DETAILED GUIDELINE FOR VALUE-FOR-MONEY TEST FOR BUILD-TRANSFER-OPERATE (BTO) PUBLIC-PRIVATE PARINERSHIP (PPP) PROJECTS

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KDI Public and Private Infrastructure Investment Management Center

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Detailed Guideline for Value-for-Money Test for BTO PPP Projects

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CONTENTS

PART Ⅰ DETAILED GUIDELINE FOR VALUE-FOR-MONEY TEST

Chapter Ⅰ

Introduction

SECTION 1 Background and Objectives of the Study

The value-for-money test of public-private partnerships (hereinafter, "PPPs") was introduced in Korea in 2005 when the Act on Public-Private Partnerships in Infrastructure (hereinafter, the "PPP Act") was amended.[1] Since the review on a private proposal, which has been enforced before the value-for-money test was introduced, is focused on the review on technical and financial appropriateness of the substance of the private proposal, it has failed to assess whether the proposed project itself is feasible or whether it is more appropriate to implement the project by PPP than by public finance. The introduction of the value-for-money test in Korea by the amendment to the PPP Act in 2005 made it possible to analyze whether it is appropriate to implement a project through a public-private partnership as well as the feasibility of the implementation of the

1) (Article 7 (5) of the Enforcement Decree of the PPP Act) If the total project cost of a proposed project is not less than KRW 200 billion, upon receiving a request for review thereon pursuant to paragraph (3), the head of PIMAC shall conduct the value-for-money test, which shall include the analysis of the appropriateness of demand estimation and the analysis of costs and benefits in comparison with a hypothetical case where it is implemented as a government-financed project. <Newly Inserted on Mar. 8, 2005; Dec. 28, 2007>

project.[2] In particular, the introduction of the methodology for the analysis of the value for money (hereinafter, "VFM"), which the United Kingdom, Australia, Japan and other countries have adopted as a methodology for assessing value for money, has enabled people to scrutinize the VFM of PPPs in detail.

Although the Basic Plan for PPP projects stipulates the stages of implementing the VFM test and the scope of the analysis by stages, a manual providing for the methods of implementation in detail was needed in order to conduct the VFM test practically. Hence, the KDI Public & Private Infrastructure Investment Management Center (PIMAC) has shaped up the methodology for the VFM test through the "Study on Detailed Guideline for Conducting the Value-for-Money Test (Proposal Review) of BTO Unsolicited Projects and the Determination of Bonus Points therefor (Draft) (hereinafter, "Detailed Guideline for VFM Test")" and has performed the VFM test and the private proposal review. The number of projects on which either the VFM test or the proposal review has been conducted in accordance with the "Detailed Guideline for VFM Test" as at December 2009 reaches 141.

2) At present, even where the total project cost of an unsolicited project is less than KRW 200 billion, the project shall be also subject to a review on "value-for-money" of the proposal pursuant to Article 7 (5) of the Enforcement Decree of the PPP Act in the same manner as the "value-for-money test" that shall be conducted with regard to an unsolicited project with a total project cost of at least KRW 200 billion. Such review is called a "private proposal review" but is the same as a "value-for-money test" in its substance and nature. Thus, both the review and the test are referred collectively as "value-for-money test" hereinafter without distinguishing them from one another. Therefore, this detailed guideline for the "value-for-money test" may be also applied to a "proposal review" that shall be conducted in the same manner with regard to an unsolicited project with a total project cost of less than KRW 200 billion.

<Table Ⅰ-1> The Number of Cases of VFM Test of PPPs and Private Proposal Review

Classification	2005	2006	2007	2008	2009	Total	Percentage
Road	6	6	7	21	5	45	31.9%
Railroad	5	6	3	3	6	23	16.3%
Environment	4	9	5	5	15	38	27.0%
Port & Harbor	1	-	-	1	-	2	1.4%
Building	0	1	1	11	3	16	11.3%
Others	3	5	4	2	3	17	12.1%
Total	19	27	20	43	32	141	100%

The "Detailed Guideline for VFM Test" published in 2007 indicates the fundamental direction of the methodology of the VFM test but has limitations in providing solutions for various issues arising in the course of an actual VFM test. In addition, it is necessary to prepare new guidelines for reflecting distinctive characteristics of each PPP project, since the guidelines for the preliminary feasibility study have been applied even to conduct the feasibility assessment, which comprises a large part of the VFM test. While guidelines for the VFM test and the proposal review on sewage treatment projects and waste disposal projects (incineration facilities) have been prepared for PPPs in the environmental sector through the "Study on Guidelines for VFM Test of PPP Projects in the Environmental Sector (PIMAC, 2007)," neither a standard manual fully covering all projects nor guidelines for transportation projects, such as road projects, are presently unavailable.

Under such circumstances, this Study aims to re-establish the methodology for analysis and enhance objectivity and consistency in the VFM test by subcategorizing and specifying details of the VFM test provided for in the "Detailed Guideline for VFM Test." It is intended to prepare standard guidelines

for the VFM test that may be applicable to all kinds of projects in common through this Study by examining issues drawn out in the course of the VFM test and the methodology that foreign countries have applied to the VFM test. Although specific projects in this Guide are limited to the road sector, the applicable methodology may be regarded as standard guidelines in its nature and may be applied to projects in all sectors. Nevertheless, it is still necessary to take distinctive characteristics of each project into consideration, when it is intended to apply this Guide to a PPP project in any other sector.

SECTION 2 Scope and Substance of the Study

Through this Study, the feasibility assessment, the assessment of the VFM of a public-private partnership, the establishment of PFIs, and the calculation of the ratio of bonus points, which consist of stages of the VFM provided for in the "Detailed Guideline for VFM Test," will be further specifically defined and will be partially revised and supplemented, where necessary.

As to the feasibility assessment stage, the methodology for the preliminary feasibility study applies *mutatis mutandis*, but the analysis methodology by which distinctive characteristics of a PPP will be established in regard to the determination of the level of user fees and the setup of a reference project. In regard to the VFM assessment stage, more specific details of the method of determining a public-sector comparator (hereinafter, "PSC") and PFI, VFM rate, and the review on financial profitability will be presented, while the items of the qualitative VFM analysis will be subdivided more specifically than the current standards. In regard to the establishment of PFIs, matters that shall be taken into consideration in addition to options in the financial aspect will be presented, while the standards applicable in providing for a ratio of bonus points will be presented in detail.

The "Detailed Guideline for the VFM Test" is the detailed guideline

applicable to the VFM test and the proposal review on unsolicited projects. The "VFM test" differs from the "proposal review" in official terms, but an identical methodology for testing applies to both of them. Although the scale of the total project cost subject to the "proposal review" is relatively smaller than that subject to the "VFM test," the "proposal review" demands the same amount of effort, time, and costs as the "VFM test" does in conducting a substantive review, such as the review on economic feasibility and the review on the appropriateness of implementing a PPP project, and thus, it is required to apply the procedure and standards similar to those for the "VFM test."

As discussed above, the existing "Detailed Guideline for VFM Test" provides for the methodology for the VFM test of unsolicited projects, but this Study presents the comprehensive methodology for the VFM test of projects solicited by the Government (hereinafter, "solicited projects") and the directivity for conducting the VFM test of solicited projects as well, which are expected to increase, while covering general terms and conditions of unsolicited projects at the same time. At present, there are very few cases of the VFM test conducted in regard to unsolicited projects, except for BTL PPPs, and so there are limitations in completing the methodology therefor. Hence, this Study presents a rough framework for the application of the methodology and it is planned to make perfect guidelines by supplementing contents in detail in the future.

The projects in this Study are limited to road projects, and so the methodology for the estimation of specific demand and costs in assessing the feasibility and VFM is also limited to those for the road sector. Nevertheless, the details of each test stage or the framework of the estimation of demand and costs can be also applied to other industrial sectors. In particular, the details regarding the feasibility assessment, the establishment of alternatives, and the calculation of the ratio of bonus points can be applied comprehensively to railroad, port, harbor, building, and environmental projects, and therefore it can be said that the results of this Study are standard guidelines for the VFM test in its nature.

Chapter II

VALUE-FOR-MONEY TEST SYSTEM

SECTION 1 Objectives of Value-for-Money Test

The PPP Act[3] clearly provides that, in order for the competent authority to implement an infrastructure facility project under a public-private partnership, it shall analyze the feasibility of the project and shall designate it as a potential PPP project through the deliberation by the Review Committee. The Enforcement Decree of the PPP Act[4] also provides that the competent authority shall request the head of PIMAC to review on the contents of a proposal before it makes a final decision on whether to implement a proposed project as a PPP project, and the head of PIMAC shall, in turn, conduct a VFM test, including the appropriateness of the estimated demand and the B/C analysis, comparing the proposal with a hypothetical case where the project is implemented as a government-financed project, if the total project cost is at least KRW 200 billion.

Both "feasibility analysis" in the PPP Act and "VFM test" in the Enforcement Decree of the same Act may be construed as a VFM test. As

3) A summary of the provisions of Article 8-2 of the PPP Act.
4) Article 7 of the Enforcement Decree of the PPP Act.

discussed above, the VFM test is an essential step that shall be undergone in order to designate a project as one eligible for a public-private partnership or implement an unsolicited project.

Generally, the VFM test is divided into: Stage 1 (feasibility assessment); stage 2 (VFM assessment of PFI); and stage 3 (establishment of PFI alternatives). At stage 1 -feasibility assessment- the feasibility of the relevant project shall be assessed, mainly focused on its economic feasibility. If the feasibility for implementation is ensured at stage 1, it shall be assessed at stage 2 -VFM assessment of PFI- whether implementing the relevant project as a PPP project is more appropriate than implementing it as a government-financed project by analyzing the VFMs of PSC (Public Sector Comparator) and PFI (Private Finance Initiative). At stage 3 -establishment of PFI alternatives- the project cost and operating cost appropriate on the government's side are deducted, based on the results of the analysis at stage 2, and the scale of the appropriate Government subsidies is calculated through additional analysis on financial profitability.

<Table II-1> Provisions Relevant to VFM Test of the PPP Act and the Enforcement Decree

Provisions	Text
PPP Act	Article 8-2 (Designation of Potential PPP Projects) (1) Where the competent authority intends to implement an infrastructure facility project under a public-private partnership, it shall designate the project as a project eligible for a public-private partnership (hereinafter referred to as "potential project") on condition that the project shall meet the following requirements: <*Amended on Jan. 27, 2005*> 1. The project shall conform to medium- and long-term plans for infrastructure facilities and the order of priority of Government-invested projects. 2. The project shall be profitable enough to induce the private sector to participate therein. (2) If the scale of a project is equivalent to or exceeds the scale specified by Presidential Decree, the competent authority shall conduct an analysis of the feasibility of the project and bring the case to the Review Committee for deliberation before designating it as a potential project. (3) When the competent authority designates a project as a potential project, it shall promptly give public notice of the designation through the Official Gazette (or its web-site). <*Amended on Jan. 27, 2005*>

Provisions	Text
Enforcement Decree of the PPP Act	Article 7 (Implementation Process for Projects Proposed by Private Sector) (3) If the competent authority finds that a project proposal submitted pursuant to paragraph (1) meets formal requirements and conforms to law and the competent authority's policies, it shall request the head of the Public and Private Infrastructure Investment Management Center (hereinafter referred to as "PIMAC") under Article 23 (1) of the Act to review the details of the project proposal before deciding whether to implement the proposed project as a public-private partnership project. In such cases, unless the competent authority demands to supplement the proposal pursuant to paragraph (2) or where any other extenuating circumstance arises, it shall make such request for the review within 30 days from the filing date of the project proposal and, if it is impossible to make a request for the review within the period specified above, the competent authority shall notify the proposing person of the reasons therefor and the scheduled date for requesting the review. *<Amended on Mar. 8, 2005; Dec. 28, 2007>* (4) If data necessary for the review requested pursuant to paragraph (3) on the contents of a proposal are inadequate, the head of PIMAC may request the competent authority to supplement the data within a specified period. *<Newly Inserted on Dec. 30, 2000; Mar. 8, 2005>* (5) If the total project cost of a proposed project is at least KRW 200 billion, the head of PIMAC shall conduct a value-for-money test, upon receiving a request for the review on the project paragraph (3), including the analysis of the appropriateness of the estimated demand and the B/C analysis, comparing the proposal with a hypothetical case where the project is implemented as a government-financed project. *<Newly Inserted on Mar. 8, 2005; Dec. 28, 2007>* (6) Unless the value-for-money test under paragraph (5) shall be conducted or any other extenuating circumstance arises, the head of PIMAC shall submit his/her opinion on a proposal to the competent authority and the Minister of Strategy and Finance within 60 days from the date on which he/she receives a request for the review but may present his/her opinion different from the initial proposal with regard to the appropriate project cost, user fees, the rate of return, and other terms and conditions for implementing the project, if he/she concludes that it is proper to implement a project as a public-private partnership project,. *<Amended on May 24, 1999; Mar. 8, 2005; Feb. 29, 2008>* (7) Unless any extenuating circumstance arises, the competent authority shall notify a proposing person of its opinion on the proposal in writing, such as whether to implement the proposed project as a public-private partnership project, taking the opinion of the head of PIMAC into consideration, within 60 days from the date on which it receives the opinion from the head of PIMAC but, if it is unable to give such notice within the period specified above, shall notify the proposing person of the reasons therefor and the expected date of such notice. In such cases, if it is intended to implement a proposed project under any subparagraph of Article 8 as a public-private partnership project, the proposal shall be brought to the Review Committee for prior deliberation. *<Amended on Mar. 8, 2005>*

As discussed above, the VFM test is a process of assessing whether a PPP project ensures the feasibility for implementing the project from the aspect of the national economy or policies and whether implementing the project as a PPP project is more appropriate than implementing it as a government-financed project. A PFI alternative produced through the VFM test is a project option implementable on the government's side and may be helpful to the competent authority in proceeding with negotiations on the original proposal or with a third party who will submit an alternative proposal in the future.

In particular, bonus points may be given pursuant to Article 7 (8) to a person who makes the initial proposal on an unsolicited project within the maximum of ten percent of total points in evaluating project proposals, and thus, a ratio of bonus points is given to the person who makes the initial proposal, if the feasibility and the VFM are ensured as a result of the VFM test.

SECTION 2 Methodology for Value-for-Money Test by Stage

A VFM test shall be conducted in accordance with the following procedure, and an opinion on the review at each stage shall be presented and then an overall final opinion shall be presented. If there is no proposal for a solicited project, the steps "review on the formal requirements for the project proposal," "review on the appropriateness of detailed terms and conditions of the proposal," and "grant of the ratio of bonus points" are not applicable:

- ◦ Review on formal requirements for the project proposal (for unsolicited projects)
- ◦ Assessment of the feasibility of the project
- ◦ Assessment of the VFM of a public-private partnership
- ◦ Analysis of the PFI alternative
- ◦ Review on the appropriateness of detailed terms and conditions of a

proposal (for unsolicited projects)

◦ Presentation of the overall opinion and the ratio of bonus points (for unsolicited projects).

"Review on formal requirements for the project proposal" is to review whether a proposed project plan describes all elements specified in Article 7 (1) of the Enforcement Decree of the PPP Act and satisfies formal requirements for a proposal. The elements constituting the formal requirements for a proposal specified in Article 7 (1) of the Enforcement Decree of the PPP Act are:

◦ The scope of the assessment of the feasibility of the proposed project

◦ Details of the project plan

◦ Details of the total project cost and the financing plan

◦ Details of the determination of the free-use period or the ownership period for profit

◦ A plan for the management and operation of facilities

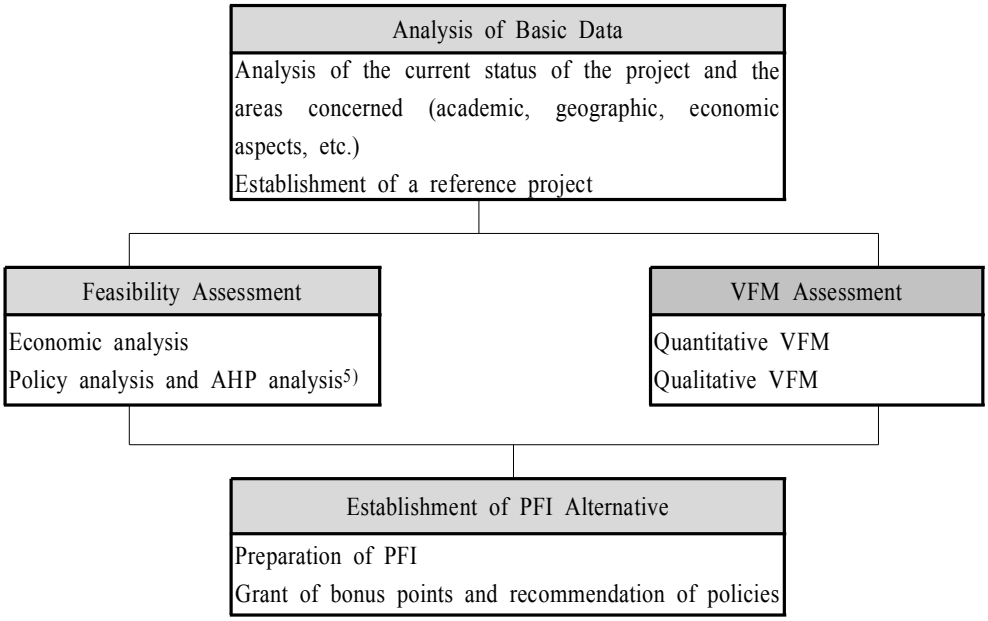
◦ A plan for revenue, including user fees, and expenditure

◦ Details of ancillary projects, if any, and reasons therefor

◦ Other matters that the person proposing the project considers necessary for the implementation of the project.

After assessing whether a private proposal covers all elements specified above, and thus, satisfies the formal requirements for a proposal, the VFM test shall be conducted in the order of the feasibility assessment, the VFM assessment, and then the establishment of a PFI alternative as illustrated in Figure Ⅱ-1.

[Figure II-1] Methodology for Value-for-Money Test



5) Policy analysis and AHP analysis are unnecessary for all projects subject to analysis, and the guidelines relating to such analyses are presented in Section 9 of Chapter III, "Overall Feasibility Assessment."

1. Stage 1: Feasibility Assessment (Decision to Invest)

In order to assess the feasibility of a project, it is necessary to analyze basic data about the project and establish a reference project. Basic data to estimate demand for the project can be utilized in the process of estimating demand by analysing such data. The analysis of basic data generally consists of the analysis of the current status of social and economic indexes, the analysis of the current status of traffic-related facilities, and the review of relevant plans. The current status of social and economic indexes are analyzed by referring to the statistical almanacs of the areas concerned about the population, the number of households, the number of people schooling or commuting, the number of registered automobiles, etc. in neighboring the project site. The analysis of the current status of traffic-related facilities is helpful for ascertaining distinctive characteristics of the traffic situation by examining the current status of transportation facilities, such as roads and railroads in the vicinity, and the current status of traffic volume. The review of relevant plans is to review higher-level plans relating to traffic issues and local plans for the neighborhood of the project site.

The establishment of a reference project is the process of determining the scope of a project for the feasibility assessment and the VFM assessment. The reference project for a solicited project is established by referring to the scope of the basic plan or the basic design established by the competent authority, while the reference project for an unsolicited project is generally established by referring to the scope of the project in the project proposal from the private sector.

Once a reference project is established, the feasibility assessment shall be conducted based on the reference project. The feasibility assessment is to assess whether a project is one necessary at the level of the national economy through a feasibility review at the level of the preliminary feasibility study (or feasibility

assessment) that shall be conducted if the project is to be implemented as a government-financed project. In principle, the feasibility assessment shall be conducted in accordance with the "Study on Amendment and Supplement of the Standard Guidelines for Preliminary Feasibility Studies of Road and Railroad Projects (5th ed.)" published by the Korea Development Institute. If it is concluded through the feasibility assessment that a project is feasible, the VFM assessment of a public-private partnership follows as stage 2.

2. Stage 2: Assessment of Value for Money of a Public-Private Partnership (Decision for PFI)

The VFM assessment of a public-private partnership is to estimate the total life cycle costs of a public sector comparator (hereinafter, "PSC"), under which a reference project is implemented as a government-financed project, and a private finance initiative, under which a project is implemented as a PFI project, for the entire period of the project and then compare the government's share of costs of each of such options. If the government's share of costs in the PFI is smaller than the government's share of costs in the PSC, it is determined that the PFI will deliver value for money.

The VFM assessment of a public-private partnership shall be conducted through the quantitative VFM analysis and the qualitative VFM analysis, and whether a PFI will deliver value for money is determined finally by aggregating the results from the quantitative and qualitative VFM assessments.

3. Stage 3: Establishment of PFI Alternative and Determination of Bonus Points

If it is concluded that a project will deliver VFM in a public-private partnership or the feasibility for implementing as a PFI project, a PFI alternative is developed. Through such an alternative, the total project cost and operating

cost are made up with an appropriate cost, among the costs of the PSC and the PFI alternative, and the rate of return and the level of Government subsidies are presented through an analysis on sensitivity, etc.

For an unsolicited project, a ratio of bonus points is also given. The ratio of bonus points is given through comprehensive assessment at the level of the quantitative VFM and the appropriateness of the proposed business plan. The review on the appropriateness of contents of a proposal is to take precautions and provide relevant knowledge necessary for implementing the project and examine the fidelity of contents of the private proposal and the capability of implementing the project. The appropriateness of contents of a proposal is graded for each item by A, B, C, D, or F, and a proposal with its appropriateness highly graded is interpreted as a proposal more consistent with the government's medium- and long-term plans and plans for public-private partnerships and is given a ratio of bonus points.

SECTION 3 Methodology for Value-for-Money Test by Project Implementation Method

As most BTO PPP projects have been implemented to date as unsolicited projects, the guidelines for VFM test are prepared mainly for unsolicited projects. However, cases where a project is implemented in accordance with a PSC established by the competent authority by modifying part of a proposal have been recently increasing in cases of unsolicited projects, and some government-financed projects are implemented as solicited projects. Therefore, it is necessary to establish the methodology for the VFM test for various project implementation methods.

Through this Study, it is intended to present the methodology for the VFM test, not only for unsolicited projects in a simple ordinary form, but also unsolicited projects with a PSC and solicited projects. In order to conduct the

VFM test, a reference project shall be established, and the Public Sector Comparator (PSC) and the Private Finance Initiative (PFI) shall be determined.

In order to conduct the VFM test of an unsolicited project in a simple form, a PSC_P as a PSC applicable to PFI_P, which represents the project proposal proposed by the private sector, shall be established. The subscript "$_P$" is an abbreviation of 'private' and means that the reference project is established as privately proposed. However, the reference project for an unsolicited project with a PSC available or a solicited project shall be established by the competent authority. The PSC for an unsolicited project is an option that the competent authority requests an analysis after partially modifying the length, origin, destination, or junctions of a route or any other matter regarding an unsolicited project, and it may be deemed that such option has a reference project separately established by the competent authority as a solicited project does. Therefore, both PSC_G and PFI_G shall be estimated. The subscript "$_G$" means that the reference project has been established by the Government. As regards an unsolicited project, PSC_P, PSC_G, and PFI_G, except PFI_P to which the research team shall apply the contents of a proposal as they are, shall all be estimated in the course of the test.

The table below is a summary of the project options discussed above.

<Table II-2> Establishment of Options for Analysis in VFM Test

Project Options	Unsolicited Projects	Unsolicited Projects with PSC Available	Solicited Projects
PFI	PFI_P (private project proposal)	PFI_P (Proposal)	PFI_G (estimated by the research team)
		PFI_G (estimated by the research team)	
PSC	PSC_P (estimated by the research team)	PSC_P (estimated by the research team)	PSC_G (estimated by the research team)
		PSC_G (estimated by the research team)	

1. Value-for-Money Test of Unsolicited Projects

In order to implement an unsolicited project, either the VFM test or the proposal review shall be conducted on the private proposal. Although the PPP Act distinguishes the "VFM test" from the "proposal review" based on the scale of projects, the analysis methodology and the scope of analysis may be deemed identical:

◦ For a project with a total project cost of not less than KRW 200 billion: Conduct a "VFM test."

