingly, tests are conducted for sensitivity of results to the four important factors: (1) traffic revenue, (2) interest rate, (3) government contribution, and (4) construction cost.

Traffic Revenue Sensitivity

The traffic revenue in the base case is forecasted by (1) doing regression analysis for the unit traffic revenue (i.e., the traffic revenue collected from a unit length of highway in operation) and (2) multiplying it by the total length of highway in operation. In the sensitivity analysis, the overall traffic revenue in the base case is decreased by 10 percent and 20 percent. This is partly to reflect the concerns that the highways to be built from now on will be in relatively less traveled corridors and the traffic revenue growth in the future may be decelerated as such

highways are included in the revenue pool. As shown in Table 6-10, the decreased traffic has a great degree of adverse effect on the redemption period and maximum debt amount on JHPC's account. In the worse case, redemption cannot be achieved by 2050 and JHPC would have to raise additional debt of 20,000 billion yen (based on the base case) at maximum. The debt amount in JHPC's account is charted in Figure 6-19.

Interest Rate Sensitivity

The interest rate in the base case is assumed to be 5 percent so that the current debt amount in the model resembles that of actuality and the past history of non-operating costs (i.e., debt service costs) can be reproduced. In the sensitivity analysis, the interest rates of 6 percent and 7 percent are applied. As shown in Table 6-10, the higher interest rates have a great degree of adverse effect on the redemption period and maximum debt amount on JHPC's account. In the worse case, redemption cannot be achieved by 2050 and JHPC would have to raise additional 20,000 billion yen of debt at maximum. The debt amount in JHPC's account is charted in Figure 6-20.

Government Contribution Sensitivity

The amount of government contribution in the base case is assumed from the regression analysis over the past 30 years. In the sensitivity analysis, the amount of government contribution in the base case is increased by 100 percent (i.e., doubled amount) and decreased by 100 percent (i.e., no government contribution). This is to reflect the recent decision resulting from the discussions on restructuring of JHPC, where the national government's direct contribution is to be eliminated in the future. (Namely, the latter case simulates the recent decision.) Because the government's direct contribution (about 300 billion yen in fiscal 2000) shares only a small part of total budget in JHPC (about 5,400 billion in fiscal 2000), the effect is limited. As shown in Table 6-10, as long as the traffic revenue and interest rate are as assumed in the base case, even the case of no government contribution achieves redemption in 2045 (i.e., 4 years later than the base case) with relatively small amount of newly raised debt (i.e., 7,000 billion yen). On the other hand, even if the government contribution was doubled, the improvement is also limited. The debt amount in JHPC's account is charted in Figure 6-21.

Construction Cost Sensitivity

The construction cost in the base case is forecasted by (1) doing regression analysis for the unit construction cost (i.e., the cost for constructing a unit length of highway) and (2) multiplying it by the total length of newly-built highway. In the sensitivity analysis, the overall construction costs in the base case is increased by 15 percent and 30 percent. This is partly to reflect the concerns that the highways to be built from now on will be in locations where land acquisition and construction itself may be relatively expensive. However, as shown in Table 6-10, the effect of increased construction cost is relatively small. Even in the worse case, the deterioration is comparable in the less poor cases in traffic revenue (10 percent decrease) and interest rate (6 percent) sensitivities. The debt amount in JHPC's account is charted in Figure 6-22.

Summary

From the sensitivity analyses, it was identified that traffic revenue and interest rate are of particular importance in the financial projection of JHPC. In these areas, careful forecasts are required. The government contribution, while it is one of the current topics in JHPC restructuring, has only limited impact on its financial projection. Also, every other thing being equal, construction cost has relatively small impacts, although its importance cannot be overemphasized. The sensitivity analyses confirmed that poor traffic revenue prospects and heavy financial burdens for JHPC can actually be serous threats for its future financial robustness.[42]

Table 6-10 Sensitivity Analysis Results

		Redemption	Maximum Debt Amount	Remarks
Base Case		2041	33,724 Billion Yen (2013)	
Traffic Revenue	10 % Decrease	2049	43,142 Billion Yen (2018)	
	20 % Decrease	Later than 2050	53,938 Billion Yen (2018)	
Interest Rate	6 %	2047	41,904 Billion Yen (2018)	Base Case 5 %
	7 %	Later than 2050	53,304 Billion Yen (2018)	
Government Contribution	100 % Increase	2038	29,621 Billion Yen (2008)	
	100 % Decrease	2045	41,277 Billion Yen (2018)	
Construction Cost	15% Increase	2044	39,997 Billion Yen (2017)	
	30 % Increase	2048	47,596 Billion Yen (2018)	

[42] As previously noted, the results should be interpreted as illustrative. The attentions should be directed to the sensitivities of results to important factors, rather than the figures themselves.

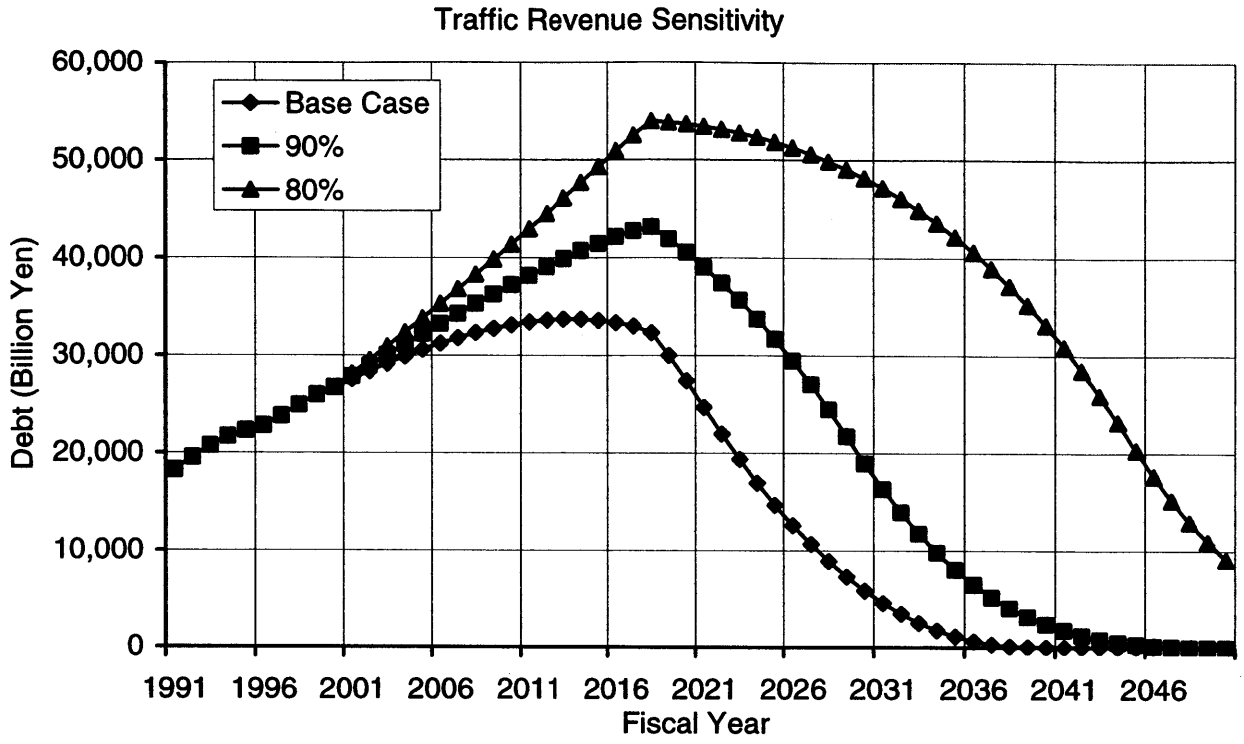


Figure 6-19Traffic Revenue Sensitivity

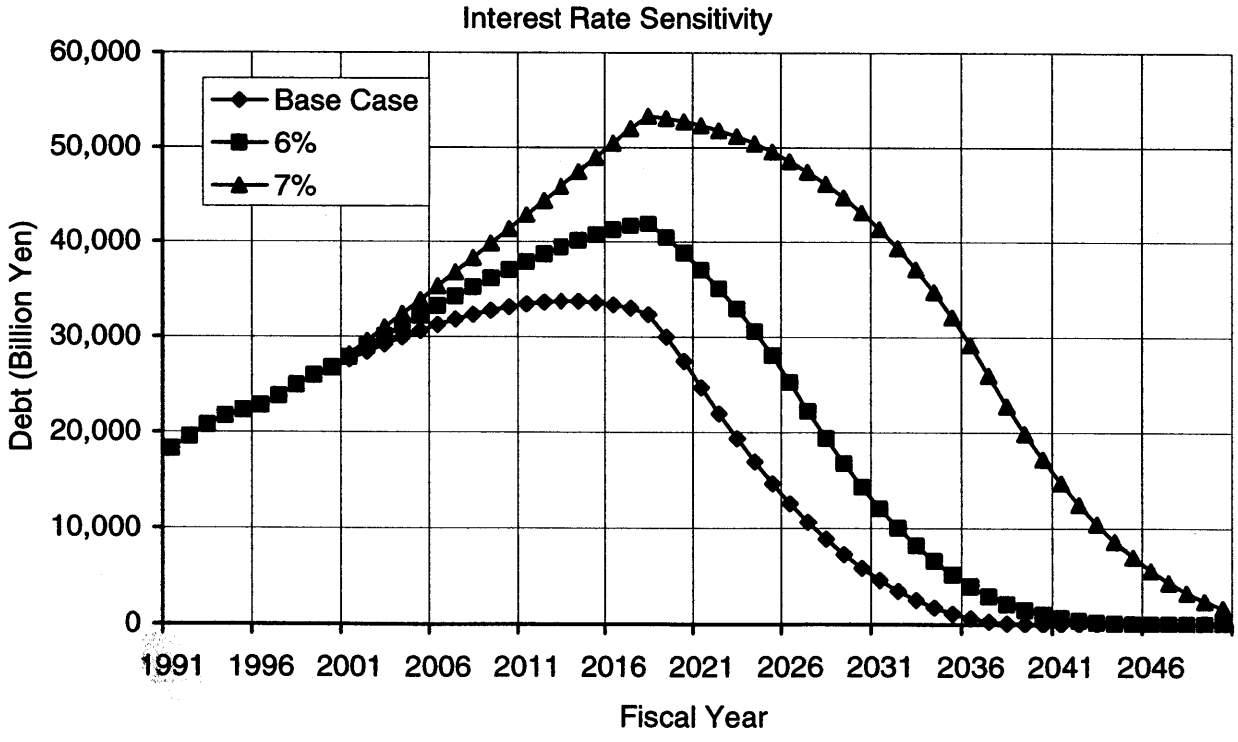


Figure 6-20Interest Rate Sensitivity

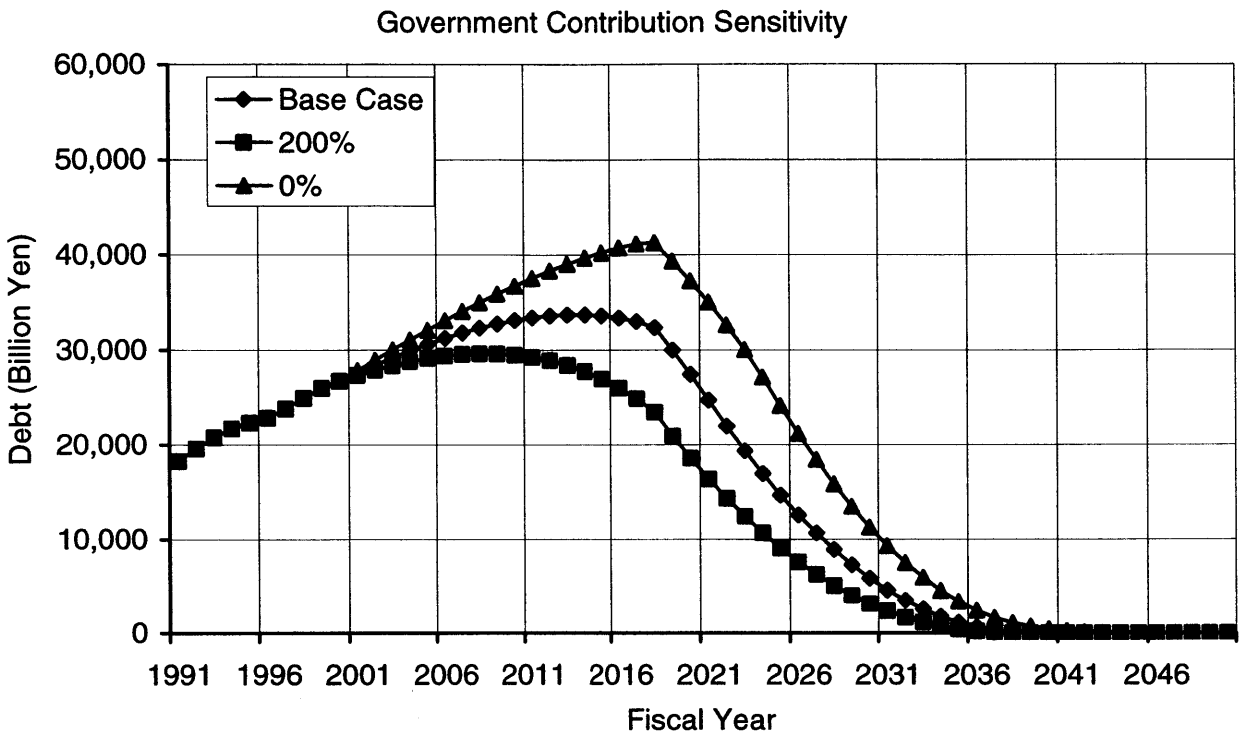


Figure 6-21Government Contribution Sensitivity

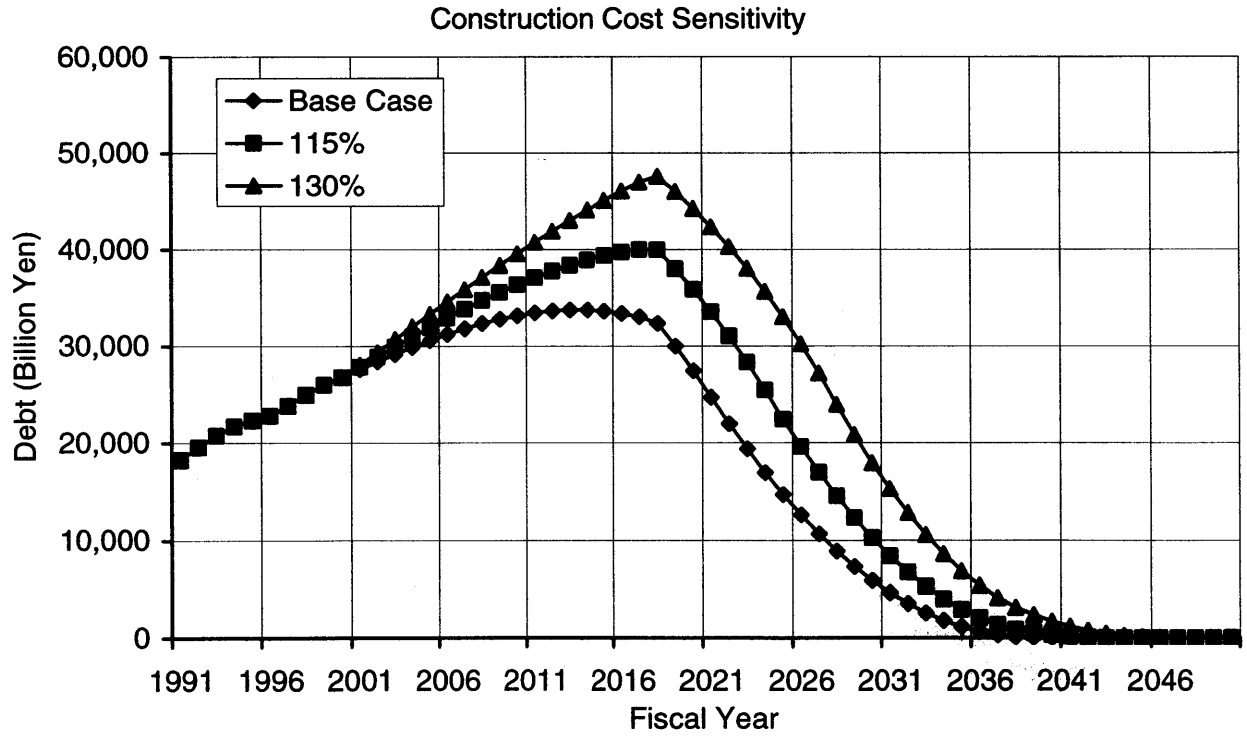


Figure 6-22Construction Cost Sensitivity

6.2. Japanese PFI

The financial problems for public sector in Japan are not only for the highway public corporations, but also broadly for national and local governments. Indeed, the Private Finance Initiative (PFI), developed in the UK, has gained the attraction of Japanese government officials as an alternative method for public works procurements and the legal environment needed for its implementation has been established. Although its implementation is yet to come in the field of highway development, PFI has so far been applied in considerable number of occasions, mainly in building sector. In this section, the legal framework of Japanese PFI and its current applications are briefed.

6.2.1. PFI Act and Related Policies[43]

In 1997, Japanese government announced that it would consider the implementation of PFI in public infrastructure procurement as one of the means of economic restructuring. Since the collapse of the Bubble Economy in the early 1990s, Japan had been facing terrible recession and struggling for recovery. The resulting decline in the tax revenues had forced the government to reduce the public expenditure, which made difficult the public infrastructure development under the traditional systems. Also, there was an expectation that PFI would create new business opportunities, particularly for the construction and the financial industry. About two years later, the Diet finally enacted the Private Finance Initiative Promotion Act (Law No.117 of 1999) in July 1999. The act went into effect in September 1999. Japanese PFI was officially launched.

The so-called PFI Act defined the objective of the program and established the basic rules that further legislations should observe. Although provisions regarding the implementation of PFI were not so detailed, the act aimed to promote PFI by requiring the government to take several actions. It was stipulated that the Prime Minister should issue a secondary ordinance to further elaborate the implementation methods and the so-called PFI Promotion Committee was to be organized.

In compliance with the law, the PFI Promotion Committee was formed with the nine experts from non-governmental organizations in October 1999. After extensive discussions, the *Basic Policies* of PFI was finalized by the committee and issued by the Prime Minister in March 2000. The *Basic Policies* provided the general and fundamental principles regarding the

[43] Kato (2001) provides a more extensive description on these legislation issues, including the actual articles in the PFI Act (Kato 2001).

implementation process: PFI project evaluation and selection, bidder invitation and selection, risk allocation, and government supports.

In the PFI Act, it was provided that the so-called *Implementation Policies* were to be prepared on project-by-project basis. While the PFI Act and the *Basic Policies* established the general rules in the PFI implementation, the specific conditions in individual projects are to be considered in this *Implementation Policies*. An *Implementation Policies* is supposed to cover the detailed information regarding: (1) outlines of the project (nature of the project, the scope of work, the schedule and so on), (2) operator selection process, (3) principles for risk sharing, (4) outline specifications, (5) dispute resolution process, (6) treatment of contract termination, (7) government support measures, and (8) other related issues.

Also, the committee published three guidelines for the PFI implementation: "*The Guideline for the Implementation Process of the PFI Project*" and "*The Guideline for Risk Allocation of the PFI Project*" in January 2001 as well as "*The Guideline for VFM (Value for Money)*" in July 2001. These guidelines were designed to address the most important issues in the implementation of PFI and serve as a reference for government officials to execute PFI projects.

Table 6-11 Timelines Regarding Establishment of PFI Legislations

Year	Month	Events
1999	July	The PFI Act was enacted.
	September	The PFI Act went into effect.
	October	The PFI Promotion Committee was formed and started the preparation of the Basic Policies.
2000	March	The Basic Policies of PFI were issued.
2001	January	"The Guideline for the Implementation Process of the PFI Project" and "The Guideline for Risk Allocation of the PFI Project" were published.
	July	"The Guideline for VFM (Value for Money)" was published.

6.2.2. Review of Japanese PFI Legislations

Objectives

According to the Basic Policies, the objectives in PFI implementation are: (1) to provide less expensive and better quality public services through the integrated procurement, and efficient and effective risk management of public infrastructure, (2) to reform the way that the public sector involves in public service provisions, and (3) to assist Japan's economic

revitalization by creating new business opportunities in PFI itself and other related industries (e.g., promotion of project financing in financial markets). In all these objectives, a more active participation of the private sector is the underlying premises that could improve the public infrastructure services.

Project Selection

The PFI Act stipulates that PFI alternatives should be taken into consideration whenever they seem appropriate for the nature of specific projects. In addition to the projects conceived by the governments, PFI projects could be proposed by the private sector, although no formal procedure is provided in the legislations. When possibility is recognized to apply PFI concepts in a project, whether publicly or privately proposed, the advantage of PFI scheme is examined through the process of Value for Money (VFM) evaluation. PFI is adopted when it demonstrates higher VFM than a conventional method. The mechanics of VFM evaluation technique is detailed later.

Forms of PFI

Although they are not described expressly in the legislations, the following three types[44] of PFI arrangements are assumed in *the guideline for VFM (Value for Money)*. Also, they are often found in related publications. The distinction is based on the payment method from the government viewpoint.

Service sold to the public sector type, where the private sector finances, designs, builds, operates, and provides services to the public and the public sector pay for the provided service to the private sector. In other words, the private sector sells the service to the public sector at a predetermined price, as the name says.

1. *Financially free standing project type*, where the private sector designs, builds, finances, and operates a facility, recovering costs entirely through direct charges on the users of the asset (e.g., tolling) rather than from payments by the public sector. Public sector involvement is limited to enabling the project to proceed through assistance with planning, licensing and other statutory procedures.

[44] The three types are basically identical to the ones that are adopted in the U.K. PFI.

2. *Joint venture type*, which is the combination of the two types above. Where the costs of the project are not met entirely through charges on the end users, the government subsidy supplements the revenues from user charges. The subsidy is justified when the project is believed to provide social-economic benefits that monetary revenues do not fully reflect. In short, the government subsidy is to make viable a socio-economically beneficial but financially unprofitable project.

If the national government assumes liabilities as a result of these arrangements, the PFI Act stipulates that they cannot last longer than a period of 30 years.

Bid Process and Award Criteria

The bid process is outlined in *the Basic Policies* and *the Guideline for the Implementation Process of the PFI Project*. Primarily, the winning bid should be chosen through competitive bid process, where the lowest cost proposal is selected. However, because PFI, where designs are proposed by the private sector, entails other factors that should be taken into account in bid evaluation, so-called "*comprehensive evaluation bidding*" has been proposed and necessary legal grounds are being developed. The most important measurement in bid evaluation is VFM and it is explained in the next section.