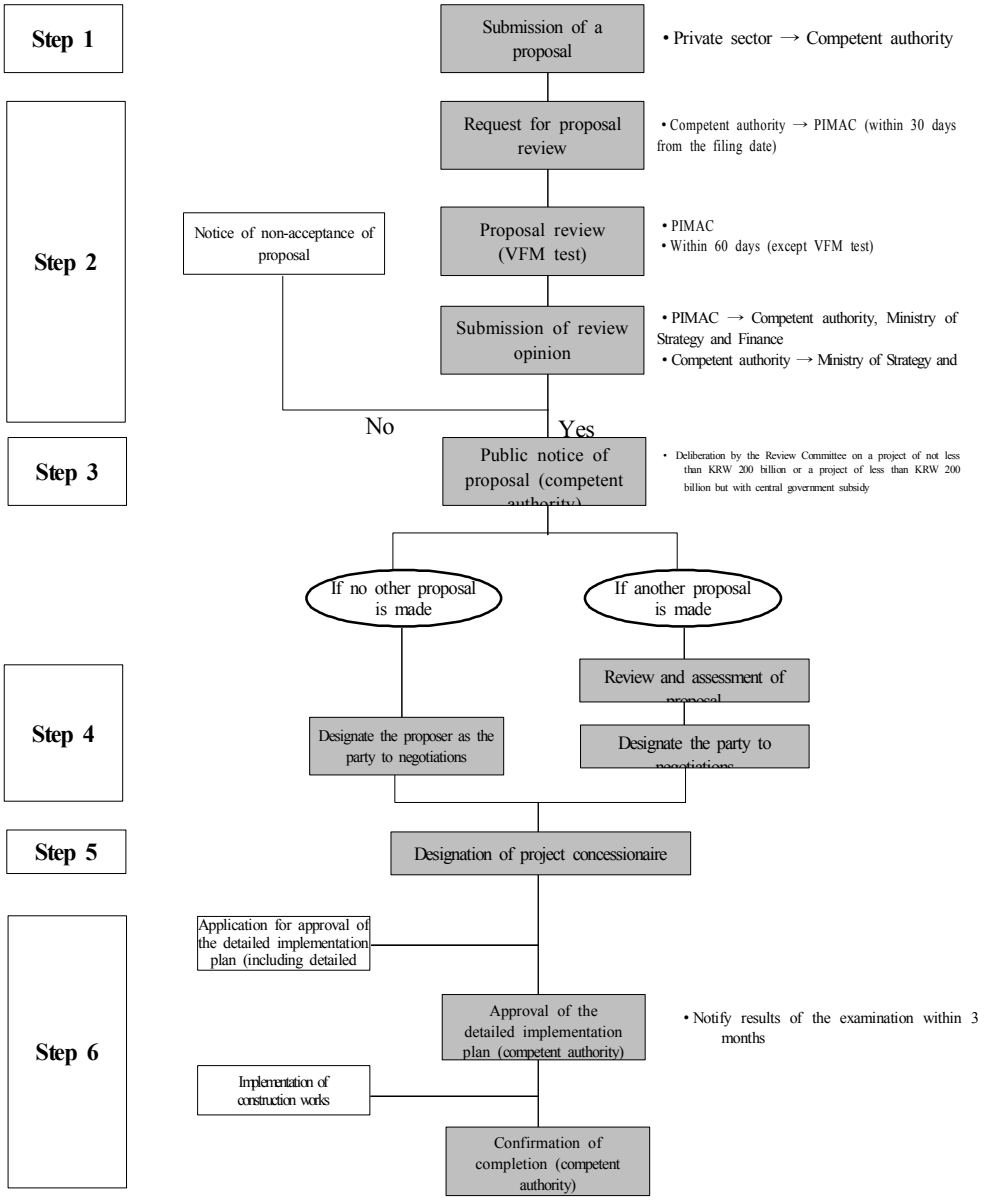
◦ For a project with a total project cost of less than KRW 200 billion: Conduct a proposal review.

The KDI Public & Private Infrastructure Investment Management Center (PIMAC) is designated as a research institute for performing studies on both the "VFM test" and the proposal review, but there is a slight difference in the operation of budgets for the two types of test. While a separate budget for the "VFM test" is reflected by the Ministry of Strategy and Finance in the budget of PIMAC for the performance of the test, the budget required for the "proposal review" shall be borne by the competent authority. PIMAC shall perform the VFM test and the proposal review within the appropriated budget in accordance with the procedure for the implementation of unsolicited projects. The results of this Study are applicable to both the VFM test and the proposal review.

The reference project at the time when the VFM test is conducted on an unsolicited project becomes part of the private proposal. A PSC is determined on the basis of the project overview, the details of design, and other details in the private proposal. If there is an omission in the contents of a private proposal with regard to design, costs, etc. and the omission has a significant impact on the project, both an option with such omission excluded and another option with such omission included may be prepared for a PSC. The VFM assessment shall be conducted on the basis of the option with the omission

excluded for a like-for-like comparison, but a PFI alternative shall be prepared on the basis of the option with the omission included.

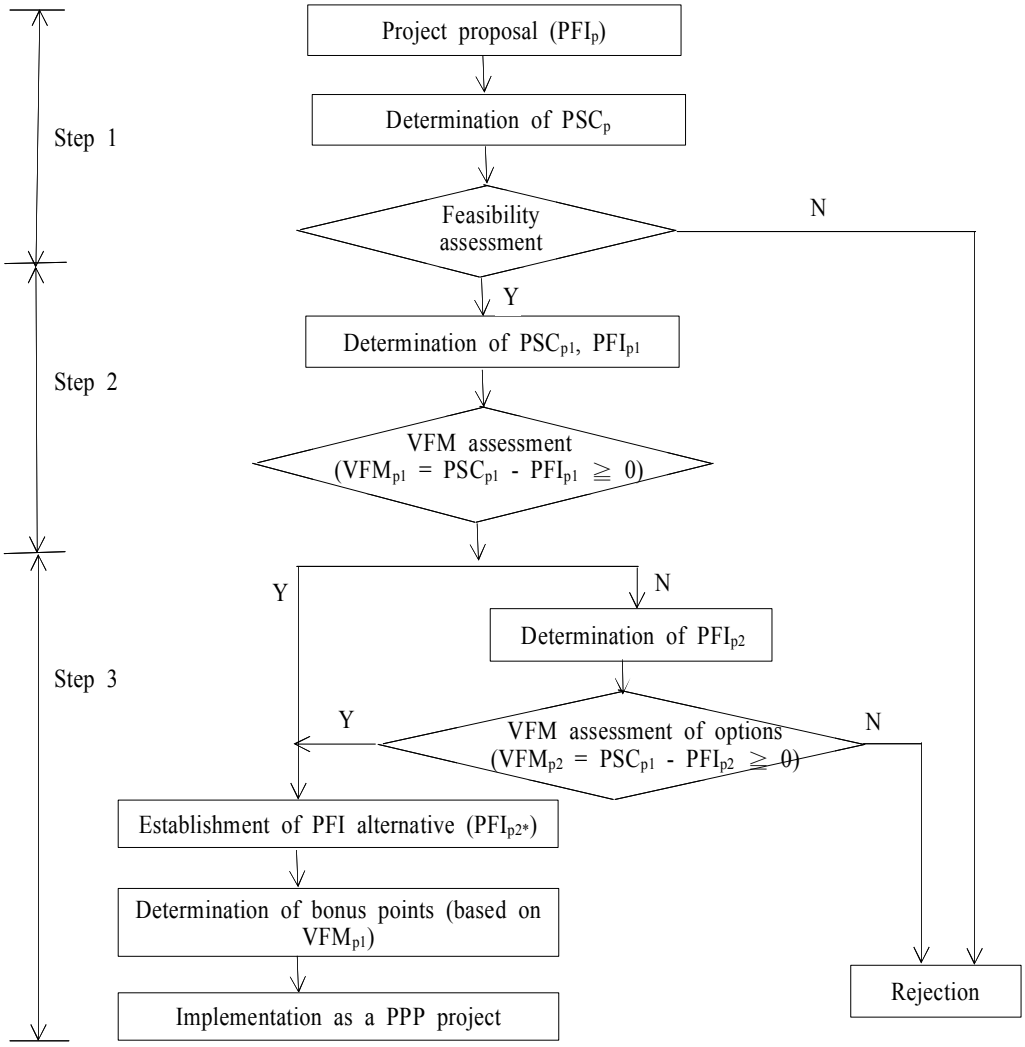
[Figure II-2] Procedure for Implementing BTO Unsolicited Projects



A. General Unsolicited Projects: Where There Is No Public Sector Comparator

In conducting the VFM test of a general unsolicited project, the reference project shall be established based on the details of the project proposed by the private sector and the feasibility assessment and VFM of the project shall be conducted. In order to conduct the feasibility assessment, PSC_P shall be determined, based on the details of such private proposal. Once the feasibility is ensured, the step of the VFM assessment follows. The manner of conducting the VFM test by stage is as set out in Figure Ⅱ-3 below:

[Figure II-3] Flow Chart of Execution of Value-for-Money Test of General Unsolicited Projects



Feasibility assessment shall be conducted on the basis of PSC_P, which is the design value, but VFM shall be assessed by comparing the Government share of costs in PSC_{P1} and PFI_{P1} in which the successful bid rate is applied to costs

determined with the design value. If it is found as a result of the analysis that the Government share of costs in PFI_{P1} is smaller than the Government share of costs in PSC_{P1}, it is determined that the project will deliver VFM. If it is determined that the project will deliver VFM, a PFI alternative shall be established, and the ratio of bonus points for the proposal shall be determined. If it is determined that a proposal will not deliver value for money for a public-private partnership, another PFI alternative, PFI_{P2}, shall be prepared by modifying the proposal in part, the VFM thereof shall be re-analyzed, and the potential for implementing a PPP project shall be determined finally.

B. Unsolicited Projects with Public Sector Comparator Available

If a private proposal does not conform to the government's relevant plans, the competent authority may modify the original proposal in part or request KDI to conduct an additional review by establishing a PSC based on higher-level plans. If VFM test reveals that the feasibility or the VFM of the PSC is higher than those of the private proposal, the competent authority will reflect the PSC in the invitation of alternative proposals.

The Basic Plan for PPP projects in 2009 (Public Notice No. 2009-14 by the Ministry of Strategy and Finance) clearly provides that the competent authority "shall review whether a private proposal conforms to relevant development plans and whether the proposal conforms to higher-level plans for the relevant facility, financial conditions, etc. through consultation with related agencies" before requesting KDI to conduct a review on the proposal and "may request the head of PIMAC to review a further option, if there is such further option different from the proposal as a result of the consultation with related agencies." Consequently, it is expected that the cases where a PSC option in addition to an original proposal is reviewed in the course of the private proposal review will increase. Moreover, since the competent authority shall specify the scope of a project (for example, the route of a road project, etc.), reflecting the results of the consultation with related agencies therein and shall give public notice

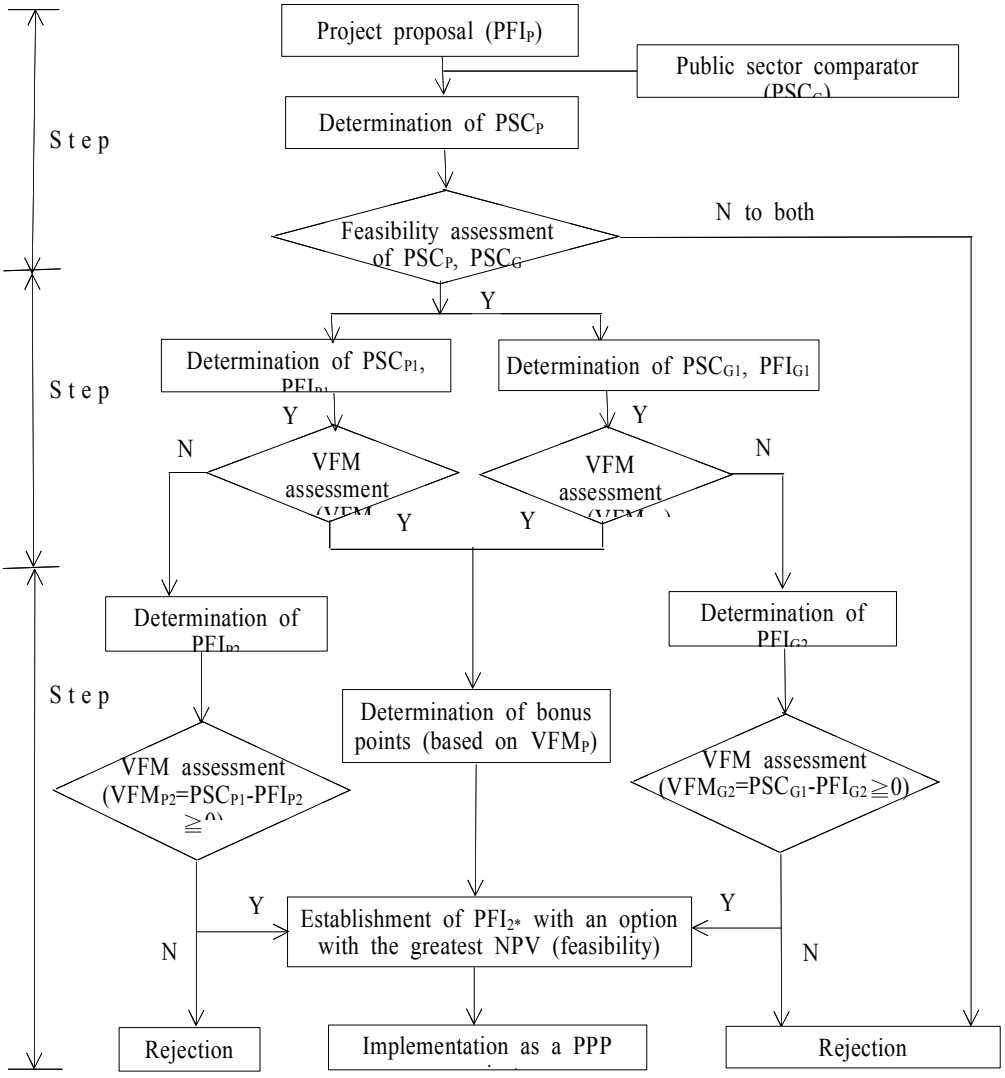
thereof and may include details different from those of the original proposal in the public notice, it is likely that the VFM test of a PSC will become more important.

The review on an unsolicited project with a PSC available means to review a project option presented by the Government along with a private proposal in the course of reviewing an unsolicited project. In other words, it means that assessments of feasibility and VFM of both a private proposal and the PSC are conducted simultaneously. The feasibility for both options for a PSC shall also be assessed by establishing PSC_P set up with the private proposal as the reference project and PSC_G set up with the PSC as the reference project.

If it is determined that both options are unfeasible, it is impossible to implement the project. If one of either options is feasible, the VFM assessment shall be conducted on the basis of the feasible option. If it is found that the option will not deliver VFM, the final VFM assessment shall be conducted on the basis of the PFI alternative, and the project may be implemented as a PPP project if the VFM is secured.

If both options have feasibility and VFM, the most suitable option is selected, taking into consideration the NPV (Net Present Value) determined through the feasibility assessment, rather than the VFM, and a PFI alternative is established on the basis of the option. The reason why the option with the greatest NPV is selected as the most suitable option is that it is desirable to select a necessary project in the social and economic aspects in making a decision to implement the project if the VFM of the PFI is secured. Although a PFI shall be established on the basis of the option with the greatest NPV in the feasibility assessment, the ratio of bonus points shall be determined on the basis of the private proposal.

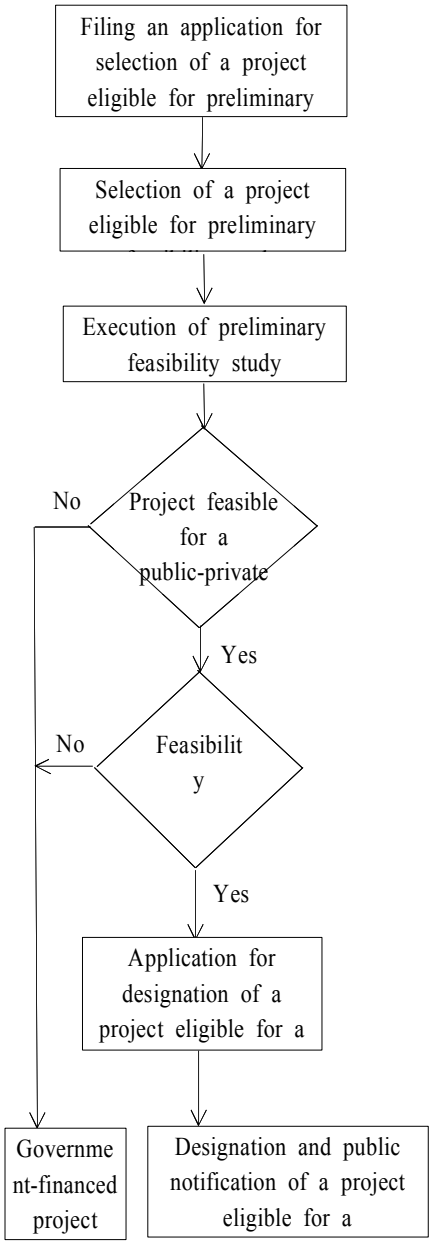
[Figure Ⅱ-4] Flow Chart of Execution of Value-for-Money Test of General Unsolicited Projects where PSC is Available



2. Value-for-Money Test of Solicited Projects

Cases where a review is conducted in order to change a government-financed project to a PPP project have been recently increasing. Such projects may be deemed implemented as solicited projects. If it is determined that a PPP project is feasible or if the competent authority decides to implement a project as a PPP project, as a result of the preliminary feasibility study, the competent authority may conduct basic designing works, the feasibility assessment, and the VFM test of a public-private partnership and implement the project as a solicited project. If the total project cost of a project is not less than KRW 200 billion, it is required to submit the results of the VFM test of a public-private partnership to the KDI Public & Private Infrastructure Investment Management Center (PIMAC) for review.

[Figure II-5] Designation of Solicited Projects



- Head of a central government agency → The Ministry of Strategy and Finance
- A project with a total project cost of not less than KRW 50 billion and with central government subsidy of not less than KRW 30 billion

- The Ministry of Strategy and Finance (the Advisory Council for Assessment of Government-Financed

- Executing agency: PIMAC
- Comprehensive assessment, including B/C analysis and AHP
- Evaluation of the checklist on potential for implementing the project as a PPP project

- Preliminary VFM test
  - Executing agency: PIMAC
  - Total project cost of KRW 200 billion (at least

- Projects with a total project cost of at least KRW 200 billion:
  (request for review: Competent authority → PIMAC; the results of the feasibility assessment and the VFM test of a public-private partnership by the competent authority)
- Projects with a total project cost of less than KRW

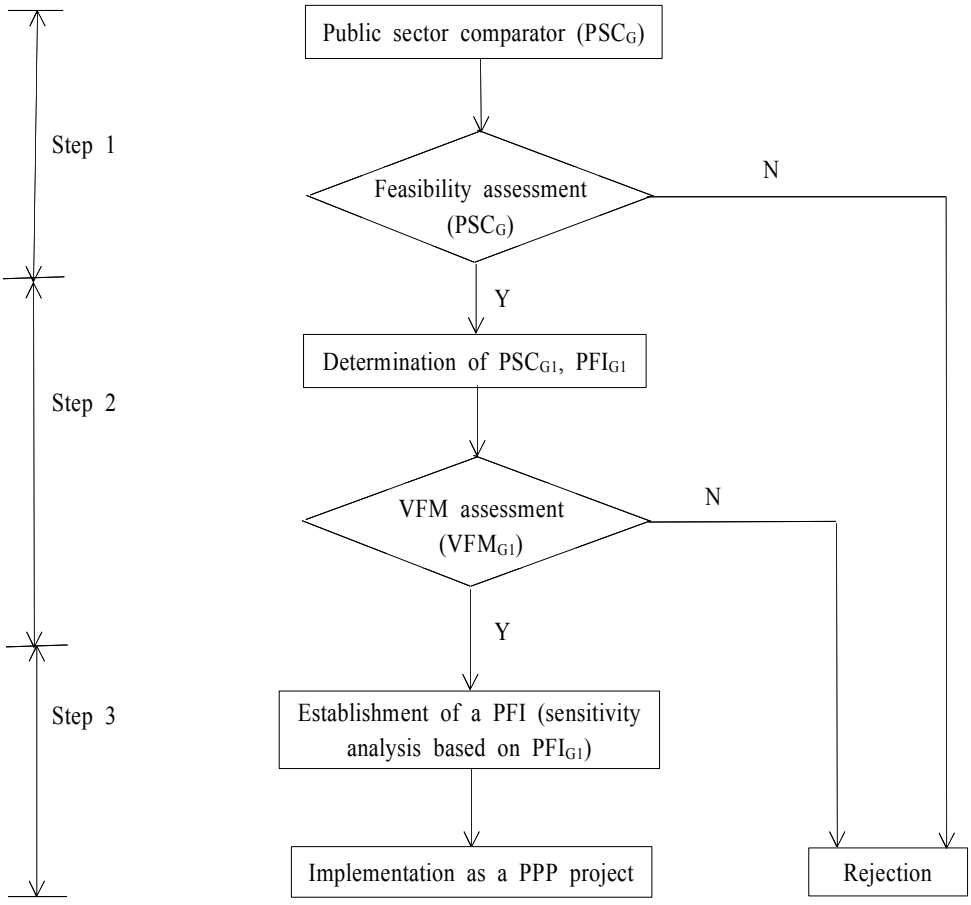
→

- Competent authority → The Ministry of Strategy and Finance (excluding projects of less than KRW

- Projects with a total project cost of at least KRW 200 billion: Designate an eligible project through deliberation by the PPP Review Committee
- Projects with a total project cost of less than KRW 200 billion: The competent authority shall notify the Ministry of Strategy and Finance thereof after designation and public notification thereof

The VFM test of a solicited project shall be conducted by determining PSC_G and PFI_G based on the reference project established by the Government. The reference project, which shall be established by the Government, may be established separately by the competent authority for the implementation of the project or by applying relevant higher-level plans *mutatis mutandis*.

[Figure II-6] Flow Chart of Execution of Value-for-Money Test of Solicited Projects



As regards an unsolicited project, it is possible to establish a more specific

PSC by modifying and supplementing the proposed design, since the VFM test is conducted by establishing a reference project in accordance with the proposal. Since a proposal is used as it is for a PFI, it is also easy to establish a practical alternative for an unsolicited project. As regards a solicited project, on the contrary, it is difficult to establish an alternative if little data is available about past performance, since detailed costs of a PSC shall be prepared on the basis of a basic design or a basic plan and a PFI alternative shall be established in the course of analysis on the basis of PPP precedents.

Since there is no private proposal involved, it is not necessary to determine the ratio of bonus points, and the scope of the establishment of a PFI alternative is also limited to the sensitivity analysis of the rate of return, user fees, Government subsidies, etc. based on costs of the PFI alternative. A more specific method for the establishment of PSC alternatives and PFI alternatives for a solicited project is presented in "Stage 2. VFM Test of a Public-Private Partnership" in Chapter Ⅳ. Since the VFM test of solicited projects is still at an early stage, the methodology applicable to unsolicited projects is applied, and an emphasis is given to the part where differentiation is required in this Study. Therefore, this Study needs to be revised and supplemented by using data accumulated about the VFM test of solicited projects in the future.

SECTION 4 Organization of Research Team for Value-for-Money Test and Operation of Review Sessions

The VFM tests on unsolicited projects are conducted by the KDI Public & Private Infrastructure Investment Management Center (PIMAC). The system for the organization of a research term for conducting a preliminary feasibility study applies *mutatis mutandis* to the organization of a research team responsible for a VFM test. A specialist or a higher-ranking researcher in PIMAC leads a research team and assumes the role of the head researcher, and a research team

is organized with experts from specialized research institutes, including universities, external research institutes, engineering firms, and accounting firms. Such specialized research institutes determine the demand for and costs of a PSC and a PFI in accordance with the detailed Guideline for VFM test, other guidelines and memoranda, etc. and conduct the assessment of the economic feasibility and the VFM. The head researcher in PIMAC performs his/her role as the leader of a research team and conducts tests through consultation with research institutes. The head researcher may also reflect opinions of experts from various specialized fields in a VFM test.

The VFM test on a solicited project is conducted by the competent authority who will probably organize a research team in a similar manner.

Where a VFM test is conducted by the KDI Public & Private Infrastructure Investment Management Center (PIMAC), the test shall be reviewed at internal review sessions of PIMAC and external review sessions with officials from the competent authority and the Ministry of Strategy and Finance. The internal review sessions are categorized into progress review sessions, interim review sessions, and final review sessions, according to the stage of each test, and the results of a VFM test and the issues related to the implementation of the relevant project are discussed. The purpose of internal review sessions is to produce objective and reasonable results from a test not only with the research team but also with experts inside and outside of the KDI Public & Private Infrastructure Investment Management Center (PIMAC).

If the total project cost of a project is at least KRW 200 billion, an external review session is held with officials from the Ministry of Strategy and Finance and the competent authority as well as the research team after internal review sessions for a VFM test are closed. In the external review sessions, officials from the competent authority and the Ministry of Strategy and Finance review the report submitted by the KDI Public & Private Infrastructure Investment Management Center (PIMAC) on the results of a test, express their opinions thereon, and discuss and settle major issues.

CHAPTER III

DETAILED GUIDELINE FOR FEASIBILITY ASSESSMENT

SECTION 1 Overview of Feasibility Assessment

"Feasibility assessment" is the stage at which it is assessed whether a proposed PPP project is necessary for the national economy if it is implemented as a government-financed project. The same methodology as that applicable to a preliminary feasibility study applies to "feasibility assessment."

In principle, "feasibility assessment" shall be conducted in accordance with the "Study to Amend and Supplement General Guidelines for Preliminary Feasibility Studies (5th ed.)," the "Study to Amend and Supplement Standard Guidelines for Preliminary Feasibility Studies of Road and Railroad Projects (5th ed.)," and other guidelines relevant to a preliminary feasibility study. Basically, feasibility is assessed in accordance with the following process. First, the overview of a project and basic data about the project are arranged in order and major issues of the VFM study are highlighted. Secondly, the economic feasibility is evaluated by estimating demand, benefits, and costs. Thirdly, a policy analysis is conducted, if necessary in view of the nature of a specific

project. Fourthly, the feasibility of the project is assessed comprehensively.

In order to assess feasibility, a PSC applicable in cases where a PPP project is implemented as a government-financed project shall be established. Such PSC shall be established on the assumption that services will be provided at the same level as those provided by an unsolicited project, and such project providing services at the same level is referred to as a reference project. Except for exceptional cases, the project proposed by the private sector for the review of an unsolicited project is utilized as a reference project for such unsolicited project. A project proposed by the competent authority is established as a reference project for a government-financed project.

If an intended project is determined feasible as a result of the feasibility assessment of the project based on a reference project, the stage of assessing the VFM of a PFI follows.

SECTION 2 Issues in Analysis of Basic Data and Tests

1. Analysis of Basic Data

The first work to be done, among other works, in implementing a public investment project or assessing the feasibility of such project is to analyze basic data about the area in which the project is to be implemented. A research team begins a survey by visiting the project area and collecting basic data about the area. Basic data about such area is categorized for analysis into the current status of trip patterns, natural environment, living environment, and social and economic conditions.

Through analysis of the current status of trip patterns, the number of lanes, length, traffic volume, etc. of each type of road in the prospective project area are presented. In connection with the analysis of natural and living

environments, data about the living environment are researched to assess and analyze its direct impact on people's food, clothing, and dwelling, such as natural conditions of the area in which the project is situated, water pollution, land contamination, sanitary conditions, and noise from construction works. In connection with the analysis of social and economic environments, an analysis is conducted on the structure of population, the structure of employment in each type of industry, local gross production, the current status of land use, etc. In the meantime, an intensive analysis is conducted on the current status of traffic-generating facilities, such as an industrial complex or a port or harbor related to the project at issue, if the project is for a road leading to an industrial complex or a port or harbor.

In conducting the analysis of basic data, it is important to ascertain the current status of the area related to the project at issue, rather than to simply enumerate typical data about the area. For example, the analysis of the current status of trip patterns must make it possible to estimate the importance of the project at issue even before completing the analysis on trip patterns in full scale by ascertaining what is the significance of the project at issue under the current traffic system of the area.

2. Review on Higher-Level and Related Plans

It is important to endeavor to ascertain the significance of the project at issue to the overall traffic network, such as the relevancy of the project to the sections connecting to the project and contiguous networks. In order to assess the significance, this Study ascertains and presents the higher-level or related plans that specify the project at issue. Plans established nationwide include the comprehensive national land plan, the national backbone network plan, the plan for the construction of national railroad networks, the medium-term transportation investment plans, the basic plan for the improvement of roads, the five-year plan for the national and regional roads.

Ultimately, roads and railroads are facilities for providing convenience in the movement of travellers and freight, and thus, development plans that affect such traffic demand shall be ascertained and described. The details of the development plans expected to generate traffic in a large scale, such as large housing sites, industrial complexes, ports, harbors, leisure complexes, etc., the current status of the implementation of such projects, and the time schedule for the future development shall described in detail.

3. Issues in Value-for-Money Tests

The overview of the project, the current status of trip patterns, and basic data about natural, social and economic conditions shall be closely analyzed, and who is in charge of the project in the competent authority and what the most important issues that must be analyzed in the VFM assessment through field survey are shall be figured out.

Not only the ordinary nature of a project but also problems relating to the natural, social, and economic conditions of the project area, whether to implement a project for transportation facilities or a development plan for transportation facilities, and problems relating to environmental impacts may be raised as issues subject to the test. The important issues subject to analysis in the test of the project at issue shall be highlighted, and solutions for such issues shall be presented in the course of the test.

4. Creation of Scenarios

Another task that shall be finalized prior to the full-scale test is to establish an analysis scenario. A scenario shall be established if it is difficult to determine key factors that affect the feasibility of the project at issue at the stage of conducting the VFM test. Cases where it becomes necessary to establish a scenario in a VFM test can be categorized roughly as below.

First, cases exist where there is no fixed future timetable for implementing

projects for transportation facilities affecting the feasibility of the project at issue at the time when the VFM test is conducted. Transportation facilities in the nature of networks are independent of one another, linked with one another, and interchangeable. If there is a plan established for a project closely linked or interchangeable with the project subject to the VFM test, it is important to reflect such plan in the traffic analysis network accurately. If the year in which the project shall be made available to the public for access is not fixed at this stage, the most practicable case shall be established as a scenario for analysis.

Secondly, cases exist where future development plans that will affect the demand for transportation facilities are fluid. For example, where a plan is established for a facility that is likely to generate heavy traffic but the completion year has not been fixed, a scenario shall be established for analysis, taking the possibility of completion into consideration.

5. Determination of User Fees

A. Determination of Toll Options

Traffic demand will vary according to toll rates of a road, and benefits and toll revenue will also vary depending upon the traffic demand, and consequently the results of the economic efficiency of the project at issue and the VFM of the PFI will vary as well. Therefore, it is necessary to take heed to determine user fees for a proposed project in the analysis for the VFM test, and toll options shall be created, taking the characteristics of the project into consideration.

"Feasibility assessment" is the stage of assessing whether a proposed PPP project is necessary for the national economy if it is implemented as a government-financed project. In order to assess whether a project is feasible for the national economy, it is required to determine user fees for a PSC that can be utilized in the estimation of traffic demand for the PSC and the calculation

of benefits.

User fees for a PSC shall be determined, taking into comprehensive consideration traffic volume, economic efficiency, and characteristics of the area at issue, among the toll rates of the Korea Highway Corporation, toll rates prescribed for similar projects, and those prescribed by the Toll Road Act, and more specific methods of calculation are as set out below.

B. Calculation of User Fees for PSC

1) Guidelines for Calculation of User Fees for PSC

Although the toll rates of the Korea Highway Corporation have been generally applied to user fees for the PSC of each road project, various options may be taken into consideration, such as a local government's toll rates for toll roads, toll rates for nearby PPP roads, toll rates for unsolicited projects, traffic congestion fees, toll rates calculated by applying a certain rate to toll rates of the Korea Highway Corporation, and toll rates under the Toll Road Act.

It is necessary to assess user fees for a PSC discreetly because the fees affect the feasibility of the project at issue, and it is also necessary to clearly provide for the guidelines for the calculation of user fees for a PSC so as to ensure to maintain consistency in the analysis of projects.

User fees for a PSC are calculated as follows. First, toll rates of the Korea Highway Corporation shall apply to user fees for a PSC, if the competent authority is a central government ministry and the project at issue is for an expressway that will connect metropolitan/provincial areas.

If the competent authority is a local government and the project at issue is for a road connecting local areas other than metropolitan/provincial areas, user fees for a PSC shall be calculated in accordance with the following guidelines to reflect distinctive characteristics of the competent authority in the determination of the level of toll rates:

◦ Stage 1: Research on practicable options

(1) Determine user fees at the level of toll rates of the Korea Highway Corporation.

(2) Determine user fees at the level of toll rates for similar projects operated by the competent authority.

(3) Toll rates applicable under the Toll Road Act[6]: Determine user fees at the level of toll rates for recovering costs invested in a PSC.

· User fees for a road project, for example, shall be determined at the level of user fees for a PSC where invested costs (construction cost + operating cost) are recoverable by applying *mutatis mutandis* the principle of repayment under the Toll Road Act.

◦ State 2: User fees for a PSC shall be determined, taking into comprehensive consideration traffic volume, economic efficiency, and characteristics of the area involved and the road project at issue, among the level of toll rates determined by the methods under (1) through (3) above.

2) Calculation of User Fees by Applying the Toll Road Act

The method of calculating user fees by applying the Toll Road Act is divided into two steps:

Step 1 involves determining the initial user fees of a PSC (PSC_t), in which the difference between revenue and costs by applying the demand and costs under a proposal shall be "zero." The reason user fees are determined by applying the demand and costs under a proposal is that the determination of toll rates of a PSC is the first step of the analysis and the demand for and costs of the PSC have not been determined yet. The demand and costs shall be applied as they are without any adjustment thereof, because they have the nature of replacement demand and replacement costs applicable in order to assess the level of rough user fees. However, they may be adjusted, if an adjustment is

6) The Toll Road Act provides that the competent administrative authority (government agency) may operate toll roads and collect tolls during not more than 30 years, but the revenue of the tolls shall not exceed the total sum of the costs of construction and maintenance.

necessary in light of the nature of the project at issue or if the level of the proposal is found unreasonable. It shall be assumed that the project cost is funded by issuing national bonds and operating costs are funded by the Government in the same manner as the method of determining a PSC for the quantitative VFM analysis. The principle of non-profit under the Toll Road Act shall be applied without considering a rate of return. In other words, the PSC_t in which the principal of the project cost and interest thereon and operating costs can be recovered shall be determined by applying a discount rate and constant costs without converting them into present values.

Step 2 involves determining a PSC_T, which represents the final user fees of a PSC in which costs of a PSC may be recovered, through a feedback process after estimating the demand based on the initial user fees (PSC_t). It might be difficult to determine the PSC_T, if the demand for a project has a high elasticity[7] depending upon toll rates. In such cases, the fee nearest to recoverable cost of the PSC may be determined as the PSC_T by repeating the feedback process many times.

C. Calculation of User Fees for PFI Alternatives

In principle, the proposed toll rates shall be applied as PFI user fees as they are proposed. The demand estimated on the basis of the proposed toll rate shall be applied to the VFM analysis. However, it may be required in determining PFI user fees to consider problems that may arise when the toll rates proposed for an unsolicited project are high or the ratio of construction subsidies is high. In other words, it is necessary to analyze the impact of lowering toll rates on a project if toll rates are lowered because of civil petitions likely to be raised in the stages of implementation and operation of the project in cases where toll rates are high. Since a high ratio of construction subsidies imposes a heavy burden on the Government, it is necessary to examine variances in construction subsidies likely to arise when the revenue of user fees is increased by raising

7) Elasticity of price to demand = Variability (%) of demand/Variability (%) of price

proposed toll rates.

Therefore, the demand for a project may be estimated on the basis of PFI user fees re-determined at the stage of the establishment of a PFI for the VFM analysis, the financial sensitivity analysis, etc. Although it might be possible to examine the impact of variances in toll rates on a project so that it can be referred to in making a decision, such process may require considerable time and costs. Thus, additional options for toll rates may be established by reflecting the nature of the project therein.

6. Base Time

The end of the year immediately preceding the time of a VFM assessment shall be set as the base year of the feasibility analysis.

Costs of a PSC shall be determined and presented as at the time of the price proposed in the relevant proposal, but shall be converted for the purpose of the feasibility analysis into costs as in the base year by applying a deflator for the construction industry. If the difference between the base time of the price proposed in the relevant proposal and the base year of the feasibility analysis does not exceed one year, however, costs of the PSC determined without applying a deflator for the construction industry additionally shall be applied to the feasibility analysis as they are.

The deflators for the construction industry are as set out in Table Ⅲ-6 below. The construction cost indices[8] published by the Korea Institute of Construction Technology may be utilized for an adjustment for monthly time lags, if necessary.

8) See: Webpage regarding construction cost indices published by the Korea Institute of Construction Technology (http://www.kict.re.kr/division/pds_list.asp?dept_code=31200).

<Table III-7> Variances in Construction Cost Indices for Transportation Facilities

Time / Sector	2005	2006	2007	2008
Investment in construction	100.0	103.0	107.9	119.5
	-	-	100.0	110.8

Source: The Economic Statistics System of the Bank of Korea (http://ecos.bok.or.kr), the expenditure to GDP (deflator) for the construction investment sector.

SECTION 3 Technical Analysis

1. Overview

The VFM assessment of a BTO PPP project consists of: Stage 1, feasibility assessment; stage 2, VFM assessment of the private proposal; and stage 3, the establishment of a PFI alternative.

The feasibility assessment at stage 1 means a process of determining costs of a PSC that will provide the same level of services as will an unsolicited project and conducting the feasibility analysis thereon, and the VFM assessment at stage 2 is a process of assessing what level of VFM is secured by the project proposed in a PFI in comparison with the PSC. The project that will provide the same level of services as a PFI is called a reference project. Except in extraordinary cases, the project proposed by the private sector is utilized as the reference project for an unsolicited project, whereas the project offered by the competent authority is utilized as the reference project for a government-financed project.

The determination of costs of a PSC is the process most basic in conducting

the feasibility assessment and the VFM assessment. In determining costs of a PSC, technical examination is required first to ascertain whether the designs proposed by a proposer satisfy various standards and are safe and economical. Through the examination of proposed design documents, the appropriateness of relevant plans and route plans, the appropriateness of traffic measures, the appropriateness of the scale of facilities, including the main route and tollgate offices, and the plan for the operation of such facilities shall be comprehensively examined. Moreover, the appropriateness of designs for earthworks, safety works for slopes, drainage works, structural works, tunnel works, paving works, works for ancillary facilities, in addition to horizontal alignments, shall be examined in order to find whether the designs meet the standards of facilities required for the road at issue and to review the relevant design standards.

This Section discusses major points necessary in the technical analysis of private proposals, and thus, may be utilized as the basis for costs of a PSC.

2. Review on Design Standards

A. Classification and Design Speed of Roads

1) Classification of Roads

Pursuant to the Commentaries on and Guidelines for the Rule on Standards of Structure and Facilities of Roads (Ministry of Land, Transport and Maritime Affairs, Mar. 2000), roads are classified according to the functions, mobility, and accessibility of roads, and the design speed, the cross-sectional composition of roads, and other applicable standards are determined according to the classification of roads. Thus, it is the most important to classify a road into a category consistent with its purpose.

2) Design Speed

Design speed means a speed specified in order to form the physical shape of a road, which affects the driving of vehicles, and the basic speed in determining the geometric structure of a road, that is, the speed of automobiles, which is the basis of road design.

Pursuant to the Commentaries on and Guidelines for the Rule on Standards of Structure and Facilities of Roads (Ministry of Land, Transport and Maritime Affairs, Mar. 2000), the design speed shall be determined according to the category of each road and by subtracting the speed by not more than 20km per hour, considering the topographic conditions, economic efficiency, etc.

B. Cross-Sectional Composition of Roads

The cross-section of each road shall be composed properly for its functions in preparing a road plan, and the cross-section of each road shall be capable of accommodating traffic volume in conformity with the traffic demand for the predetermined target years and the demanded level of the plan. The plan for a proper cross-sectional composition shall be established by applying the Commentaries on and Guidelines for the Rule on Standards of Structure and Facilities of Roads (Ministry of Land, Transport and Maritime Affairs, Mar. 2000) *mutatis mutandis*.

3. Review of Scale of Facilities

A. The Number of Lanes Required

Since the number of lanes of a road is determined by estimated traffic volume, it shall be determined properly through surveys and analyses of traffic conditions.

The number of lanes shall be determined by the methods of determining the number of lanes required under the Commentaries on and Guidelines for the Rule on Standards of Structure and Facilities of Roads (Ministry of Land,

Transport and Maritime Affairs, Mar. 2000) and the Road Capacity Manual (Ministry of Land, Transport and Maritime Affairs in 2001), taking into consideration the balanced construction of lanes, economic efficiency, etc.

B. Plan for Facilities for Entrance and Exit

1) Overview

The site of a facility for entrance and exit shall be located at an intersection of major roads or in an area in the vicinity of a city or village and the proper form of such facility shall be selected by examining the connectivity to access roads, the relevancy with relevant urban plans, economic efficiency, and publicness.

In planning a facility for entrance and exit, present conditions of local communities shall be taken into consideration first, and points through which the traffic on interconnecting roads can be allocated reasonably and such traffic can access the facility shall be selected.

2) Selection of Sites of Facilities for Entrance and Exit

An access road connected to a facility for entrance and exit shall be planned to have adequate capacity to accommodate entering and exiting traffic volume and to minimize the time required to travel from major traffic-generating sources, such as an urban section, an industrial area, a port, a harbor, and a tourist destination, to the facility for entrance and exit. In addition, such road shall be planned to distribute traffic volume entering and exiting from a facility for entrance and exit properly to the road network in the area so as not to impose an excessive burden on the existing road network. The Road Design Guidance (Korea Highway Corporation in 2002) and the latest design standards shall be reflected in planning the distance between a facility for entrance and exit and another facility.

Considerations in planning facilities for entrance and exit

- Securing the functions as an intersection in conformity with major functions (mobility, accessibility) of the project route.
- Reflecting the existing traffic system and clarifying the allocation of roles of intersections.
- Reflecting the results of the analysis on relevant plans and conditions of the neighborhood.
- Planning facilities, considering civil petitions, cultural heritage, etc.
- Whether the appropriate level of services for each direction of generated traffic volume is secured.
- Determining the form, considering users' convenience and the operating system.

C. Tollgate Office Plan

1) Classification of Operating Systems

Tollgate offices installed for the collection of tolls are classified into main line tollgate offices and interchange tollgate offices, according to the location of tollgates and into closed type and open type according to the method of collecting tolls.

The Road Design Guidance (Korea Highway Corporation, Dec. 2001) clearly states that the closed operating system is better for a road in which the distance between intersections is long, through which many vehicles travel a long distance, and in which there is a substantial difference between travelling distances, while the open operating system is proper for a road in which the distance between intersections are short, through which many vehicles travel a short distance, and traffic volume is dispersed evenly to various areas. In addition, a proper operating system shall be determined by reflecting social and regional characteristics therein.

2) Determination of Number of Lanes at each Tollgate Office

The number of lanes required for a tollgate office is determined by three factors: Traffic volume (intervals between entering vehicles); service time

required for the collection of tolls; and the level of services (the measure of the quality of service indicating passengers' average waiting time).

The number of lanes at each tollgate office is determined by reflecting the Road Design Guidance (Korea Highway Corporation, Dec. 2001), the Review on the Standards for Determination of the Number of Lanes at each Tollgate Office (Design Office of the Korea Highway Corporation, Jun. 2008), and other latest revisions to relevant standards.

3) Review on Toll Systems

Systems for the collection of tolls at each tollgate office are divided into the manned manual toll collection system (hereinafter, "TCS") and the unmanned electronic toll collection system (hereinafter, "ETCS").

TSC is a system under which users stop their vehicles and pay tolls by cash, a card, tokens, or other means, while ETCS is a system under which users pay tolls by a smart card with a digital electronic chip embedded therein by exchanging information about tolls, such as the entry time, tollgate offices, and the class of vehicle, through wireless telecommunications between the antenna installed at each tollgate and the on-board units (hereinafter, "OBUs") mounted on each vehicle without necessarily stopping their vehicles when they pass through a tollgate.

According to the Review on the Standards for Determination of the Number of Lanes at each Tollgate Office (Design Office of the Korea Highway Corporation, Jun. 2008), the average service time when using high-pass lanes, which is the ETCS operated by the Korea Highway Corporation, has been shortened from between 8 and 13 seconds to between 2 and 3 seconds.

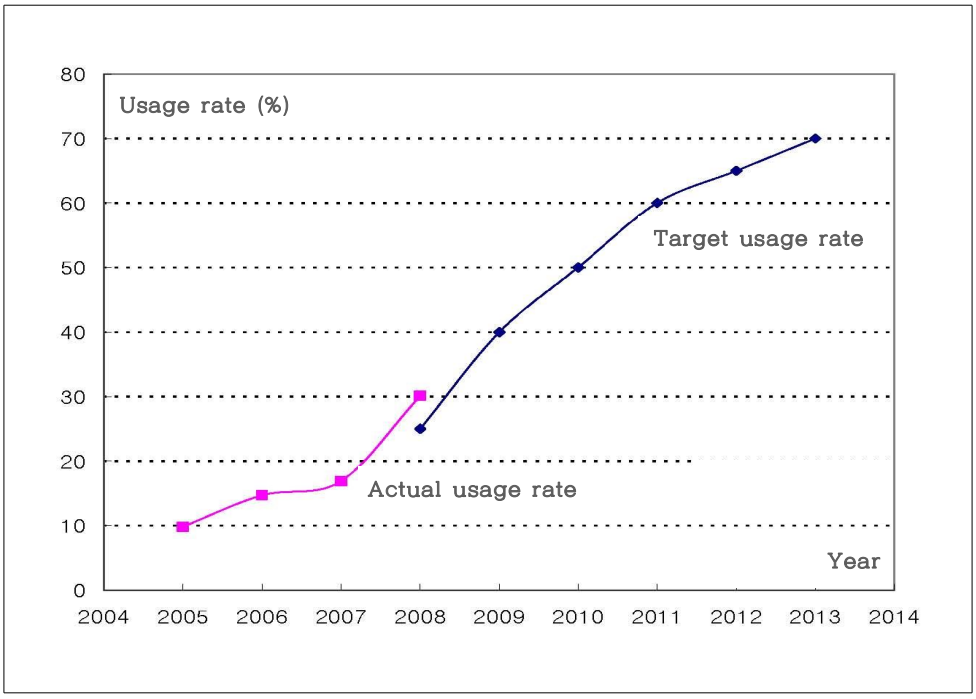
〈Table III-1〉 Annual Usage Rates of High-pass (ETCS)

(Unit: %)

Categories	2005	2006	2007	2008	2009	2010	2011	2012	2013
Target usage rate	-	-	-	25	40	50	60	65	70
Actual usage rate	9.8	14.7	16.9	30.1					

Source: The Review on the Standards for Determination of the Number of Lanes at each Tollgate Office, the Design Office of the Korea Highway Corporation, June 2008

[Figure III-1] Annual Usage Rates of High-pass



The actual usage rate of high-pass lanes has been increasing year after year and reached 30.1% in 2008, exceeding the target usage rate of 25%. The Government plans to raise the target usage rate of high-pass lanes (ETCS) up to

70% by 2013 and implements various schemes to raise the usage rate of the high-pass, such as the increase of high-pass lanes, a discount of tolls, the introduction of electronic deferred payment cards, and the installation of OBUs in newly delivered vehicles.

The introduction of a ETCS increases the capacity of accommodating traffic volume during rush hours, and thus, is considered effective for enhancing economic efficiency by reducing personnel expense and investments in the installation of facilities of tollgate offices.

A toll collection system for each tollgate office is an important factor that also affects the determination of the size of tollgates and the number of lanes, and thus, shall be determined by thoroughly examining characteristics of traffic, social and economic conditions of the area where a toll road is located, the aspects of management and finance, users, etc.

In principle, the usage rate of a ETCS proposed by a concessionaire shall be applied as the usage rate of the ETCS for a PSC, but the appropriateness of the usage rate of the ETCS proposed by the concessionaire shall be examined before applying it, taking into consideration the current status of the usage rate of the ETCS, the target usage rate for the future, and factors that shall be taken into consideration in preparing a tollgate office plan.

Considerations in preparing a tollgate office plan

- Selection of the location for tollgate offices, reflecting social and local conditions therein.
- Determination of the size of tollgate offices in conformity with design standards.
- Selection of a proper operating system, closed or open type.
- Determination of the number of lanes at each tollgate office, considering the future usage rate of the ETCS.
- Determination of the number of lanes at each tollgate office, considering traffic volume, service time necessary for collecting tolls, service standards, etc.
- Securing structural stability by installing canopies.
- Securing access roads for management of tollgate offices and planning of facilities for turning back.

4. Review on Selection of Road Route

A. Selection of Road Route

The selection of a route involves technical works for determining the center line and structure of a road roughly in the course of the review on comparative routes and the determination of the optimal route, based on results of a road network survey, economic and social research, traffic survey, environmental survey, and technical survey (soil, geology, marine survey, etc.) as part of a road plan. Therefore, a plan shall be prepared to select the optimal route by examining technical, environmental, economic, and social aspects.