A problem in the process is that the selection is made in a one-time bidding and there are no such steps as pre-qualification or short-listing, due to constraints of the laws regarding public procurements (e.g., so-called Kaikei-Rei or Accounting Act). Therefore, full efforts are required for each bidder to join a bidding where unreasonably large number of bidders competes. Given the overwhelming amount of tasks needed to prepare PFI project proposals, the bidding costs under the system can be unbearably high for the private bidders. In order for PFI to be widely used, reconsideration should be made in the long-lasted and therefore maybe outdated legal frameworks governing the public works procurements. (Nishino 2001)

As for the specifications, *the Basic Policies* and *the Guideline for the Implementation Process of the PFI Project* dictate that it should be minimal but definitive so that the private sector can fully exercise their technical capabilities and be evaluated on a level playing field. Also, the specification should be primarily based on service performance and not on facility's physical standard. In performance-based specification, care should be taken so that the evaluation of proposals be measured in an objective and pre-specified criteria.

Regulation

The Basic Policies and the guidelines provide only simple principles in regulating the PFI projects and leave the decisions on detailed mechanisms to individual projects. The provided general principles are that the managing government bodies should monitor the design, construction, operation and maintenance of the project, the financial conditions of the project company, and safety and environmental protection measures employed in the project. Although they are general, they show the government recognition of the needs for their commitment and regulatory oversight in PFI projects.

Risk Sharing

As with the regulation, *the Basic Policies* and the guidelines provide only simple principles in risk sharing and leave the detailed consideration to contracts in individual projects. The provided general principles are that all the risk should be identified and measured, and assigned to the best party to manage them. The shared risks should be expressed in the contracts. A method to do this is proposed in *the guideline for risk allocation of the PFI project* and presented in the next section.

Government Support

The PFI Act enlists a number of government supports that can be provided in PFI projects. They include the following:

1. *Use of public land for free or at a discount*: The national and local governments may let the project use public land for free or at a discounted price.
2. *Interest-free lending*: The national government may provide interest-free lending out of its budgets. Also, it may utilize a government financial institution (e.g., the Development Bank of Japan) to facilitate the lending.
3. *Supports for fund raising*: The national and local governments assist the private sector to raise necessary funds for the projects or specially consider issuance of local bonds.
4. *Supports for land acquisitions*: The government supports land acquisitions for the project (using eminent domain if necessary) so that the private undertaker can acquire and use the land with reasonable ease.

5. *Financial supports*: The national and local governments establish the legal and taxation environments to promote the successful implementation of PFI projects. Also, the governments provide the necessary financial and monetary assistance.

The Basic Policies further supports the provisions in the PFI Act. It states that the financial assistance, when provided, should be comparable to those that publicly financed projects could usually enjoy. Also, it states that the taxation treatments should be based on the existing laws for the time being, but other supporting measures should be employed subsequently. One issue here is that the depreciation of the physical assets is to be made over 38 years according to the related laws, while PFI projects are of terms shorter than 30 years. Because this mismatch leads to accounting loss at the end of PFI projects, the private sector is requesting the government to consider appropriate adjustments (Nishino 2001).

6.2.3. Project Evaluations in Japanese PFI

Because the PFI projects lasts for a long period of a few decades, great attentions are necessary in economical and financial evaluation of the projects that is used to analyze the strengths of project execution methods. Firstly, financial evaluation is important so that the participants are confident that the project will remain financially stable over its life. Secondly, a project evaluation method is needed in helping the government officials select PFI alternative over a conventional procurement method. The latter is Value for Money evaluation. It is so specific and crucial in PFI that one guideline (i.e., *the guideline for VFM*) has been devoted solely to explain an overall framework and mechanics of the evaluation.

The VFM evaluation is conducted by the government considering the implementation of PFI. It is to review whether or not PFI could bring savings in government expenditures and therefore would be worth pursuing. As detailed later in this subsection, VFM is a concept that represents the government cost savings from PFI implementation in obtaining the same level of public services as in the conventional method. If there is VFM, PFI is selected as the procurement method for a specific project. In addition, once PFI has been selected, the method is applied in evaluating private bidders' proposals, where the proposal with highest VFM wins.

In practice, the financial evaluation and the VFM evaluation are concurrent, because the government expenditure under PFI is mainly decided from the financial projection of the private operation. However, because, unlike financial evaluation techniques with great popularity, the

VFM evaluation is unique in PFI projects, this subsection focuses on the specific method of VFM evaluation. Nevertheless, it should be noted that underlying is the financial analyses conducted by the private sector (and the government) to obtain the estimates of public expenditure in the PFI alternatives.

Before the VFM Evaluation

Lately people have become more aware of proper use of their taxes and tend to ask their governments more accountability than before. Moreover, the governments, national or local, are facing severe fiscal shortcomings and have to spend their money economically. Consequently, Japanese public works have incorporated cost-benefit analyses as a standard process of their project selection, where the social economic benefits of a prospective project are compared to its total costs and economically worthwhile projects are to be selected for implementation. Also, the governments are obliged to publicize the results for accountability purposes.

Although they are important, the cost-benefit analyses have to be distinguished from the project evaluations discussed in this section. The cost-benefit analyses are tools to help the government officials select economically worthwhile projects to be implemented. Once the government has identified the necessity of a certain project, the project needs to be delivered anyway. In other words, the selection between the PFI and the direct public procurement is a methodological decision in meeting already identified project needs, while the cost-benefit analysis assists government officials in making project execution decision (in some form or another).

VFM Evaluation: the PFI Decision and the Bid Evaluation

Overview

When the needs of an infrastructure facility are confirmed through the economic evaluation mentioned above, the government then explores the way to provide the facility to the public. The PFI Act requires the government to take into account the use of PFI, when it is believed that the implementation leads to more efficient and effective execution of the project. The governments' primary option has been a publicly-financed direct procurement and now this is used as a benchmark and compared with a PFI project.

The notion of Value for Money (or VFM), an indicator of PFI benefits that has been

used in the U.K. where PFI was originated, plays a key role in PFI project evaluation in Japan as well. The VFM is an idea to represent an efficient and economical use of government money. In principle, VFM comes from two aspects of enhanced service quality and reduced costs. When the service quality remains unchanged, the lower cost leads to VFM; on the other hand, even when the cost is the same or increased, significant improvement in service quality can result in VFM.

It always is (or should be) the government's mission to provide better service to the public at a lower cost. The fundamental objective of PFI is to help the government achieve this mission by using private sector's managerial and technological capability. Then, the objective of PFI is expressed as to obtain VFM in government's infrastructure development. It therefore follows that the PFI is employed if and only if a PFI project demonstrates VFM.

The VFM evaluation is, literally, the method to examine whether or not the PFI has VFM and should be employed in a specific project. If the PFI project demonstrates its cost advantage over the conventional procurement, the PFI is said to "have value for money (VFM)" and should be selected.

While the quality improvement matters in theory, the cost reduction is used as the primary measure of VFM in practice, because the measurement of quality is difficult and often subjective. As for the costs, the VFM evaluation has two important features. First, it takes into account the total cost of the project. When the scope of work includes design, construction, operation and maintenance of the project, the VFM evaluation compares all the costs for these work segments. Second, the evaluation quantitatively measures the costs for risk.

Definition of VFM

The VFM is specifically defined as the cost savings for the government achieved through implementation of PFI. The estimated public expenditure under a conventional procurement method is called the *public sector comparator* (or PSC) and used as a benchmark against which the estimated public expenditure under PFI is compared. The latter is specifically called the *life cycle cost of PFI* (or LCC). As mentioned earlier, the VFM is measured for a same level of service quality in practice for the purpose of clear and objective comparison.

Mathematically, the VFM is expressed as follows. As mentioned, VFM is the measurable representation of the government goal in obtaining quality infrastructure service at minimal costs.

VFM = PSC – LCC

The calculation of two terms in the right-hand side of the equation follows.

Public Sector Comparator (PSC)

The formal definition of PSC is the total estimated public expenditure that the government would pay if the project were to be financed under the conventional procurement method. If the scope of project includes design, construction, maintenance, and operation, then PSC should account for all the estimated cost for these activities. Also, it is stated in *the guideline for VFM* that the indirect cost of the government regarding the management of the project should be included. Basically, the estimate for each of these activities would be acquired from the past record. Because the estimates are obtained as a stream of cash flow spread out for the entire period of the project, the cash flow is discounted into a net present value (or NPV). In converting cash flow into NPV, a risk free rate, such as the rate of the long-term government bonds, can be used as a government discount rate.

The figure calculated stands for all the explicit costs for the provision of the specific infrastructure facility. But, as mentioned earlier, the PSC should also account for the implicit costs for risk. Although the public sector has not expressly considered costs for risks, they should be considered to ensure equally footed comparison with private sector's cost estimate that usually takes them into accounts. The risk costs are separately calculated and added into the PSC in the adjustment step explained later.

Public Expenditure under PFI (LCC)

The expectations in PFI are that the private sector would bring significant cost savings for the public infrastructure provision. The *Basic Policies* states that these savings are expected to come from the integrated management of project phases, where the private sector could make full use of their managerial and technical capabilities.

In the VFM evaluation for the PFI implementation decision, the government, with appointed professional consultants, estimates the reduced costs under PFI and compares them with PSC described above. Because these estimates are provided by the government and not by the private sector, the estimated cost reductions may differ from the real offer from the private sector in bidding stage. The government estimates may be higher or lower than the private estimates. However, since these government estimates are the only available figure at this stage,

they are used as the decision criteria as to the PFI implementation.

In the bidding stage and the contract closing stage, this LCC is replaced by the real offer from the private sector. Because LCC in these stages reflects the actual prospects of the private sector companies, it serves as the measurement for the actual benefits of PFI and is used for the evaluation of private bids and the contract negotiation.

In the same way as PSC, LCC includes the estimated public expenditures for all the design, construction, maintenance, and operation of the project. It should be noted that the cash flow accounted for in LCC is not all the cost of the project but all the public expenditure. PFI does not preclude the government payment for the projects. Instead, the idea is that the government is to purchase the infrastructure services from the private sector and the price that the government pays for the services are considered in LCC.

Consequently, VFM primarily concerns about evaluating the "Services sold to the public sector" project, where the public sector pays all the cost in compensation for the services provided. The evaluation is not so clear-cut for the "Joint ventures" projects and the "Financially free-standing" projects, where the public sector pays part of or none of the cost of the project, respectively. In these arrangements, *the guideline for VFM* simply states that the evaluation should be based on whether PFI is believed to bring efficiency and effectiveness into the project.

Adjustments

As mentioned earlier, PSC should include the risk costs that the government implicitly assumes in infrastructure projects. The rationale is that the government has not accounted for the risk cost in their budget while the private sector spends significant money to mitigate the risks. Since LCC usually includes such risk costs, PSC should also include them in order to ensure fair and meaningful comparisons between PSC and LCC. *The guideline for VFM* proposes the following steps to calculate the risk costs to be added to PSC.

Risk identification

First of all, all the types of risk have to be identified. Although it is difficult to foresee the unforeseeable in the future, the risks should be identified and listed as comprehensively as possible. As a helpful guide, *the guideline for risk allocation of the PFI project* numerates typical forms of risks to be considered in each phase of a project, as shown in Table 6-12.

Risk quantification

Next, the identified risks are to be quantified in monetary terms. In doing so, two figures

of impacts (or consequences) of risks and probabilities of risks are estimated. The impact of risk is the possible monetary damage that the risk would cause when it were to materialize. The probability of risk is the likelihood that such an event actually happens.

After these figures are estimated for each year in the period of the project and for each type of risk, a product of the impact of risk and the probability of risk is taken to obtain the risk cost for a specific type of risk. Then, the products of all the risk types are summed into the risk costs.

$$\text{RiskCosts} = \sum \text{impact} \times \text{probability}$$

Table 6-12 Typical Forms of Risks to Be Considered

Phase	Risk Types
Preliminary survey and design phase risks	Delay of the completion of design Cost overrun in design Defects in design work
Land acquisition risks	Delay of the land acquisition Cost overrun in land acquisition
Construction phase Risks	Delay of construction completion Cost overrun in construction Third party damages Defects in construction works
Maintenance and operating phase risks	Delay of the start of operation Demand risk Failure in maintenance and operation Material damages in project facilities Tort liabilities Technology risk Defects in maintenance and repair works
Closing phase risk	Residual value risk Shortage of closing costs
Risks in the whole project life	Force majeure risk Financial risks (e.g., Inflation, Interest rates, and Currency exchange rates) Regulatory and legal risks (e.g., Tax rate changes, Technical standard changes, and Permitting)

Source: Cabinet Office, Japan (2001): "The guideline for risk allocation of the PFI project"

Theoretically, the impacts are given with a certain range of possibility. For example, the construction cost overrun may be estimated in the range of zero to, say, 20 percent of total cost estimate. Accordingly, the probability of cost overrun is given as a probability distribution function. Then, mathematical expression of risk cost for the cost overrun is given as follows:

$$\text{RiskCost}(\text{CostOverrun}) = \int x \times P(x)$$

, where x denotes the amount of cost overrun and P(x) the probability of cost overrun of the amount x.

While true in theory, the estimation of such accuracy is hard to obtain in practice. So *the guideline for VFM* suggests some approximation techniques. One of them is to assume a probability distribution function in discrete form, where a reasonable number of impacts are assumed and associated probabilities are assigned to each of the impacts. Then, the summation of all the products of impacts and probabilities are obtained as risk cost for a certain type of risk. Further, instead of estimating these figures for each year term, the risk cost may be calculated as an aggregate cost considered in the whole life of the project. In this approximation, the probability of risk is calculated as a probability that a certain type of risk could materialize during the whole period of the project. This should give a reasonable level of accuracy, while it cannot follow the discounting procedure. Alternatively, if the risk is managed by such means as insurance, the premium for buying such insurance may be used as the risk cost.

Other adjustments

Adjustments should also include other equitable adjustments, again, for the purpose of fair and meaningful comparison between PSC and LCC. Two aspects are suggested in *the guideline for VFM*. First, if PFI is to receive special financial supports (apart from payments for the service purchased) from the government such as low interest lending or government subsidy, the government costs for such supports should be added to LCC. Second, if the project, PFI or conventional, is to generate new source of taxes, these tax revenue for the government should be subtracted from LCC and/or PSC.

Summary

In summary, VFM is obtained in the following simple equation. PSC and LCC of the PFI project are calculated in the way just explained. The adjustments for the risk costs and the other factors are made. Finally, VFM is obtained as the difference between PSC and LCC (both adjusted).

$$VFM = PSC - LCC$$

$$PSC = NPV_{PSC} + RISK - TAX_{PSC}$$

$$LCC = NPV_{PFI} + AID - TAX_{PFI}$$

where, NPV_{PSC}: The gross net present value of the public expenditure under a conventional procurement,

RISK: The risks costs that the public sector implicitly bears under a conventional procurement,

TAX_{PSC}: Taxes a conventionally procured project would pay,

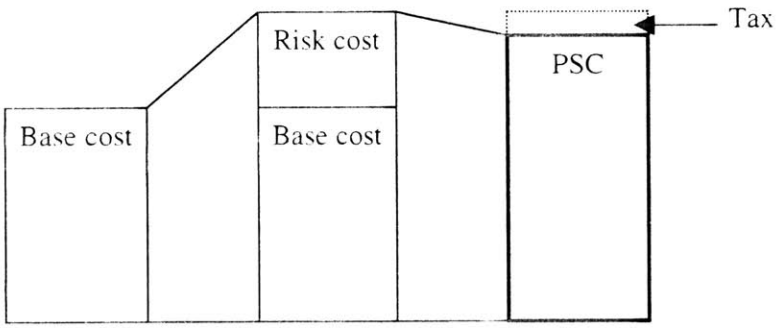
NPV_{PFI}: The gross net present value of the public expenditure under the PFI.

AID: Financial supports by the government, and

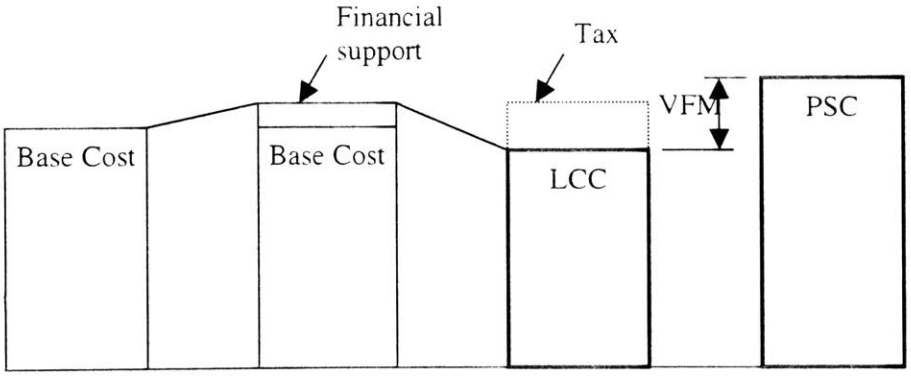
TAX_{PFI}: Taxes a PFI project would pay.

Obviously, the positive VFM means that it is believed that PFI contributes to the government cost saving and therefore should be implemented for the specific project in question.

Public Sector Comparator (PSC)



Life cycle cost of the PFI (LCC) and the Value for Money (VFM)



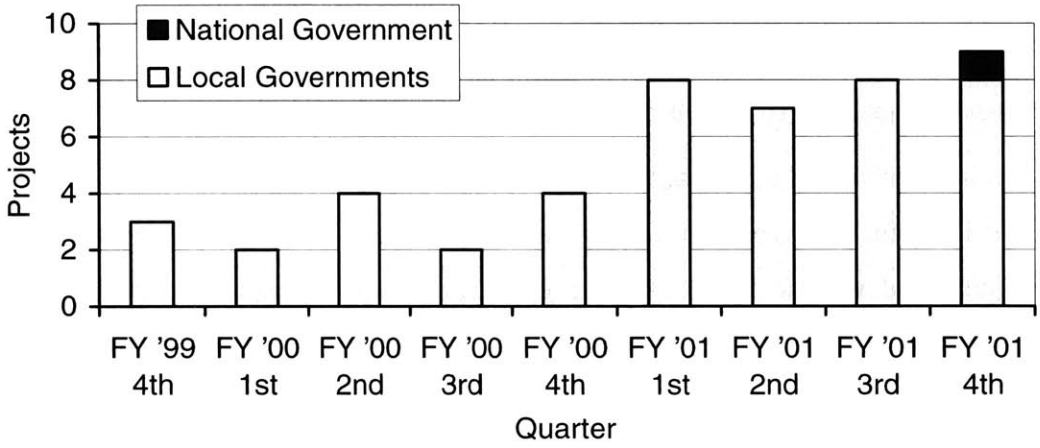
Source: Cabinet Office, Japan (2001): "The Guideline for VFM (Value for Money)"

Figure 6-23Value for Money (VFM) Calculation Concept

6.2.4. Early Examples of Japanese PFI Projects

Trends in PFI Implementation

Soon after the PFI Act had been enacted in 1999, its implementation started at local levels, broadly in the prefectural, municipal, and town governments. More accurately, three projects located in Tokyo metropolitan area had already been procured under PFI concepts at the time of the law enactment.[45] They were used as model projects in establishing aforementioned three guidelines. So far, PFI have increasingly been sought mainly in local governments and to a far less extent in the national government. Figure 6-24 shows the number of projects where *the Implementation Policies* have been issued (i.e., PFI has officially chosen as the procurement method and the private bids have been invited). PFI has mainly applied to building types (as opposed to infrastructure), as shown shortly.



Source: http://www8.cao.go.jp/pfi/iinkai.html

Figure 6-24Number of PFI Projects with the Implementation Policies Issued

PFI Has Been Mainly Pursued by Local Governments

As of April 2002, *the Implementation Policies* have been issued for total 50 projects, 49 of which are in local governments and only one is in the national government. Also, as many as 171 projects are under planning, which range from preparation of *the Implementation Policies* to preliminary feasibility analysis. Again, the projects by local governments share the vast majority in them. Table 6-13 and Figure 6-25 show the number of projects by managing agency and by

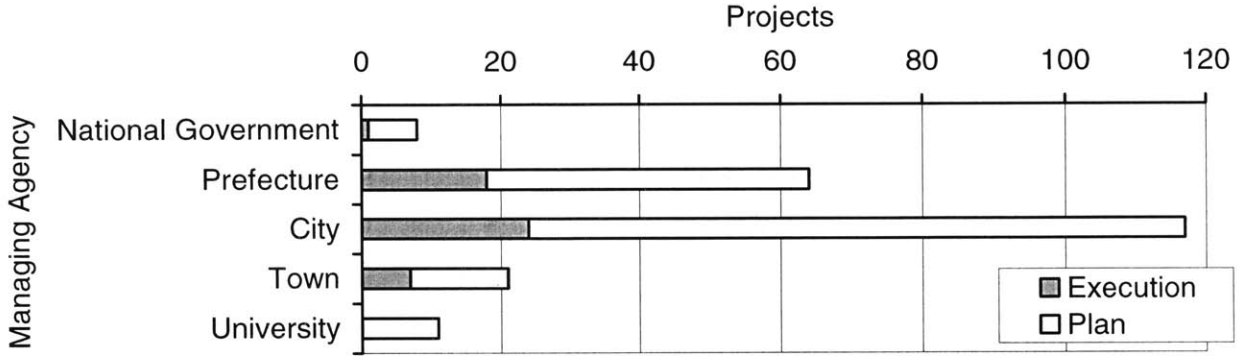
[45] The projects are (1) Kanamachi Co-generation Plant in Tokyo Metropolis, (2) Prefectural University of Health and Welfare in Kanagawa Prefecture, and (3) Kimizu Wastes Treatment Plant in Chiba Prefecture.

the development phases.

Table 6-13 Number of PFI Projects by Managing Agencies and Development Phases

	Execution Phase	Planning Phase	Total
Local Governments *	49	164	213
National Government	1	7	8
Total	50	171	221

Note: The figures in "Local Governments" include the projects by universities.
Source: www.pfinet.jp



Source: www.pfinet.jp

Figure 6-25Number of PFI Projects by Managing Agencies and Development Phases

Buildings Have Been the Major Areas of PFI Application

In terms of facility types, buildings (i.e., government offices, education and research facilities, medical and welfare facilities, leisure facilities, and regional development projects) share most of projects that have been proposed under PFI. Infrastructures (parks, water supply and wastewater treatment facilities, port facilities, and parking facilities) are only less than 25 percent of the total in terms of numbers. Table 6-14 and Figure 6-26 show the distribution of facility types and managing agencies.