The best option shall be selected by fully reviewing comparative routes, and the horizontal and vertical alignments shall be examined to ensure that the route conforms to design standards by conducting an on-site detailed survey on the prospective route.

As to the standards for the geometric structure of roads, the Commentaries on and Guidelines for the Rule on Standards of Structure and Facilities of Roads (Ministry of Land, Transport and Maritime Affairs, Mar. 2000) and the latest design standards shall apply.

Check List for Selection of Route

Social aspects	• Relationships with relevant higher-level plans, local development plans, urban plans, etc. • Relationships with cities, collective residential areas, ports and harbors, airports, industrial complexes, tourist destinations, etc. • Relationships with historic relics, buried cultural heritage, etc. • Relationships with schools, hospitals, religious facilities, public cemeteries, and other obstacles • Convergence of local residents' opinions and a route that can resolve civil petitions in advance
Technical aspects	• Considering overlapping with major places along the route and a nearby road route • Selection of a possible south route in an area with heavy snow • Selection of a detour route to avoid soft grounds, if possible • Selection of a route where it is easy to install intersections, considering the location of access roads, etc. • Considering the location of sites for bus stops, rest facilities, etc.
Economic aspects	• Selection of an economical route by utilizing the VE/LCC approach • Economic analysis depending upon the location of intersections and the size of facilities
Environmental aspects	• Considering impacts on natural and living environments • Selection of a route to minimize the encroachment on farmland and the creation of waste pieces from farmland • Selection of a route that makes it possible to ascertain and preserve landscape, geological heritage, and local scenic resources worth conservation • Selection of a route that makes it possible to utilize scenic resources by separating slow-speed lanes and high-speed lands, if a road passes through an area with outstanding landscape • Compliance with the Guidelines for Construction of Environment-Friendly Roads
Local aspects	• Enhancement of effects of development by accommodating development plans of local governments and metropolitan/provincial governments • Removal of conflicts with future local development plans and causes adversely affecting the potential for development • Whether it is possible to flexibly cope with changes in local plans in the future

B. Design Standards

A general checklist for design standards, the scale of facilities, and the selection of a route shall be prepared as set out below, and then the best plan shall be established, reflecting the checklist therein.

The following matters shall be taken into consideration in reviewing design standards for a project proposal:

Checklist for design standards

- Whether the design speed is appropriate for the category of the road
- Whether the minimum radius of curve and the maximum longitudinal slope are appropriate
- Whether the combination of horizontal and vertical alignments is appropriate
- Whether cross-sectional components of each lane and the combination of such components are appropriate
- Whether cross-sectional components satisfy width standards
- Whether standards for geometric structure depending upon the design speed of connecting roads are satisfied
- Whether the location and form selected for entrance/exit facilities are appropriate
- Whether the scale determined for facilities at each tollgate office is appropriate and whether tollgate office squares satisfy standards for geometric structure

5. Review of Road Design

A. Earthworks Plan

Earthworks are the work section that takes the largest part of construction costs in most road projects, except structures (bridges, tunnels, etc.), and thus, the flow of earthworks and the distance of transportation shall be reviewed meticulously.

The volume of earthworks shall be minimized as much as possible in planning horizontal and vertical alignments, the volume of cutting and piling

shall be balanced, and a plan shall be prepared to make an economical road, taking into comprehensive consideration the connectivity with bridges, tunnels, and other structures.

Checklist for earthworks plan

- Whether the volume of earthworks is minimized and whether the volumes of earth cut and filled are harmonized
- Whether places are appropriately selected as borrow pits and spoilbanks
- Whether the flow of earthworks and the distance of transportation are determined properly
- Whether a scheme is established to minimize damage caused by rock blasting to surrounding environments
- Whether the slope inclination of soil and rock and the slope inclination of the section to be filled with soil conform to design standards
- Whether stability and economic efficiency have been taken into consideration in selecting the slope inclination and protective works for slope

B. Plan for Drainage Facilities

Drainage facilities shall be planned by taking into consideration topographical conditions, weather, geological features, and other conditions of the site and maintenance and management of such facilities during the period of public use, which are essential factors in maintaining functions of a road and safety.

In particular, abnormal changes of weather shall be taken into consideration in planning drainage facilities, and the Design Manual for Roads in Mountainous Areas (Ministry of Land, Transport and Maritime Affairs, Jul. 2007) shall also be referred to for mountainous areas.

Checklist for Drainage Facilities Plan

- Whether design standards for drainage are applied *mutatis mutandis* to the determination of planned flood volume and the planning of drainage cross-section
- Whether the drainage plan for road surface is established appropriately in accordance with hydraulic calculations
- Whether the specifications applied to drainage facilities for slope and the distance between such facilities conform to design standards
- Whether the specifications of culverts are appropriate and whether economic efficiency has been taken into consideration in establishing the culvert plan
- Whether the flow velocity designed to prevent erosion of draining structures is appropriate and whether protective facilities for waterways are installed properly
- Whether the Design Manual for Roads in Mountainous Areas has been taken into consideration in establishing the plan, if a road passes through a mountainous area

C. Paving Plan

The types of pavement are divided mainly into asphalt concrete pavement and cement concrete pavement, and a proper thickness of pavement shall be determined by considering traffic volume and freezing depth in the area at issue.

Moreover, the ground and topographical conditions of the planned route, characteristics of traffic, economic efficiency (including expenses for maintenance and management), workability, environmental conditions, weather conditions, and conditions for the procurement of materials shall be taken into consideration comprehensively in determining proper construction methods.

Checklist for paving plan

- Whether ground conditions, the ratio of large vehicles, maintenance and management, the impact of noise, and LCC have been taken into consideration in selecting the type of pavement
- Whether the types of pavement on nearby routes have taken into consideration in the type of pavement and the composition of cross section
- Whether the economic efficiency has been compared with the standard cross section and the characteristics of traffic on the designed route have been surveyed
- Whether the factors determining the type of pavement, including freezing depth, road surface strength, and design CBR, have been determined accurately
- Whether the designed cross section of pavement is appropriate (Overall pavement thickness $\geq$ Design freezing depth)
- Whether the construction method and thickness applied to pavement of bridge surface are appropriate
- Whether the drainage layer and the impact of freezing have been taken into consideration in determining the cross section of pavement of tunnel sections
- Whether the location and sizes of approach slabs and connection slabs conform to design standards

D. Plan for Ancillary Facilities

A plan for ancillary facilities shall be prepared in order to provide convenience and safety to people and vehicles using a road, and various guidelines and the latest design standards shall be reflected in planning the most suitable ancillary facilities for the purpose.

Checklist for ancillary facilities plan

- Whether the places for the installation of road signs, the specifications of the installations, the method and forms of installation are appropriate
- Whether road surface markings are installed in accordance with applicable standards
- Whether the location of devices inducing the line of sight and the distance between such devices comply with standards
- Whether the location of safety fences and the form of installation of such fences comply with standards
- Whether facilities for road safety (shock-absorbing devices, anti-skid devices, etc.) are excessive and comply with standards
- Whether the appropriate size and type of noise barriers have been selected
- Whether the selected location and scale of resting places and tollgate offices are appropriate
- Whether the plan for environment-friendly facilities, such as those for prevention of road kill, is appropriate

6. Review of Bridge Design

Geographical features and current status shall be taken into consideration in planning a bridge so that a type of bridge with structural stability, workability, economic efficiency, and ease of maintenance and management is selected, and the most suitable bridge plan shall be established by carrying out structural calculation fit for the characteristics of the bridge and considering various standards, once the type is determined.

〈Table Ⅲ-2〉 Essential Considerations in Bridge Planning

Categories		Essential considerations
Preliminary assessment	Selection of type of bridges	• Selection of the type fit for the nature of the project and the route • Selection of the most suitable type of bridges through the VE/LCC approach • Selection of the type of bridges with structural stability and outstanding features for maintenance and management
Considerations	Reflection of relevant plans	• Consultation with related authorities and reflection of measures for minimizing civil petitions • Reflection of future development plans for roads, rivers, railroads, and other traversal facilities
	Structural planning	• Planning the cross section and shape, considering aesthetic view and workability • Considering surrounding geographical features, road traffic volume, and workability • Selection of a temporary construction method for minimizing civil petitions
	Structural calculation	• Applying an analysis approach fit for the type of bridges • Testing by a specialized program for structural analysis • Planning the bearing through an earthquake-proof analysis fit for the characteristics of bridges
	Maintenance and management	• Preferential examination of the type of bridges with outstanding features for maintenance and management • Selection of a proper type, considering durability and functionality
	New technology, new construction methods	• Introduction of new technology and new construction methods for the most suitable designing and construction

Checklist for bridge planning

- Whether the location, length, span-length, etc. of each bridge are properly planned
- Whether a bridge crossing over a river complies with standards for river facilities
- Whether relevant future plans have been taken into consideration in planning
- Whether environment, civil petitions, and economic efficiency have been taken into consideration in comparison and review with respect to the installation of a bridge on a geographically built-up section
- Whether workability, economic efficiency, and local features have been taken into consideration in selecting the type of bridges
- Whether materials mainly used and the design load comply with design standards
- Whether specifications of bridges are consistent with design documents (design reports, structure drawings, and other drawings)

7. Review of Tunneling Plan

A. Basic Direction-Setting

The location and length of a tunnel are determined according to the horizontal and vertical alignments, and the most suitable plan shall be established by applying various specifications and standards *mutatis mutandis* and considering workability, economic efficiency, and environmental factors in designing a tunnel. In order to optimize the design of tunnels, soil tests shall be conducted, and data about construction works carried out on nearby sections shall be analyzed in advance.

〈Table Ⅲ-3〉 Basic Direction-Setting for Tunnel Design

Categories	Basic Direction-Setting
Survey plan for each stage of design works	• Establishment of a survey plan, considering the design method for each structure • Establishment of a survey plan during the stages of preparation, supplementation, and detailed construction • Conducting a survey, considering city centers and densely populated areas
Analysis of conditions of site location and comfortable cross section of tunnel	• Tunnel alignment plan focused on harmonization with nature • Inducing maximally enhanced functionality of tunnels with minimal inside cross-sectional area • Establishment of plans, considering connectivity with existing access roads
Reflection of design methods for optimizing excavation and timbering	• Establishment of safety-first work process plans, considering initially invested costs and costs invested in the future • Review on the appropriateness of timbering through reliability analysis and reflection of the review in design
Environment-friendly tunnel design, considering geographical conditions	• Establishment of excavation plans for minimizing civil petitions, considering local residents • Establishment of construction plans for minimizing damage caused by tunnel construction to residents • Plan for entrances of tunnels, minimizing damage to natural environment
User-oriented facilities plan	• User-priority-based planning for safety • Facilities plan, considering construction costs and expenses for maintenance and management

B. Plan for Horizontal and Vertical Alignments of Tunnels

Essential considerations in planning horizontal and vertical alignments of tunnels are as set out in Table Ⅲ-4 below.

〈Table Ⅲ-4〉 Essential Considerations in Planning Alignments of Tunnels

Categories	Essential Considerations
Horizontal alignment	• Select places where soil conditions are good, maintenance and management are easy, and the impact on the surrounding environment is insignificant in planning tunnels. • Avoid, if possible, a valley or a fold layer where unsymmetrical pressure is anticipated, a talus, an area where a survey indicates that water is likely to gush out in a large volume, and a fault or fractured zone where stability is doubtful in planning tunnels. • The horizontal alignment shall be in a straight line, but economic efficiency and workability shall be taken into consideration, and the horizontal alignment shall be interconnected and harmonized with the vertical alignment in planning tunnels. • An adequate distance between ground and underground structures and facilities for existing tunnels shall be secured to minimize the impact on such structures in establishing alignment plans. If it is unavoidable to pass by such facilities in a short distance, the impact of boring tunnels shall be examined to select appropriate construction methods and alignments, considering the importance and structural characteristics of existing structures. • Requirements for the location of ventilation openings, escape shafts, working shafts, which are facilities ancillary to tunnels, and facilities outside tunnels shall be also reflected in tunnel alignment plans.
Vertical alignment	• Safety in driving, ventilation, facilities for disaster prevention, drainage, and workability shall be taken into consideration in determining the vertical alignment, and an inclination shall be planned to be gentle without causing any problem in drainage (minimum 0.3 to 0.5%, maximum 3%, if possible). • The minimum depth of soil cover of tunnels under cross-sectional plans shall be determined so as to secure structural safety of tunnels.

C. Tunnel Cross-Sectional Plan

Essential considerations in planning the cross section of tunnels are as set

out in Table Ⅲ-5 below.

〈Table Ⅲ-5〉 Essential Considerations in Planning Cross Section of Tunnels

Categories	Essential Considerations
Review on specifications of common ducts	• Determine the size of common ducts through the review on the capacity of facilities depending upon the length of each tunnel. • Determine the thickness of side walls of common ducts to protect facilities in common ducts and review on the shape of side walls, considering the safety of drivers.
Review on drainage system	• Review the appropriateness of drainage facilities and layout of draining structures. • Review schemes for disposal of ground water and waste water.
Review on distance of jet fans	• Review the appropriateness of the distance between tunnel lining and jet fans, if jet fans are to be installed, and analyze the most suitable distance to avoid a decrease in the effect of boosting pressure by frictional resistance caused by the generated wind to tunnel walls.
Review on installation of passage for inspectors	• Review whether to install passages and handrails for inspectors.
Review on cross section of pavement inside tunnels	• Determine the thickness of the cross section of pavement inside tunnels by applying the latest design standards.

D. Tunnel Boring Plan

Essential considerations in planning tunnel boring are as set out in Table Ⅲ-6 below.

〈Table III-6〉 Essential Considerations in Planning Tunnel Boring

Categories	Essential Considerations
Review on the most suitable boring and construction methods	• Review boring and construction methods, considering geographical and geological features of tunnel sections, environmental impacts, and stability. • Suggest an appropriate construction method for areas where residential houses are densely concentrated near tunnel entrances.
Mechanization and informatization	• Review schemes for enhancing efficiency by making construction equipment bigger and automatic. • Pursue optimized construction management by applying an automatized system for construction management.
Establishment of measures for stabilization of tunnels	• Apply a forecasting method for fragmental zones of fault and soft ground. • Review excavation methods and supplementary methods for sections underneath city centers, border zones of a specific type of rock, sections where a belt of weathering has been developed, and sections through which a tunnel passes.
Establishment of environment-friendly construction plan	• Prevent damage to the environment by minimizing cutting of earth at tunnel entrances and applying supplementary and reinforcement methods. • Dispose of muck and review the reflection of the disposal in the boring direction, considering the living environment for local residents.

E. Plans for Tunnel Entrances and Portals

In planning tunnel entrances, soil conditions, surrounding geographical features, ground water, the stability of the slope at tunnel entrances, and the harmony with the surrounding environment shall be taken into consideration comprehensively in selecting the most suitable location and form. In addition, designing for aesthetic view shall be carried out by minimizing damage to natural environment and considering local conditions, and a plan for the structure of tunnel entrances shall be established to satisfy the drivability in tunnels and the functionality of tunnel entrances.

〈Table Ⅲ-7〉 Essential Considerations in Planning Tunnel Entrances and Portals

Categories	Essential Considerations
Review of tunnel entrances	• Select a location harmonized with surrounding landscape. • Select the location with the least eccentric earth pressure from a topographical aspect. • Consider the layout of structures relating to tunnels near tunnel entrances and facilities for maintenance and management.
Review on structure of tunnel entrances	• Induce relaxation of drivers' psychological tension. • Determine a style fit for the protection of tunnel entrances. • Review the impact of surface load and the stress arising at tunnel entrances and review structures considering the impact of temperature.
Review on location of tunnel entrances	• Select a proper location based on surrounding landscape and soil conditions. • Ensure a minimum soil cover height of up to 3 to 5 meters and consider stability likely to be threatened by rockfall and an eccentric earth pressure.
Review on joints	• Review waterproofing works at joints between open-cut structures and internal linings. • Review boring works after applying a stabilization method for crowns and smooth joints between structures inside tunnels and open-cut structures.

F. Tunnel Disaster Prevention Plan

In planning tunnels, a plan for disaster prevention facilities complying with relevant design standards and suitable for the size of tunnels shall be established to build facilities for efficient fire-fighting activities and safe escape.

The disaster prevention grade for each tunnel shall be determined on the basis of the length of the tunnel, and the disaster prevention grade shall be adjusted upwards, if the degree of danger in a tunnel exceeds a prescribed level as a result of the assessment of the degree of danger, considering traffic volume, etc.

Local conditions and traffic conditions of each tunnel shall be taken into consideration in compliance with the Guidelines for the Installation of Disaster Prevention Facilities for Road Tunnels (Ministry of Land, Transport and

Maritime Affairs, Dec. 2004) in planning the location and distance of disaster prevention facilities for tunnels and applicable standards.

〈Table III-8〉 Classification of Disaster Prevention Grades Based on Tunnel Length

Grades	Tunnel Length (L)
Grade 1	3,000 m or longer (L ≥ 3,000 m)
Grade 2	Not less than 1,000 m but less than 3,000 m (1,000 m ≤ L <3,000 m)
Grade 3	Not less than 500 m but less than 1,000m (500 m ≤ L < 1,000 m)
Grade 4	Less than 500 m (L ≤ 500 m)

Source: Guidelines for the Installation of Disaster Prevention Facilities for Road Tunnels (Ministry of Land, Transport and Maritime Affairs, Dec. 2004)

Checklist for tunneling plan

- Whether horizontal and vertical alignments, stopping sight distance, minimum radius comply with standards for designed sections
- Whether the cross sectional shape and measurements have been taken into consideration in planning inner sections of tunnels
- Whether site conditions and soil conditions have been taken into consideration in planning the distance between centers of parallel tunnels
- Whether local conditions, scale of tunnels, design concept, and construction method are reviewed in planning tunnels
- Whether surveys on the impact of the surrounding environment on tunnels and research on relevant laws and regulations have been carried out
- Whether the method, location, and interval of physical prospecting are appropriate
- Whether the timbering pattern applied is appropriate
- Whether the location of tunnel entrances and the selection of styles of entrances are appropriate
- Whether the tunnel ventilating method and the plan for ventilating facilities are appropriate
- Whether the plan for disaster prevention facilities is appropriate

8. Review of Electric Sector

A. Basic Direction-Setting

The electrical sector may be divided into tunnel electricity (including telecommunications and electrical disaster prevention), road electricity, and optical fiber telecommunications cable conduit line and shall be planned in the direction to enhance the easiness in maintenance and repairing, economic efficiency, and functionality. If functional levels are the same, a simpler system shall be pursued, if possible, while if there is a conflict between economic efficiency and easiness in maintenance and repairing, easiness in maintenance and repairing shall take precedence, except where excessively uneconomical.

B. Plan for Electric Facilities in Tunnels

Main requirements for electric facilities in tunnels shall be ascertained to select appropriate electric facilities, and countermeasures in emergency, convenience in maintenance and management, and economic efficiency shall be taken into consideration comprehensively in planning electric facilities in tunnels.

Essential considerations in planning electric facilities in tunnels are as set out in Table Ⅲ-9 below.

〈Table III-9〉 Essential Considerations in Planning Electric Facilities in Tunnels

Categories	Essential Considerations
Reliability	• Set up a system for reliable electric supply. • Select electric equipment with high reliability. • Select equipment that enables the improvement of the quality of power sources.
Easiness in maintenance and management	• Plan for easiness in operation, maintenance, management, and repairing. • Plan for energy-efficient and economical facilities. • Plan for a comprehensive control and crime prevention system.
Safety	• Set up a comprehensive disaster prevention system for quick evacuation in emergency. • Strengthen functions for prevention of crimes and disasters. • Reflect designs for control of dust and noise and earthquake-proofing.
Environmental impact	• Establish measures for reducing noise, vibration, and pollution. • Select the location of equipment for minimizing the impact on structures. • Selecting recyclable electric equipment.
Prevention of and countermeasures for accidents	• Plan effective lighting facilities. • Apply high-intensity indicating lamps with outstanding visibility. • Select incombustible and fire-resistant materials.

C. Plan for Electric Facilities on Roads

Electric facilities on roads are lighting equipment on general sections, except tunnel sections, and may be divided into the lighting system on road sections, the internal lighting system in passage culverts, and the lighting system for the inspection of bridges.

In order to operate a road efficiently and improve traffic safety, lighting facilities shall be installed on interchange sections, entrances and exits of

tunnels, and long bridges.

Checklist for electric facilities on roads

- Whether the amended KSA3701 (Nov. 29, 2007) has been reflected in the standards for illuminance of street lamps
- Whether the materials on the surface of roads have been taken into consideration in applying reflectance to the calculation of the illuminance of lamps in tunnels
- Whether the specifications of cables satisfy the KSC IEC and whether cables to be applied are manufacturable
- Whether the specifications, materials, heights, and location of street lamps are appropriate
- Whether the useful life, maintenance, management, and LCC have been taken into consideration in selecting street lamps
- Whether the height of the stabilizer box of each street lamp is appropriate and whether a breaker is installed for protection against a short circuit
- Whether it is necessary to install lights, where there is a passage culvert, at least 10 m long, and whether such lights meet standards
- Whether lighting facilities and consents for safety inspection are properly applied for the type of box, whether a bridge, at least 50 m long, is in the form of box structure
- Whether high-efficient equipment and materials have been introduced in planning

D. Plan for Optical Fiber Telecommunications Cable Conduit Lines

Optical fiber telecommunications cable conduit lines are infrastructure for the establishment of a dedicated telecommunications network and shall be installed by considering the installation, access, maintenance, and management of cables and relationships with other structures.

〈Table III-10〉 Standards Applicable to Optical Fiber Telecommunications Cable Conduit Lines and Considerations in Design

Categories	Applicable Standards and Considerations
Applicable Acts, subordinate statutes, and reference data	• The Framework Act on Telecommunications, the Telecommunications Business Act, the Information and Communications Construction Business Act, road-related Acts, and other relevant Acts and subordinate statutes
Construction of conduit line	• The conduit line shall be installed under a shoulder at a land-filled section and in a selected layer under a L-type gutter at a cut section. • The conduit line shall be installed in the common duct in a tunnel section and in a crash wall or a bridge box in a bridge section. • Soil cover for the conduit line shall be maintained at least 1.2 m, while a protective facility shall be installed for the conduit line if soil cover is inadequate.
Diameter and number of cores of conduit	• Earthwork and bridge sections: 1COD conduit, Φ 100 mm × 1 core (Φ28×5) • Tunnel sections: 1COD conduit, Φ 100 mm × 1 core (Φ28×5) • Crossing sections: 1COD conduit, Φ 100 mm × 1 core (Φ28×5)
Composition of crossing conduit line	• COD conduit, Φ100 mm × 1 core (28×5), shall be installed at a point where demand for a crossing conduit line is expected to arise, such as a cut slope, a curve, the entrance or exit of a tunnel, a point 3km ahead of an interchange or junction, among points where ITS facilities are expected to be installed, while a manhole (Sugong No. 2) shall be install at the opposite side, linking to the manhole (In-gong) in the main route.
Grounding equipment	• Security grounding facility (100 Ω or less).
Protection of cable	• A warning tape shall be buried at 30 cm above the Φ100 mm main conduit line.
Conduit line at entrances and exits	• If the transmission room is installed at a tollgate office, the capacity for an interchange shall be the same as the capacity of the main conduit line, while a conduit line with the capacity double the capacity of the main conduit line shall be installed up to the building site, if the transmission room is installed at a branch office.
Conduit line at roadside service area	• A COD conduit, Φ100mm × 1 core (Φ28×5), shall be installed from the manhole of the main line up to the building site.

Checklist for planning optical fiber telecommunications conduit lines

- Whether the conduit line installed in the common duct in a tunnel is interfaced with the electrical and mechanical sectors
- Whether a crossing conduit line and a manhole (Sugong No. 2) have been installed under an agreement with other sectors with regard to a point where ITS facilities are expected to be installed
- Whether there is no problem in interfacing with the adjoining construction section

9. Review of Architectural Sector

A. Basic Direction-Setting

In planning architectural facilities for roads and tunnels, relevant laws and regulations, geometric structure, and geographical conditions shall be taken into consideration to build such facilities at suitable places on an appropriate scale.

Priority shall be given to convenience of workers and users in planning architectural works, and structural stability, economic efficiency, and design factors and environment-friendly factors of buildings in harmony with surrounding landscape shall be reflected in establishing such plan.

〈Table III-11〉 Essential Considerations in Planning Architectural Works

Architectural factors	Functional factors	Convenience
• Economic efficiency • Functionality • Convenience • Aesthetic view of buildings in appearance • Environment-friendly ecological architecture	• Securing the appropriate functions for management • Systemizing traffic flow for management • Establishing a plan for aesthetic view harmonized with surrounding landscape • Convenience in maintenance and management	• Pursuing visual comfortability for drivers and passers-by • Securing safety for drivers • Securing convenience for users

B. Technical Analysis of Architectural Facilities

1) Determination of Sites for Tollgate Offices and Sizes of Buildings therein

Tollgate offices are divided into tollgate offices on the main line and tollgate offices at interchanges, and the main tollgate office shall be located at a place selected, among tollgates on the main line and those at interchanges, by considering the accessibility from the entire route and the efficiency in maintenance and management, so that facilities for maintenance and management and operating organizations can be stationed there.

The Korea Highway Corporation, which currently operates the most toll roads, determines the sites for tollgate offices and the scale of buildings therein based on the number of tollgates.

<Table III-12> Standards for the Area of each Type of Tollgate Offices of the Korea Highway Corporation

Type	Number of lanes	Total floor area (㎡)	Size of building site (m)	Notes
Small	Less than 10 lanes	600	40 × 80	
Medium	Less than 20 lanes	735	45 × 90	
Large	Less than 30 lanes	867	45 × 120	

Checklist for architectural works for tollgate offices

Traffic flow plan and layout plan	• Whether accessibility and functionality of tollgate offices have been taken into consideration in layout and securing traffic flow • Whether the traffic flow of pedestrians is separated from the traffic flow of vehicle • Whether parking places for vehicles for maintenance and management are separated from those for staff and users • Location of outdoor spaces (facilities for rest and physical exercise, etc.) and connectivity of buildings • Whether equipment taken out and brought in has been taken into consideration in planing traffic flow of vehicles • Whether the traffic flow (connecting passage) between a tollgate office and tollgates is minimized
Floor plan	• Whether the administration zone is separated from the facility zone • Whether the traffic flow of staff and users inside a building is minimized • Whether it is possible to monitor roads and tollgates by eyes
Cross-section plan	• Whether the height of floors required for each functional room and the height of equipment have been taken into consideration in planning the appropriate height of a building • Whether the topographical features of the site of each tollgate office have been taken into consideration in reviewing a cross section

Checklist for tollgate plan

Traffic flow plan and layout plan	• Appropriateness of the traffic flow of staff, connecting the tollgate office, connecting passage, and islands • Review of columns of canopies and connectivity with tollbooths
Floor plan	• Whether islands have been taken into consideration in determining the appropriate location of canopies • Whether the maintenance and management of canopies have been taken into consideration in planning the installation of facilities

2) Plan for Facilities for Maintenance and Management

Roads shall be properly maintained and managed during the period of

operation for maintaining the safety and comfort of road users, and a plan for offices for maintenance and management shall be established for storing equipment, materials, etc. for maintenance and management.

〈Table III-13〉 Categorization of Facilities of Maintenance and Management Offices

Categories	Purposes of Installation and Whether to Install	Notes
Warehouse for materials for winter	• Space secured for storing and preparing equipment for clearing snow from roads	
Service warehouse	• Space for servicing vehicles for maintenance and management and producing and preparing various road fixtures	
Garage	• Space for parking vehicles for maintenance and management	
Gas stands	• Securing a gas station for vehicles for maintenance and management • Storing reserve petroleum and equipment for filling petroleum in gas stands for vehicles for maintenance and management	
Vehicle wash stands	• Operating temporary vehicle wash stands by installing fire hydrants and drainage facility by parking stands for vehicles for maintenance and management	
Facilities for disposal of waste soil	• Securing facilities and places for disposal of wastes from road cleaning	Including open-air storage yards
Guard posts	• To be determined to install them according to the operation plan	

3) Plan for Rest Facilities

A rest facility is a place where drivers can use a toilet and recover from fatigue after driving a long distance continuously on a road where entrance to and exit are restricted and where facilities for filling gas to automobiles, servicing vehicles, and other services are provided, and thus, a rest area or a small-scale rest area shall be installed at a suitable location.

Checklist for construction of rest areas

Scale plan	• Whether required parking lots are secured according to traffic volume • Whether the sizes of the site and facilities are adequate for the number of parking lots
Layout plan and traffic flow plan	• Whether the installation of a rest area is permissible under the land use plan • Whether the traffic flow of large vehicles are separated from the traffic flow of small vehicles • Whether convenience and accessibility have been taken into consideration for the use of each facility
Floor plan	• Whether the functional zoning plan for each facility is appropriate • Whether the disabled, the aged, and the sick have been taken into consideration in planning barrier-free facilities
Cross-section plan	• Whether functions and human style have been taken into consideration in determining proper heights of floors of each building • Whether maintenance, management, and workability have been taken into consideration in planning cross-sectional style

4) Plan for Facilities for Management of Tunnels

A plan for facilities for the management of tunnels shall be established so as to make it possible to respond promptly to a fire accident in a tunnel, set up the control system, and maintain, manage, and inspect various facilities for disaster protection, installed in each tunnel for ventilation, fire-fighting, and traffic.

〈Table III-14〉 Basic Direction of Planning Facilities for Tunnel Management

Categories	Purpose of Installation and Use	Facilities Installed
Control post	• Minimum facility for unmanned control for the maintenance, management, and control of operation of facilities for disaster prevention and ventilation in each tunnel	Electric room, auxiliary generator room, Co_2 room
Control office	• Equipped with facilities for the maintenance and management of facilities for disaster prevention and ventilation in each tunnel and facilities to control operation of such facilities • Equipped with facilities to monitor the state of each tunnel all the times by full-time controllers	Electric room, auxiliary generator room, Co_2 room, mechanical room, central control room, administration room, toilets, shower room, night watch room
Integrated control center	• An office where personnel stay all the times in order to ascertain the state of tunnels under the control of nearby control posts or control offices and inspecting facilities for disaster prevention and ventilation in each tunnel	Such office may be installed in all tollgate offices where controllers stay all the times.

10. Review of Mechanical Sector

A. Basic Direction-Setting

The mechanical sector may be divided into facilities for the ventilation of tunnels, facilities for disaster prevention in tunnels, facilities for remote monitoring and control, TAB, maintenance and management, and mechanical systems of buildings, and the most suitable plan for mechanical facilities shall be established by considering safety, economic efficiency, maintenance, and management to set up a reasonable system.

〈Table Ⅲ-15〉 Basic Direction-Setting for Design of Mechanical Systems

Categories	Basic Direction-Setting
Facilities for ventilation of tunnels	• Planning ventilation through analysis of design standards and estimated traffic volume of the target year • Planning the tunnel ventilation method, considering characteristics and the current state of surroundings of each tunnel • Planning a reasonable ventilation method through analysis of expenses for maintenance and management and costs initially invested • Planning economically through analysis of specifications and capacities of ventilating facilities • Establishing a plan for the efficient operation of ventilating facilities according to traffic conditions
Facilities for disaster prevention in tunnels	• Establishing a plan for disaster prevention facilities suitable for relevant design standards and the size of each tunnel • Establishing facilities for efficient fire-fighting activities and safe evacuation • Strengthening safety through setting up scenarios for the proper operation of disaster prevention facilities in preparation against a fire • Determining the capacity of facilities for removing smoke, considering reverse flow of smoke at the time of a fire
Facilities for remote monitoring and control	• Maintaining comfortable driving conditions by recording and analyzing changes in driving conditions in each tunnel • Applying commercial programs and improving interface for efficiency in the operation of systems • Applying facilities for measuring conditions inside and outside of each tunnel and managing data from such measurements • Promoting efficient maintenance and management through the integrated control of facilities in each tunnel
TAB, maintenance, and management	• Establishing a plan for adequate capacity of facilities and efficient control and operation • Establishing a plan to cope with errors in systems and problems in controlling systems • Curtailing expenses for maintenance and repairing through periodic and systematic management of table schedule • Preparing a plan for proper facilities and operation of such facilities through TAB
Mechanical systems of buildings	• Planning the layout of equipment in each mechanical room, considering the traffic flow for maintenance and management and movements of equipment • Selecting cooling and heating devices for comfortable indoor conditions • Establishing an energy-saving sanitation system • Selecting the most suitable ventilation method by ascertaining characteristics of each room • Planning fire-fighting facilities for minimizing injuries to controllers and damage to equipment in preparation against accidents

B. Design Standards for Mechanical Facilities

1) Design Standards for Tunnel Ventilation

As to design standards for tunnel ventilation, the PIARC (Permanent International Association of Road Congresses) method, which was publicly announced by the Korea Highway Corporation as the method for the calculation of ventilation volume, shall apply, and the standards shall be planned to conform to the standards under the Regulation on Structure and Facilities of Roads (Ministry of Land, Transport and Maritime Affairs), the Road Design Manual (Ministry of Land, Transport and Maritime Affairs) and the Road Capacity Manual (Ministry of Land, Transport and Maritime Affairs).

2) Design Standards for Tunnel Disaster Prevention Facilities

A plan for disaster prevention facilities suitable for relevant design standards and the size of each tunnel shall be established in planning tunnels to establish facilities for efficient fire-fighting activities and safe evacuation.

The disaster prevention grade for each tunnel shall be basically determined on the basis of the length of the tunnel, but shall be upscaled, if the degree of danger for the tunnel exceeds the specified level as a result of an assessment of the level of danger, considering traffic volume and other factors.

The location of tunnel disaster prevention facilities, the distance between facilities, and applicable standards shall be planned in accordance with the Guidelines for the Installation of Facilities for Disaster Prevention Facilities for Road Tunnels (Ministry of Land, Transport and Maritime Affairs, Dec. 2004), considering local conditions and traffic conditions of each tunnel.

C. Appropriateness of Plans for Mechanical Facilities

1) Tunnel Ventilation Plan

Tunnel ventilation is an important part of a tunnel plan, which is the element not only determining the mainframe structure of a tunnel and the cross-sectional shape of a tunnel, but also closely related to the basic plan for the selection of a route, and thus, shall be planned meticulously as a part of the plan for the entire tunnel.

It is necessary to review the traffic patterns greatly affecting ventilation, the disaster prevention plan, and an impact on surrounding environments from a broader point of view.

〈Table III-16〉 Essential Considerations in Planning Tunnel Ventilation

Categories	Essential Considerations
Selection of tunnel route	• Benefits, geographical features, planimetric features, geological features, etc. shall be taken into consideration in reviewing a tunnel route. • The ventilation plan, including the selection of the location of the vertical shaft and the inclined shaft and the amount of ventilation, becomes an important factor in selecting a route, if a tunnel is long.
Collection of data necessary for ventilation design	• Once the route is determined, data necessary for the ventilation plan shall be collected. • Essential items of necessary data are as follows: (1) Traffic data; (2) weather data; (3) environmental data; (4) geographic, planimetric, and geological data; (5) relevant laws and regulations.
Determination of required ventilation volume	• Necessary ventilation volume shall be calculated on the basis of the traffic volume of each tunnel and specifications of civil engineering works.
Preparation of basic ventilation plan (Selection of ventilation method)	• A basic plan for the determined route shall be prepared, including the ventilation methods based on location conditions of each tunnel, such as required ventilation volume, weather, and environmental conditions. • Whether ventilation facilities are required shall be reviewed first, among other things, in preparing a basic plan. • If ventilation facilities are required, advantages and disadvantages of various ventilation methods shall be compared and examined.
Cross-sectional plan and calculation of ventilating power	• Once the basic plan for ventilation is finalized, detailed review on a space plan for ventilation facilities, mechanical rooms, ducts, etc. and required ventilating power shall be carried out. • Space planning and the calculation of ventilating power shall be carried out approximately at the stage of basic planning and detailed review on determined items shall be carried out in connection with other items.
Determination of facility specifications	• Duct design, specifications of ducts, specifications of ventilating units, layout plan, and a plan for buildings for ventilating plants shall be based on the results of the review of all items. • Operating conditions in normal conditions and in emergency shall be taken into consideration in preparing facility specifications, and designing facilities for environmental monitoring, measurement, operation, and control shall be carried out.

2) Tunnel Disaster Prevention Plan

The main purposes of a plan for disaster prevention facilities for each tunnel are the prevention of accidents, early response, escape and evacuation, activities for fire-fighting and rescue, and the prevention of expansion of accidents, and the roles of disaster prevention facilities shall be precisely recognized throughout all stages of preventive measures and *ex post facto* measures for accidents and the connectivity between the facilities and purposes of the installation of the facilities shall be taken into consideration to prepare the plan for management and operation of the facilities clearly.

The stages of the development of a tunnel fire are divided into the stage of self-rescue, at which road users themselves shall make judgment on the state at the early stage of the fire, and the stage of fire-fighting and rescue, at which personnel from related agencies, including police and fire stations, shall attend at the scene to conduct activities for fire-fighting or rescue.

〈Table III-17〉 Essential Considerations in Planning Tunnel Disaster Prevention

Categories	Essential Considerations
Accident prevention plan	• The prevention of accidents shall be planned in compliance with operating regulations and statutory regulations. • The controller for each facility shall be placed, and a public information plan shall be established, to conduct educational and training programs, raise users' consciousness of safety, and help users recognize potential danger in tunnels.
Early response plan	• The guide for quick evacuation shall be emphasized as the means for early response in the plan. • The plan shall include the installation and operation of facilities for removing or discharging smoke with an adequate capacity in preparation against a fire. • The plan shall be established to prohibit the entrance of vehicles into a tunnel at the early stage of a fire and help road users easily recognize facilities for information or warning.
Plan for fire-fighting and rescue activities	• The accessibility of fire-fighters shall be taken into consideration in planning facilities for activities for fire-fighting and rescue. • If a tunnel is closed for a long time due to a fire, economic losses will be incurred, and therefore it is necessary to establish a plan for the installation and operation of disaster prevention facilities for active activities for fire-fighting.
Plan for evacuation facilities	• There are many cases where road users have to judge the state on their own to make a decision to evacuate, and thus, evacuation facilities for guiding evacuations shall be planned. • In order to secure early evacuation, which is the first objective of disaster prevention facilities, facilities for removing or discharging smoke shall be planned, considering characteristics of each tunnel for a certain level of conditions for evacuation. • The installation of an escape communications shaft and an escape shaft is effective as facilities for evacuation, and thus, the plan for the installation of such facilities shall be reviewed meticulously.
Plan for operation of disaster prevention facilities	• Matters regarding devices for the collection of data and monitoring for collecting conditions inside of each tunnel shall be taken into consideration in formulating the plan as may be necessary for the operation of disaster prevention facilities. • Where disaster prevention facilities, which shall be operated by controllers after checking conditions for evacuation, are installed, a full-time control system shall be established. • The limits of functions of each disaster prevention facility shall be taken into consideration in establishing an efficient management system for the scale of operation facilities.

3) Plan for Remote Monitoring and Control

A plan for the facilities for the remote monitoring and control of road tunnels shall aim at the improvement of the efficiency in tunnel ventilation through optimal control and the prompt response to an accident in emergency.

Proper automatic control and operation makes it possible to extend the useful life of equipment, maintain machines and facilities in the optimal conditions for operation to reduce expenses for maintenance and management, and may be utilized as data for the future improvement of facilities and the improvement of operating manners.

〈Table Ⅲ-18〉 Essential Considerations in Planning Remote Monitoring and Control

Aspects	Essential Considerations
Control	• A plan for energy-efficient control shall be established to make it possible to respond quickly to trends in traffic changes and pursue the integrated management for each system.
Extendibility	• A plan shall be established to set up an integrated system that makes it possible to apply and extend an open structure and a standard interface and provide for unmanned operation, considering extension in the future.
Maintenance and management	• To secure functions for self-examination and package management reporting and to secure the security function for the access by each grade for security.

4) Plan for TAB, Maintenance, and Management

TAB shall be carried out after all systems are completely set up through Testing, Adjusting, and Balancing (TAB) so as to install facilities for design purposes.

The purposes of a plan for maintenance and management is to create comfortable tunnel conditions through the maintenance of functions of facilities and the periodic maintenance and management and to secure originally

contemplated functions through early detection of problems in equipment.

〈Table III-19〉 Essential Considerations in TAB, Maintenance and Management

Categories	Essential Considerations
TAB plan	• Collecting data relating to ventilation facilities and preparing various forms • Conducting field inspections and preparing measurements • Testing functions of ventilation facilities in the factory and conducting test operations and measurements on such facilities (operation in each operating mode, measuring wind speed and pressure, etc.) • Conducting test operation and measurements of fire-fighting facilities, adjusting such facilities, and preparing reports thereon
Plan for maintenance and management	• Forming proper organizations and conducting periodic educational programs for improving skills of personal for maintenance and management • Estimating monthly consumption of each energy source to prevent unnecessary energy consumption • Keeping a service manual and history cards of each facility • Allocating an identification number to each facility and arranging materials, equipments, and tools for repairing

D. Review of Mechanical Facilities in Buildings

An environment-friendly energy-efficient plan shall be established for mechanical facilities at each tollgate office, rest area, and management office so as to provide staff with comfortable environment and improve efficiency in management.

Checklist for mechanical sector

- Whether the analysis on specifications of tunnels and traffic volume for each type of road is appropriate for designing tunnel ventilation and disaster prevention
- Whether design standards applicable to ventilation are proper for the determination of tunnel ventilation volume
- Review needs of mechanical ventilation through comparison between natural ventilation volume and required ventilation volume
- Whether the selected ventilation method is proper for conditions of surroundings and specifications of tunnels
- Whether the layout of ventilation facilities and selected specifications are appropriate
- Whether facilities applied through LCC analysis are appropriate
- Whether design standards for disaster prevention are proper for the selection of disaster prevention facilities
- Whether the determined disaster prevention grade is appropriate in light of specifications of tunnels
- Whether the type, quantity, and layout of applied disaster prevention facilities and the plan for the operation of such facilities are appropriate
- Whether the disaster prevention scenario is proper for the detection and information of a fire, and activities for evacuation, fire-fighting, and rescue
- Whether the information system between related institutions around a tunnel is appropriate for the preparation against a fire
- Apply commercial programs and enhance interface for the improvement of efficiency in systems
- Whether ventilation facilities in tunnels can be effectively controlled through automatic control
- Whether facilities can be smoothly controlled in normal conditions, at the time of a fire, and different situations in each tunnel
- Whether the TAB plan is appropriate for the testing, adjusting, and balancing of applied systems
- Whether the plan for mechanical facilities in buildings is proper for improving working conditions of controllers and securing functions for maintenance and management

ll. Review of Environmental Sector

A. Basic Direction-Setting for Environmental Plans

The impact of the implementation of a road project on water quality, air quality, and flora and fauna shall be meticulously reviewed from the planning stage through the operation stage and the forecasted state and measures for reducing the impact shall be appropriately prepared.

Essential standards for each environmental factor shall conform to Table 1 annexed to the Enforcement Decree of the Framework Act on Environmental Policy (Presidential Decree No. 20975) and Table 8 relevant to Article 20 (3) of the Enforcement Rules of the Noise and Vibration Control Act (Ordinance No. 321 of the Ministry of Environment), and proper measures for reducing the impact thereof shall be established in accordance with such standards.

B. Maps of Ecosystem and Natural Environment

According to Public Notice No. 2007-67 by the Ministry of Environment, natural environment shall be preserved by utilizing maps of ecosystem and natural environment or a plan for the use and development of land shall be established or implemented.

The maps of ecosystem and natural environment are classified into Grade 1 region through Grade 3 region, and restrictions are placed in adminstration plans and development plans for each region. In addition, separately designated management zones shall be subject to regulation on activities pursuant to relevant Acts, and an appropriate plan shall be established in advance, reflecting the maps of ecosystem and natural environment therein.

C. Total Water Pollution Load Control System

1) Overview

The total water pollution load control system means a system for establishing the target water quality suitable for the purpose of using water from a river and managing the water to lower the total pollution load discharged from a discharging zone in each river basin to less than the load permitted to achieve

the established target water quality and provides for the basic matters regarding the implementation of the total load system, the basic plan established by each local government, and guidelines for the establishment of implementation plans, including substances subject to the pollution load control in the Nakdong River basin, the Geum River basin, Yeongsan River basin, and Seomjin River basin, surveys on sources of pollution, and the method of calculating the pollution load.

2) Timetable for Implementation

· The 1st total pollution control plan period: 2004 through 2010.

· The 2nd total pollution control plan period: 2010 through 2015.

※ Establishment of the basic plan for 2nd total load control: 2007 through 2008; Establishment of the implementation plan: 2009 through 2010.

3) Applicable Schemes

At present, the target water quality of each river basin has been publicly notified by the Ministry of Environment, and the pollution load has been allocated to each basin unit subject to the total load control according to the target water quality.

Since it is possible to implement a project only where the project has been reflected in the water pollution load control plan, it is necessary to consult with the competent local government to ensure that the load discharged from each basin as a consequence of the implementation of the project meets the load allocated to the competent local government.

Checklist for environmental sector

- Whether a route that can minimize damage to the environment has been selected through a review of alternative routes
- Whether a distance secured between the route and villages does not exceed standards for air quality
- Whether the water pollution load control system has been reflected and a detour from a specific use zone relating to water conservation has been taken into consideration
- Whether severe cutting or high filing of soil has been minimized to prevent a significant change in landscape
- Whether an area worth ecological or environmental conservation has been taken into consideration
- Whether major species of flora and vegetation are conserved and whether damage to habitats of fauna or the severance of an animal route is minimized
- Whether natural view worth conservation is preserved
- Whether designated cultural heritage has been taken into consideration

Section 4 Cost Estimation for Feasibility Assessment

1. Overview

This section presents standards for the cost estimation necessary for the feasibility assessment (the decision to invest), the fist stage of the VFM test.

The cost of a road project consists mainly of the total project cost and operating costs. The total project cost is the cost incurred in the construction, extension, or improvement of a road, while the operating costs are a sum of costs incurred in the operation of the contemplated facility, including costs of repairing and improvement and substantial repair costs, which are invested during the period of operation after the completion of the facility.

The PSC (Public Sector Comparator) cost is based on the assumption that

services shall be provided at the same level as services provided through the project proposed by the private sector and means the cost incurred if the project is implemented as a government-financed project.

The PSC cost shall be determined on the basis of the results of the technical review on the project proposed by the private sector and the standards regarding engineering service fees and the government's standard cost estimation and unit prices and by referring to data about the results of similar facilities carried out as government-financed projects, if necessary. If the cost estimated by a concessionaire is more accurate and feasible, however, the PSC cost shall be adjusted, based on the cost estimated by the concessionaire. In principle, the intermediate value shall apply to expenses and engineering service fees within the extent set by the standards for fees in applying the standards for service fees for the purpose of determining the PSC cost, except in extraordinary cases.

The design value or quoted value to which the successful bid rate is not applicable is suggested as the cost for the purpose of the feasibility assessment, exclusive of value-added tax. In principle, the base time for the determination of the PSC cost shall be the same as the base time for the cost proposed by the concessionaire for the purpose of the like-for-like comparison with the proposal: *Provided*, That the latest significant change, if any, in the standards relevant to the cost determination shall be taken into consideration in making such determination.

2. Determination of Total Project Costs

The total project costs consist of survey costs, design costs, construction costs, incidental costs, operation equipment costs, taxes and public charges, project implementation charges, and operating reserves.

〈Table III-20〉 Descriptions of Main Items of Total Project Costs

Items	Descriptions of Project Costs
Survey costs	Land survey costs and other survey costs (soil test costs, surface survey costs for cultural heritage, survey costs for excavation (digging-out) of cultural heritage, etc.)
Design costs	Costs incurred in basic and detail designs
Construction costs	Sum of material costs, labor costs, expenses, and administrative expenses for the implementation of a project and profits
Compensation	Compensation for land and obstacles
Incidental costs	Costs of design and responsible supervision, environmental impact assessment costs, costs of preliminary environmental impact testing, expenses incurred in follow-up environmental impact assessment, costs of preliminary review on impact of disasters, costs of deliberation on impact on natural view, expenses incurred in outsourced services for the traffic impact analysis and the establishment of measures for improvement, costs of project feasibility analysis, insurance premiums
Operation equipment costs	Costs of equipment, facilities, computer systems, etc. initially put for the operation of facilities (costs of toll collection systems, traffic control systems, vehicles for maintenance and management, etc.)
Project implementation charges	Various charges payable to the Government for the implementation of a project (charges for cooperation in conservation of ecosystem, charges for damage to a development-limited zone, charges for preservation of farmland, usage fees for occupancy and use of public waters, etc.)
Operating reserves	Personnel expenses and other expenses relating to an operating organization necessary for preparation for the operation of facilities, where appropriate.

A. Survey Costs

Survey costs consist of costs incurred in carrying out basic surveys for the implementation of a project, including land survey costs, surface survey costs for cultural heritage, and survey costs for the excavation (digging-out) of

cultural heritage.