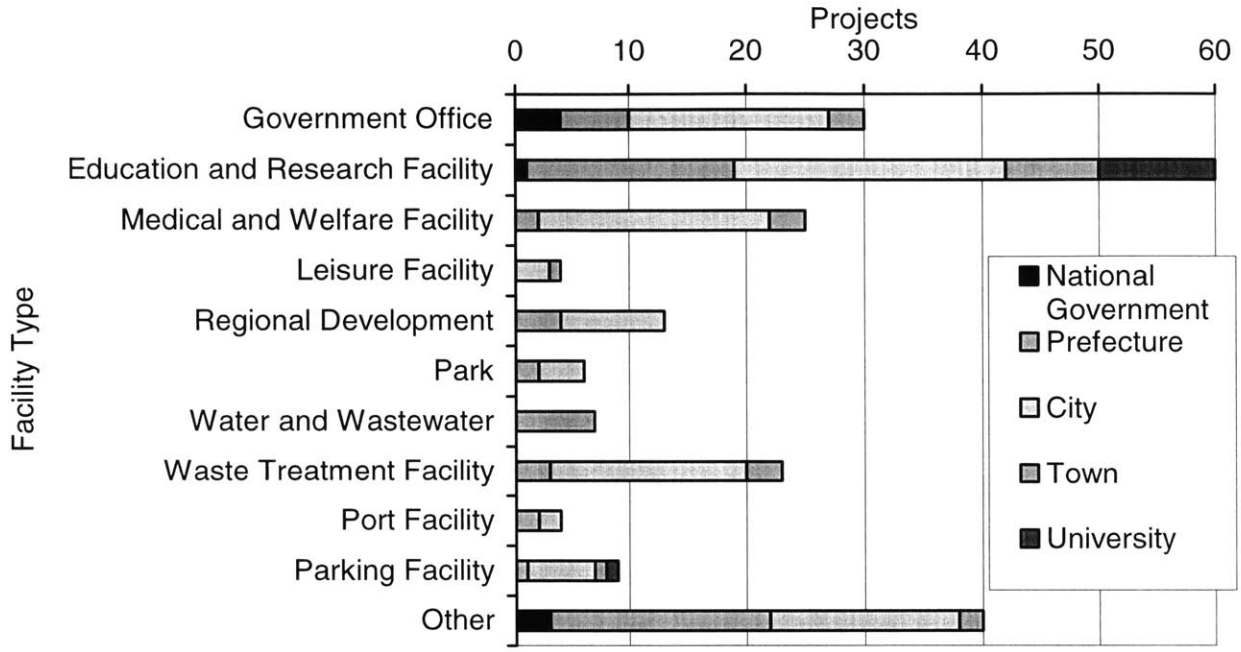
Table 6-14 Number of PFI Projects by Managing Agencies and Facility Types

	Building	Infrastructure	Other	Total
Local Governments *	127	49	37	213
National Government	5	0	3	8
Total	132	49	40	221

Note: The figures in "Local Governments" include the projects by universities.
Source: www.pfinet.jp

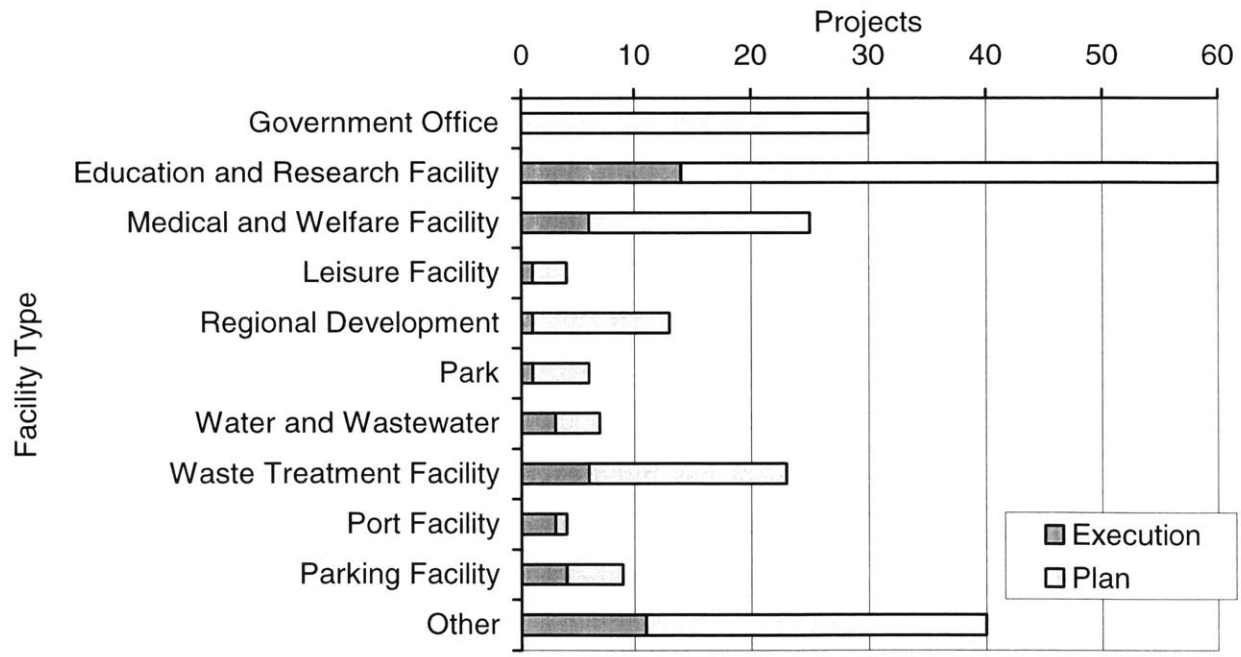
As shown in Figure 6-27, while many projects are under planning phases in building sector, infrastructure projects (exclusive of water and wastewater treatment facilities) are not

planned in the near future. These figures show that application of PFI in infrastructure sector has been and will be less active compared to that in building and other sectors.



Source: www.pfinet.jp

Figure 6-26Number of PFI Projects by Facility Types and Managing Agencies



Source: www.pfinet.jp

Figure 6-27Number of PFI Projects by Facility Types and Development Phases

Possible Reasons for the Trend

The observed trend in PFI implementation highlights that: (1) local governments applied PFI in many building projects and some infrastructure projects, (2) the national government is beginning to apply PFI to building projects, and (3) the national government has not started even planning of PFI projects in the field of infrastructure. The observation can be graphically summarized as in Figure 6-28.

	Building	Infrastructure
Local Governments	**Active**	**Less Active**
National Government	**Less Active**	**Non Active**

Figure 6-28Activeness of PFI Implementation in the Early Examples

Given that considerable shares of public works are procured by local governments with funding assistance from the national government[46], the tendency that the local governments share the majority in the managing agencies of PFI projects is somewhat natural. One thing that can be said would be that the funding assistances from the national government are insufficient to fulfill the funding needs for the local governments to provide their public facilities. Also, at the local government level, there may be lack of staffing levels or technical sophistication of the officials that makes attractive the integrated procurement enabled in PFI. From the private sector's point of view, the suggested shortfall in funding and/or staff capacity in the local governments would mean that potential market opportunity exists in PFI projects at the local level.

On the other hand, the national government may not pursue PFI solution so eagerly, because they have relatively ample tax revenues and technically sophisticated officials. While the local governments have their own tax resources, significant amount of their fiscal revenue comes from the local allocation taxes levied and distributed by the national government. Because of this system, the national government practically has the first claim to the overall national tax revenues. Also, the national government has hired excellent officials specialized in technical mattes through annually-held competitive exams, which prospective university graduates take for the positions with nationally acknowledged prestige.

However, a question still remains: Why has PFI not been broadly applied in the field of

[46] In fiscal 1999, about two-thirds of public construction works (totaling about 15 trillion yen) were in local governments and local-based agencies. (Source: Annual Statistics of Public Construction Started in fiscal 1999 (MLIT))

infrastructure? In the local governments, the application of PFI is less active in the field of infrastructure than in building sector. Furthermore, the national government has never implemented PFI in infrastructure procurement. One reason may be that the advantages of integrated procurement were more obvious in building sector than in infrastructure sector, because the building sector had experienced design-build approach in the private owner projects. In contrast, the infrastructure sector, dominated by the public owners, had long relied on design-bid-build approach. For the experts in infrastructure fields (owners, designers, and contractors alike), the integrated procurement of design, construction, operation and even financing under PFI might have been too large a leap to make in a short term.

In addition, maturity in the operation industry differs between in the building sector and in the infrastructure sector. For example, while private institutions exist in hospitals and schools, the infrastructures have been operated most exclusively by the public sector. Although there are notable exceptions (e.g., railway, electricity, and telecommunications companies), the sectors that are now under the responsibility of the public sector have been monopolized by the governments and their agencies. In absence of private operating companies, it may have been difficult for the government officials to be convinced that PFI would enable efficient and reliable public services.

Still there is another possible reason, which may be more fundamental than those above. The reason is concerned with the nature of infrastructure investment. The infrastructure investment usually is large and spreads over a long period of time. It is also irreversible in that once a facility is constructed, it necessarily remains there with only one possible way to use. Moreover, the demand is often hard to predict. The tenants for the building projects are often the government itself, while infrastructure is, by definition, provided for the public use. With the investment scale ignored, the demand predictability is far more favorable in the building sector than in the infrastructure sector. Additionally, buildings allow flexible use in that the government office floors could be remodeled and used for other uses if the floor space needs for the government activity change. In contrast, infrastructures are designed specifically for its initially conceived use. Obviously, roads are supposed to be used as roads and airports can only be used as airports. This irreversible and inflexible nature of investment with significant scale in infrastructure can be one of the important reasons for the less active PFI application in the sector.

6.3. Japanese PFI in Highway Development

In Section 6.1, the financial problems of Japan's highway development, particularly the highway public corporations, are reviewed. Also, Japanese PFI is introduced in Section 6.2. PFI is becoming common mainly in building-type projects by local governments, as a reform measure for constrained monetary and technical capacities in those governments. Following these reviews, this section presents discussions on the necessary reform measures to continue the development of Japan's still needed highway network. Although many on-going discussions focus on the policy reforms for the nation's highway development in general and the organizational reforms of the highway public corporations, this thesis deals with these issues only in a broad and somewhat qualitative manner. Rather, the focus of the thesis is the possibility of PFI application to the highway development, as a reform measure reinforcing the major policy changes in the area. The question is what PFI has to offer to improve the efficiency of highway development program in Japan.

6.3.1. Policy Reform for Japan's Highway Development

Observed Problems

In Section 6.1, the historical backgrounds of Japan's highway development are reviewed and its current status and future prospects are discussed. As noted, Japan has achieved a nationwide highway network in a remarkably short period through the use of highway public corporations. The accelerated development has been made possible largely by two strategies employed by the public corporations: the toll revenue pooling system and the redemption principle. Because these systems have allowed the public corporations to finance all the routes in the network as a whole, it has been believed that they are helpful in developing wider highway network, mixed with profitable and unprofitable routes, in a shorter period than structured otherwise.

Although the achievement of advanced highway network throughout the nation seems to support the strengths of the systems, the accelerated development has caused high level of debt in the highway public corporations. Recently, their large debt obligations have been attracting intense criticisms. These criticisms are based on the concerns that the promised redemption of their debt may not be actually achieved at the end of the redemption period. It has been pointed

out that the aforementioned highway development strategies (i.e., the toll revenue pooling system and the redemption principle) have tended to ignore the financial feasibility of individual routes, despite its advantages in quick development of nationwide highway network. When Japan's economy was rapidly growing in the past several decades, this accelerated highway development was highly appreciated and made this drawback of the system less significant. However, as Japan's economic growth is becoming stable rather than rapid and the highway routes with high-priority and accordingly high-demand have been constructed, the drawback becomes gaining more emphases.

The recently increasing criticisms against the nation's highway development seem to have its point. In Section 6.1, it is understood from the past financial record of JHPC that it has been spending more and more money in debt service payments. Also, it is found that the traffic revenue growth has been stable lately and may not be so large in the future. Further, the financial projection of JHPC reveals that the financial robustness of JHPC can be significantly weakened by lower future traffic demand and higher interest rates. Even if the traffic volume and interest rates are unchanged from the forecast, JHPC will find it necessary to raise more debts to finance the new construction and partially re-finance the outstanding debts, which may become difficult under the growing opposition against the large public expenditures for highway development. It is apparent that some reform measures are necessary.

Reform Measures in Highway Development

Responding to the public's concerns about the nation's large public expenditure, Koizumi administration is now tackling with administrative reforms. While the efforts are directed to various activities in many areas of public spending, the organizational reform of the highway public corporations is considered particularly important. The dominant direction of the discussion is that the current operation of the highway public corporations can be privatized. The proponents believe that because the current operation of the highway public corporations is making some profit, it can be separated from the government and organized as (almost) pure private companies. Such arguments are typical in general contexts of privatization efforts[47] and also in Japan's organizational reforms of public-owned companies, as exemplified by the railway companies and telecommunication companies.

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[47] See Chapter 2 for related discussions.

However, the situation is more complicated for the future extension of highway networks. Because the current highway development plan was established with the purpose of assisting balanced economic development in the nation, the plan originally included various routes with different locations and thus different demand potentials. Since the highways have been constructed for the routes with higher-priority, the routes with higher-demand potential have largely been completed, leaving the routes with lower-demand potential. These routes are, in general, less profitable than those already completed. If JHPC is to be re-organized as a private company, the new company, driven solely by financial concerns, may not be able to develop these roads. In such cases, the national government will have either to directly build those highways or to provide monetary support for the company, in order to achieve the originally intended policy objective.

The discussions on the organizational reform of the highway public corporations is still underway, and thus a number of scenarios can result regarding the future development of Japan's highway network. For the purpose of discussion, it is assumed here that JHPC (probably now a privatized company) is to be left with all or most part of the responsibility. Then, the following is a generic strategy for the future highway development, as a shared responsibility between the national government and JHPC. First, all the routes in the future highway network have to go through the process of cost-benefit analysis so that the government expenditure, direct or indirect, can be justified. The highway development necessarily accompanies large investments, which may come from tax money. Also it needs right-of-way acquisition, which significantly affects the lives of people living along the route. Therefore, national consensus about the development needs based on the social-economic benefits is an important prerequisite for successful highway development.

Second, once a highway network plan is finalized, financial strengths of individual routes in the network should be carefully examined. It should be noted that today's financial distress of the highway public corporations is largely attributable to insufficient attentions to these analyses. The analyses will become more important in future network extension, because most of the future routes, located in less developed regions, are with relatively small traffic demand. If these relatively unprofitable routes are believed to meet important policy objectives and are to be included in the highway development plan, it must be ensured that the financial burden for them is within the size that can be covered with the profitable routes. In particular, it

is important that paces of network expansion are appropriate, as the past experiences of the highway public corporation suggest. Too aggressive network expansion has been one of the causes for large debts of the public corporations. Because the traffic volume grows only slowly, the investment should be paced accordingly so that the traffic revenue growth can keep up with the pace of capital investment. The needs for highway development have been so urgent in Japan that little care has been taken on this nature of highway network investments. For the future, a more modest investment strategy will be needed.

Third, based on the financial strength of each route, responsibility for its development must be assigned to either JHPC or the national government. If JHPC is privatized, it will naturally have much tighter budget constraints than it has today. Without increased involvement of the national government, JHPC alone will not be able to develop all the planned routes. Particularly for the routes with important policy objective but poor financial viability, direct undertaking by the national government or its explicit subsidies to JHPC may be needed.

Along with the model procedure above, restructuring of toll rate settings will be helpful in strengthening the financial conditions of JHPC from the revenue side. The toll rates are virtually uniformed for all the routes under the current system, although the potential traffic demands are different in each highway route or segment. Economically, toll rates set inconsistent with the traffic demand can distort the actual use of the highway. It is desirable to differentiate the toll rates according to the demand. Toll rates should be set high in heavily traveled routes so that congestion can be mitigated. On the other hand, the rates should be set low in lightly traveled ones so that additional traffic can be encouraged. Such differentiation in toll rates will help JHPC maximize toll revenue by taking full advantage of the potential traffic demand. However, the advice may be difficult to follow, because the current toll rates have been set uniformed in order to avoid possible controversy over the different treatment of users in different regions who receive basically identical services.

6.3.2. PFI Application as a Reform Measure

Whether the new routes are to be developed by JHPC or the national government, efforts must be made to improve the efficiency of highway development. While there can be many areas where such efforts are effective, the procurement method that has virtually unchanged for decades in Japan is worth reconsidering. When the public's expectation to the

government was rapid provision of necessary infrastructure, standardized public procurement method was efficient and met the public's expectation. However, other issues are coming in play in Japan's infrastructure development. Reduction of direct construction and maintenance costs as well as financing costs has become more important than before. Also, the speed of public infrastructure provision can be reduced more or less. Therefore, the long-employed single procurement method should no longer be preferable in every occasion, but instead rearrangement of public infrastructure procurement is necessary so that the best suitable method can be applied in each of various situations.

As seen in Chapter 4 and Chapter 5, the U.S. and the U.K. has already started implementing public-private partnerships in their highway development. Although relative degree of success varies for each of the projects, these examples suggest the possibility that private participation can be effective in improving highway development in technical and financial aspects. Also, as seen in Section 6.2, the governments in Japan (mostly at local level) have started implementing PFI as well, since the PFI Act was enacted in 1999. It is found that there are two major tendencies in PFI implementation in Japan. First, PFI has tended to be implemented by local governments, which are, in general, facing with severer shortages in fiscal and technical capacities than the national government. Second, PFI has tended to be implemented in building projects, as opposed to infrastructure projects. The large scale of investment and uncertainty of demand are thought to be the major difficulties for the PFI application in infrastructure projects. Highway development is no exception for the trends; highway infrastructure, developed by the highway public corporations under direct supervisions of the national government (or the ministry of land, infrastructure and transport (MLIT), to be more specific), has been one of the fields of public works where PFI has so far attracted little interests. However, its implementation needs more serious attentions, because, structured properly, PFI may bring a number of benefits to Japan's highway development, which includes the following.

Additional Funding Capacity

Under PFI, private financing, structured with equity contributions and debts from the private capital markets, is arranged for the capital costs needed in the initial construction. As mentioned earlier, the tendency that local governments with additional funding needs actively

seek for PFI application in Japan suggests that this feature of PFI is preferred in many occasions. However, PFI can completely eliminate the public expenditure for infrastructure services, only when a project has enough revenue from the users to repay debts and generate profits for the investors. Because such occasions are exceptional rather than normal in infrastructure, there will often be needs for service fee payments from the public sector. Then, a contractual obligation for service fee payments remains with the government, creating other form of liability for the government. The benefit of PFI as an additional funding capacity, isolated from other benefits, reduces to a mere change in the form of government liabilities.

The same discussion applies to PFI applied to highway infrastructure. Although private financing could be repaid through direct toll revenues, it is unlikely that many profitable routes exist. Given that the future extension of Japan's highway network will be in relatively low-demand routes located in less developed regions, most projects will require cross-subsidies from the existing routes. On one hand, since PFI is specifically designed to allow various forms of payment from the public sector, it is suitable framework to accommodate such cross-subsidy through the service fee payments. However, on the other hand, the public sector will not be relieved from monetary resource needs. Instead, PFI only changes the way the payments are made. Again, unless other benefits are provided, PFI reduces to a mere change in the form of liabilities for the government (or JHPC) responsible for the highway development.

Moreover, difference between the scale of public budgets and capacity of private financing further reduces the effectiveness of financial contribution from the private sector. If the national government assumes responsibility for new highway development, its huge annual budget will outweigh the contribution from private financing. Even if the responsibility remains with the highway public corporations, their current budget levels are so large that provision of additional funding capacity through PFI will not significantly reduce their financial problems. Thus, the benefit of PFI in providing additional funding for new highway investment is not quite remarkable. Instead, contributions in the following two areas are more important.

Technical Capability

Because PFI often requires service fee payments from the government, the government will be left with liabilities, only in a different form. Then, PFI should lead to reduction in the public expenditures in order to be actually beneficial to the government. The cost reduction may

be enabled through integrated procurement of design, construction and operation. Proper risk transfer to the private sector may be another source of cost reduction. As explained in Section 6.2, PFI uses VFM (i.e., Value for Money) concept to evaluate the overall cost reduction that the government achieves through PFI. Because the VFM evaluation process clarifies the total government expenditure under the conventional methods including risk costs and compares it to the expenditure required by the private operator under PFI, the government can make sure that PFI will reduce their expenditure with reasonable confidence.

It is probable that the integrated procurement under PFI can reduce the total cost and construction time for highway development. Firstly, under integrated procurement method in PFI, the private sector will usually employ life cycle costing approach to minimize the total development costs. The approach will be particularly effective in highway projects, which require large initial investments and long-term maintenances. Although it is believed that the officials in the highway public corporations have employed the same approach, the integrated procurement process can promote effectiveness of the approach. Because the private sector is more sensitive to the profitability of a project than the public sector, the private will opt for new technologies that can reduce maintenance costs even if they slightly increase initial cost. Such new technologies may not be employed under the conventional method, because the design architects are not always familiar to them. Also, the supplier of the new technology may not fully cooperate in the design phase, because they are not sure if they can be a part of the project at this point. Secondly, the fairness requirement in ordinary public works biddings may impose additional constraints on the public sector in introducing new technologies. In order to treat the competitors fairly, bid specifications cannot include advanced technologies that are available for only one or two companies. Under PFI, on the other hand, comprehensive proposals, based on output specifications, allow and even encourage the use of advanced technologies. Thirdly, the period required for design and construction may be reduced through design-build approach employed under PFI. When the project can be opened to traffic earlier, the project can start receiving toll revenue earlier than otherwise. At the same time, the highway can start providing the public with its designed social-economic benefits earlier, increasing the total benefits in NPV terms. If the cost increase needed for the acceleration is sufficiently small, the cost-benefit ratio in the project can be increased.

Risk Sharing

Risk sharing between the public and the private sector is another benefit that PFI brings for the public sector. So far, the highway public corporations have been directly undertaking virtually all the activities regarding the highway development. Accordingly, they have born all the associated risks, with partial and contingent, but still important support from the national government. Basically, the private sector has never shared considerable level of risks. However, since the construction-related industries have matured sufficiently, there are likely to be some areas where the private sector can manage risks better than the public sector. Then, the public sector bearing all the risks may not necessarily be the best way for risk management in highway development.

Again, it is the VFM evaluation to measure reduction in risk costs for the public sector under PFI. In the initial state of highway development, the risk costs, when they incur, are paid by the public sector. If some risk items are transferred to the private sector under PFI, the public sector is relieved from the needs for paying these costs. The cost is born by the private sector and included in service fee payments from the public sector. The process can be sought of "out-sourcing" risk management from the public sector to the private sector. Payments are finally required from the public sector, but they are reduced when the private sector can efficiently manage the transferred risks and minimize the cost for them. However, if the public sector tries to transfer risks that could not be properly controlled by the private sector, it would increase the payment from the public sector, contrary to their initial intent. The choice of risk items that are transferred to the private sector is crucially important.