1) Land Survey Costs

Land survey costs are divided into direct land survey costs and indirect land survey costs in accordance with the Standards for Land Survey Service Fees (Public Notice No. 2005-352, Ministry of Land, Transport and Maritime Affairs). Direct land survey costs are costs directly incurred in land survey and a sum of direct personnel expenses and direct expenses, while indirect land survey costs are costs excluded from the direct land survey cost and a sum of expenses and engineering service fees.

The land survey costs of a PSC shall be divided into direct personnel expenses and other expenses based on the standard construction cost estimation, the Standards for Land Survey Service Fees, and wages of land survey engineers.

The land survey for a road project is divided mainly into framework survey and route survey, which consist of the components in Table Ⅲ-21, below, respectively.

a) Direct Personnel Expenses

The land survey for a road project is categorized mainly into framework survey and route survey, and direct personnel expenses are determined according to this categorization. The categories of land survey for the purposes of determining direct personnel expenses are as set out in Table Ⅲ-21, below.

〈Table Ⅲ-21〉 Classification of Land Surveys for Calculation of Direct Personnel Expenses

Categories	Types
Framework survey	Benchmark survey, level survey, survey on current status
Route survey	Route selection, route preoccupancy, center line survey, vertical cross section survey, horizontal cross section survey, plane table survey

The direct personnel expense is the sum of salaries, allowances, bonuses, retirement and severance reserves, and other benefits paid to survey engineers who directly carry out surveying works, information processing engineers, information processing technicians, aero-photographers under Article 18 of the Enforcement Decree of the Land Survey Act, and commercial pilots, navigators, air mechanics, surveyors, etc. under Article 25 of the Aviation Act.

The unit wage for land survey service of each grade of engineer is determined on the basis of the unit wage surveyed and publicly announced by an institution or organization designated and authorized to prepare statistics pursuant to the Statistics Act. The direct personnel expense is determined on the basis of the progress of land survey, the composition of personnel for each type of work, and workers required for each area in accordance with the standard construction cost estimation.

As to wages of land survey engineers for the purpose of calculating personnel expenses, the wages of survey engineers publicly announced by the Korean Association of Land Surveying and Mapping shall be applied, and the unit wages of land survey engineers in 2009 are as set out in Table Ⅲ-22 below.

<Table III-22> Wages for Land Survey Engineers in 2009

Categories		Type of job	Unit cost (KRW)	Remarks
Engineers		Professional engineer	232,956	
		Special level	184,739	
		Advanced level	142,120	
		Intermediate level	128,951	
		Entry level	99,185	
Technicians	Land survey	Advanced level	122,168	- These unit wages include bonuses and retirement and severance reserves. - These unit wages are on a daily basis and the results calculated by averaging the weighted value of the number of personnel by the number of actual working days.
		Intermediate level	98,309	
		Entry level	75,937	
	Mapping	Advanced level	151,819	
		Intermediate level	112,804	
		Entry level	88,757	
	Drawing	Advanced level	160,742	
		Intermediate level	126,814	
		Entry level	102,984	
	Aerial photography	Advanced level	158,665	
		Intermediate level	158,151	
		Entry level		
Others		Commercial pilot	208,702	
		Navigator	187,051	
		Air mechanic	193,066	

Source: Table of wages of land survey engineers in 2009 (Korean Association of Land Surveying and Mapping, Administration No. 2008-655)

b) Other Expenses

Other expenses mean salaries for the maintenance and management of a land survey business establishment, office expenses, utility bills, consumables, furnishings, communications expenses, taxes and public charges and are determined within the range of between 110% and 120% of direct personnel expenses in accordance with the Standards for Land Survey Service Fees (Public Notice No. 2005-352, Ministry of Land, Transport and Maritime Affairs).

c) Engineering Service Fees

Engineering service fees include the fees for the use of technologies

developed or held by a land survey business entity and fees for the acquisition of technologies, expenses for survey and research, expenses for the development of technology, expenses for technical training, and profits and are determined within the range of between 20% and 40% of the sum of direct personnel expenses and other expenses in accordance with the Standards for Land Survey Service Fees (Public Notice No. 2005-352, Ministry of Land, Transport and Maritime Affairs).

d) Determination of Land Survey Cost of PSC

The land survey cost of a PSC is determined by referring to the details of the land survey costs incurred by the competent authority but, if such data are not available, is determined in accordance with the guidelines for the calculation of land survey costs under the Standard Cost Estimation. The calculation sheet of land survey costs presented by the Standard Cost Estimation is as set out in Table Ⅲ-23 below.

<Table III-23> Calculation Sheet of Land Survey Costs

Items		Quantity	Unit	Unit cost	Amount (KRW)	Remarks
1. Direct personnel expense						
Framework survey	1 Benchmark survey					
	2. Level survey					
	3. Survey on current status					
Total						
Route survey	1. Route selection					
	2. Route preoccupancy					
	3. Center line survey					
	4. Vertical cross section survey					
	5. Horizontal cross section survey					
	6. Plane table survey					
Total						
Sub-total						
2. Other expenses: (1. 115% of direct personnel expense)						
3. Engineering service fees: (1. Direct personnel expense + 2. 30% of other expenses)						
4. Grand total: (1+2+3)						

2) Soil Test Cost

The soil test cost of a PSC is calculated in accordance with the Standard Cost Estimation for Soil Test (Korea Engineering and Consulting Association, May 2004), the Standards for Quality Tests of Construction Projects (Public Notice No. 2008-83, Ministry of Land, Transport and Maritime Affairs), and the Standards of Units for the Calculation of Quality Test Cost (Public Notice No.

2008-97, Ministry of Land, Transport and Maritime Affairs).

The soil test cost consists mainly of costs of boring tests, physical prospecting, field tests, and indoor tests and other expenses in the following methods of calculation.

a) Boring Tests

Boring test costs shall be calculated for earthworks, bridges, and tunnels respectively as set out in Table Ⅲ-24 below in accordance with the Standard Cost Estimation for Soil Tests (Korea Engineering and Consulting Association, May 2004), but the frequency and depth of tests may be changed according to the conditions of each site.

<Table III-24> Standards for Determination of Number of Ground Boring Tests for Civil Engineering Works

Categories	Number (Interval)		Depth of Test Boring
Base course	Length of base course	Rough design survey: 300~500 m Detailed design survey: 200~300 m	• Examine the distribution of rock base to check whether there is a section filled with soil or whether consolidation settlement or liquefaction possibly occurs on the ground
Earth cutting	Length of cut section	Cut less than 20 m high: In 2 places minimum Cut not less than 20 m high: Once at an interval of 150~200 m Survey for rough design: At an interval of 100~200 m Survey for detailed design: At an interval of 50~100 m	• Examine the stability of slope: If the height of the planned road is not more than 2 m
Bridge	• In 4 places on the foundation of each abutment and pier along each direction of a bridge • The section between bridge piers and surrounding areas shall be additionally tested in the areas where geological strata are irregular, where the ground is anticipated to be settled, and where bearing capacity is inadequate.		• Check down to 2 to 4 times as deep as the minimum width of the foundation or minimum 2 m deep, where a fresh rock bearing layer is continuously distributed (not more than the depth to which stress affects). • Check one point in a section where soft ground, a fractured zone of fault or an underground hollow (lime) is anticipated by boring a deep hole.
Tunnel	• Urban subway: At an interval of 200 m for an open-cut section on the basic design and at an interval of 100 m for the detail design • Mountain tunnels: At least 2 points at the entrance of a tunnel in each direction at an interval of 30~50 m • At an interval of 50 m at a section where it is anticipated that a rock layer with severe variance in the quality of rock passes through (soft ground, a fractured zone of fault)		• In principle, down to 1.0 D under the level of the planned base course • Down to 1.2 times the planned height, if inevitable, but not more than 2 m minimum under the height of the planned road • If a bed rock is not discovered, continue checking for a fresh bed rock down to not less than 3 m deep.
Foundation for structures	• One hole for each structure • At least 4 holes at an interval of 15~30 m, where a structure is long but the test is only for the structure		• At least 5 m deep under the bearing layer or the level of earthworks, or until a bed rock is discovered
Soft ground	• Rough survey: 100~200m • Detailed survey: 50~100m		• Until discovering strong bearing layer (weathered rock, soft rock) • Until discovering a fresh base rock stretching not less than 3 m continuously

Source: Standard Cost Estimation for Soil Tests (Korea Engineering and Consulting Association, May 2004)

The appropriate boring test cost of a PSC shall be calculated by reviewing the number of boring tests for the PFI based on the Standards for the Determination of the Number of Boring Tests in Table Ⅲ-24 or by reviewing it in comparison with the boring test cost of a project on which negotiations have been recently completed.

b) Field Tests and Indoor Tests

Since the components of a field test or an indoor test vary according to the conditions of the relevant site, the test cost of a PSC shall be determined by calculating the number of tests in accordance with the Standards for Quality Tests of Construction Projects (Public Notice No. 2008-83, Ministry of Land, Transport and Maritime Affairs), referring to the components of the field test or indoor test suggested by the PFI and then by reviewing it in comparison with the test cost of a project on which negotiations have been recently completed.

c) Miscellaneous Expenses

Miscellaneous expenses include transportation expenses, expenses incurred in the installation of machines and instruments, and the expenses incurred in printing reports, and the expenses for a PSC shall be determined on the basis of the details of miscellaneous expenses incidental to the soil test costs of the PFI.

d) Other Expenses and Engineering Service Fees

In calculating other expenses and engineering service fees, other expenses shall be 110% to 120% of direct personnel expenses in accordance with the Standard Cost Estimation for Soil Tests (Korea Engineering and Consulting Association, May 2004) and engineering service fees shall be 20% to 40% of the sum of direct personnel expenses and other expenses.

3) Surface Survey Costs for Cultural Heritage

A surface survey for cultural heritage is carried out in order to check the burial and distribution of relics in accordance with Article 91 of the Cultural

Heritage Protection Act in the area of a project when the project plan for a construction project is established, and the detailed items of the surface survey costs for cultural heritage consist of direct personnel expenses, direct expenses, other expenses, scientific service fees, etc.

The surface survey cost for cultural heritage in a PSC is determined in accordance with the Standards for Survey Service Fees for Buried Cultural Heritage (Public Notice No. 2009-11, Cultural Heritage Administration).

a) Direct Personnel Expense

The direct personnel expense is determined by multiplying the personnel expense for each grade of surveyors by the number of participating manpower and then by multiplying the calibration factor applicable to the size of the area concerned and the level of difficulty of works required.

The method of calculating the standard number of manpower for the determination of direct personnel expense is as follows:

〈Table III-25〉 Standard Number of Surveyors

Stage of Survey		Standard Number of Surveyors by Level			
		Team leader	Senior surveyor	Surveyor A	Surveyor B (or assistant surveyor)
Preliminary survey		0.2 person	0.2 person	0.8 person	0.5 person
Field survey	Land	-	1.0 person	1.0 person	1.0 person
	Underwater	-	0.1 person	0.4 person	1.2 persons
Arrangement and analysis		-	0.2 person	1.0 person	0.5 person
Preparation of reports		0.3 person	0.6 person	1.2 persons	1.0 person

Note: The standard number of manpower means the number of manpower required for 100,000㎡ and, if necessary for a documentary survey or field survey on folk customs, geological features, or natural environment, surveyors from related fields may be dispatched.
Source: Standards for Survey Service Fees for Buried Cultural Heritage (Public Notice No. 2009-11, Cultural Heritage Administration)

The number of participating surveyors by level is determined by multiplying the area calibration factor and the difficulty calibration factor in accordance with

the Standards for Survey Service Fees for Buried Cultural Heritage.

- Number of participating surveyors[9]= ∑(Standard number of persons by level × Area calibration factor × Difficulty calibration factor)
- Area calibration factor: $\left(\frac{\text{Area to be surveyed } (m^2)}{\text{Standard area } (100{,}000\,m^2)}\right)^{0.6}$
- Difficulty calibration factor: To be classified by the form (complex type, line type) and location (flatland, mountainous district) of the area subject to land surface survey

〈Table III-26〉 Calibration Factors for Level of Difficulty

Categories	Complex type	Line type
Flatland (wide open area)	1.0 (standard)	1.2
Mountainous district A	1.2	1.4
Mountainous district B	1.4	1.6

Notes: 1) As to a small area of less than 30,000㎡ subject to any kind of an underground survey or a land survey, the standard grade (1.0) shall apply as a calibration factor for the level of difficulty.
2) Complex type: Complexes (industrial complexes, apartments, housing sites, public parks, dams, water reservoirs, and other collective sections), borrow pits (quarrying, soil collection, etc.)
3) Line type: Roads, railroads, waterways (rearrangement and improvement of rivers, water supply pipelines, etc.)
4) Flatland: Where mountainous districts are less than 30%
5) Mountainous district A : Where a mountainous district is not less than 30% but less than 70%
6) Mountainous district B : Where a mountainous district is not less than 70%
Source: Standards for Survey Service Fees for Buried Cultural Heritage (Public Notice No. 2009-11, Cultural Heritage Adminstration)

As to the standard unit personnel expense of surveyors by level, the expenses publicly notified by the Cultural Heritage Administration each year through the Official Gazette and its web-site shall apply, and the standard unit personnel expense of surveyors by level in 2008 are as set out in Table Ⅲ-27 below.

9) Any figure below the decimal point in the number of participating surveyors so calculated shall be rounded off to the nearest tenth.

<Table III-27> Standard Unit Personnel Expense of Surveyors by Level

Categories	Standard Unit Expense (per day)
Team leader	276,303
Senior surveyor	208,903
Surveyor	174,734
Assistant surveyor	116,562
Assistant	91,545

Source: Standards for Survey Service Fees for Buried Cultural Heritage (Public Notice No. 2009-11, Cultural Heritage Administration)

b) Direct Expenses

Direct expenses are direct expenses necessary in carrying out a survey, including site operating cost, material cost for survey, rent, expenses for advisory meetings, expenses for the arrangement of relics, and expenses for publish reports, and shall be determined in accordance with the Standards for Survey Service Fees for Buried Cultural Heritage (Public Notice No. 2009-11, Cultural Heritage Administration).

c) Miscellaneous Expenses

Miscellaneous expenses are expenses not included either in direct personnel expenses or in direct expenses, including indirect expenses, such as personnel expense not directly invested, consumables for office, furnishings, expenses for repairing machines and instruments, depreciation cost, communications and transportation, rent, taxes and public charges, and shall not be more than the range of between 120% and 130% of direct personnel expenses.

d) Scientific Service Fees

Scientific service fees are fees for the use of scientific research findings possessed by a person to whom a surveying service is commissioned, including expenses for scientific research and expenses for education and training of

surveyors, and shall not be more than the range of between 10% and 30% of the sum of direct personnel expenses and miscellaneous expenses.

4) Expenses for Excavation (Digging-out) of Cultural Heritage

An excavation survey is conducted in the land or sea bottom where it is believed, after carrying out a surface survey for cultural heritage, that the cultural heritage specified in Article 55 (1) of the Cultural Heritage Protection Act is buried.

The scale of remains, the period of excavation, etc. shall be taken into consideration in determining expenses for an excavation survey for cultural heritage, in accordance with a contract between parties (the relevant project concessionaire and excavation survey agency), and the Standards for Survey Service Fees for Buried Cultural Heritage (Public Notice No. 2009-11, Cultural Heritage Administration) shall be referred to in determining the expenses.

In cases of expenses incurred in the excavation survey for cultural heritage in a PSC, since it is difficult to predict the extent of excavation for cultural heritage and the time when excavation is required at the stage prior to the implementation of the project, the expenses shall be reflected only when such expenses are suggested in the PFI, and the need to reflect the item and the adequacy of the amount shall be discussed through future negotiations to determine the expenses.

a) Direct Personnel Expenses

An excavation survey for cultural heritage is conducted with or without another (closer) excavation survey subsequent to the former survey, and direct personnel expenses are divided again into personnel expenses for field survey and personnel expenses for arrangement and preparation of reports. The calculation method thereof shall be determined by referring to the Standards for Survey Service Fees for Buried Cultural Heritage (Public Notice No. 2009-11, Cultural Heritage Administration).

b) Direct Expenses

Direct expenses incurred in carrying out a survey include travel expenses, expenses for transportation and communications, site operating expenses, material costs incurred in surveys, outsourced service fees, rent, expenses for meetings, costs of the installation of temporary buildings, expenses for the transportation of equipment and materials, expenses incurred in the arrangement of relics, and expenses incurred in publishing reports and shall be determined in accordance with the Standards for Survey Service Fees for Buried Cultural Heritage (Public Notice No. 2009-11, Cultural Heritage Administration).

c) Miscellaneous Expenses

Miscellaneous expenses shall not be more than the range of between 120% and 130% of direct personnel expenses.

d) Scientific Service Fees

The fees shall not be more than the range of between 10% and 30% of the sum of personnel expenses and other expenses.

B. Design Costs

Design costs are costs incurred for the basic and detail designs for the implementation of a project and shall be calculated by multiplying the estimated project cost (exclusive of value-added tax) under the Standards for Engineering Service Fees publicly announced by the Ministry of Knowledge and Economy by the rate applicable to the relevant work of the construction sector as calculated by straight-line interpolation.

Pursuant to Article 21 of the Construction Technology Management Act, if a service provider intentionally or negligently causes property damage to the subject matter of service or a third party while performing a service contract on designing works, the service provider shall be liable for such damage, and thus, shall subscribe for insurance or a liability mutual aid fund in order to insure against such damage. In such cases, the project owner shall reflect costs of subscribing for insurance or a liability mutual aid fund in the service cost.

Design costs of a PSC shall be determined by assuming that orders for basic and detail designs are placed simultaneously and applying 1.4 times the fee rate for detail design according to the construction costs under the Standards for Engineering Service Fees, and the liability insurance premium shall be included in the calculation of the total design costs.

However, if an error in total design costs is anticipated in determining design costs of any other sector because the project cost of other works comprise a large portion of the total project costs, the fee rate applicable to the relevant sector, other than for the construction sector, may be applied separately.

<Table III-28> Fee Rates for Construction Sector under Standards for Engineering Service Fees

Rate / Project cost	Fee Rate for each Type of Work (%)			
	Basic Design	Detailed Design	Supervision	Total
KRW 1 billion or less	1.77	3.55	1.66	6.98
KRW 2 billion or less	1.63	3.27	1.53	6.43
KRW 3 billion or less	1.57	3.15	1.48	6.20
KRW 5 billion or less	1.54	3.09	1.45	6.08
KRW 10 billion or less	1.51	3.01	1.41	5.93
KRW 20 billion or less	1.46	2.91	1.37	5.74
KRW 30 billion or less	1.45	2.90	1.35	5.70
KRW 50 billion or less	1.41	2.84	1.33	5.58
KRW 100 billion or less	1.40	2.79	1.30	5.49
KRW 200 billion or less	1.38	2.76	1.28	5.42
KRW 300 billion or less	1.37	2.72	1.25	5.34
KRW 500 billion or less	1.34	2.70	1.23	5.27
More than KRW 500 billion	Fee rate for basic design = $2.75 \times (\text{Project cost})^{-0.0265} - 0.006822$ Fee rate for detail design = $5.0 \times (\text{Project cost})^{-0.0229}$ Fee rate for supervision = $3.4816 \times (\text{Project cost})^{-0.0386} - 0.00084$			

Source: Standards for Engineering Service Fees in 2008 (Public Announcement No. 2008-109, Jun. 2008, Ministry of Knowledge and Economy)

The fee rate for detailed design at the time when the project cost is in the middle between two different units on the fee rate table is determined as follows by straight-line interpolation:

$$y = y1 - \frac{(x - x2) \times (y1 - y2)}{x1 - x2}$$

Note 1) x: Amount in question, x1: Larger amount, x2: Smaller amount

Note 2) y: Fee rate for project cost in question, y1: Rate for smaller amount, y2: Rate for larger amount

Note 3) Where orders for basic and detail designs are placed simultaneously, 1.4 times the fee rate applicable to detail design shall be applied.

The liability insurance premium shall be determined by the premium rate for liability insurance under the Guidance on Liability Insurance for Design, Supervision, and Other Services and Work Process therefor (Public Notice No. 2008-75, Ministry of Land, Transport and Maritime Affairs) pursuant to Article 37-3 of the Enforcement Decree of the Construction Technology Management Act.

Nevertheless, the design cost of a PSC shall be determined by applying the premium rate for liability insurance for detail design, since it is assumed that basic and detail designs are placed simultaneously.

〈Table III-29〉 Table of Liability Insurance Premium Rates

Categories	Type of Project	Net Service Fee								Standard construction period (Year)
		More than KRW 500 million, but not more than KRW 1 billion		More than KRW 1 billion, but not more than KRW 2 billion		More than KRW 2 billion, but not more than KRW 3 billion		More than KRW 3 billion, but not more than KRW 5 billion		
		Basic rate	Additional rate	Basic rate	Additional rate	Basic rate	Additional rate	Basic rate	Additional rate	
Basic design	Bridge	0.466	0.074	0.452	0.072	0.437	0.070	0.423	0.068	3
	Road	0.420	0.067	0.407	0.065	0.394	0.063	0.380	0.061	3
	Tunnel	0.584	0.093	0.566	0.090	0.548	0.087	0.529	0.084	4
Detail design	Bridge	0.933	0.149	0.904	0.144	0.875	0.140	0.846	0.135	3
	Road	0.839	0.134	0.813	0.130	0.788	0.125	0.761	0.122	3
	Tunnel	1.167	0.186	1.130	0.180	1.094	0.175	1.059	0.169	4

Source: Table of Liability Insurance Premium Rates (Engineering Financial Cooperative, Apr. 1, 2008)

〈Table III-30〉 Guidelines for Calculation of Design Cost for each Sector

Sector	Guidelines for Determination of Design Cost
Electrical sector	· Guidelines for Designing for Electrical Facility Projects, Fee Rates for Design Supervision, and Placement of Supervisors (Public Notice No. 2007-158, Ministry of Knowledge and Economy, Dec. 2007)
Architectural sector	· Guidelines for Scope of Services of Architects and Service Fees therefor (Public Announcement No. 2002-270, Ministry of Land, Transport and Maritime Affairs, Oct. 2002)

Where additional works are carried out at the competent authority's request pursuant to Article 17 of the Standards for Engineering Service Fees (Public Announcement No. 2008-109, Ministry of Knowledge and Economy), further service fees shall be reflected for additional works performed due to a cause for

which the engineering service entity is not liable and additional works performed with the competent authority's approval.

〈Table III-31〉 Details of Additional Works

No.	Details of Additional Works
1	· Various land surveys
2	· Various surveys, tests, and inspections
3	· Expenses incurred for engineers who work in the site for supervision
4	· Convergence of residents' opinions and documentation necessary for various licenses and permits
5	· Preparation of various survey reports, including survey reports on stocking of trees
6	· Preliminary environmental impact test, such as preliminary review on impact of disasters, review on impact on natural view, environmental assessment on ecosystem
7	· Surface survey on cultural heritage
8	· Environmental analysis on radio wave and preparation of reports
9	· Preparation of various plans, including operation plans
10	· Operation of telecommunications equipment and analysis on interface and communications software
11	· Tests of hydraulic models and tests of numerical models
12	· Production of models and preparation of perspective plans or aerial view maps
13	· Preparation of reports, expenses for copying and printing
14	· Expenses for preparation of site maps and expenses for preparation of a list of assets eligible for compensation (excluding land prices and appraisal of assets eligible for compensation)
15	· Taking aerial photographs (including by unmanned remote-controlled helicopters)
16	· Special data expense (royalties for patents, knowhow, etc.)
17	· Production of movies for advertisement
18	· Premium for liability insurance or liability mutual aid fund covering damage caused by negligence of the other party to a contract in accordance with relevant Acts and subordinate statutes

Note: Costs of the works specified in No. 1 through 11 shall be calculated by adding the fixed amount of actual costs, while costs of the works specified in No. 12 through 18 shall be calculated by reflecting actually incurred costs.

Source: Standards for Engineering Service Fees in 2008 (Public Announcement No. 2008-109, Ministry of Knowledge and Economy, Jun. 2008)

C. Construction Costs

According to the Basic Plan for Public-Private Partnership Projects (Ministry of Strategy and Finance, 2008), the competent authority shall prepare appropriate standards for the quality level of design documents that shall be included in each project plan, considering the nature of the relevant type of project, as a scheme for minimizing the cost of a project proposal, and the method of calculating construction costs varies depending upon the quality level of design documents required by the competent authority according to the nature of each type of project.

In principle, the review of construction costs for the purpose of feasibility assessment shall be carried out based on the level of design documents submitted along with a private proposal, and supplementation may be requested if the quality of the design documents submitted along with a private proposal is inadequate for review.