Among the various risk items, those manageable by the private sector would include construction risks and interest rates risks. Because a private consortium participating in PFI projects typically includes a construction company in its members, it usually has sufficient familiarity to construction projects. Their understanding of construction risks would be more than equal to that by the public sector. Also, management of interest rate risks is among the specialties of financial professionals. Since various forms of risk hedging techniques have been developed in the field, financial experts are becoming indispensable assets for a large investment project. On the contrary, traffic risk, another important risk item in highway development, would not be suitable for management by the private sector. Because the route for PFI project is likely to be chosen from the network planed by the national government, the private sector cannot

choose profitable routes, if any, based on their market researches. Besides, there is little or no practical scope for the private sector to encourage the use of highway. Such effort would also be inconsistent with environmental protection, even if it were successful. The public sector, as a network planner, will have to remain responsible for traffic volume risk and analyze the risk in establishing their overall investment program.

Chapter 7. Private Sector's Roles in PFI Application to Japan's Highway Development

As discussed in Chapter 2 to Chapter 5, there are sufficient experiences in private involvement in infrastructure development around the world. The experiences suggest that the private sector, in many instances, has satisfactorily responded to the expectations from the public sector by bringing remarkable innovations in infrastructure projects. They also suggest that the private sector definitely has its limitations in assuming certain responsibilities in the projects, where strong commitments from the public sector are needed.

In Chapter 6, it is understood that the highway public corporations in Japan need reform measures in order to continue their highway development in the future. Among a number of measures that can be beneficial, PFI is believed to bring considerable benefits. However, successful implementation of PFI depends on the effective contributions brought by the private sector. Also, success can be achieved only when workable framework for the private sector is established by the public sector.

In this chapter, implications for the private sector of PFI application to Japan's highway development are discussed. In the specific context of Japan's highway development, what does the private sector have to offer in contributing to the overall highway development program through individual highway projects? What conditions do they require in order to make the most of their strengths without too much worrying about their weaknesses? What will be the desirable future directions of their technological growths in order to enhance their contribution and competitiveness in PFI highway projects? The chapter addresses these questions.

7.1. Future Prospects of Highway Infrastructure Market for the Private Sector

Currently on-going discussions on policy reforms in Japan's highway development may appear discouraging to the private sector. The needs for downsizing the planed highway network have often been emphasized in the discussions. Because the current highway network plan was established 15 years ago in 1987 based on Japan's economic development prospected at that time, it may be true that the plan is out-dated and need to be re-examined. However, in a macro perspective, Japan's highway network is considered premature when compared to the networks constructed in other developed countries, according to the Ministry of Land, Infrastructure and Transport (or MLIT). As seen in Table 7-1, Japan's highway development is still behind those in other developed nations. It seems that the network needs more investment for further extensions.

Table 7-1 Highway Development Statuses in Selected Countries

	U.S.A. (1994)	Germany (1994)	U.K. (1993)	France (1994)	Italy (1991)	Japan (1999)
Total Length (km)	73,271	11,143	3,141	9,000	6,301	6,453
Length/Population (km/10,000 people)	2.83	1.37	0.56	1.56	1.11	0.51
Length/Vehicle (km/10,000 cars)	3.78	2.64	1.38	3.01	2.05	0.94
Length/Land Area (km/10,000km^2)	75	312	137	163	209	171

Source: MLIT Toll Road Website

Although needs are outstanding for further highway development in Japan, the serious financial problems faced with the highway public corporations cannot be ignored. Organizational reforms may be necessary so that the corporations can improve their efficiency. Privatization scheme, which is one of the central points in the discussions on policy reforms, can help the corporations incorporate profit-sensitive strategies. In that case, their capacity for building new highways may become limited, because a private entity must prioritize a financial viability over a social-economic benefit in approving new large investments. Then, routes with a high social-economic benefit but with a poor financial viability may have to be undertaken directly by the national government. Alternatively, government subsidies may be provided for the highway public corporations to develop those routes. The pace of investments can also be lowered in order to balance the level of investments with the traffic revenues. Whatever changes are made to the current highway development policy in Japan, they are likely to change (probably reduce) the

size of highway infrastructure market. Thus, from the private sector's viewpoint, particularly from the construction companies' viewpoint, the outcome of the current policy reform discussions has an important effect on their future prospects of highway infrastructure market in Japan.

Also important for the private sector is possible changes in the procurement methods for highway development. Although Japan has long relied on traditional design-bid-build approach in its public works procurement, increasing pressures on the public sector for overall reduction of their expenditures may result in re-arrangement of the long-lasted practices. The experiences in other countries, such as the U.S. and the U.K., suggest that the governments have found advantages in variable methods in improving the efficiency of public works procurement in time and cost. In Japan, PFI has been initiated as an effort to reduce the overall costs for public works and thereby lighten the governments' financial burden. The application has so far been mostly in building-type projects conducted by local governments. Nevertheless, PFI may (and probably should) also be employed in infrastructure projects by the national government, such as highway projects, given its potential advantages over the conventional methods in bringing efficiency in public works procurement.

Once implemented, PFI will change the roles of the government officials in public works procurements and also the way the private sector has to offer their services to the governments. In order to accommodate these changes, open-minded attitudes are needed in the government officials. However, the efforts are important in the private sector, as well. Unless the government officials are convinced that PFI will be worth their burdensome efforts to change the current procurement practices that they are accustomed to, its implementation will never take place. In order for the future prospects of highway infrastructure market in Japan to be improved through PFI implementation, it is essential for the private sector companies to prepare themselves to assume their new role under the scheme.

7.2. Possible Contributions from the Private Sector

Structured properly, PFI can help JHPC[48] achieve efficiency improvements in highway infrastructure development. As discussed in Section 6.3.2, PFI is expected to bring important benefits to the public sector, including provision of additional funding capacity and reduction of total public expenditures through technical innovation and efficient risk management. The benefit in providing additional funding may be limited for highway development, because the lack of funding in JHPC far exceeds the capacity that the private sector could provide and highway development projects will often require service fee payments from JHPC. Rather, the expected reduction in public expenditure under PFI will be surely beneficial for the future highway development. Even a certain percentages of cost reduction will lead to huge savings in terms of amounts, because the total investment required for developing uncompleted lengths of highway network plan is of significant scale.

The expectations from JHPC are, at the same time, the challenges and opportunities for the private sector. Specifically, PFI will require improvement in skills for the private sector to arrange the financing for the projects. In doing so, sophisticated risk analysis technique will be needed. Also, life cycle cost approach will become more important under PFI in order to reduce the total development cost. Relatively narrow scope of cost reduction in initial construction phase will become inadequate. While these new scope of services will be a great challenge for the private companies, they can also be a great opportunity for those that are successful in the efforts. When the construction technologies are becoming largely mature in the industry, the new aspects of technical advantages will favor successful competitors in the new field. In particular, because competitions for simple cost reduction may be unfavorable for the big construction companies with large overhead costs in research and/or design divisions, the expanded technical capabilities required for total project development can become an additional source of their competitiveness.

Financial Contribution

Although direct contributions in financial aspects may have limited impacts for the public sector, arrangement of necessary financing for PFI projects is not at all trivial for the

[48] In the discussions from this point on, it is assumed, where relevant, that JHPC continue to undertake major responsibility in Japan's highway development.

private sector. In the financial analysis of JHPC in Section 6.1.3, it is found that JHPC has developed, on average, about 200 kilometers of highway annually at an average cost of about 7.3 billion yen per kilometer based on the past trend. From these macro figures, a PFI project for 20 kilometers or 10 percent of highway development in a year, for example, would cost about 146 billion yen. Given that annual sales revenue for a major construction company is within 1 trillion yen range, the size of required capital for highway development is overwhelmingly large. Because of the scale itself and uncertainty of the payoffs, such projects would be deemed too much for the private companies to undertake and require active financial commitment from JHPC.

Additionally, because the financing costs for the private sector are often higher than that for the public sector, the private financing of highway development itself will not actually reduce the overall costs for the highway development. First, it is important for the private sector to explore innovative financial arrangements in reducing the financing costs. One good example is the risk diversification through portfolio approach employed by the Road Management Group in the U.K. DBFO road projects (the A1(M) between Alconbury and Peterborough and the A419/A417 between Swindon and Gloucester), where financing for two road projects conducted by one private operator was raised as one integrated package, reducing the overall risk levels for the lenders and equity investors and the administrative costs for debt arrangement.[49] Second, more importantly, efforts are required in minimizing overall capital needs for private highway development. Therefore, the contributions in the following two aspects are far more important than the contribution in providing private financing.

Technical Innovation

Under PFI, superiority of proposals from the private sector to the conventional public procurement is measured in VFM evaluations. The VFM concept, as explained in Section 6.2.3, is an innovative idea to represent the overall improvements brought by the private proposals. Because it reflects the financing cost for the projects born by the private sector, efforts for reducing financing cost are important. However, when construction companies are to participate in PFI projects, their essential contributions are likely to be found in other areas. Because VFM can be achieved in reduction of life cycle cost through combined responsibility for integrated

[49] See Section 5.5.4 for the details.

process of design, construction, maintenance and operation of projects, technical capability to configure all the related activities in the whole project package is the basic requirement to make advantageous the presence of construction engineering professionals in the private project teams.

The technical capability of this kind has been neither required nor valued in the conventional procurement systems. For example, contractors for construction works have been specifically asked to finish the works in designated time at a minimum costs. The period and resulting pace of construction have been often predetermined from the annual budget constraints on the public sector and the political targets for the start of highway service provisions. Then, the contractors, in making bids for the project, optimize the construction schedule within the given period so that the cost can be minimized, making the most efficient use of available resources. However, if the payoffs for the construction works are directly linked to the revenues based on the use of highway (i.e., direct toll collection or shadow toll payment from JHPC), the private operator is given an incentive to open the highway to the traffic earlier by accelerating the construction schedule. While the acceleration can be achieved through the use of fast-tracking method in design-build approach, it may also be achieved by choosing time-reducing construction method even with slight cost increases. Also, the early opening of the highway is beneficial from the social-economic point of view, as mentioned in Section 6.3.2.

Additionally, the output specifications provided in PFI can encourage the private sector to employ new, or old but rarely used technologies to reduce the operation and maintenance costs for the project. For example, electric toll collection system will reduce the cost for collecting toll revenues while improving the accuracy of traffic counts and associated revenues. In the private highway projects in the U.S. and BOT-type toll road projects in the U.K., these technologies have been chosen by the private operator, where profit-sensitive private companies found the technologies attractive, accelerating their use in highway projects.

Procurement methods and related rules can change the choices of materials for the pavements and other structures in highway projects. One interesting example is found in the U.S. Because the federal monetary assistances for interstate highway system are provided for the initial cost and not for the maintenance cost of the projects, state governments often choose relatively capital intensive design in their highway facilities. Concrete pavements are typically preferred to asphalt pavements; although the former is usually costlier than the latter in initial construction, it can increase the basis for the federal assistance. Interestingly, Massachusetts

Turnpike (a part of I-90, but ineligible for the federal assistance because of its toll collection) utilizes asphalt pavement, which costs less in the initial and allows using toll revenues for future resurfacing. (Lecture Notes 1.146) The fact suggests that the government arrangement of infrastructure projects can impose uneconomical decision criteria and affect the technology selections. In Japanese PFI highway projects as well, the technology selection may be changed, when more flexibility is given for the designers in the private sector. The future approach will emphasize the life cycle cost concepts. A new technology will be employed if it can reduce the maintenance cost while keeping the initial cost increase to none or reasonably small.

Efficient Risk Management

Efficient risk management by the private sector is another source of public expenditure reduction through private participation in highway development. As mentioned in Section 6.3.2, although the current situation in Japan's highway development is full assumption of all the related risks by JHPC, there is likely to be a room for improvement through risk sharing between the public and the private sector. Even under PFI, often the costs for risk are ultimately paid through service fee payment from JHPC. However, if the private sector can manage the risk under its responsibility more efficiently than JHPC, it reduces the cost for risk included in the service fees from JHPC. Then, JHPC is better off with the private participation.

From the private sector's point of view, their capability in risk management will become an important factor in the competition for PFI contracts. The extent of private contribution in terms of efficient risk management is measured, again, in the VFM evaluation in PFI. When the private sector can assume much risk at minimum costs, VFM is generally maximized. However, if risks that cannot be controlled effectively by the private sector are to be transferred, they will increase the chance of project failures and thus the financing cost, reducing VFM. The private sector, as well as the public sector, must be careful for the nature of risk that the private sector could efficiently manage.

Important risk items include the traffic demand risk. In the U.S. and U.K. highway projects, various risk-sharing approaches have been employed. In the U.S. private highway projects studied in Chapter 4, the private sector has assumed the demand risk along with most of other risks. Among the projects, Dulles Greenway project has suffered from significant revenue shortage. In the U.K. projects studied in Chapter 5, the traffic risk is assumed by the private

sector in the BOT-type projects and shared between the public and the private sector in the DBFO road projects. The extended government commitment in the U.K. approach has seemed helpful in stabilizing the financial conditions of DBFO highway projects. The experiences suggest that the demand risks may not be suitable for private assumptions. The traffic demand is probably beyond the control of the private sector, because it is largely determined from the external economic conditions. Even if the private sector manages the highway properly, the demand will not increase significantly.

Nevertheless, there are important risk items that the private sector can manage better than the public sector. They are probably better at managing the risk regarding the construction works, such as cost overruns and/or latent defects in existing facilities if the project includes the management of such facilities. Also, the private financing arranged with financial professionals will be able to effectively address the interest rate fluctuation risks, for example, through the use of innovative financial instruments to hedge those kinds of risks. In these areas of risk management, advanced skills and experiences will become necessary.

7.3. A Workable Framework for PFI Application

The basic framework for public-private partnerships must be established by the public sector, which is responsible for the public works procurement. This framework largely decides the way the private sector can provide their services under the partnerships. Indeed, the study in Chapter 4 and Chapter 5 suggests that the success of the public-private partnerships in the U.S. and the U.K. depended most deeply on the framework established by the government. Although broader scope of discretion given to the private sector allowed larger extent of innovation, too an ambitious approach often placed unreasonably high risks on the projects. The private highway projects in the U.S. were structured as nearly a pure private venture, where most of responsibilities in the highway projects were shifted to the private sector. In this approach, only two out of five projects studied proceeded with a reasonable ease, while the others were significantly delayed, halted, or terminated. On the other hand, the U.K. government has taken an approach to keep the projects under its own control and improve them by using the private capabilities. In this approach, although the scope of innovation might be somehow limited, the projects were executed without serious obstacles.

An important lesson from these experiences is that there is a limit to which the private sector, on behalf of the public sector, can assume responsibilities in highway projects. When they are asked to go beyond the limit, it increases the chance of failure in the project. The tasks that are beyond the private sector's capabilities are better done by the public sector. The possible contributions from the private sector through PFI and their effectiveness are discussed in the previous section. The framework for PFI implementation in Japan's highway infrastructure must be structured to maximize the possibility for innovations brought by the private sector. On the other hand, the private sector will need the public sector's efforts in the following areas. The framework has to address these issues properly.

7.3.1. Project Establishment

There are important items in project establishment that require active roles in the public sector. In order for PFI to truly address the problems in the highway development program in Japan and proceed without significant disruption, the public sector has to carefully select the project for PFI application and assume responsibility for right-of-way acquisitions in many cases. These are probably the necessary preconditions for the private sector to make the most of their

capabilities in PFI highway projects.

Project Selection

The existing plan for Japan's highway network was established and once fixed in the related laws. The plan concerned with the balanced economic development throughout the nation. Although the plan is currently under discussion about its economic reasonableness and therefore subject to change in the future, the plan resulted from the discussion will serve as the future vision for Japan's highway network. Then, the revised network plan will be the primary target for the public sector responsible for highway development in Japan.

In order for PFI to be an assisting measure for this goal, PFI projects have to be selected from the planed nationwide network. It is difficult, if not impossible, to identify traffic demands unsatisfied with the comprehensive nationwide network in the first place, provided that the plan is established fully reflecting the local traffic needs. Even if a suitable project could be identified outside of the planned network, making private investments on the project would distort the overall policy objectives to provide the nation with equal opportunities for highway transport. The private highways would serve only highly developed regions, where traffic demands have already realized. Since such regions usually have highways already built or planed by the public sector, the private highways would compete against the public highways in attracting the users, hurting the profitability of the projects in both parties. For balanced and efficient highway development, project selection from the comprehensive network established by a single authority is preferable.

Then, what kind of projects should be selected for PFI application? Since the payments under PFI need not be solely from the road users through tolls, the project selection does not have to be based on the strength of traffic demand on the route. The selection based on the financial viability based on real toll revenues will find few projects suitable for PFI. On the contrary, PFI projects should probably be selected based on the possibility of VFM improvement through the increased private participation. If the construction of a certain route requires high level of technological sophistication, such a route may have rooms for innovations from expanded discretions to the private sector and thus be suitable for PFI application. However, too much construction risk typically inherent in such projects can also be a major difficulty in closing fixed-cost contracting, which is common in privately developed projects. The bottom line

is that the private sector can and should participate in only the projects whose suitability for PFI application has been closely studied and confirmed by the public sector.

Right-of-way Acquisition

Right-of-way acquisition is one of the most important issues in virtually all the highway projects. Difficulty and importance of right-of-way acquisition depends on the purpose of the highway projects. Although congestion relieving roads, which are often located in highly developed urban areas, have relatively large toll revenue prospects, the costs and times required to obtain necessary right-of-way typically reduce the relative attractiveness of such highways from financial viewpoint. On the other hand, for development roads, often located in less developed suburbs, acquiring necessary right-of-way may be relatively easier, although their traffic revenue prospects may be less strong as well. Development roads may also suffer from significant delays in right-of-way acquisition because of lately increasing environmental protection activities. Costly and time-consuming environmental surveys may become large obstacles for keeping the project on budget and on schedule. The bridges may enjoy relative ease in acquiring the right-of-ways. In many cases, the right-of-way acquisition is required only on the landsides where roads are built to connect the bridge with existing highway network.[50]

Difficulty of right-of-way has actually impaired some projects in the U.S. and the U.K., as studied in Chapter 4 and Chapter 5. Because the state of California asked of the private operators to acquire the right-of-ways and necessary environmental permits in their AB680 projects, one of the projects (i.e., SR125) suffered from significant delays in clearing the environmental permit. The Birmingham Northern Relief Road, one of the four BOT-type projects in the U.K. and only one overland road project among them, suffered from a similar problem.

In the U.K., the government, presumably, has learned from the experience and relieved the DBFO road projects from such problems. All the eight projects in the first tranches (i.e., Tranch 1 and 1A) were selected from their highway development program for which right-of-way and necessary permits had been acquired before inviting the private bids. Although this approach may reduce a certain scope for innovation that could have been obtained from the private participation, right-of-way acquired beforehand is definitely desirable for the private sector. It may even be a required precondition for participating in those projects with confidence.

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[50] The purposes of highway projects are summarized in Section 3.1.1.

In Japan, the right-of-way acquisition is no easier than in the U.K. or in the U.S. The kind of problem presented above is similarly likely in the congestion relieving roads and development roads. Also, bridge projects often need right-of-way clearances in Japan, because fisherman's fishing rights often raise issues in compensations for the potential losses that the construction works cause for their productions. (Kato 2001) In order for PFI in highway development to attract sufficient number of private participants, the approach taken by the U.K. government may have to be followed, at least in the early period of its implementation.

7.3.2. Payment Mechanism

The payment made for the service provided is one of the most important concerns for the private sector in deciding to participate in PFI highway projects. Various types of payment mechanisms are possible under PFI. As summarized in Section 6.2.2, they are (1) service sold to the public sector type, (2) financially freestanding project type, and (3) joint venture type. Because the level of government payment in the joint venture type can be adjusted according to the direct revenue received from the users, this type can be arranged in infinite number of ways in theory. The payment mechanisms should be considered as a spectrum of government payment levels ranging from zero to full payment.

The flexibility of payment mechanism in PFI is useful in applying it to highway projects. Although PFI highway projects could be arranged as financially freestanding type, where the private operator relies only on the direct toll collection from the users, highway projects with sufficient traffic demand to enable the arrangement would be rarely found, given the maturity of the highway networks in the country. Also, the arrangement, even if successfully implemented, has important drawbacks in applying to the current financing system of highway development in Japan. When the routes with strong revenue prospects are taken out of the toll revenue pooling system of the highway public corporations, the financial condition of the public corporations is adversely affected. Payment mechanism under PFI should both expand the list of projects suitable for its application and fit into the current highway financing system.

Overall Prospects for Traffic Demand

As already mentioned, Japan has already developed its important highway routes with high priority and therefore large traffic demand. The remaining lengths in the planned highway network are mostly the ones that run through less developed regions. Because the direct toll

revenue will not be large enough to cover the development costs for those routes, PFI highway projects cannot be structured as financially freestanding type in these instances. Indeed, the opponents against PFI implementation in highway projects often argue that PFI is hard to apply to highways on the ground that the revenue prospects are not good enough for private financing.

However, the argument fails to recognize that even public authorities, such as JHPC, could not structure those projects as financially freestanding type. In their original strategy, JHPC are to develop such routes using the revenues from their existing routes, which is the very basis of claimed advantages in the redemption principle based on the toll revenue pooling system. After all, few, if not none, of the future highway projects in Japan are likely to be financially freestanding as individual projects, whether it is developed by JHPC or under PFI. Then, PFI highways have reasonable rationale to rely on the cross-subsidies from the existing routes, as JHPC's highways would normally do. The advantage of PFI should be sought in reduction of such cross-subsidies directly provided by JHPC.

Consistency with Toll Pooling Systems of the Highway Public Corporations

Although it is not quite hopeful, some routes or segments may be found where traffic revenue prospects are sufficiently large and stable to cover the development costs. In such cases, PFI highway projects could be arranged as financially freestanding type. If PFI highway project can be structured as financially freestanding type, it is generally beneficial to the society. The needs for the tax moneys in highway development are largely reduced and beneficiary payment through toll collection for highway development can be strictly applied. Efficiency in PFI may lead to reduction in the use of resources such as construction materials and labors, which is also desirable from an economic standpoint.

One important weakness in this system is obviously that it cannot be the standard model for PFI highways due to recognized scarcity of such occasions. Another weakness is related to the toll revenue pooling system so far employed by JHPC and other highway public corporations. The strong revenue base, which enables a financially freestanding PFI highway, will, at the same time, be a hard-to-find profit gaining opportunity for JHPC when developed by JHPC itself. They lose opportunity to gain what could have otherwise been used to compensate for the losses in developing other unprofitable routes. Therefore, the financially freestanding type arrangement will be hardly attractive and acceptable for JHPC, keeping them from actively seeking for PFI

application. JHPC will want to make arrangement for sharing extra profit from those profit-making projects.

In addition, when the toll revenue is more than sufficient, the private sector makes unreasonably high profit from the project, creating the needs for price regulation by the public sector. For example, a rate-of-return price regulation system may be imposed so that toll rates can be adjusted downward if the private operator begins to make higher profits than pre-specified. Alternatively, price regulation can be imposed where the toll rates are preset in down-sloping manner with inflation adjustment so that incentives for cost reduction can be given to the private operator.[51] These systems usually result in toll rates set at different level from other routes.

Toll rate differentiation in PFI highways makes an important exception for the nationwide uniform toll rates employed under the current toll pooling system Because the nationwide uniform toll rates have been one of the crucial policy decisions in Japan's highway development, it can bring back the politically sensitive issues in equity. Thus, price regulation needed under financially freestanding type PFI highways can be problematic.

Also, toll rate differentiation can create another practical inconvenience in toll collection. The PFI highway projects form a part of the integrated network developed by JHPC. For example, a user may travels from a JHPC highway, through a PFI highway, and again to a JHPC highway. Then, he/she usually gets a ticket when entering a highway and pays as exits. In exiting the highway, the tolls are calculated and collected in consistent with the two different toll rate standards employed by JHPC and the private operator. The lengths of highway traveled by the user must also be known to calculate the toll, for each of the highways operated by JHPC and the private operator. The calculation should be technically possible. When the example traveler finally exits the JHPC highway, his/her starting point indicated on the ticket should facilitate the calculation, by showing the total travel lengths on the JHPC highways and on the PFI highway.

However, such payments may be inconvenient for the users and practically difficult for the operators and JHPC. Because the calculation is likely to be more complicated than single toll rates set by JHPC, the user may not be able to instantly understand that he/she is paying the right price. The inconvenience is even larger for the operator and JHPC. When one of the two entities changes its toll rates, the whole system for the toll rate calculation should be re-adjusted. Moreover, all these inconveniences are caused only for the small length of PFI highway in the

[51] The discussions on price regulation systems are presented in Section 3.2.3.

network. The PFI highways are likely to be for the length of 10 to 20 kilometers from the funding capacity constraints on the private operators. The increased administration costs for the periodic toll rate changes and possible confusions on the users and operators make the individual toll rate settings allowed to the private sector less attractive.

If price differentiation should be avoided, an alternative is the extra profits paid back to JHPC. The superiority of private operation could be measured with the amount of such payments from the private operator to JHPC, in this case. However, this mechanism will reduce the incentives for the private sector to reduce maintenance and operation costs, because their efforts in cost reduction will simply be sucked by JHPC. As seen in Section 3.2.3, profit sharing mechanism could be employed, where profits beyond a certain point will be split between the private operator and JHPC. But such mechanisms may create disputes about the settings of thresholds and the proportions payable for each party.

Concerns for Traffic Demand Risk

The financially freestanding type arrangement based on direct toll collection from the users cannot address properly the concerns for traffic demand risk in PFI highway projects. Highway projects are subject to demand fluctuations. Traffic demand forecasts often turn out to be incorrect because of its technical difficulties and strategic biases, as discussed in Section 3.1.3. Under JHPC's direct development, the traffic demand risk is one of the important risks assumed by JHPC. Under PFI. the risk must be assumed by any one of the parties involved or shared between them. The question is who is suitable and therefore should be responsible for assuming the risk in PFI highway projects.

First, because the traffic risk stems largely from the project selection, it is reasonable that the network planner assumes responsibility for its decision in project selection. As discussed, it is considered appropriate for the public sector to select PFI projects from JHPC's highway network plan to meet the objectives in the nation's highway development program. Then, the logical consequence would be that the public assumption of traffic revenue risk is reasonable. Indeed, it is important to give the network planner (i.e., the public sector) incentives for serious consideration about the demand risk in adopting a specific highway route in its program.

Second, the private sector is no more suitable for assuming traffic demand risk than the public sector. For the private sector, they are unable not only to select profitable route on its

discretion, but also to take actions to resolve the problem when the risk materializes. In addition, if the private sector assumes the traffic demand risk through direct toll collection, it will require its own discretion over the toll rate settings. Given the risk of traffic demand fluctuation, the private sector will consider the discretion as a final resort to minimize the damages from the uncertainty. If the traffic is too small, the operator will consider toll rate reduction to encourage more uses. The opposite will happen, when the highway capacity cannot meet the unexpectedly large traffic volume. As discussed above, the toll rates set by the private sector are not desirable from the viewpoint that the Japan's highway policy has been the nationwide uniform toll rate settings. Also, the impracticability of toll differentiation for limited length of PFI highway is another drawback.

All these considerations suggest that the public sector has the responsibility for the highway route selection and the associated traffic demand on the routes. Also, the private sector is not suitable for assuming the traffic demand risk because of the nature of traffic demand and institutional restriction placed by Japan's highway development policy. Traffic risks should primarily be born by the public sector and the payment mechanism must be structured accordingly.

When the payment for the private sector is to be from the direct tolls, one possible option to assign the traffic demand risk on the public sector is minimum revenue guarantees, where JHPC guarantees pre-specified minimum revenues and compensates for any shortfalls in toll revenue. The level of revenue guarantees asked by the private sector can be one of the evaluation criteria for the private proposals. Although the private sector is relieved from traffic demand risk under the system, JHPC has nothing to gain from the system. While JHPC assumes the downside risk, it cannot share the upside profit. Further discussion on the minimum revenue guarantee including treatment of upside profit is presented later.

Proposed Payment Mechanisms

Although payment mechanisms can be arranged as appropriate in individual projects, it may be beneficial if there is a standard method that applies to basically all the PFI highway projects to be implemented. Because it is likely that the officials in JHPC and the private sector experts are recurrently participating in the biddings and contract negotiations, the standardization of payment mechanism will be helpful in letting them accustomed to the system and learn from

the experiences. The mechanism must be applicable for the many occasions where the traffic revenue is insufficient and also for the less likely occasions where the traffic revenue is so strong that JHPC thinks it deserves some share on it. Also, it is desirable that the mechanism can allow the traffic revenue risk to be primarily born by the public sector.

Direct Toll Collection with Minimum and Maximum Revenue Ceilings

One possible option is direct toll collection with minimum revenue guarantee and maximum revenue ceiling. The system is conceptually represented as in Figure 7-1. When the direct toll revenue falls below the guaranteed minimum level, the public sector directly compensates for the shortfalls. The minimum level is determined in the contract from the cost for the private operator in providing the highway service. Therefore, the highway route with poor traffic demand and/or with large demand risk can be developed under PFI. If PFI can reduce the cost for the highway development, the public expenditure can also be reduced. On the other hand, when the direct toll revenue exceeds the pre-determined maximum ceiling, JHPC receives the extra. Therefore, the toll revenue pooling system can be effectively protected.

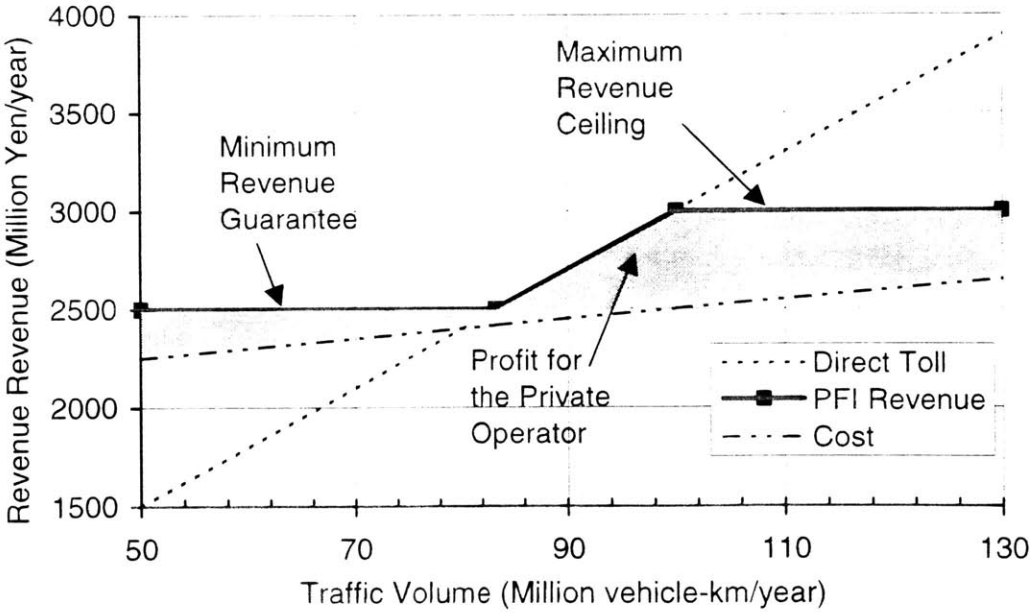

Figure 7-1 Direct Toll Collection with Minimum and Maximum Revenue Ceilings

Highway projects require large initial cost that is fixed regardless of the traffic volume and relatively small maintenance and operation costs that somewhat change according to the traffic volume. Conceptually, the average costs can be thought of as the broken line in Figure 7-1.

Because of the slope of the average cost according to the use of highway, the profit for the private operator increases as the traffic volume reduces down below the threshold for the minimum guarantee. On the other hand, it decreases as the volume increase up above the threshold for the maximum ceiling. The horizontal lines representing the minimum and maximum ceiling can be given a slope so that the payment from JHPC can be changed according to the traffic and the profit for the private operator can remain stable. However, in between the thresholds, the profit for the private operator is significantly affected by the traffic demand, because the system has no adjustment in the range. The unstable profit in this range will be a disadvantage of the system from the private sector's point of view.

Also, because the traffic demand is considered generally poor in Japan's highway projects, most of the project may have the traffic volume less than the minimum guarantee. Accordingly, the highway projects will require payment from JHPC in most of the cases. As the traffic volume reduces, the relative portion of the direct toll revenue becomes small in the total revenue for the private operator. Moreover, it is likely that the private operator delegate back the toll collection to JHPC at a certain cost, because the private operator has not been specialized in toll collection and managing only a few toll booths for a long time is not economical. Then, it may become meaningless for the private operator to directly collect the tolls.

Shadow Tolls: A Preferred Payment Mechanism

Another option is shadow toll payment mechanism employed in the U.K. DBFO highway projects. The shadow toll mechanism is defined as the service fee payment from the government based on the actual use of the highway measured in terms of vehicle-kilometers. As experimented in the U.K., the shadow toll rates can be structured in several traffic volume bands and for different car types such as cars and truck (NAO 1998). In applying the mechanism in Japan, real tolls will be collected by JHPC and added into the toll revenue pooling system. The mechanism may be preferred when direct toll collection by the private sector has few practical advantages, as discussed above.

To understand how the mechanism handles the problems of insufficient revenues or extra profits in PFI highways, an illustrative model of shadow toll structure is considered. On the highways of JHPC, toll revenue of 1,862.3 billion yen was received from traffic volume of 68,362 million vehicle-kilometers in fiscal 2000 (JHPC Year Book 2001). Thus, actual tolls paid by the highway users are, on average, about 30 yen per vehicle-kilometer. In this illustrative

model, a shadow toll structure, based on four levels of traffic volume bands, is constructed as shown in Table 7-2. In each band, shadow toll rates are assumed in terms of yen per vehicle-kilometer, with the toll rate set to zero in the highest band. The structure is modeled similar to those that were employed in the U.K. DBFO highways. The associated annual toll revenues (shadow and real) are graphed in Figure 7-2.

Table 7-2 Illustrative Shadow Toll Structure

Traffic Band (Million vehicle-km per year)			Shadow Toll (¥ per vehicle-km)	Real Toll (¥ per vehicle-km)
0	to	60	40	30
60	to	90	25	
90	to	125	10	
125	to	infinity	0	

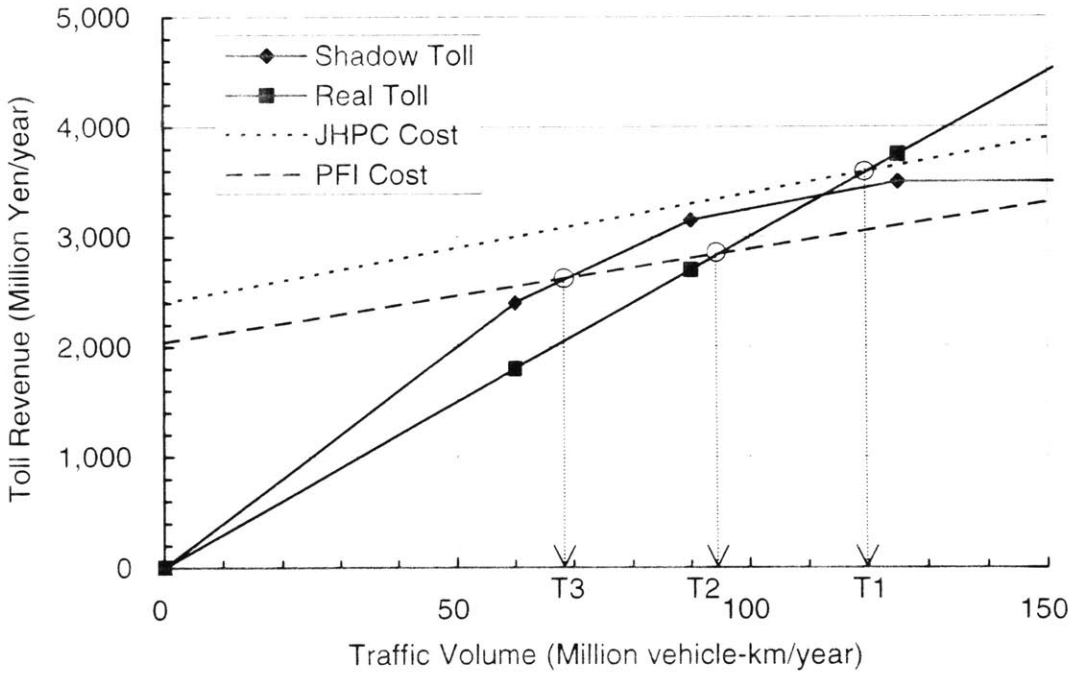

Figure 7-2 Shadow and Real Toll Revenues

In Figure 7-2, T1 represents the minimum traffic volume that JHPC requires to achieve financial feasibility of the project, independent from the toll revenue pooling system. It is expected that the minimum volume can be lowered to T2 in financially freestanding PFI highway, when PFI can reduce the average cost for the highway development. Thus, expected cost reductions through PFI would be beneficial in expanding the list of projects where financial

feasibility is achieved as an individual project, particularly when such consideration were strictly required.

However, the traffic volumes expected in the future highways may be even less and it is likely that the toll revenue pooling system needs to remain for the future expansion of the highway network. Then, shadow toll mechanism can further lower the minimum volume to T3. Because the shadow toll payment exceeds the real toll revenue for JHPC, the project creates net loss for JHPC that has to be compensated for with revenues from other routes. Nevertheless, PFI is beneficial for JHPC when the total expenditure in shadow toll is reduced from the original cost for JHPC.

Figure 7-3 is a close-up view of Figure 7-2, where traffic volume is relatively small (around 70 to 110 million vehicle-kilometers per year). When the traffic demand is small, the real toll is insufficient to cover the cost of PFI. The shadow toll can provide the way to achieve financial feasibility for the private operator in PFI. Although JHPC is required a net expenditure (i.e., the difference between the shadow toll and the real toll), it is reduced from the cost that JHPC would have paid under the conventional method. Because the shadow toll exceeds the PFI cost, the private sector can also gain a profit.

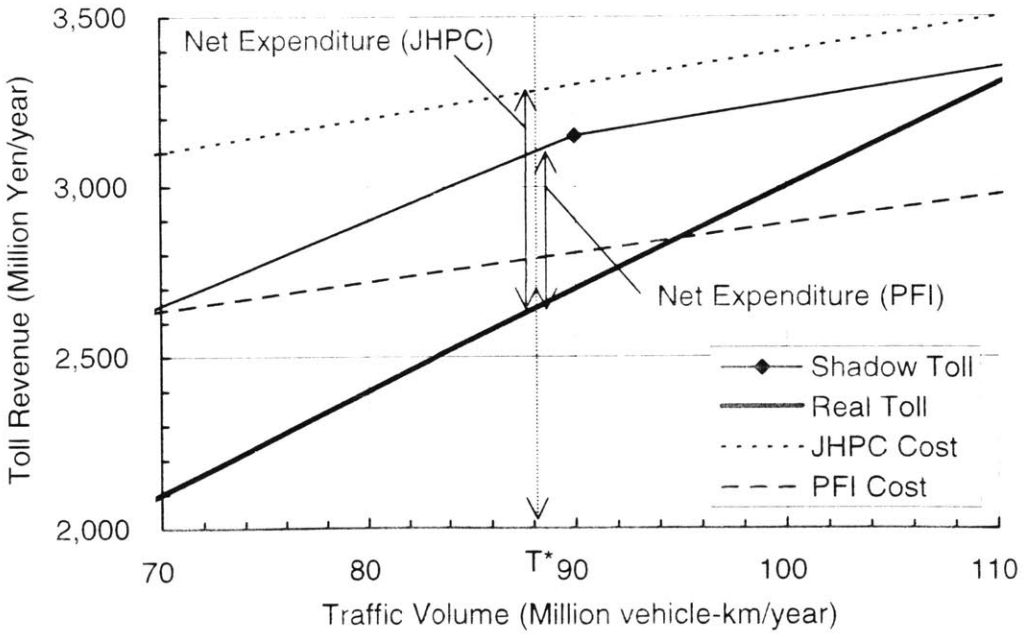

Figure 7-3 Reduction in Expenditures from JHPC in Low Demand Cases

Figure 7-4 is a close-up view of Figure 7-2, where traffic volume is relatively large (around 130 to 170 million vehicle-kilometers per year). Because the shadow toll rates are

determined primarily based on the cost for the private operator in PFI, the rates may be set below the real toll rates. JHPC can increase gains in that case. The net gain can be used to compensate for losses in other projects, maintaining (or increasing) the benefits of toll revenue pooling system. The private sector can still earn a profit, because the shadow toll revenue exceeds the PFI cost.

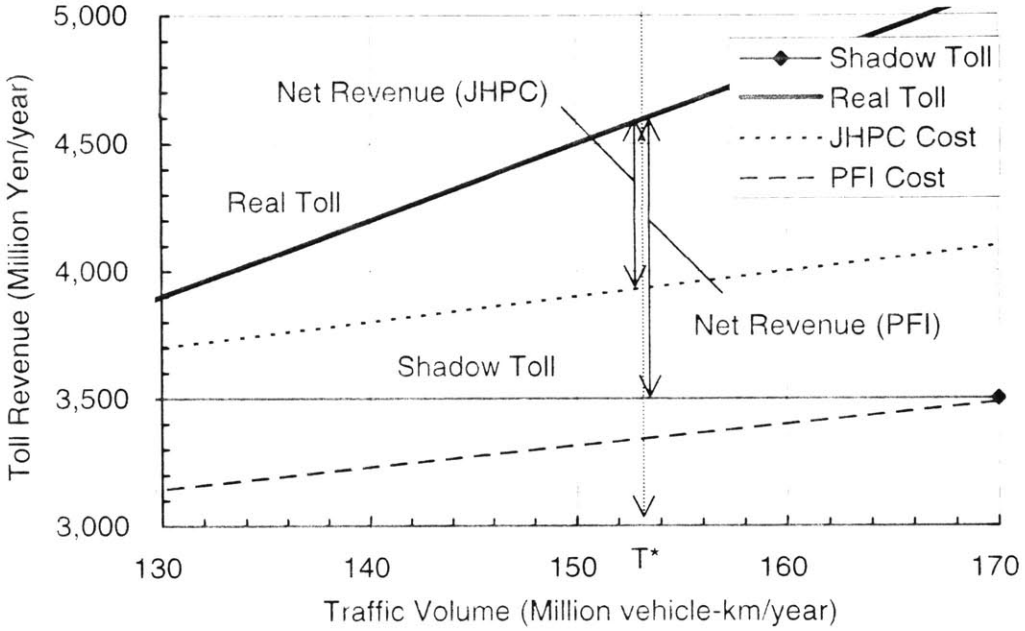

Figure 7-4 Increase in Net Revenue for JHPC in High Demand Cases

In addition, the shadow toll structure serves as risk and profit sharing mechanisms between the private operator and JHPC. Figure 7-5 is a close-up view of Figure 7-2, where traffic volume is medium (around 90 to 130 million vehicle-kilometers per year). If JHPC directly undertakes the project under the conventional method, it can earn gains from the project only when the traffic volume exceeds about 120 million vehicle-kilometers per year. In other cases, JHPC incurs net losses for the specific project. Next, if PFI is introduced as financially freestanding type, the private operator incurs loss when the traffic volume falls below about 95 million vehicle-kilometers per year. The private operator is at a risk of revenue shortfalls. In this situation, the shadow toll can eliminate the traffic volume risk from the private sector. At the same time, the payment from JHPC is reduced at the all level of traffic volume. The chances that JHPC can gain from the project are increased.

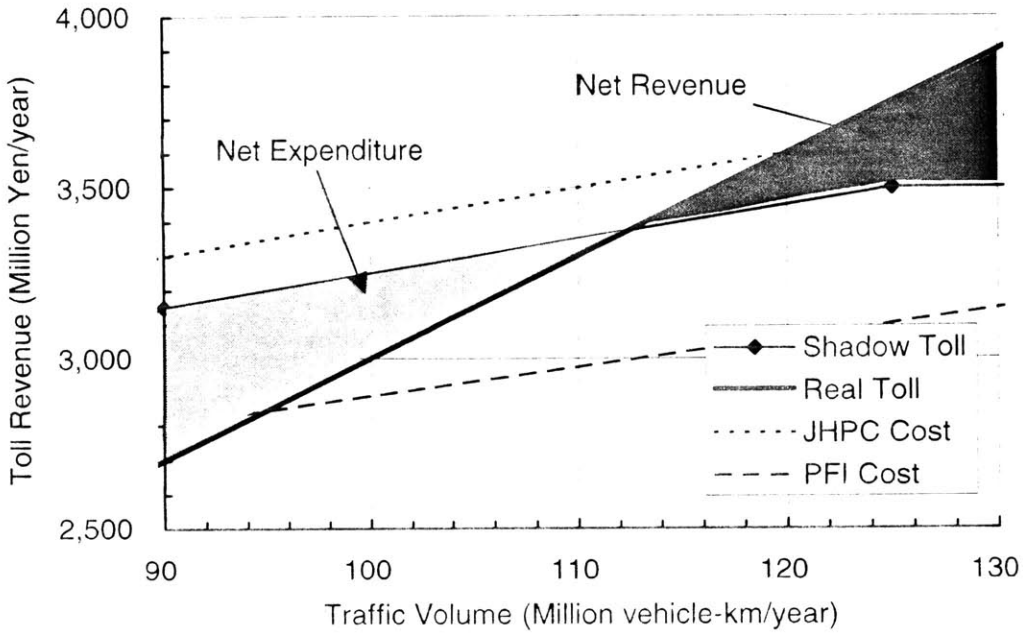

Figure 7-5 Risk and Profit Sharing between JHPC and the Private Operator

As understood from the analyses conducted above, in order for PFI to be beneficial for both JHPC and the private operator, the kinked line representing shadow toll payment must be below the JHPC cost line and above the PFI cost line in Figure 7-6. In other words, the public sector should be able to reduce the expenditure for highway development, while the private sector should earn sufficient profit under PFI.