In addition, if it is necessary to conduct a review on an additional route or a rough review on an alternative route in determining the construction costs of a PSC, the construction costs may be determined by experts in accordance with the Standard Guidelines for Preliminary Feasibility Assessment.

1) Outlines for Determination of PSC Construction Costs

The construction costs of a PSC shall be calculated on the assumption that the route proposed by a project proposer is carried out by the Government and shall be re-determined through technical review and review on the quantity and unit cost (historical construction cost, unit construction cost of each facility) of each type of work section.

Construction costs are the sum of material costs, labor costs, expenses, administrative expenses, and profits for the implementation of a project and shall be calculated by applying the guidelines for the determination of anticipated prices under Article 9 of the Enforcement Decree of the Act on

Contracts to which the State is a Party, the government's standard cost estimation and unit prices, and historical unit costs of similar facilities.

[Figure III-2] Flow Chart of Calculation for PSC Construction Costs

Review on appropriateness of basic unit cost	Review on the appropriateness of material costs, labor costs, expenses, rent for heavy equipment, the time for transportation
↓	
Review on appropriateness of the quantity calculated	Review on the standards for the calculation of quantity for each type of work section and the quantity calculated
↓	
Review on appropriateness of unit costs calculated	Review on the appropriateness of unit costs calculated, including historical construction cost, itemized unit cost, and quotation sheets
↓	
Calculation of final PSC construction cost	Calculating the optimal construction cost in implementing a government-financed project by reflecting the above-stated matters

2) Review on Appropriateness of Basic Unit Costs

The appropriateness of the basic unit costs suggested by a project proposer for material costs, labor costs, expenses, and rents for heavy equipment shall be reviewed.

(a) Material Costs

Material costs shall be compared with the prices available on price reports as data for the calculation of prices and the ordinary contract unit prices of the Public Procurement Service for the purposes of review and analysis.

(b) Labor Costs

The review of labor costs shall be based on a survey report on the actual state of wages (current unit wages in the market) in the construction industry,

announced by the Construction Association of Korea twice each year, and a survey report of the Korea Engineering and Consulting Association on the actual state of wages.

(c) Expenses

The review of expenses shall be based on various price reports and the medium-term basic data released by the Public Procurement Service.

(d) Rents for Heavy Equipment

The review of rents for heavy equipment shall be based on various price reports, the Standard Cost Estimation of Construction Works, etc.

3) Review on Appropriateness of Quantity Calculated

Construction costs shall be calculated for each type of work section with the design quantity, the construction cost calculated for cost estimation, and historical construction costs. Since calculating quantity without errors is as important as determining the appropriateness of historical construction costs and the construction costs calculated for cost estimation, a meticulous review on the quantity calculation sheet for each section shall be conducted for calculating construction costs accurately by applying the latest design standards, etc.

Defects discovered from designs through technical analysis as those of which improvements are needed shall be reviewed comprehensively along with the calculation of quantity by introducing the concepts of VE (Value Engineering) and LCC (Life Cycle Cost).

4) Review on Appropriateness of Unit Costs Calculated

The calculation of unit costs is the final stage of the calculation of construction costs, and the cost calculation method by standard cost estimation and the method of calculating historical unit costs based on data about results of projects performed in the past may be mainly applied to the calculation. The method of calculating historical unit costs is the method utilized for the determination of the expected price of a similar project by extracting the unit

price of each type of work section, including material cost, labor cost, and direct construction expenses, from unit contract prices. Therefore, the method makes it possible to reflect the knowhow accumulated at the stage of construction better than the method using standard cost estimation, and the unit cost of each type of work section by the method tends to be lower than the unit cost calculated by standard cost estimation.

Since the construction costs of a project ordered by the Government have been recently determined by using historical unit costs, it is advisable to review the appropriateness of the calculation of unit costs based on historical construction costs in calculating the construction costs of a PSC on the assumption that the Government implements the project.

<Table III-32> Comparison between Historical Cost System and Cost Estimation System

Description	Cost Estimation System	Historical Construction Cost System
Method of preparing statements	It varies depending upon designers and project owners.	Statements are prepared in uniform forms in accordance with the Quantity Calculation Standards, which is the standard classification system.
Method of calculating unit costs	Cost calculation based on cost estimation formulas	Calculation with the accumulated historical unit cost of each type of work section on the basis of unit contract costs
Direct construction costs	Separate unit costs of materials and labor and expenses	Includes unit costs of materials and labor and expenses
Indirect construction costs (other expenses)	Based on each cost item (labor cost, etc.)	Based on direct construction costs
Design modification	Item adjustment method, index adjustment method	Index adjustment method (apply the index of construction costs)

5) Results of Determination of PSC Construction Cost

If any anomaly is discovered as a result of the review of the appropriateness of basic unit costs, quantity calculation, or the calculation of unit costs based on technical analysis, the construction cost of a PSC shall be re-determined by reflecting such anomaly and applying the detail program.

〈Table Ⅲ-33〉 Comparison between Construction Costs of PFI and PSC

(Unit: millions of KRW)

Item	PFI applied cost	PFI design cost (1)	PSC design cost (2)	Increase/decrease (2) - (1)
A. Cost of civil engineering works				
A-1. Net construction cost				
A-1-1. Earthworks				
A-1-2. Stabilization of slopes				
A-1-3. Earthworks				
A-1-4. Structures				
A-1-5. Tunnels				
A-1-6. Pavement				
A-1-7. Traffic safety facilities				
A-1-8. Incidental works				
A-1-9. Disposal of wastes				
A-2. Miscellanies				
B. Cost of electrical works				
C. Cost of mechanical works				
D. Cost of architectural works				
E. Cost of landscaping				
Total construction cost (A~E)				

D. Compensation

Compensation encompasses the acquisition costs of land (lot purchase costs, including prices for acquiring buildings and standing trees thereon), the compensation for obstructions, the resettlement of residents, and the compensation for goodwill and other rights, and the amount and the annual investment rate of lot purchase costs and compensation for obstructions shall be determined in accordance with the Study to Amend and Supplement General Guidelines for Preliminary Feasibility Studies (5th ed.) to be reflected equally in the PSC and the PFI.

1) Guidelines for Determination of Lot Purchase Costs

Lot purchase costs for the purpose of a preliminary feasibility study and review consist of acquisition costs of land and compensation for obstructions. Acquisition costs of land are costs incurred in acquiring or expropriating the land necessary for a public-interest project subject to a preliminary feasibility study and review, while compensations for obstructions are costs incurred in expropriating articles that obstruct the use of the land, such as buildings, structures, crops, and trees.

The guidelines currently effective for a preliminary feasibility study and review play the role as a reference price at the stage of the implementation of a project by specifically presenting the method of calculating lot purchase costs. However, it is necessary to estimate the costs in analyzing the financial feasibility of a project, since the ratio of lot purchase costs in a public-interest project for a road, railroad or the like has been gradually increasing.

According to the method of applying the compensation multipliers under the currently effective guidelines, the compensation multiplier applicable to the acquisition costs of land is 1.766 times the publicly notified land price, while 30% of the acquisition costs of land apply to compensation for obstructions. Therefore, the compensation multiplier applicable to the total lot purchase cost

is 2.296 times the publicly notified land price.

However, the analysis on the outcomes of compensation and the statistics of average land prices shows that there is a substantial difference between regions and projects in the unit cost of lot purchase costs and that there is also a substantial difference between regions in the ratio of the compensation cost of a public project to the publicly notified average individual land price, while the ratio of compensation for obstructions to the cost of a project site has been recently falling down to the range of 10%. Therefore, it is necessary to reflect such differences between regions and land categories in compensation multipliers, and compensation for obstructions shall be modified to make it realistic.

<Table III-34> Outcomes of Compensation for Land for Public Use

(Unit: millions of KRW, 1,000㎡)

1994	1996	1997	1998	1999	2000	2001	2002	2003	2004
66.30	74.45	57.94	51.84	43.84	54.38	52.02	57.60	52.12	54.46

Source: Construction Statistics Annals, "Annual Report on Official Announcement of Land Prices"

<Table III-35> Unit Compensation Cost of Land for Public Use and Publicly Notified Individual Land Price

(Unit: KRW/㎡)

Unit Compensation Cost (KRW/㎡)			Individual Land Price (KRW/㎡)			Unit Compensation Cost/Individual Land Price		
2002	2003	2004	2002	2003	2004	2002	2003	2004
57.600	52.122	54.459	14.923	16.996	20.150	3.86	3.07	2.70

Source: Construction Statistics Annals for the years 2002, 2003 & 2004

〈Table III-36〉 Outcomes and Ratio of Compensation for Land and Obstacles

(Unit: 100 billions of KRW)

2001	2002	2003	2004	2005	2006
0.23	0.23	0.20	0.15	0.14	0.11

Source: Annual Report on the Planning and Use of National Land, 2008

The following table is for compensation multipliers extrapolated from the data about the outcomes of compensation for road projects and railroad projects recently performed as data for modifying the currently effective compensation multipliers stated above. Since the data about outcomes of compensation are those mainly for regions outside of the Seoul Metropolitan Area, and thus, it is impossible to divide the regions into the Seoul Metropolitan Area and other regions or into metropolitan/provincial economic zones, regions are divided into *Si* sections and *Gun* sections. The outcomes of the compensation multipliers in each *Si*/*Gun* section and each land category is generally higher than those under the currently effective guidelines.

〈Table III-37〉 Compensation Multipliers for Compensation Cases in each Region and each Land Category (Summary)

Categories	*Si* section	*Gun* section	Average
Building site	2.37	3.61	3.40
Rice paddy	2.45	3.21	3.12
Dry field	2.50	2.94	2.89
Forest	6.52	6.02	6.11
Others	3.38	4.49	4.28
Average	3.84	3.86	3.85

The following table shows the results of a survey conducted on

compensation multipliers through questionnaires to appraisers who have practiced appraisal for compensation, taking into consideration the fact that the level of publicly notified land prices has increased by approximately four times on average in comparison with the recent land price fluctuation rates. The questionnaires queried the compensation multipliers for the Seoul Metropolitan Area, the regions outside of the Seoul Metropolitan Area, and *Si*/*Gun*, as well as the nationwide average compensation multiplier for each land category. The compensation multiplier that an appraiser currently applies is in the range of between 1.5 and 2.7 for each region and between 1.5 and 2.0 for each land category, which is slightly lower or higher than those under the currently effective guidelines.

〈Table Ⅲ-38〉 Results of Surveys on Compensation Multipliers for each Land Category

Regions		Rice paddy	Dry field	Building site	Forest
Seoul Metropolitan Area	*Si* section	1.51	1.52	1.37	1.98
	Gun section	1.74	1.72	1.50	2.53
Regions Outside of Seoul Metropolitan Area	*Si* section	1.76	1.72	1.65	2.25
	Gun section	1.81	1.81	1.65	2.49
Si section		1.58	1.57	1.41	2.09
Gun section		1.86	1.90	1.57	2.69
Seoul Metropolitan Area		1.56	1.54	1.44	1.87
Regions Outside of Seoul Metropolitan Area		1.77	1.79	1.52	2.40
Nationwide		1.56	1.50	1.40	1.94

Three options may be suggested as methods of estimating the acquisition costs of land based on precedents of compensation and results of surveys through questionnaires with regard to compensation multipliers. Option 1 is the estimation method by which approximately 5% of parcels of the land eligible

for compensation within the project site are extracted as samples, considering important features of land, such as specific-use zones and land categories, and a summary appraisal of such samples is requested of the Korea Association of Property Appraisers or the Korea Appraisal Board. Option 2 is the estimation method by which compensation multipliers applicable to the project site are extrapolated from data about compensation already paid to the land in the vicinity of the project, which have been submitted by the project concessionaire who has requested the preliminary feasibility review and the lot purchase cost is estimated with the compensator multipliers. Option 3 is the method for which the standard compensation multipliers suggested in the following table are applied. The following Table Ⅲ-39 is the table of standard compensation multipliers applicable when the acquisition cost of land is calculated with compensation multipliers. Compensation for obstructions is estimated by adjusting to the range of between 10% and 15% according to the conditions of each project site.

<Table Ⅲ-39> Compensation Multipliers for each Region and each Land Category (Draft)

Regions		Rice Paddy	Dry Field	Building Site	Forest
Seoul Metropolitan Area	*Si* section	1.50	1.50	1.40	2.00
	Gun section	1.75	1.75	1.50	2.50
Regions outside of Seoul Metropolitan Area	*Si* section	1.75	1.75	1.65	2.30
	Gun section	1.80	1.80	1.65	2.50

2) Underground Compensation Cost

Underground compensation cost shall be determined in accordance with

Article 5 of the Enforcement Decree (Presidential Decree No. 21232, Dec. 31, 2008) of the Urban Railroad Act, and the reasonable price of a parcel of land shall be the value appraised by an appraisal firm designated by the competent Mayor/Governor, among appraisal firms under Article 28 of the Public Notice of Values and Appraisal of Real Estate Act, based on the publicly notified standard land price under subparagraph 5 of Article 2 of the same Act.

The method of determination shall conform to the method under Table 1 annexed to the Enforcement Decree (Presidential Decree No. 21232, Dec. 31, 2008) of the Urban Railroad Act, and the further detailed determination guidelines shall be prescribed by ordinance of the Special Metropolitan City, a Metropolitan City, a *Do*, or a Special Self-Governing Province, whichever is the competent authority, considering the actual status of the use of the land concerned and the land in the vicinity, the conditions of location, and other local features.

Underground compensation cost
• Reasonable price per unit area of land × Rate of obstruction to three-dimensional use × Area subject to partitioned surface right

E. Incidental Costs

1) Design Supervision Costs

Design supervision shall be carried out in accordance with Article 22 of the Construction Technology Management Act and Article 39 of the Enforcement Decree of the same Act, and the projects subject to design supervision and the scope of works are as set out in Tables Ⅲ-40 and Ⅲ-41, respectively.

〈Table III-40〉 Scope of Projects subject to Design Supervision

Scope of Projects	Basic design (limited to cases where the project owner determines that design supervision is necessary) and detail design for a project for the construction of a Class 1 or 2 facility under the Special Act on the Safety Control of Public Structures
	Basic design (limited to cases where the project owner determines that design supervision is necessary) and detail design for a construction project that includes a Class 1 or 2 facility under the Special Act on the Safety Control of Public Structures
	Basic and detail designs for a construction project that includes a structure built by a new or extraordinary method and that the project owner determines that design supervision is necessary
	Basic and detail designs for any other construction project for which the project owner determines that design supervision is necessary

Source: Article 39 of the Enforcement Decree of the Construction Technology Management Act (Presidential Decree No. 21181, Dec. 24, 2008, amended by another Decree)

〈Table III-41〉 Scope of Design Supervision Services

Scope of Services	1. Review on compliance with the Acts and subordinate statutes, the design standards for construction projects, and the standards for the performance of construction projects, relevant to construction projects
	2. Review on the appropriateness of the form of the installation of structures and the selection of construction methods
	3. Review on the appropriateness of the selection of materials for use
	4. Preliminary review on the workability of designs
	5. Review on the accuracy of structural calculation
	6. Review on the appropriateness of land surveys and soil tests
	7. Management of design process
	8. Review on the reasonableness of the construction period and construction cost
	9. Review of the economic efficiency of designs
	10. Review on the appropriateness of proposed designs
	11. Review on the appropriateness of the preparation of drawings and specifications
	12. Preparation of the report on results of design supervision

Source: Article 39-2 of the Enforcement Decree of the Construction Technology Management Act (Presidential Decree No. 211181, Dec. 24, 2008, amended by another Decree)

The design supervision cost of a PSC is calculated by applying the fee rates proportional to construction cost under the Guidelines for Design Supervision Fees (Public Notice No. 2005-445, Ministry of Land, Transport and Maritime Affairs, Dec. 23, 2005), and 1.4 time as much as the fee rate for detail design shall be determined as the fee rate for basic and detail designs.

When the design supervision cost of a PSC is reflected in basic and detail designs, the design VE cost shall not be additionally reflected, since the review on the economic efficiency of designs (design VE) is included in the scope of works of design supervision: *Provided*, That the design VE cost may be additionally reflected through consultation with the competent authority, if design supervision is not carried out at the basic design stage.

The design supervision cost is determined by straight-line interpolation, based on designed construction cost, by referring to Table Ⅲ-42, Table of Design Supervision Service Fee Rates.

〈Table Ⅲ-42〉 Table of Design Supervision Service Fee Rates

Construction Cost (KRW in 100 millions)	Basic Design (%)	Detail Design (%)
500	0.181	0.368
700	0.174	0.354
1000	0.167	0.339
1500	0.162	0.329
2000	0.157	0.319

Source: Standards for Design Supervision Service Fee Rates (Public Notice No. 2005-445, Ministry of Land, Transport and Maritime Affairs, Dec. 23, 2005)

If the construction cost is in the range of between two different units on the fee rate table, the design supervision service fee rate shall be determined by straight-line interpolation as follows:

$$y = y_1 - \frac{(x - x_2)(y_1 - y_2)}{x_1 - x_2}$$

Note) x: Amount in question, x_1: Larger amount, x_2: Smaller amount

Note) y: Fee rate proportional to the construction cost, y_1: Fee rate for smaller amount, y_2: Fee rate for larger amount

The design supervision service fee rate shall be calculated in the following formula, if construction cost exceeds KRW 200 billion: *Provided*, That the fee rate shall be determined by applying the fee rate calculated in the following formula based on the construction cost of KRW 300 billion, if the construction cost exceeds KRW 200 billion but does not exceed KRW 300 billion:

- $y = 1.1124 \times X^{-0.1707} \times 1.4$

Note) y: Fee rate for the stage of detail design, X: Construction cost (unit: 100 millions of KRW)

2) Responsible Supervision Cost

Article 27 (1) of the Construction Technology Management Act provides that a construction project shall be subject to the responsible supervision by a company specializing in supervision under Article 28 in order to secure and improve the quality of construction projects. In principle, the responsible supervision service fee shall be calculated by the fixed cost estimation method in accordance with the Standards for Supervision Service Fees for Construction Projects (Public Notice No. 2008-846, Ministry of Land, Transport and Maritime Affairs) as follows:

a) Calculation of Number of Supervisors

(1) Calculation of Total Number of Supervisors

The total number of supervisors shall be determined by the number of supervisors responsible for a construction project under Table Ⅲ-44 after classifying sections of the project by the level of difficulty of work sections in

accordance with <Table Ⅲ-43>.

〈Table Ⅲ-43〉 Classification of Work Sections of Civil Engineering Works

Categories	Simple Work Sections	Ordinary Work Sections	Complicated Work Sections
Work sections	- Development of ordinary building sites without a structure - River banks, shore banks, river roads - Roads (excluding national roads, regional roads, and motorways) - Pipe culverts for waterworks or sewerage - Rainwater ditches - Repairing of pavement - Dredging and reclamation - Ordinary landscaping works	- Roads (urban street roads, national or regional roads, and motorways), railroads, and subway without a long bridge (200 m or longer) - Sewerage culverts 600 ㎜ or wider - Water supply pipe culverts 400㎜ or wider - Breakwaters, piers with a simple structure - Sewers and waterway tunnels. - Development of building sites with a structure, such as a common duct and a bridge - Airport runways - Sluices and sluiceway gates in a river - Large landscaping structures - Other simple work sections, facilities excluded from any complicated work section	- Bridges with an asymmetrical and complicated structure - Roads, railroads, subways with a long bridge or tunnel - Construction of a tunnel with a large diameter, multi-level intersections - Estuary dams, lock gates, dams - Water purification plants, sewage or wastewater treatment plants - Pumping stations for distribution or pumping of water - Breakwaters, piers in a complicated structure - Construction of foundation of large structures - Renovation of large structures - Underwater structures

Source: Public Notice No. 2008-846, Ministry of Land, Transport and Maritime Affairs

<Table III-44> Number of Supervisors for Construction Projects (Responsible Supervision)

Construction Cost (100 millions of KRW)	Average Supervision Period (months)	Total Number of Supervisors (man-months)		
		Simple Work Sections	Ordinary Work Sections	Complicated Work Sections
50	17	32	35	39
70	24	41	45	50
100	28	51	57	63
150	30	68	76	84
200	37	83	92	101
300	38	110	122	134
400	38	134	149	164
500	39	156	173	190
700	45	197	219	241
1,000	54	252	280	308
1,500	54	333	370	407
2,000	54	406	451	496

Source: Public Notice No. 2008-846, Ministry of Land, Transport and Maritime Affairs

If the construction cost is in the range of between two different units, the total number of supervisors shall be applied by straight-line interpolation, while if the construction cost is at least KRW 200 billion, the total number of supervisors for ordinary work sections shall be determined in the calculation formula in accordance with Table Ⅲ-45, and -10% shall be applied for simple work sections to the total number of supervisors for ordinary work sections and +10% for complicated work sections.

<Table III-45> Number of Supervisors (Y) for Ordinary Work Sections with Construction Costs of at least KRW 200 Billion

Responsible Supervision	Construction Supervision	Measurement Supervision	Remarks
$Y = 2.3811\ X^{0.6899}$	$Y = 1.6668\ X^{0.6899}$	$Y = 0.9524\ X^{0.6899}$	X: Construction costs

Source: Public Notice No. 2008-846, Ministry of Land, Transport and Maritime Affairs

(2) Calculation of Number of Part-Time Supervisors

In principle, the ratio of part-time supervisors to the total number of supervisors shall be 10% for simple work sections, 15% for ordinary work sections, and 20% for complicated work sections, respectively, in accordance with the Standards for Supervision Service Fees for Construction Projects (Public Notice No. 2008-846, Ministry of Land, Transport and Maritime Affairs), but the project owner may adjust the ratios according to the unique characteristics of each project.

(3) Guidelines for Placement of Supervisors

If the successful bid price for a project is less than 70% of the expected price of the project, additional supervisors shall be placed in accordance with Table Ⅲ-46 based on the number of supervisors in the plan for the placement of supervisors according to the successful bid ratio in order to prevent poor performance of the project: *Provided*, That the foregoing shall not apply where the project owner concludes that poor performance is unlikely.

〈Table Ⅲ-46〉 Rate of Additional Supervisors according to Successful Bid Ratio for Construction Cost

Successful Bid Ratio	55% or less	55%~60%	60%~65%	65%~70%
Additional Rate	50%	40%	30%	20%

Source: Public Notice No. 2008-846, Ministry of Land, Transport and Maritime Affairs

b) Determination of Direct Personnel Expenses

Direct personnel expenses shall be determined by applying 22 days as the number of days of supervision per month in accordance with Article 8 of the Standards for Supervision Service Fees for Construction Projects, publicly notified by the Ministry of Land, Transport and Maritime Affairs, and

multiplying the wages (per day) of supervisors surveyed and publicly announced by the Korea Construction Consulting Engineers Association in accordance with the Statistics Act.

c) Determination of Miscellaneous Expenses

Miscellaneous expenses are expenses excluded from direct costs (direct personnel expenses and direct expenses) and shall be determined within the range of between 110% and 120% of direct personnel expenses according to the Standards for Supervision Service Fees for Construction Projects, publicly notified by the Ministry of Land, Transport and Maritime Affairs.

d) Determination of Engineering Service Fees

Engineering service fees are fees for the use and acquisition of technologies developed and possessed by a company specializing in supervision, including expenses for survey and research, expenses for development of technology, expenses for technical training, and profits, and shall be determined within the range of between 20% and 40% of the sum of direct personnel expenses and other expenses.

e) Determination of Direct Expenses

Direct expenses include expenses necessary for supervision, including expenses for accommodation for supervisors, printing expense, and salaries for local clerks, and shall be determined in accordance with the Standards for Supervision Fees for Construction Projects.

f) Liability Insurance Premiums

Liability insurance premiums shall be determined in accordance with the table of premium rates of liability insurance for supervision fees.

〈Table Ⅲ-47〉 Table of Liability Insurance Premium Rates for Responsible Supervision

Type of Works	Net Service Amount										Standard construction period (years)
	KRW 500 million or less		More than KRW 500 million, but not more than KRW 1 billion		More than KRW 1 billion, but not more than KRW 2 billion		More than KRW 2 billion, but not more than KRW 3 billion		More than KRW 3 billion, but not more than KRW 5 billion		
	Basic rate	Additional rate	Basic rate	Additional rate	Basic rate	Additional rate	Basic rate	Additional rate	Basic rate	Additional rate	
Bridge	0.981	0.156	0.952	0.152	0.922	0.147	0.893	0.143	0.863	0.137	3
Road	0.883	0.141	0.857	0.137	0.830	0.132	0.803	0.128	0.776	0.124	3
Tunnel	1.227	0.196	1.191	0.190	1.154	0.184	1.117	0.178	1.080	0.173	4

Source: Table of Liability Insurance Premium Rates for Responsible Supervision, the Engineering Financial Cooperative (Apr. 1, 2008)

3) Environmental Impact Assessment Cost

Environmental impact assessment shall be conducted in accordance with Articles 3 (2) and 23 (1) of the Enforcement Decree of the Environmental Impact Assessment Act, and the scope of projects in cases of road construction is as set out in Table Ⅲ-48.