For the private sector, the kinked line representing shadow toll structure must be above their cost for PFI highway project, where relevant. Because the shadow toll payment is linked to the traffic volume, there are segments in the kinked line that are below the PFI cost line. This means that the private operator believes that the traffic volume will not fall below the level that makes break-even point of the proposed shadow toll revenue and the PFI cost. Therefore, the kinked line changes its shape according to the traffic volume expected by the private operator, as shown in Figure 7-6. If the operator forecasts smaller traffic, the kinked line will move leftward (as in Shadow Toll A in the figure) so that the average cost can be covered from the payment based on less traffic. On the other hand, if the operator forecasts larger traffic, the kinked line will move rightward (as in Shadow Toll B in the figure).

For JHPC, the changes in the shape of shadow toll structure also change its level of payment. As the kinked line in Figure 7-6 moves leftward, the payment from JHPC will increase. It is important to understand that the VFM evaluation in PFI highway makes sure that the

payment is always below the JHPC cost line. Therefore, PFI even with relatively large payment from JHPC can be considered beneficial.

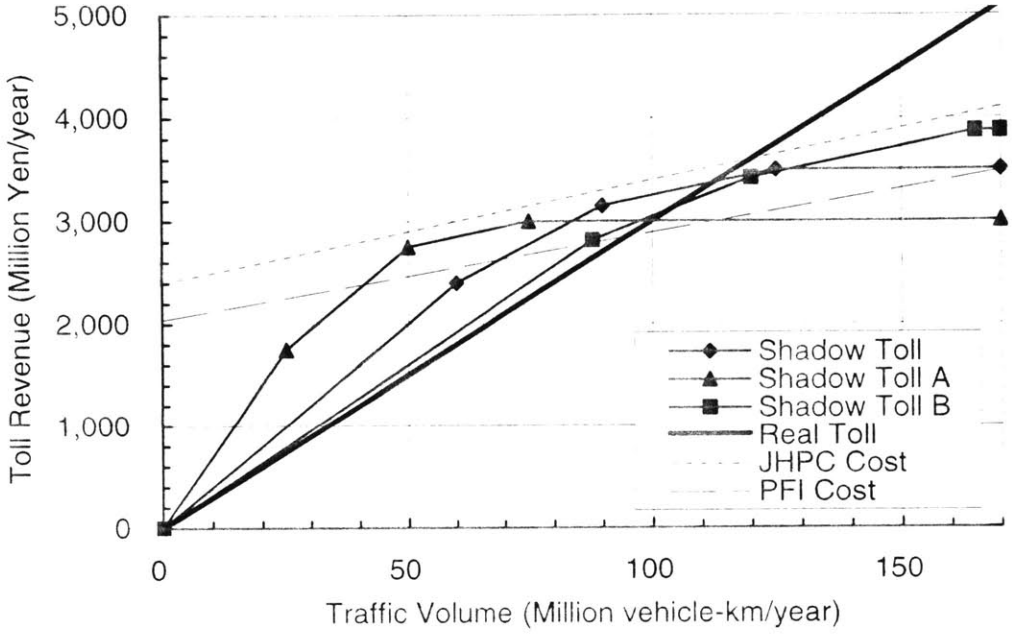

Figure 7-6 Shadow Toll Structures According to Traffic Demands

Then, it is also important to understand how the private operator can propose the shadow toll payment that is lower than JHPC cost. Because the shadow toll rates proposed by the private bidder are the most important items in VFM evaluation, the private bidders under competitive pressures will keep the shadow toll payment as small as they can. They may do so by reducing the targeted profit margin, based on strategic considerations to beat other bidders. However, more fundamental and sustainable efforts will be to reduce the average cost required for the project, keeping the profit margin unchanged.

In addition to the suitability for the economic characteristics and policy framework of Japan's highway projects, the shadow toll mechanism can be used as a contract management instrument for the public sector. As studied in Chapter 5, the U.K. government has structured the shadow toll mechanism so as to adjust the periodic payments to encourage safety improvement efforts by the private sector, to give a penalty for failure in fulfilling maintenance obligations stated in the contracts, and to compensate for the changes in the scope of works necessitated by changes in various conditions surrounding the project. This feature of the shadow toll payment is not easily achievable through direct user toll payment.

One important drawback is that innovative ideas regarding toll rates cannot be brought from the private sector under the system. Because such ideas as toll-paying SOVs using HOV-lanes and variable toll rates for time-of-day were among the most important innovations brought by the private sector in the U.S. private highway projects, shadow toll payment mechanism, when employed in Japan, may discard one of the important areas of private contributions. However, differentiating toll rates is practically difficult in Japan's highway, where the highway public corporations have set their tolls equal in all over the nation for political purposes, as discussed earlier. Therefore, this drawback can be considered almost irrelevant in PFI application to highway projects in Japan, at least for the time being.

7.4. Private Sector's Challenges in PFI Application

As discussed in Section 7.2 and Section 6.3.2, there are several important areas where the public sector can expect and the private sector can bring improvements through PFI in Japan's highway infrastructure. First of all, private financing under PFI is one of the important benefits, where the private sector needs to expand its expertise in arranging a large scale financing at a minimum cost. However, its effectiveness is limited, because of the overall scale of funding needs for highway development and the continued needs for public expenditures in PFI projects. Rather, primary efforts have to be directed to reduction of total expenditures.

Under the shadow toll payment mechanism proposed in Section 7.3.2, the importance of cost reduction through PFI is further highlighted. The shadow toll rates should be set below the original expenditure level of JHPC and above the reduced cost under PFI. The extent to which the costs are reduced under PFI decides the realized benefits in the expenditure reduction for JHPC and the achieved profit from the PFI highway project for the private sector. To put it in another way, the private sector receives a part of the expenditure reduction for JHPC as a reward for its contribution. Then, the challenge for the private sector to reduce the expenditure of JHPC is also an opportunity for increasing their profits through expanded scope of service provision under PFI.

7.4.1. Technology Development for Successful PFI Implementation

For the private companies in construction-related businesses, their capabilities are primarily demonstrated in the technical innovations in construction and maintenance of the physical facilities of highways, which enable reductions of lifecycle costs of the projects. Also, efficient management of design and construction risks is among the important areas where technology advancements are required.

Capital cost required in the initial stage is probably the most crucial item in the lifecycle costs of highway projects. In the financial projection model of JHPC presented in Section 6.1.3, the unit construction cost is obtained as about 7.3 billion yen per kilometer in fiscal 2001, in an overall macro figure. On the other hand, the unit repair cost and the unit maintenance and overhead cost are obtained as about 29.1 and 54.9 million yen per kilometer in fiscal 2001, respectively. If the project life is set 30 years in PFI highway, the total repair and maintenance costs amount to about 2.5 billion yen without inflation or discounting. In these rough calculations,

the initial cost is about three times as large and important as the operation costs. Moreover, the initial cost requires fund raising, while the operation costs are paid out from the operating revenues. Therefore, the financing costs are changed, either upward or downward, by the initial construction cost.

Reduction of construction cost has always been important for the construction companies. Their competitiveness has most exclusively decided by their costs under the conventional design-bid-build procurement method. Their efforts will be continuously needed even under the method. However, PFI allows and requires expanded efforts in this area. When the specification is provided in an output requirement and the design of highway facilities can be proposed by the private sector, the private companies are allowed to explore innovative construction methods. As mentioned earlier, an innovator has had to wait for others catch-up under the conventional procurement before the new technology can be used in the public works procurement, because of the requirement that specifications be based on widely available technologies. Since such a restriction is removed in PFI biddings based on output specifications, pressures and incentives will be increased for the construction companies to enhance their technological advantages in order to maintain their competitiveness in the industry.

Infrastructure requires proper maintenance and repair for its entire life. Indeed, in developed countries, where most necessary infrastructure has already been developed, the maintenance and repair of the infrastructure is becoming one of the important concerns for the public sector and one of the increasing markets for the private sector. The importance is unchanged in PFI highway projects. Although small in their annual amount, operation costs (i.e., repair cost, and maintenance and overhead cost) total in a considerable amount during around 30 years of the project life of PFI highways. Therefore, they have crucial impacts on the total cost of the projects. Because the design and the quality of construction works decide the needs for the maintenance and repair cost, serious considerations for them are important. Additionally, in a highway project, the labor costs for hiring the manpower in toll collection are incurred in its daily operations. Electric toll collection (ETC) system will be effective in reducing the labor costs, as the examples of private highways in the U.S. and the U.K. have demonstrated. Familiarity in the overall structure of operation costs for highways will be another source of competitiveness for the PFI bidders.

Finally, solid understanding of risks in highway projects and efficient management of

them become indispensable for successful PFI highway projects. Although the traffic demand risk is to be primarily born by the public sector through shadow toll mechanism, the private sector is not completely free from the risk. Because the shadow tolls are linked to the actual traffic and not to the forecast, their revenue changes depending on the actually realized traffic volume. In particular, since the shadow toll falls below the average cost of PFI projects where the traffic is very low, the private operator needs to make sure that the traffic volume will be larger, at least, than the minimum threshold. Also, if the shadow toll rates have to be set at zero in the largest traffic band as in the U.K. DBFO road projects, the shadow toll again may fall below the cost where the traffic volume is significantly larger than the anticipated. While the toll revenue does not increase in the largest traffic band, the average cost may slightly increase as the use of highway increases. Thus, the private operator should conduct its own traffic demand forecast and obtain reasonable confidence in the range of traffic volume that are likely to be realized on the highway. Although the forecast may be arranged through appointing experts in transport demand analyses, the operator must become familiarized and experienced to the techniques and the typical pitfalls in those analyses.

Also, the risk regarding interest rate fluctuation is another type of risks that the private operator must understand. Because the long-term financing arranged for highway projects tends to be with a floating interest rate linked to major index, a risk hedging technique will be important. Also, if the project requires refinancing because of the relatively short maturity of available debt instruments, some measures are necessary in minimizing possible fluctuation of interest rates applied to the future refinancing. Again, advices from the financial experts will be needed in this area, if the private operator consortium does not include financial institutions. For construction companies, knowledge to well arrange financing in cooperation with financial experts becomes indispensable.

The expertise of construction companies is most importantly demonstrated in managing risks regarding design and construction of the highway project. As mentioned earlier, initial construction costs share the largest part of total development cost for highway projects. When the competitive pressure in PFI biddings encourages the bidders to reduce their total cost as much as they can, the construction costs will be the first item that attracts attentions in the efforts. Although the efforts for construction cost reduction based on increased flexibility is essential in PFI projects, it is quite possible that a strategic aspect in the competition forces a construction

company, as a contractor in the project, to lower its contract prices, reducing the profit from the construction contract. When the company, as also an equity investor, can recover the shortfall from the profits in the operation phase, such strategic price reduction may be possible. However, because the construction contract in PFI project is likely to be arranged as a fixed-price contract, the construction company typically assumes the risk regarding the construction cost. Then, the strategic price reduction leads to increased exposure of the construction company to the risk. Allowances for contingencies in the contract price are likely to be minimized. In order to protect themselves from such exposure, construction companies must be armed with scientific risk analyses techniques based on their engineering knowledge and the statistical records accumulated from their experiences in the past works.[52]

7.4.2. Project Planning Method Based on Life Cycle Cost Approach

So far, the discussions have dealt with the important items, such as initial construction cost, maintenance cost, and risk, individually. However, these items are interrelated to each other. Indeed, as explained in Section 6.2.3, VFM is achieved after integrated efforts of reducing expenditures from the public sector reflecting all the reductions in construction cost, maintenance cost, risk cost and so on. Design and construction schedule should also be considered, because it can change the timing and level of public expenditure for the PFI project and the cost and risk of the private sector. Thus, successful project planning under PFI requires configuration of the important decisions regarding the project. An illustrative example is used to discuss an effective method of PFI project planning.

Motivation

There are three major parties involved in a PFI highway project: the public sector, the private operator, and the lender, who participates in a project with a different desire. The public sector wants to maximize VFM through PFI implementation, while the private operator tries to make sufficient profit from the project. The lender, on the other hand, needs to make sure that the project will generate cash flows large enough to cover the debt repayment. The planning method, first, has to help them understand the prospects in achieving their individual goals.

[52] In addition, it may be sensible to arrange some sort of reward system for successes in construction price reduction and risk management where a construction company in a PFI consortium can claim a larger share of profits in the operation phase than its equity share, because the profits are largely attributable to the risk-taking efforts by the construction company. (See Kato 2001 for an example of such models.)

The private operator, who arranges the project through their own efforts and the negotiations with the public sector and the lender, has to maximize VFM and their own profit, while maintaining minimum solvency of the project, so that they can make a proposal that is competitive in the bidding stage and is financially robust in the execution stage. The method, then, has to assist the operator in identifying the critical cost items in establishing the project plan and allocating their efforts for cost reductions according to the importance of each item. Because the monetary resource and time for preparing the proposal is usually limited, effective use of them is crucial for succeeding in the PFI bidding.

Also, the method should be helpful in deciding the schedule of design and construction for the project. Typically, the private operator tries to accelerate the project in order to reduce the interests for construction financing and advance the start of revenue collection. The acceleration can be usually achieved through fast-track schedule enabled under design-build approaches. However, because the fast track scheduling may cause the head-started construction works to be redone as a result of design changes, it can turn out to be costlier than the ordinary scheduling. Therefore, the effectiveness of accelerated schedule must be understood in advance.

Further, the interrelationships of the important factors should also be considered in the method. For example, there can be a case where the materials selected for the pavement and/or other structures affect the maintenance costs of the project. A new technology, such as electric toll collection systems, may be available, which is likely to reduce the operation cost. Because employing these advanced technologies usually comes at a certain cost for their initial installment, the initial cost increase must be worth its effect in reducing the maintenance and operation costs. Also, for example, there can be a case where an innovative construction method that shortens the construction time is available. Again, since the innovative method often comes at a certain cost, the selection of method should be based on the judgment of the additional cost and the increased benefits that its employment will bring about.

Illustrative Model

In order to give little more practical thoughts on the issues raised above, an illustrative model is constructed. An example framework to analyze various aspects in PFI projects is presented in Nishino (2001). Using the framework as a basis, the model constructed here is arranged so that it can be used in PFI highway projects. Major arrangements are made in the cost

assumptions and timeframe for the analysis. Also, the construction time can be extended up to five years, while the original model only deals with single-year construction period. When the assumption on the construction time for PFI is changed, the constructed model automatically adjusts the start and the end of operation period, and the timings of cost and revenue stream.

Key Assumptions[53]

Key assumptions regarding the model case are summarized below. Other assumptions, including some minor ones, are presented in Table 7-3 and Table 7-4.

1. The project is a 20-kilometer overland highway developed under the responsibility of JHPC. The average characteristics of JHPC highways, which are discussed in Section 6.1.3, are used, where relevant.
2. Unit construction cost of 7.3 billion yen per kilometer is assumed.
3. Unit repair cost and unit maintenance and operation cost are assumed to be 29.1 and 54.9 million yen per kilometer per year, respectively.
4. Long-term rehabilitation is conducted at year 10, 20, and 30 in the operation period.
5. JHPC receives direct user tolls and adopts them in their toll revenue pool. Unit toll revenue of 330.6 million yen per kilometer per year is assumed, where relevant.
6. The private operator receives service fee payment from JHPC. The payment is fixed, instead of linked to the traffic (i.e., shadow toll), for simplicity.
7. Construction time is 5 years for both JHPC's direct procurement and PFI in the base case. The construction costs are spread evenly for the period.
8. Operation period under PFI is 30 years, commencing on completion of the construction.
9. The highway facility is transferred back to JHPC for free at the end of operation period.
10. Risk adjustment for PSC is made using rough estimates of possible cost increases.
11. Tax adjustment for PFI is made, based on the understanding that additional taxes levied from the PFI project benefit the public sector (not specifically JHPC) in a broad sense.
12. Discount rate of 4 percent is used for obtaining VFM for JHPC.

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[53] The assumptions are made quite roughly without extensive efforts for actual data collection. Therefore, the model presented here should be interpreted solely as an illustration of the project planning method. Any of the results obtained in the model does not mean whether or not PFI is actually effective in Japan's highway projects. Rather, they are intended to represent the kinds of figures that require important engineering judgments in the course of project planning under PFI.

Table 7-3 Assumptions in the Model Case

(Unit: Billion Yen)

Items	Assumptions					Remarks
Basic Conditions						
Highway Length (km)	20					
Proportion of Structure	70%					
Proportion of Equipment	30%					
Discount Rate	4%					
	Rates	PSC		PFI		
Ownership and Project Scheme						
Land Ownership		Public		Public		Lent for free (PFI)
Highway Structure Ownership		Public		Private		
Operation Period		30		30		
Contract Arrangement				BOT		Asset Transferred at
Price at Asset Transfer				Free		
Construction Plan						
Construction Time		5		5		PFI Reduction 0%
Interest Rate (Construction Financing)		7%		7%		
Initial Investment						
Construction Cost		146.0		131.4		PFI Reduction 10%
Design Cost	5.0%	7.3		6.6		
Indirect Cost	5.0%	7.3				
Real Estate Acquisition Tax	Rate 4.0%			3.7		Taxable Base 70%
Real Estate Registration Tax	Rate 0.6%			0.6		Taxable Base 70%
Financing Arrangement Cost	5.0%			7.1		
Construction Financing Interest Charge		11.2		22.4		
Total Development Cost		171.8		171.7		PFI Reduction 0%
Financing Plan						
Ratio						
Equity		0%		20%		
Debt (Government Bond)		100%				
Debt (Public Institution)				40%		
Debt (Private Bank)				40%		
Debt Arrangement		Repayment Period	Interest Rate	Repayment Period	Interest Rate	Equal amount of annual installment
Debt (Government Bond)		20	5.0%			
Debt (Public Institution)				20	5.0%	
Debt (Private Bank)				20	6.0%	
Depreciation						
				Structure	Equipment	
Depreciation Period				38	15	
Maintenance and Operation						
Maintenance and Operation Cost		1.40		1.12		PFI Reduction 20%
Indirect Cost (PSC)		0.28				Overhead Cost 20%
Taxes						
Fixed Property Tax	Rate 1.4%					
City Planning Tax	Rate 0.3%					
Corporate Tax	Rate 40.87%					
Long-term Rehabilitation						
		Structure	Equipment	Structure	Equipment	
Year 10	Percentage	5.0%	10.0%	4.5%	9.0%	See Note.
	Amount	5.1	4.4	4.1	3.5	PFI Reduction 10%
Year 20	Percentage	10.0%	12.5%	9.0%	11.3%	See Note.
	Amount	10.7	6.0	8.7	4.8	PFI Reduction 10%
Year 30	Percentage	15.0%	15.0%	13.5%	13.5%	See Note.
	Amount	17.7	8.1	14.1	6.5	PFI Reduction 10%
Service Fee Payment						
Initial Amount				24.0		
Step-down	Percentage			25%		

Note: Based on accumulated capital cost

Table 7-4 Assumptions in the Model Case *Continued*

(Unit: Billion Yen)

Items	Assumptions			Remarks
	Rates	PSC	PFI	
Risk Adjustments				
Construction Phase		10%		
Operation Phase		20%		
Public Expenditure for Administration of PFI Project				
Bid Preparation Cost			0.5	Adviser Fee etc.
Monitoring (Construction)			0.1	
Monitoring (Operation)			0.05	

Illustrative Result Figures in the Base Case

The constructed spreadsheet model is shown in Table 7-6 to Table 7-12 at the end of this section. Before looking at the resulting figures for important indices in project evaluation, the structure of service fee has to be explained. The service fee is the most important decision variable in the analysis, which significantly affects VFM for JHPC, the returns on investment for the private operator, and the solvency criteria for the lenders. The service fee is manually input as 24 billion yen per year initially, which steps down by 25 percent once the debt repayment is complete. The resulting figures in the base case are tabulated in Table 7-5.

Table 7-5 Result Figures in the Base Case

	Index	Unit	Result	Target	Definition
JHPC	PSC	¥ B	240.1	–	Public sector comparator (See Section 6.2.3)
	LCC	¥ B	224.6	–	Life Cycle Cost of PFI (See Section 6.2.3)
	VFM	¥ B	15.5	>>0.0	VFM = PSC – LCC
	VFM (%)	%	6.5	>>0.0	VFM (%) = VFM/PSC
PFI Operator	Project IRR (After Tax)	%	7.4	–	Internal rate of return (before interest and after income tax, or EBI) on total investment in initial construction
	Project IRR (Before Tax)	%	9.9	–	Internal rate of return (before interest and income tax, or EBIT) on total investment in initial construction
	Equity IRR	%	9.6	–	Internal rate of return (net cash flow before dividend) on equity investment
	Dividend IRR	%	6.4	>6.0	Internal rate of return (dividend) on equity investment
Lender	DSCR (Minimum)		0.79	–	Debt service coverage ratio: Earnings before interest and after income taxes, divided by interest expense plus the quantity of principal repayments
	DSCR (Last year *)		1.38	>1.1	
	LLCR		1.36	>1.2	Loan-life coverage ratio: Discounted sum of earnings before interest and after income taxes, divided by total borrowing

Note: DSCR is declining as years elapse, because the debt repayment is scheduled as annual installment of equal amounts. Under the schedule, the portion of interest expense in total debt repayment increases, while other variables are assumed to be constant over time, reducing the income taxes and increasing EBI.

As shown in the table above, PFI demonstrates VFM for JHPC. Although JHPC is paying the service fee to the private operator, its overall payment is reduced by about 6.5 percent. For the private operator, they can make profits in the PFI project. In terms of dividend IRR, the project makes about 6.4 percent of return on its equity contribution. The solvency of the project is sufficient, maintaining 1.36 of LLCR. Although DSCR is 0.79 at its minimum in year 15 when major rehabilitation work is conducted, the cost can be covered from the cash flow accumulated until then. In the other years, DSCR is above 1.38.

A closer view of VFM obtained in the base case is presented in Figure 7-7. Also, PSC and LCC are obtained as shown in the equations below. From the figure and the equations, it is found that the actual payment for the PFI project from JHPC (i.e., Base Cost (PFI) of 299.50 billion yen) is increased from the original cost for JHPC (i.e., PSC of 240.11 billion yen). However, because a large part of service fee payment under PFI goes back to the public sector as corporate taxes, LCC of PFI is reduced to a level below PSC. Although PFI is beneficial in reducing a total net expenditure for the public sector as a whole, it does not benefit JHPC specifically, because JHPC cannot directly enjoy the benefit of additional taxes. Therefore, the treatment of tax becomes critical consideration in PFI projects. If only the benefit for JHPC is to be valued, tax-exempt status for the PFI operator may be required. If the tax-exempt status is allowed for the private operator, they will be able to reduce the necessary service payment from JHPC, maintaining VFM of the PFI project.

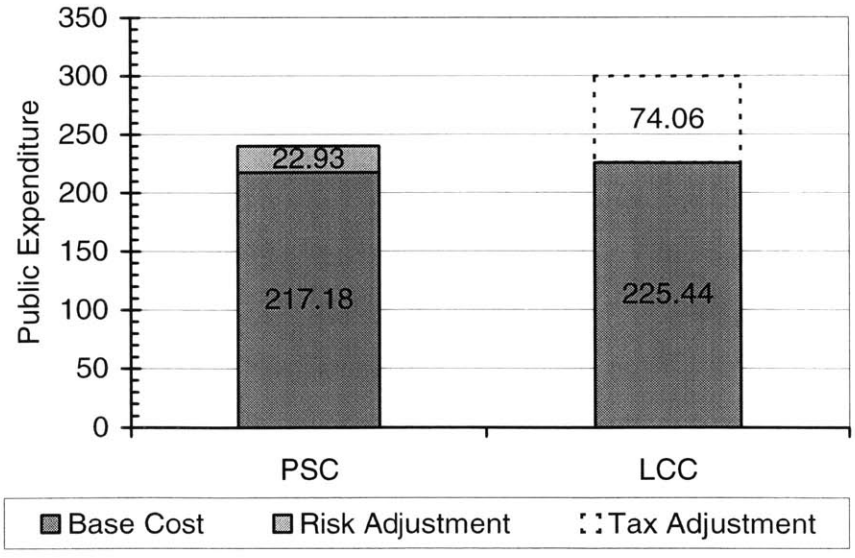


Figure 7-7 Value for Money in the Base Case

PSC = Base Cost (PSC) + Risk Adjustment = 217.18 + 22.93 = 240.11 billion yen

LCC (PFI) = Base Cost (PFI) – Tax Adjustment = 299.50 – 74.06 = 225.44 billion yen

Importantly, the overall benefits of PFI depend on the cost reduction made through its application. It is assumed that the construction cost and the operation and maintenance cost can be reduced by 10 percent and 20 percent, respectively. Because these assumptions will have crucial impacts on the benefits realized under PFI, the sensitivity of results to the assumptions should be analyzed. Also, as discussed above, when the assumptions are based on a project plan using standard way of facility design, construction method, and operating method, efforts are needed in effective improvement of the standard plan to achieve better PFI project proposal. Because the sensitivity analyses also help the private operator identify the relative importance of the cost items involved, the operator can efficiently explore the possibility for improvement through changes in a certain item in the project plan.

Sensitivity Analyses

Figure 7-8, Figure 7-9, Figure 7-10, and Figure 7-11 show the sensitivities of major indices to the reductions in the construction cost, the maintenance cost, the repair cost, and the construction time, respectively. The selected indices are VFM (%) for the public sector, Dividend IRR for the private operator, and LLCR for the lenders. In the base case, 10 percent of construction cost reduction, 20 percent of maintenance cost reduction, 10 percent of repair cost reduction, and 0 percent of construction time reduction are assumed.

The service fee payment is assumed to be unchanged. Therefore, the changes in the indices are mainly derived from the changes in risk adjustment, and tax adjustment. In an actual situation, the service fee will be changed and, accordingly, the indices will be also changed either upward or downward. In particular, the solvency index (i.e., LLCR in this case) will be kept at a similar level in any actual cases. Nevertheless, it is believed that the general tendencies in the sensitivities of indices should be maintained in this rough analysis, because the increased tax payment reflects the excessive income for the private operator. The excessive income could have been subtracted from the service fee payment in the base case to an extent where LLCR and Dividend IRR can be kept unchanged or improved. VFM will be generally improved.

From the sensitivity analyses, it is found that construction cost has the most significant impact on the indices. VFM (%) and Dividend IRR change from about 3.5 percent to 8.5 percent

as a result of changes in the construction cost reduction. For other items, the impacts on the indices are relatively small. Changes in VFM (%) and Dividend IRR are kept within the range from about 5 percent to 7 percent in these cases. In particular, the repair cost has only small impacts on the indices.

The sensitivity to the construction time reduction may need an explanation. As the construction time is reduced from 0 percent in the base case to 20 percent (i.e., 1 year in the original 5-year construction schedule), the indices generally improve. The improvements in Dividend IRR and LLCR are mainly caused from the reduced interest charge during the construction phase and the associated reduction in long-term debts (affecting the debt service costs during the operation phase). Dividend IRR increases significantly in the case of 5-percent time reduction, decreases in the case of 10-percent time reduction, and gradually increases for the further reductions. The reason for this irregularity is that the early completion of the facility changes the timing of long-term rehabilitation works. Earlier rehabilitation works are required under earlier opening of the facility. Importantly, as the construction time is reduced, VFM is also improved. Although the improvement is primarily through the increased taxes in this model case, it will be similarly achieved through reduced service fee payment in an actual case.

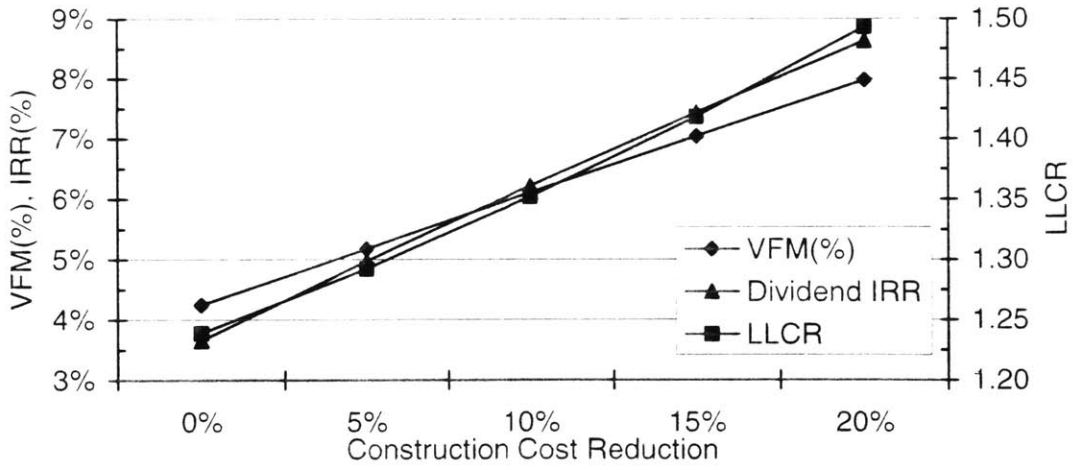


Figure 7-8 Sensitivities of Index to the Construction Cost

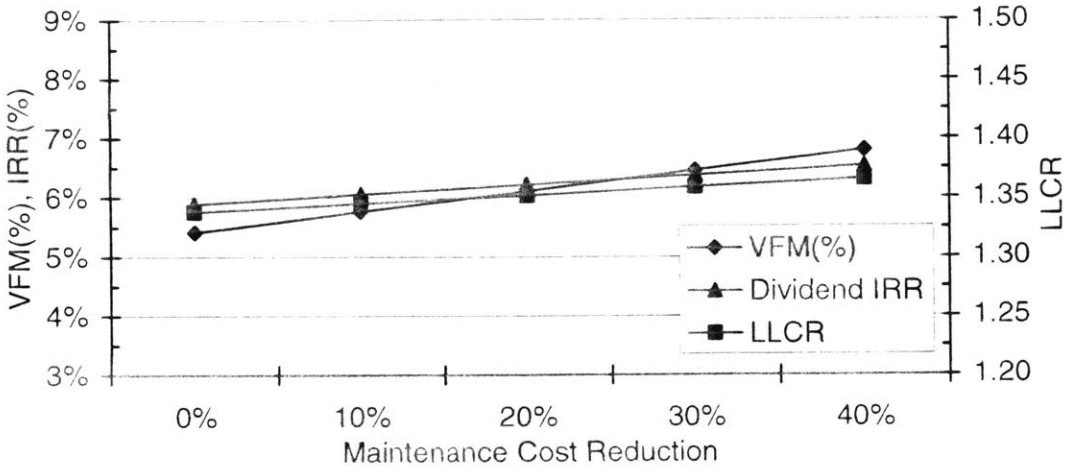


Figure 7-9 Sensitivities of Index to the Maintenance Cost

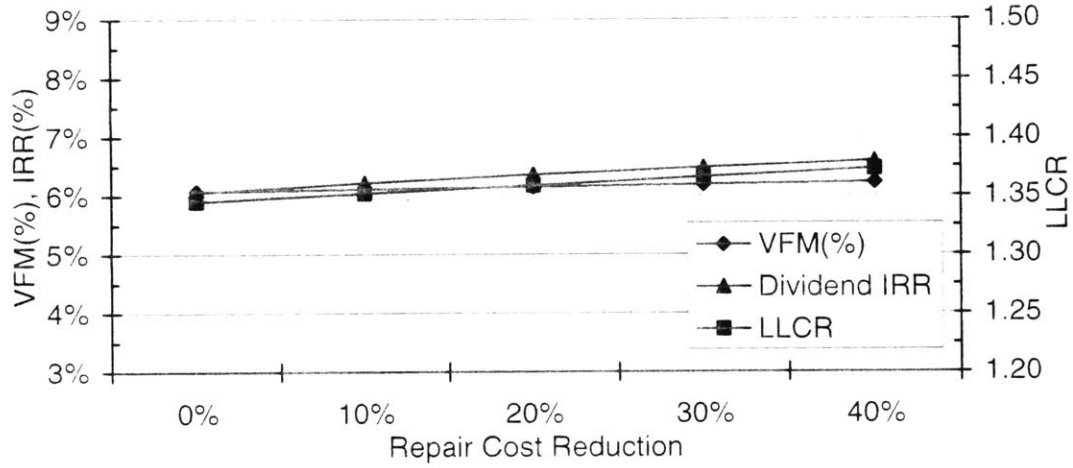


Figure 7-10Sensitivities of Index to the Repair Cost

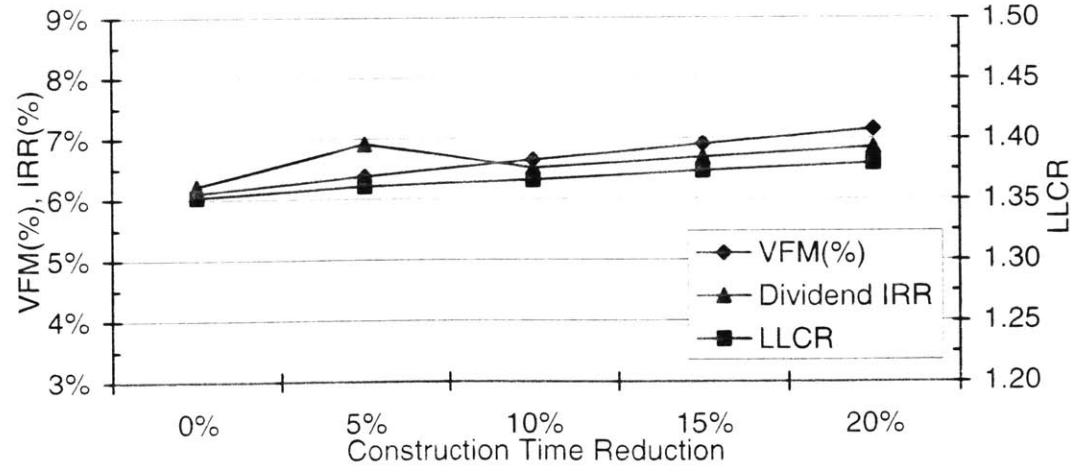


Figure 7-11Sensitivities of Index to the Construction Time

Trade-off Analyses

As mentioned earlier, it is considered that the important items discussed above (i.e., the construction cost, the maintenance and operation cost, the repair cost, and the construction time) are interrelated. When the construction cost is identified as the most important cost item as is the case in this example, the decisions regarding the other factors should be made with attentions paid to their effects on the construction cost. In this example, the effects of the maintenance cost and the construction time to the construction cost and the project evaluation indices are discussed.

When an innovative technology is to be employed to reduce the maintenance and operation cost, it is likely that it requires an additional cost in its initial installment. Therefore, the cost reduction must be sufficiently large to justify the additional cost. The total costs in the project life cycle must be lowered. The planning method has to facilitate such considerations.

In this illustrative model, the minimum maintenance cost reduction for additional construction costs is found as in Figure 7-12. In the base case, reductions in construction cost and maintenance cost are assumed to be 10 percent and 20 percent, respectively. In the analysis, the decision criterion is to maintain the improvements in the indices achieved in the base case. As the employment of innovative technology adds initial cost and lowers the extent of construction cost reduction, the required minimum cost reduction in maintenance and operation increases. The opposite happens, when an innovative technology in the initially conceived plan is given up. When the point representing the construction cost reduction and the maintenance cost reduction achieved with a certain technology is plotted above the line, the technology is considered advantageous for the PFI project.

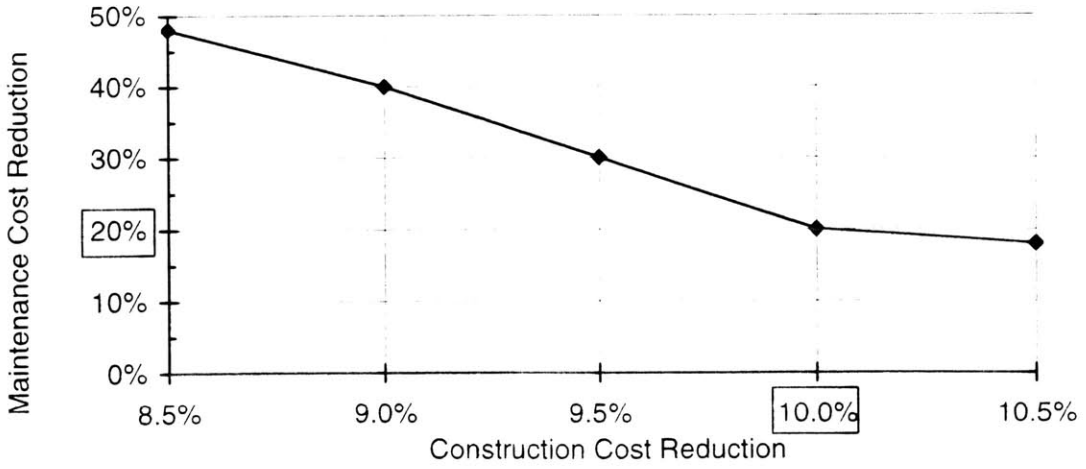
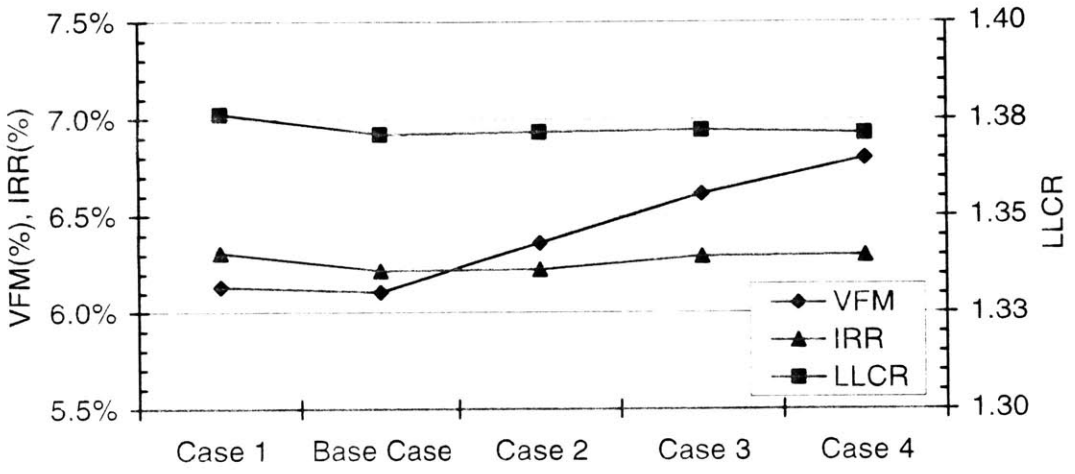


Figure 7-12Minimum Maintenance Cost Reduction for Additional Construction Costs

As shown in Figure 7-13, with the reduction of maintenance cost (along with the justifiable increase in construction cost), VFM is improved, while IRR and LLCR are not much affected. If an innovative technology reducing maintenance cost can be employed with a reasonable construction cost increase, the proposal from the private operator in the PFI bidding becomes more attractive for JHPC.



	Case 1	Base Case	Case 2	Case 3	Case 4
Construction Cost Reduction	10.5 %	10.0 %	9.5 %	9.0 %	8.5 %
Maintenance Cost Reduction	17.5 %	20.0 %	30.0 %	40.0 %	47.5 %

Figure 7-13Effects on the Index from Maintenance Cost Reductions

When the construction time is reduced with a certain innovative construction method, again the method often requires an increase in the construction cost. Therefore, the benefit in time reduction must be sufficiently large to justify the additional cost. In this illustrative model, the minimum construction time reduction for additional construction cost is found in Figure 7-14. In the base case, reductions in construction cost and maintenance cost are assumed to be 10 percent and 0 percent, respectively. As the time reduction adds cost and lowers the extent of construction cost reduction, the required minimum time reduction increases. When the point representing the reductions in the construction cost and time is plotted above the line, the additional cost to shorten the construction time is considered advantageous for the PFI project.

As shown in Figure 7-15, with the reduction of construction time (along with the justifiable increase in construction cost), VFM is improved. In this case, however, IRR is more significantly affected. As is in the sensitivity analysis based on the individual item presented above, IRR changes irregularly based on the construction time reduction. When the time is

reduced more than a half-year, the schedule for the long-term rehabilitation is advanced, as assumed. The change affects the stream of dividend, resulting in a discontinuous form of IRRs in the figure. However, since the irregularity is basically attributable to the discounting process, the general tendency is that IRR is improved as the construction time is shortened.

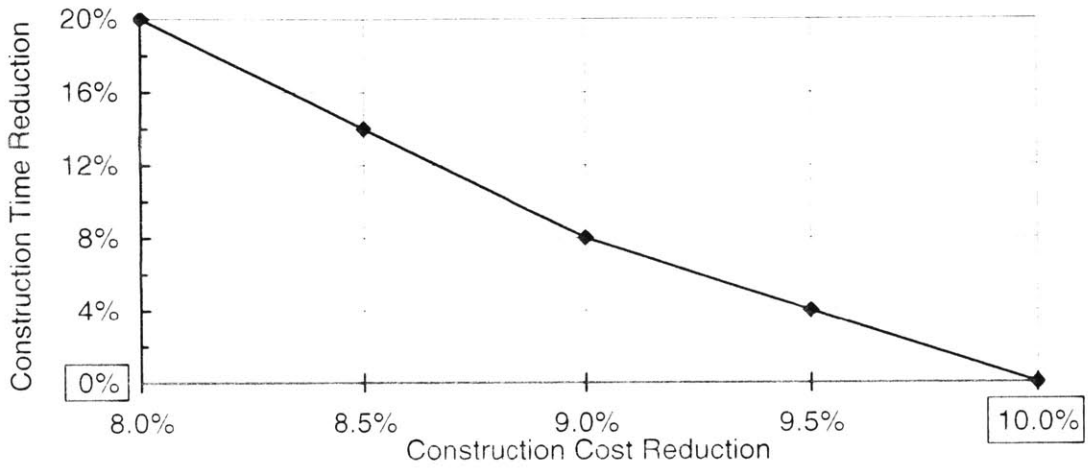
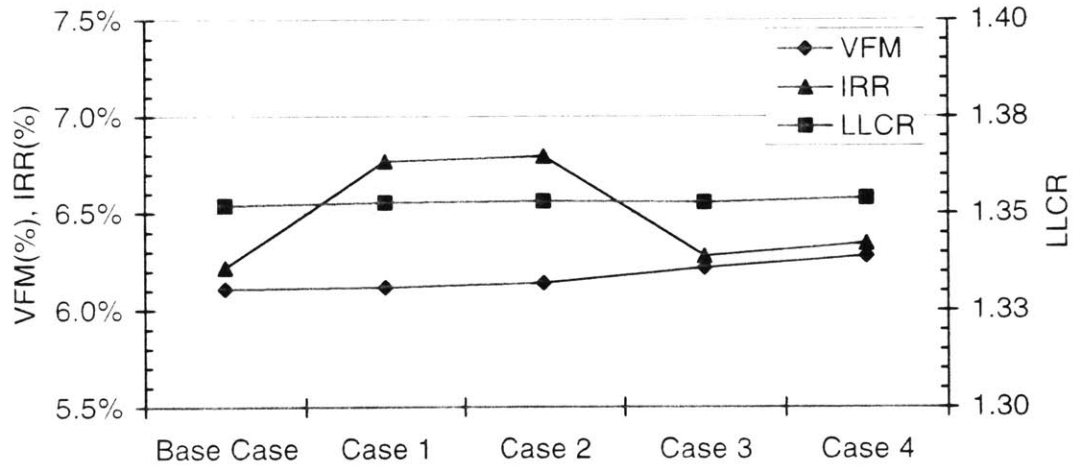


Figure 7-14Minimum Construction Time Reduction for Additional Construction Costs



	Base Case	Case 1	Case 2	Case 3	Case 4
Construction Cost Reduction	10.0 %	9.5 %	9.0 %	8.5 %	8.0 %
Construction Time Reduction	0.0 %	4.0 %	8.0 %	14.0 %	20.0 %

Figure 7-15Effects on the Index from Construction Time Reductions

The trade-off analyses suggest that proper configurations of important items can result in an improved VFM for the public sector with unchanged or improved profits for the private operator and unchanged solvency of the project for the lenders. Therefore, PFI project planning should incorporate the concept in order to enhance the competitiveness of the proposals in the

bidding and the financial success in the execution. The configurations, of course, are based on the wide and profound knowledge and experiences in the advanced technology regarding the construction and operation of highway projects. Packaging of all the engineering decisions in a project proposal is the challenge for the private sector under PFI highways.

Table 7-6 Base Costs for Public Sector Comparator

PSC (Base)

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Expenditure															
Design/Construction Phase															
Construction Cost	29.2	29.2	29.2	29.2	29.2										
Design Cost	1.5	1.5	1.5	1.5	1.5										
Overhead	1.5	1.5	1.5	1.5	1.5										
Const Financing Interest	2.2	2.2	2.2	2.2	2.2										
Sub Total	34.4	34.4	34.4	34.4	34.4										
Operation Phase															
Maintenance Cost	0.0	0.0	0.0	0.0	0.0	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Overhead	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Repair Cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5
Sub Total	0.0	0.0	0.0	0.0	0.0	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	11.2
Debt Service															
Principal	0.0	1.0	2.1	3.3	4.5	5.7	6.0	6.3	6.6	7.0	7.3	7.7	8.1	8.5	8.9
Interest	0.0	1.7	3.4	5.0	6.6	8.0	7.8	7.5	7.1	6.8	6.5	6.1	5.7	5.3	4.9
Total Repayment	0.0	2.8	5.5	8.3	11.0	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
Total Expenditure	34.4	37.1	39.9	42.6	45.4	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	25.0
Revenue (net of toll revenue)															
Debt Financing	34.4	34.4	34.4	34.4	34.4										
Total Revenue	34.4	34.4	34.4	34.4	34.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public Expenditure	0.0	-2.8	-5.5	-8.3	-11.0	-15.5	-15.5	-15.5	-15.5	-15.5	-15.5	-15.5	-15.5	-15.5	-25.0

PSC (Base)

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.8
1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	18.4	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	27.5
9.4	9.8	10.3	10.8	11.4	11.9	9.8	7.5	5.1	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.4	4.0	3.5	3.0	2.4	1.8	1.3	0.8	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13.8	13.8	13.8	13.8	13.8	13.8	11.0	8.3	5.5	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15.5	15.5	15.5	15.5	15.5	15.5	12.7	10.0	7.2	21.2	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	27.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-15.5	-15.5	-15.5	-15.5	-15.5	-15.5	-12.7	-10.0	-7.2	-21.2	-1.7	-1.7	-1.7	-1.7	-1.7	-1.7	-1.7	-1.7	-1.7	-27.5

Table 7-7 Risk Adjustment for Public Sector Comparator

PSC Risk Adjustment

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Risk Adjustment															
Design/Construction Phase	3.1	3.1	3.1	3.1	3.1										
Operation Phase	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.2
Total	3.1	3.1	3.1	3.1	3.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.2

PSC Risk Adjustment

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.7	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	5.5
0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.7	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	5.5

Table 7-8 Public Sector Comparator

PSC Calculation

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Expenditure before Discounting															
Public Expenditure	0.0	-2.8	-5.5	-8.3	-11.0	-15.5	-15.5	-15.5	-15.5	-15.5	-15.5	-15.5	-15.5	-15.5	-25.0
Risk Adujstment	-3.1	-3.1	-3.1	-3.1	-3.1	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-2.2
Total	-3.1	-5.8	-8.6	-11.3	-14.1	-15.8	-15.8	-15.8	-15.8	-15.8	-15.8	-15.8	-15.8	-15.8	-27.2
Discoute Rate	1.00	1.04	1.08	1.12	1.17	1.22	1.27	1.32	1.37	1.42	1.48	1.54	1.60	1.67	1.73
Expenditure after Discounting															
Public Expenditure	0.0	-2.7	-5.1	-7.4	-9.4	-12.7	-12.2	-11.8	-11.3	-10.9	-10.5	-10.0	-9.7	-9.3	-14.4
Risk Adujstment	-3.1	-2.9	-2.8	-2.7	-2.6	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-1.3
Total	-3.1	-5.6	-7.9	-10.1	-12.1	-13.0	-12.5	-12.0	-11.5	-11.1	-10.7	-10.3	-9.9	-9.5	-15.7
PSC (NPV)	-240.1														

PSC Calculation

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
-15.5	-15.5	-15.5	-15.5	-15.5	-15.5	-12.7	-10.0	-7.2	-21.2	-1.7	-1.7	-1.7	-1.7	-1.7	-1.7	-1.7	-1.7	-1.7	-27.5
-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-3.7	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-5.5
-15.8	-15.8	-15.8	-15.8	-15.8	-15.8	-13.0	-10.3	-7.5	-24.9	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-33.0
1.80	1.87	1.95	2.03	2.11	2.19	2.28	2.37	2.46	2.56	2.67	2.77	2.88	3.00	3.12	3.24	3.37	3.51	3.65	3.79
-8.6	-8.3	-7.9	-7.6	-7.3	-7.1	-5.6	-4.2	-2.9	-8.3	-0.6	-0.6	-0.6	-0.6	-0.5	-0.5	-0.5	-0.5	-0.5	-7.3
-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-1.4	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-1.5
-8.8	-8.4	-8.1	-7.8	-7.5	-7.2	-5.7	-4.3	-3.1	-9.7	-0.8	-0.7	-0.7	-0.7	-0.6	-0.6	-0.6	-0.6	-0.6	-8.7

Table 7-9 Income Statement of PFI Highway Project

Income Statement

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Service Fee Revenue	0.0	0.0	0.0	0.0	0.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Maintenance Cost	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Fixed Property Tax	0.0	0.0	0.0	0.0	0.0	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2	1.2
Urban Planning Tax	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.3
Depreciation	0.0	0.0	0.0	0.0	0.0	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Interest															
Const Financing	0.0	2.1	4.3	6.7	9.3										
Long-term Loan (Public)	0.0	0.0	0.0	0.0	0.0	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.1	2.0
Long-term Loan (Private)	0.0	0.0	0.0	0.0	0.0	4.9	4.8	4.7	4.5	4.3	4.2	4.0	3.8	3.6	3.4
Extraordinary Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Earning Before Tax	0.0	-2.1	-4.3	-6.7	-9.3	8.1	8.3	8.6	8.9	9.2	9.5	9.9	10.2	10.6	10.9
Corporate Tax	0.0	0.0	0.0	0.0	0.0	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.2	4.3	4.5
Earning After Tax	0.0	-2.1	-4.3	-6.7	-9.3	4.8	4.9	5.1	5.3	5.4	5.6	5.8	6.0	6.3	6.5

Income Statement

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.7
0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2
5.5	5.5	5.5	5.5	5.5	2.8	2.8	2.8	2.8	2.8	3.3	3.3	3.3	3.3	3.3	3.1	3.1	3.1	3.1	3.1
1.9	1.7	1.5	1.4	1.2	1.0	0.8	0.7	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.2	2.9	2.7	2.4	2.1	1.8	1.5	1.1	0.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.4
11.0	11.4	11.9	12.4	12.9	16.1	16.6	17.2	17.8	18.3	0.5	0.6	0.6	0.7	0.7	1.0	1.0	1.1	1.1	-65.5
4.5	4.7	4.9	5.1	5.3	6.6	6.8	7.0	7.3	7.5	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.4	0.0
6.5	6.8	7.0	7.3	7.6	9.5	9.8	10.2	10.5	10.8	0.3	0.3	0.4	0.4	0.4	0.6	0.6	0.6	0.7	-65.5

Table 7-10 Cash Flow Statement of PFI Highway Project

Cash Flow Statement

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Earning Before Int. and Dep.	0.0	0.0	0.0	0.0	0.0	17.8	17.8	17.7	17.6	17.5	17.5	17.4	17.3	17.2	17.0
Equity	29.9	0.0	0.0	0.0	0.0										
Construction Financing	0.0	32.0	34.2	36.6	29.9										
Long-term Loan															
Public Institution	0.0	0.0	0.0	0.0	59.7										
Private Bank	0.0	0.0	0.0	0.0	82.1										
Removed Asset		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Cash Inflow	29.9	32.0	34.2	36.6	171.7	17.8	17.8	17.7	17.6	17.5	17.5	17.4	17.3	17.2	17.0
Capital Expense	29.9	29.9	29.9	29.9	29.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7
Initial Investment	29.9	29.9	29.9	29.9	29.9										
Long-term Repair										0.0	0.0	0.0	0.0	0.0	7.7
Const Financing Repayment	0.0	2.1	4.3	6.7	141.9										
Debt Service		0.0	0.0	0.0	0.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Public Institution		0.0	0.0	0.0	0.0	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Principal		0.0	0.0	0.0	0.0	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.7	2.8
Interest		0.0	0.0	0.0	0.0	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.1	2.0
Private Bank		0.0	0.0	0.0	0.0	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
Principal		0.0	0.0	0.0	0.0	2.2	2.4	2.5	2.7	2.8	3.0	3.2	3.4	3.6	3.8
Interest		0.0	0.0	0.0	0.0	4.9	4.8	4.7	4.5	4.3	4.2	4.0	3.8	3.6	3.4
Paid-back Equity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Cash Outflow	29.9	32.0	34.2	36.6	171.7	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	19.6
Net Cash Flow	0.0	0.0	0.0	0.0	0.0	5.9	5.8	5.8	5.7	5.6	5.5	5.4	5.3	5.2	-2.6
Dividend		0.0	0.0	0.0	0.0	0.0	0.0	1.7	2.9	3.7	4.2	4.6	4.8	4.7	0.0
Cash Flow after Dividend	0.0	0.0	0.0	0.0	0.0	5.9	5.8	4.1	2.8	1.9	1.3	0.8	0.5	0.5	-2.6
Cummulative Cash Flow	0.0	0.0	0.0	0.0	0.0	5.9	11.7	15.8	18.6	20.5	21.8	22.6	23.2	23.7	21.1

Table 7-11 Balance Sheet of PFI Highway Project

Balance Sheet

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Asset															
Cash	0.0	0.0	0.0	0.0	0.0	5.9	11.7	15.8	18.6	20.5	21.8	22.6	23.2	23.7	21.1
Fixed Asset	29.9	59.7	89.6	119.4	149.3	144.1	139.0	133.8	128.7	123.5	118.3	113.2	108.0	102.8	105.4
Total Asset	29.9	59.7	89.6	119.4	149.3	150.0	150.7	149.6	147.3	144.0	140.2	135.8	131.2	126.5	126.4
Liability															
Const Financing	0.0	32.0	66.1	102.7	0.0										
Long-term Loan (Public)	0.0	0.0	0.0	0.0	59.7	57.9	56.0	54.0	51.9	49.7	47.4	45.0	42.5	39.8	37.0
Long-term Loan (Private)	0.0	0.0	0.0	0.0	82.1	79.9	77.5	75.0	72.4	69.6	66.6	63.4	60.0	56.5	52.7
Total Liability	0.0	32.0	66.1	102.7	141.9	137.8	133.6	129.1	124.3	119.3	114.0	108.4	102.5	96.3	89.7
Equity															
Contributed Equity	29.9	27.8	23.4	16.7	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Retained Earnings	0.0	0.0	0.0	0.0	0.0	4.8	9.7	13.1	15.5	17.3	18.7	20.0	21.2	22.8	29.3
Total Equity	29.9	27.8	23.4	16.7	7.4	12.2	17.1	20.6	23.0	24.7	26.2	27.4	28.7	30.3	36.7
Total Liability and Equity	29.9	59.7	89.6	119.4	149.3	150.0	150.7	149.6	147.3	144.0	140.2	135.8	131.2	126.5	126.4

Cash Flow Statement

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
17.0	16.9	16.7	16.6	16.4	15.1	15.0	14.8	14.6	14.3	3.6	3.6	3.6	3.7	3.7	3.6	3.7	3.7	3.7	-62.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.4
17.0	16.9	16.7	16.6	16.4	15.1	15.0	14.8	14.6	14.3	3.6	3.6	3.6	3.7	3.7	3.6	3.7	3.7	3.7	4.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.6
				0.0	0.0	0.0	0.0	0.0	13.5					0.0	0.0	0.0	0.0	0.0	20.6
12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.9	3.1	3.2	3.4	3.6	3.8	3.9	4.1	4.3	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.9	1.7	1.5	1.4	1.2	1.0	0.8	0.7	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.0	4.2	4.5	4.8	5.0	5.4	5.7	6.0	6.4	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.2	2.9	2.7	2.4	2.1	1.8	1.5	1.1	0.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	25.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.0
5.0	4.9	4.8	4.6	4.5	3.2	3.0	2.8	2.6	-11.2	3.6	3.6	3.6	3.7	3.7	3.6	3.7	3.7	3.7	-17.0
4.2	4.4	4.3	4.2	4.0	2.9	2.7	2.5	2.3	0.0	3.2	3.2	3.3	3.3	3.3	3.3	3.3	3.3	3.3	0.0
0.8	0.5	0.5	0.5	0.4	0.3	0.3	0.3	0.3	-11.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	-17.0
21.9	22.3	22.8	23.3	23.7	24.0	24.3	24.6	24.9	13.7	14.1	14.4	14.8	15.2	15.5	15.9	16.3	16.6	17.0	0.0

Balance Sheet

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
21.9	22.3	22.8	23.3	23.7	24.0	24.3	24.6	24.9	13.7	14.1	14.4	14.8	15.2	15.5	15.9	16.3	16.6	17.0	0.0
99.9	94.4	88.9	83.5	78.0	75.2	72.4	69.6	66.9	77.6	74.3	71.0	67.7	64.4	61.1	58.1	55.0	51.9	48.9	0.0
121.7	116.8	111.8	106.8	101.7	99.3	96.8	94.3	91.7	91.3	88.3	85.4	82.5	79.6	76.7	74.0	71.3	68.6	65.9	0.0
34.1	31.0	27.7	24.3	20.7	17.0	13.1	8.9	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48.7	44.5	40.0	35.2	30.2	24.8	19.1	13.1	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82.8	75.4	67.7	59.5	50.9	41.8	32.2	22.0	11.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	0.0
31.5	33.9	36.6	39.8	43.4	50.0	57.1	64.8	73.0	83.8	80.9	78.0	75.1	72.1	69.2	66.5	63.8	61.1	58.4	0.0
39.0	41.3	44.1	47.2	50.8	57.5	64.6	72.2	80.4	91.3	88.3	85.4	82.5	79.6	76.7	74.0	71.3	68.6	65.9	0.0
121.7	116.8	111.8	106.8	101.7	99.3	96.8	94.3	91.7	91.3	88.3	85.4	82.5	79.6	76.7	74.0	71.3	68.6	65.9	0.0

Table 7-12 Life Cycle Cost of PFI Highway Project

LCC of PFI

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Public Expenditure															
Service Fee Payment	0.0	0.0	0.0	0.0	0.0	-24.0	-24.0	-24.0	-24.0	-24.0	-24.0	-24.0	-24.0	-24.0	-24.0
Bid Preparation	-0.5														
Monitoring (Construction)	-0.1	-0.1	-0.1	-0.1	-0.1										
Monitoring (Operation)		0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Subtotal	-0.6	-0.1	-0.1	-0.1	-0.1	-24.1	-24.1	-24.1	-24.1	-24.1	-24.1	-24.1	-24.1	-24.1	-24.1
Adjustment of Earlier Revenue															
Toll Revenue Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tax Income Adjustment															
Subtotal	0.0	0.0	0.0	0.0	0.0	5.0	5.1	5.2	5.2	5.3	5.4	5.5	5.6	5.7	5.9
Expenditure before Discounting	-0.6	-0.1	-0.1	-0.1	-0.1	-19.0	-19.0	-18.9	-18.8	-18.7	-18.6	-18.5	-18.4	-18.3	-18.2
Discount Rate	1.00	1.04	1.08	1.12	1.17	1.22	1.27	1.32	1.37	1.42	1.48	1.54	1.60	1.67	1.73
Expenditure after Discounting	-0.6	-0.1	-0.1	-0.1	-0.1	-15.6	-15.0	-14.3	-13.7	-13.2	-12.6	-12.0	-11.5	-11.0	-10.5
LCC (NPV)	-225.4														

LCC of PFI

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
-24.0	-24.0	-24.0	-24.0	-24.0	-24.0	-24.0	-24.0	-24.0	-24.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0
-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
-24.1	-24.1	-24.1	-24.1	-24.1	-24.1	-24.1	-24.1	-24.1	-24.1	-6.1	-6.1	-6.1	-6.1	-6.1	-6.1	-6.1	-6.1	-6.1	-6.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.9	6.0	6.2	6.3	6.5	7.7	7.9	8.1	8.3	8.6	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.9
-18.2	-18.0	-17.9	-17.7	-17.6	-16.3	-16.1	-15.9	-15.7	-15.4	-4.8	-4.8	-4.8	-4.8	-4.9	-4.8	-4.8	-4.9	-4.9	-5.1
1.80	1.87	1.95	2.03	2.11	2.19	2.28	2.37	2.46	2.56	2.67	2.77	2.88	3.00	3.12	3.24	3.37	3.51	3.65	3.79
-10.1	-9.6	-9.2	-8.8	-8.3	-7.4	-7.1	-6.7	-6.4	-6.0	-1.8	-1.7	-1.7	-1.6	-1.6	-1.5	-1.4	-1.4	-1.3	-1.4

Chapter 8. Conclusion

The thesis has started with discussing the privatization schemes in public infrastructure employed by many governments in the world. The government motives to seek for these schemes and three major practical forms included in the broad concept of "privatization" are discussed. A closer review is presented for public-private partnerships (PPP), one of the most common forms of privatization in infrastructure development (Chapter 2). The discussions about PPP are extended in highway infrastructure. The economic viability and risks in highway projects are examined. Practical methods in achieving efficiency and delivering it to the public through PPP are discussed. Competition and regulatory oversight are of crucial importance for the public and the private sector alike (Chapter 3). Following the general discussions about the important issues about PPP in highway infrastructure, examples of PPP highway development programs are studied in the United States and the United Kingdom. Important legislations that have enabled the implementation of PPP in these countries are introduced. Relative advantages and disadvantages of the legal frameworks are discussed, based on the observations in some milestone projects under the legislations (Chapter 4 for the U.S. and Chapter 5 for the U.K.).

In the second half of the thesis, the focus of the research has been directed to the situations in Japan. Japan's highway development program, its historical background and its current status and future prospect, are overviewed. Japanese PFI (or Private Finance Initiative) is introduced and its potential benefits and difficulties in applying to the highway development are examined (Chapter 6). The thesis has ended with the discussions about the private sector's roles in enabling successful implementation of PFI in Japan's highway infrastructure. Important areas of contributions, desirable working environment, and necessary improvement of the capabilities are discussed from the private sector's point of view (Chapter 7). The following points are the main conclusions that the research has reached.

Conclusion 1: Experiences suggest that the private sector has brought considerable contributions through public-private partnerships in highways.

Worldwide experiences suggest that financial problems in highway development are common in many countries, although the level of severity may differ in each of the countries.

Among a range of possible solutions to the observed problems, privatization schemes have often attracted interests from the governments. In highway infrastructure, public-private partnerships (PPP) have been becoming common. The two countries studied in this thesis (i.e., the U.S. and the U.K.) have sought PPP in their highway development program.

Increasing popularity would explain the potential benefits of PPP in highways. If provided a proper policy framework, PPP brings considerable contributions from the private sector in provision of additional funding, technical innovation, and risk sharing. In many cases studied in this thesis, the private sector's efforts to respond to the public sector's expectation have been one of the crucial components of successful implementation of PPP in highways.

Conclusion 2: Experiences also suggest that the public-private partnerships have required appropriate environments, mainly provided by the public sector.

The experiences also suggest that it is not easy to successfully implement PPP. There are a number of issues that must be properly addressed in the policy framework. Because the arrangements of the issues either significantly increase or decrease the effectiveness of PPP, the public and the private sector participants must be careful about them.

One of the issues is the intensity of competition introduced in the PPP highway projects. Although it is generally believed that the private sector tends to be more efficient than the public sector, the relative efficiency can be realized only when the public sector arranges an appropriate level of competition in basically monopolistic infrastructure. The competition is often introduced through competitive biddings for the highway development rights. While the competition generally encourages the private sector to achieve cost reductions through various kinds of innovation, it also increases the risk for them in participating in the project.

Another issue is the scope of discretions allowed to the private sector in PPP highway projects. It is generally true that, the earlier the private sector is invited in the project, the larger becomes the scope of possible innovation. However, it is also likely that the private sector must assume planning risks when they participate in the project early. As observed in the U.S. and the U.K. experiences, since the planning risks, including traffic volume risk, right-of-way acquisition risk, and environmental permit risk, are not always suitable for private sector's assumption, the timing of private participation is quite important.

Overall, these arrangements almost always entail trade-offs between innovations

brought by the private sector and risks that they must assume in the project. While the private sector may have greater capability for innovation than the public sector, they are more vulnerable to the risks. PPP must be arranged in the way these strengths of the private sector can be fully exercised and their weaknesses can be supported by the public sector.

Conclusion 3: Japan's highway development has generally been successful and needs to be continued after overcoming the current problems.

A closer review of the highway development history in Japan reveals that Japan started their highway development quite late compared to other developed countries, and since then has maintained accelerated pace of investment in order to catch up with the forerunners. Although their unique financing strategies (i.e., toll revenue pooling system and redemption principle) have helped the government achieve the rapid highway development, they have also created severe financial problems in the highway public corporations.

However, it does not follow that the highway development in Japan can stop now. Instead, the macro figures suggest that the development level of Japan's highway infrastructure is still behind those of other developed nations. In order to continue the development of high standard and well-managed nationwide highway network, the government is trying to reshape its highway development program, where the development goal of the highway network and the organization to achieve the goal is under reconsideration. Through these policy reforms, Japan's highway development should regain the nation's credit and hang on its difficult mission.

Conclusion 4: Private finance initiative can be beneficial in Japan's highway development.

In efficiently executing the revised highway development program, the long-lasted procurement system should also be reconsidered. Although the conventional design-bid-build has so far been preferred as the standardized and therefore efficient method of public works procurement, effective use of public resources through appropriate selection of procurement methods will become more important than before. Private Finance Initiative (PFI) should be among the considerations.

Adopted from the U.K., PFI is an application of PPP in Japan's public infrastructure, which was officially launched in 1999 and employed mainly in building-type projects by local governments. Highways, large infrastructure under the responsibility of the national government,

have been an exception. The thesis has asserted that PFI, when applied, can benefit Japan's highway infrastructure as well. Having analyzed the economic and institutional conditions of the highway development in Japan, it is believed that PFI is particularly effective in reducing the total public expenditure through technical innovation and risk management by the private sector.

Conclusion 5: Successful application of PFI to Japan's highway development requires a workable environment for the private sector.

Although PFI is believed to be beneficial in Japan's highway development, its success requires an appropriate environment where the public sector can actually realize the benefits that they want from PFI and the private sector can expect reasonable profits from their committed resources. In order for PFI to correctly address the overall policy goal of highway development, the project should be selected by the public sector from their conceived project lists. Also, since the prospects of traffic demand on Japan's future highways are not quite favorable in general, the payment mechanism for the PFI highway projects is an important consideration. Financial commitment from the public sector should remain, but at a level lowered with PFI.

Conclusion 6: PFI application to Japan's highway development is an opportunity as well as a challenge for the private sector.

PFI is a significant challenge for the private sector, particularly for the construction and engineering companies. Arranging private financing for a large-scale highway investment is a crucially important task that the companies are now asked to do. Further, it is probably more important that their technical capabilities are advanced in order to reduce the construction cost and time, maintenance and repair cost, and risk management cost of the highway projects. Along with these individual items, the thesis emphasizes the importance and usefulness of an improved planning method that integrates various items under a total life cycle concept. Without these efforts, the benefits of PFI would remain potential and be never realized.

Importantly, PFI is also an opportunity for the companies that have accumulated broad experiences related to the arrangement of PFI projects and will continue to direct great efforts in enhancing them. Expanding their engineering expertise and incorporating them into one project package will be the challenge and the opportunity for the construction companies in the next generation of highway development in Japan.

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