〈Table III-48〉 Scope of Projects subject to Environmental Impact Assessment

Type of Project	Scope of Projects	Time to Submit and Time to Consult
Road construction	The following projects for the construction of a road under subparagraph 1 of Article 2 or Article 7 of the Road Act, or subparagraph 13 of Article 2 of the National Land Planning and Utilization Act: • Construction of a new road of at least 4km long (limited to a road of at least 25 m wide in cases of an urban area under subparagraph 1 of Article 6 of the National Land Planning and Utilization Act: *Provided*, That the foregoing shall not apply to an national expressway under subparagraph 1 of Article 8 of the Road Act or a motorway or an underground road under Article 2 (2) of the National Land Planning and Utilization Act) • Extension of a road with not less than two lanes by not less than 10km • Construction of a new road simultaneously with extension of an existing road, if the sum calculated by the following formula is at least 1: Length of newly constructed sections/4km + Length of extended sections/10km • A road stretching over an urban area and an non-urban area, if the sum calculated by the following formula is at least 1 (a road with 4 lanes is deemed at least 25 m wide): Length in the non-urban section/4km + Length in the urban section/4km	• Where the managing authority under Article 20 of the Road Act implements a project: Before determining the road zone under Article 24 of the same Act. • Where any person, other than the managing authority under Article 20 of the Road Act, implements a project: Before granting a permit under Article 34 of the same Act. • Where a road is built as an urban planning project under subparagraph 11 of Article 2 of the National Land Planning and Utilization Act: Before authorizing an implementation plan under Article 88 (2) of the same Act.

The environmental impact assessment cost consists of direct personnel expenses, direct expenses, miscellaneous expenses, and engineering service fees, and shall be calculated by the following method.

a) Direct Personnel Expenses

Direct personnel expenses shall be determined by estimating required manpower by applying Table Ⅲ-49 in accordance with the Guidelines for the Determination of Service Fees for Environmental Impact Assessment (Public Notice No. 2008-224, Ministry of Environment) and then multiplying the unit wage of engineering engineers.

<Table III-49> Guidelines for Determination of Required Manpower

Description		Required Manpower (Unit: Persons/day)			
		Specialist Engineers	Advanced-level Engineers	Intermediate-level Engineers	Entry-level Engineers
1. Determining the items and scope of environmental impact assessment (scoping)		2.0	3.0	5.0	4.0
2. Grasping outlines of the project, designating the area subject to environmental impact assessment, and surveying the current state of the area roughly		5.0	7.0	9.0	8.0
3. Establishing the elements of environmental impact and the subject matter of assessment		1.0	1.0	1.5	2.0
4. Forecasting and assessing each item and establishing a scheme for reduction					
a. Air conditions	(1) Weather	5.0	10.0	23.5	26.0
	(2) Air quality	3.5	10.0	30.5	33.5
	(3) Bad odor	9.0	12.0	11.0	7.5
b. Water conditions	(1) Water quality (surface, underground)	8.0	15.0	22.0	18.0
	(2) Hydraulics, hydrology	11.5	17.0	7.0	7.0
	(3) Marine environment	11.5	27.0	44.0	20.0
c. Land conditions	(1) Land use	4.5	4.0	7.0	9.5
	(2) Soil	2.0	3.0	6.0	6.0
	(3) Topography, geology	6.0	13.5	22.5	19.0
d. Natural ecological conditions	(1) Flora and fauna				
	(a) Land	21.5	32.5	28.5	10.5
	(b) Inland water	41.5	41.5	37.0	13.0
	(c) Ocean	56.5	86.5	90.0	30.0
	(2) National environmental assets	2.0	5.0	3.0	2.0
e. Living conditions	(1) Environment-friendly cycling of resources	4.0	8.0	14.0	13.0
	(2) Noise, vibration	12.0	11.0	21.0	17.0
	(3) Amusement, scenic views	11.5	13.5	18.5	17.5
	(4) Sanitation, public health	1.0	3.0	7.0	11.0
	(5) Radio wave interference	8.5	11.0	23.0	19.0
	(6) Sunlight interference	4.0	7.0	13.0	30.5
f. Social, economic conditions	(1) Population	-	4.5	5.0	8.5
	(2) Dwelling	-	4.5	5.0	8.5
	(3) Industries	-	2.0	3.0	6.5
5. Convergence of residents' opinions		3.5	6.5	8.0	6.5
6. Establishing a (comprehensive) scheme for reduction and unavoidable environmental impact		0.5	1.0	1.0	2.0
7. Establishing a plan for follow-up environmental impact tests		0.5	1.0	1.0	2.0
8. Establishing and assessing alternatives		3.0	4.5	7.0	6.0
9. Overall assessment and conclusion		2.0	2.0	2.5	1.5
10. Preparing a summary		0.5	0.5	1.0	1.0
11. Preparing supplements		-	0.5	1.0	1.0

Note: With regard to manpower required for each item, 100% shall be applied to essential items, while a rate of between 20% and 60% may be applied to ordinary items.

Pursuant to Table 2 annexed to the Guidelines for the Determination of Service Fees for Environmental Impact Assessment (Public Notice No. 2008-224, Ministry of Environment), required manpower shall be determined by applying the applicable factor in Table Ⅲ-50, based on 4km for a project for the construction of a new road of at least 4km long and 10km for a project for the extension of a road, with not less than two lanes, by not less than 10km, respectively.

〈Table Ⅲ-50〉 Table of Factors Applicable to Required Manpower according to Scale of Project (Projects based on Length (Roads))

Scale	Specialist Engineers	Advanced-level Engineers	Intermediate-level Engineers	Entry-level Engineers
(Standard scale ~) 1.5 times	1.21	1.21	1.45	1.45
(Over 1.5 times ~) 2.0 times	1.39	1.39	1.68	1.68
(Over 2.0 times ~) 3.0 times	1.69	1.69	2.06	2.06
(Over 3.0 times ~) 5.0 times	2.17	2.17	2.67	2.67
(Over 5.0 times ~) 7.0 times	2.55	2.55	3.16	3.16
(Over 7.0 times ~) 10 times	3.02	3.02	3.78	3.78
(Over 10 times ~) 15 times	3.68	3.68	4.64	4.64
(Over 15 times ~) 20 times	4.22	4.22	5.36	5.36
(Over 20 times ~) 25 times	4.70	4.70	6.00	6.00
(Over 25 times ~) 30 times	5.13	5.13	6.57	6.57
Over 30 times	5.52	5.52	7.00	7.00

Source: Guidelines for the Determination of Service Fees for Environmental Impact Assessment (Public Notice No. 2008-224, Ministry of Environment)

b) Direct Expenses

Direct expenses are expenses actually incurred in carrying out the environmental impact assessment, including expenses for the survey on each subject matter of assessment, expenses for the measurement and analysis of environmental quality, travel expenses, printing expenses, special data expenses (royalties for patents and know-how), and expenses for chartering a ship, and shall be determined in accordance with the Guidelines for the Determination of

Service Fees for Environmental Impact Assessment.

c) Miscellaneous Expenses and Engineering Service Fees

Miscellaneous expenses are expenses excluded from direct personnel expenses and direct expenses and shall be determined by applying a rate of between 110% and 120% of direct personnel expenses, while engineering service fees are expenses for the use and acquisition of technologies and shall be determined by applying a rate of between 20% and 40% of the sum of direct personnel expenses and other expenses.

4) Costs of Preliminary Environmental Impact Test

The purpose of the preliminary environmental impact test is to minimize environmental impact resulting from development, by conducting the predictive analysis and assessment on the survey on the environmental impact that the performance of a project is likely to have on neighboring areas in accordance with Articles 25 through 27 of the Framework Act on Environmental Policy and Articles 7 through 11 of the Enforcement Decree of the same Act and by establishing a scheme and countermeasures for reducing various kinds of environmental impact. The scope of projects subject to the test is as set out in Table Ⅲ-51 in accordance with Table 2 annexed to the Enforcement Decree of the Framework Act on Environmental Policy.

<Table Ⅲ-51> Scope of Projects subject to Preliminary Environmental Impact Test

Type of Project	Scope of Projects	Timing to Request Consultation
Road Construction	• The basic plan for the improvement of a road under Article 23-2 of the Road Act	• When the managing authority for the road consults with the head of a related administrative agency pursuant to Article 23-2 (4) of the Road Act
	• The plan for the construction of a road (excluding a national expressway) under Article 2 of the Road Act or subparagraph 13 of Article 2 of the National Land Planning and Utilization Act	• When a road route is selected for the basic design or the detail design under Article 38-9 or 38-11 of the Enforcement Decree of the Construction Technology Management Act

The costs of a preliminary environmental impact test consist of direct personnel expenses, direct expenses, miscellaneous expenses, and engineering service fees, and shall be calculated by the following method.

a) Direct Personnel Expenses

Direct personnel expenses shall be determined by calculating required manpower by applying Table Ⅲ-52 in accordance with the Standard Cost Estimation for Preliminary Environmental Impact Test (Korea Engineering and Consulting Association, Dec. 2008) and then multiplying the unit wage of engineering engineers.

<Table III-52> Guidelines for Calculation of Required Manpower (for Development Projects)

Description		Required Manpower (Unit: Persons/day)			
		Specialist Engineers	Advanced-level Engineers	Intermediate-level Engineers	Entry-level Engineers
1. Determining the items and scope of environmental impact assessment (scoping)		1.0	1.5	2.0	2.0
2. Current conditions of the area subject to the test		2.0	2.0	4.0	4.0
3. Establishing the elements of environmental impact and the subject matter of assessment		0.5	0.5	1.0	1.0
4. Forecasting and assessing each item and establishing a scheme for reduction					
a. Air conditions	(1) Weather	-	1.0	2.0	0.8
	(2) Air quality	1.0	2.0	4.0	2.5
	(3) Bad odor	1.0	2.0	2.5	1.0
b. Water conditions	(1) Water quality (surface, underground)	1.3	3.5	3.5	2.5
	(2) Hydraulics, hydrology	1.0	2.0	3.0	1.0
	(3) Marine environment	2.5	5.0	5.0	0.5
c. Land conditions	(1) Land use	0.8	1.8	1.8	0.8
	(2) Soil	0.5	1.0	1.5	0.5
	(3) Topography, geology	1.0	3.0	4.0	1.0
d. Natural ecological conditions	(1) Flora and fauna				
	(a) Land	2.5	5.5	4.5	1.0
	(b) Inland water	2.0	3.0	4.0	1.0
	(c) Ocean	2.0	2.5	2.5	1.0
	(2) National environmental assets	0.5	1.0	1.5	1.0
e. Living conditions	(1) Environment-friendly cycling of resources	0.5	1.5	3.0	1.0
	(2) Noise	0.8	2.0	2.4	0.6
	(3) Vibration	0.5	1.3	1.6	0.4
	(4) Amusement, scenic views	1.0	3.3	3.5	1.5
	(5) Sanitation, public health	-	1.0	1.5	1.0
	(6) Radio wave interference	0.5	1.8	3.0	1.0
	(7) Sunlight interference	0.5	2.0	3.5	0.5

Table Ⅲ-52 continued overleaf

Description		Required Manpower (Unit: Persons/day)			
		Specialist Engineers	Advanced-level Engineers	Intermediate-level Engineers	Entry-level Engineers
f. Social, economic conditions	(1) Population	-	1.0	1.5	1.0
	(2) Dwelling	-	1.0	1.5	1.0
	(3) Industries	-	1.0	1.5	1.0
5. Overall assessment and conclusion		0.5	0.5	1.0	2.0
6. Preparing supplements		-	0.5	1.0	1.0

Note: With regard to manpower required for each item, 100% shall be applied to essential items, while a rate of between 20% and 60% may be applied to ordinary items.

Pursuant to the Standard Cost Estimation for Preliminary Environmental Impact Test (Korea Engineering and Consulting Association, Dec. 2008), required manpower shall be determined by applying the applicable factor in Table Ⅲ-53, based on 4km for a project for the construction of a new road of at least 4km long and 10km for a project for the extension of a road, with not less than two lanes, by not less than 10km, respectively.

<Table III-53> Table of Factors Applicable to Required Manpower according to Scale of Project (Projects based on Length (Roads))

Scale	Specialist Engineers	Advanced-level Engineers	Intermediate-level Engineers	Entry-level Engineers
Less than 0.1 time	0.29	0.29	0.37	0.37
0.1 time ~ (less than 0.2 time)	0.39	0.39	0.49	0.49
0.2 time ~ (less than 0.5 time)	0.53	0.53	0.66	0.66
0.5 time ~ (less than standard scale)	0.80	0.80	0.97	0.97
(Standard scale ~) 1.5 times	1.21	1.21	1.45	1.45
(Over 1.5 times ~) 2.0 times	1.39	1.39	1.68	1.68
(Over 2.0 times ~) 3.0 times	1.69	1.69	2.06	2.06
(Over 3.0 times ~) 5.0 times	2.17	2.17	2.67	2.67
(Over 5.0 times ~) 7.0 times	2.55	2.55	3.16	3.16
(Over 7.0 times ~) 10 times	3.02	3.02	3.78	3.78
(Over 10 times ~) 15 times	3.68	3.68	4.64	4.64
(Over 15 times ~) 20 times	4.22	4.22	5.36	5.36
(Over 20 times ~) 25 times	4.70	4.70	6.00	6.00
(Over 25 times ~) 30 times	5.13	5.13	6.57	6.57
(Over 30 times ~) 50 times	5.52	5.52	7.00	7.00
Over 50 times	6.29	6.29	7.99	7.99

b) Direct Expenses

Direct expenses are expenses actually incurred in carrying out works, including travel expenses, special data expenses (royalties for patents and know-how), printing expenses, land survey expenses, and site operating expenses, and shall be determined in accordance with the Standard Cost Estimation for Preliminary Environmental Impact Test (Korea Engineering and Consulting Association, Dec. 2008).

c) Miscellaneous Expenses and Engineering Service Fees

Miscellaneous expenses are expenses excluded from direct personnel expenses

and direct expenses and shall be determined by applying 120% of direct personnel expenses in accordance with the Standard Cost Estimation for Preliminary Environmental Impact Test (Korea Engineering and Consulting Association, Dec. 2008), while engineering service fees are expenses for the use and acquisition of technologies and shall be determined by applying 25% of the sum of direct personnel expenses and other expenses.

5) Expenses for Follow-up Environmental Impact Tests

Follow-up environmental impact tests shall be conducted in order to prevent the environment from being damaged during a certain period from the commencement until after the completion of a project in accordance with Article 25 of the Environmental Impact Assessment Act and to ensure that the intial environmental impact assessment has been conducted properly.

Expenses for the tests consist of direct personnel expenses, direct expenses, miscellaneous expenses, and engineering service fees, like expenses for environmental impact assessment, and shall be determined in accordance with the Guidelines for the Determination of Service Fees for Environmental Impact Assessment (Public Notice No. 2008-224, Ministry of Environment) and the Standards for Engineering Service Fees.

6) Expenses for Preliminary Review on Impact of Disasters

The purposes of the preliminary review on the impact of disasters are to predict and analyze the impact of disasters that are likely to arise from development before implementing a development project and to establish and implement a proper plan for reducing such impact.

The projects subject to the preliminary review on the impact of disasters under Article 6 of the Enforcement Decree of the Countermeasures against Natural Disasters Act include road projects under Article 23 of the Road Act, and thus, it is necessary to conduct the preliminary review on the impact of disasters for the stage of a development project when it is intended to build a road.

Expenses for the review consist of direct personnel expenses, direct expenses, miscellaneous expenses, and engineering service fees and shall be determined in accordance with the Standard Cost Estimation for Disaster Prevention Sector (Public Notice No. 2007-21, National Emergency Management Agency, Apr. 2007) and the Guidance on Practices of Preliminary Review and Consultation on the Impact of Disasters (National Emergency Management Agency, Nov. 2007), subject to agreement between the agency for the establishment of safety measures for disaster prevention and the project owner, taking into consideration distinctive conditions according to local features and environment.

a) Direct Personnel Expenses

Direct personnel expenses shall be determined by multiplying the unit requirement for each type of work according to the work classification prescribed for each type of work and the standard work estimation by the applicable factor to get the required number of engineers who will be engaged directly in each type of work and then multiplying the required number of engineers by level by the unit wage.

An unsolicited road project shall be treated as a development project under the Standard Cost Estimation for Disaster Prevention Sector (Public Notice No. 2007-21, National Emergency Management Agency, Apr. 2007) for the purpose of direct personnel expenses, which shall be subject to the quantitative analysis, and the guidelines for the determination of required manpower are as set out in Table Ⅲ-54.

As regards items subject to the application of a calibration factor, a calibration factor shall be determined in the following formula depending upon how larger or smaller the scale of the plan (project) is than an area of 100,000 m^2 or a length of 10km to calibrate the required manpower for each unit work.

$$\alpha = \left(\frac{X}{Y}\right)^{0.25}$$

Where, X= Scale of the plan (project) (m^2,km)

Y= Scale of the benchmark plan (project) (100,000㎡, 10km)

※ If the scale of the plan (project) (X) is at least 2,000,000㎡ (100km), the applicable calibration factor shall be determined by applying 2,000,000㎡ (100km) as the benchmark area (X) for the purpose of determining the calibration factor.

〈Table III-54〉 Required Manpower for Determination of Direct Personnel Expenses (based on 100,000㎡/10km)

Description	Unit	Required Manpower (man-days)						Remarks
		Professional Engineers	Specialist Engineers	Advanced-level Engineers	Intermediate-level Engineers	Entry-level Engineers	Intermediate-level Technicians	
Total Manpower Required		11.05 (12.05)	17.15 (18.65)	24.00 (26.00)	32.65 (35.05)	35.70 (37.70)	32.70 (38.40)	
A. Preparation of a work plan	1 set	0.10	0.50	0.50	0.10	0.00	0.00	
B. Overview of project		0.00	0.00	0.20	0.20	0.50	0.50	
1) Background and purposes of project	1 set	0.00	0.00	0.05	0.05	0.10	0.00	
2) Procedure for implementation of project	1 set	0.00	0.00	0.05	0.05	0.10	0.10	
3) Scope of project	1 set	0.00	0.00	0.10	0.10	0.30	0.40	
C. Designation of the area subject to preliminary review on impact of disasters		0.20	0.30	0.50	0.50	0.70	0.20	
1) Basic survey for designation of the area subject to review	1 set	0.10	0.20	0.30	0.30	0.20	0.00	
2) Designation of the area subject to review	1 set	0.10	0.10	0.20	0.20	0.50	0.20	
D. Survey on the river basin in the area and the state of disasters		2.95	3.25	4.50	6.05	7.00	8.50	
1) Survey on characteristics of the river basin and the river	1 set	0.50	0.50	0.60	0.90	0.90	1.00	
2) Review on related plans and nearby development projects	1 set	0.40	0.60	1.10	1.50	1.20	3.00	
3) Survey on weather, hydrology, and characteristics of seas	1 set	0.30	0.30	0.40	0.50	0.70	1.00	
4) Survey on the system and characteristics of drainage	1 set	0.50	0.60	0.80	1.00	1.50	1.00	
5) Survey on landscape and soil	1 set	0.30	0.30	0.40	0.50	0.70	0.00	
6) Survey on current status of disaster prevention facilities and the management of disaster-afflicted districts	1 set	0.45	0.45	0.60	0.75	1.00	1.50	
7) Survey on current status of disasters	1 set	0.50	0.50	0.60	0.90	1.00	1.00	
E. Forecasting of impact of disasters		4.40 (5.40)	8.30 (9.80)	11.00 (13.00)	16.50 (18.90)	17.00 (19.00)	17.00 (18.20)	
1) Flood outflow analysis	100,000㎥ (10km)	2.00	3.50	5.20	9.00	9.10	7.20	Calibration factors
2) Soil outflow analysis	100,000㎥ (10km)	0.60	1.10	1.00	1.90	1.80	4.00	
3) Slope stability analysis	100,000㎥ (10km)	1.40	3.20	3.80	4.60	6.10	5.80	

Table III-54 continued overleaf

Description	Unit	Required Manpower (man-days)						Remarks
		Professional Engineers	Specialist Engineers	Advanced-level Engineers	Intermediate-level Engineers	Entry-level Engineers	Intermediate-level Technicians	
4) Forecast of storm and tidal waves	1 set	(1.00)	(1.50)	(2.00)	(2.40)	(2.00)	(1.20)	Elective
5) Review on feasibility of selection of sites for facilities	1 set	0.40	0.50	1.00	1.00	0.00	0.00	
F. Establishment of measures for reducing impact of disasters		2.80	4.10	6.00	7.80	9.00	6.00	
1) Suggestion of the direction of measures for reduction	1 set	0.60	0.80	1.50	1.40	1.00	1.00	
2) Measures for reducing disasters while developing	100,000 ㎡ (10km)	1.00	1.50	2.00	3.00	3.50	2.00	Calibration factors
3) Measures for reducing disasters after developing	100,000 ㎡ (10km)	1.00	1.50	2.00	3.00	3.50	2.00	
4) Analysis on effects of measures for reducing disasters	1 set	0.20	0.30	0.50	0.40	1.00	1.00	
G. Preparation of a list of review items		0.40	0.40	0.80	0.80	0.80	0.00	
1) Common review items	1 set	0.10	0.10	0.20	0.20	0.20	0.00	
2) Review items for each type of location	1 set	0.10	0.10	0.20	0.20	0.20	0.00	
3) Review items for each type subject to consultation	1 set	0.10	0.10	0.20	0.20	0.20	0.00	
4) Additional review items	1 set	0.10	0.10	0.20	0.20	0.20	0.00	
H. Conclusion and preparation of review reports	1 set	0.20	0.30	0.50	0.70	0.70	0.50	

Note: The area is based on 100,000㎡, and the length is based on 10km.

Source: Standard Cost Estimation for Disaster Prevention Sector (Public Notice No. 2007-22, National Emergency Management Agency)

b) Direct Expenses

Direct expenses include travel expenses, expenses for special data (royalties for patents, knowhow, etc.), expenses for printing and photocopying documents for submission, expenses for land survey, expenses for testing and surveying soil and materials, expenses for producing mockups and bird's eye view maps, consulting service fees or outsourced services of other expert engineers, site operating expenses (referring to salaries for assistants not including in direct personnel expense and operating expenses for site offices), expenses for making products related to electronic computer system (interim or final), expenses for field survey (digital photographs, expenses for shooting pictures with video tapes

and developing and printing such pictures, etc.), business promotional expenses (consulting fees for public hearings and consultation with related ministries, expenses for preparing meetings (discussions), etc.) and shall be calculated with actual expenses.

c) Miscellaneous Expenses

Miscellaneous expenses are expenses excluded from direct expenses (direct personnel expenses and direct expenses) or indirect costs, such as business promotional expenses and administrative expenses, including salaries for executives and employees in charge of general affairs or accounting, office expenses, utility bills, consumables for office work, furnishings, expenses for repairing machines and instruments, depreciation cost of machines and instruments, expenses for telecommunications and transportation, expenses for internal meetings related to business promotion, public charges, and expenses for business activities, and shall be determined within the range of between 110% and 120% of the direct personnel expense.

d) Engineering Service Fees

Engineering service fees are fees for the use and acquisition of technology developed and possessed by an engineering service entity, including expenses for technology research, expenses for technology development, expenses for technical training, expenses for survey and research, and profits, and shall be determined within the range of between 20% and 40% of direct personnel expenses plus miscellaneous expenses. Assuming that the direct personnel expenses is "A," miscellaneous expenses and engineering service fees for each type of work shall be determined in accordance with Table Ⅲ-55.

<Table Ⅲ-55> Standards for Miscellaneous Expenses and Engineering Service Fees for each Type of Work

Type of Work	Miscellaneous Expenses (KRW)	Engineering Service Fees (KRW)
• Preparation of an agreement on the preliminary review of the impact of disasters	A×110~120%	(A + Miscellaneous expenses) × 20~40%
• Establishment of a comprehensive plan for reducing damage by storms and floods	A×110~120%	(A + Miscellaneous expenses) × 20~40%
• Establishment of an Emergency Action Plan (EAP)	A×110~120%	(A + Miscellaneous expenses) × 20~40%
• Assessment and analysis of projects for recovery from disasters	A×110~120%	(A + Miscellaneous expenses) × 20~40%
• Other works for safety measures for disaster prevention	A×110~120%	(A + Miscellaneous expenses) × 20~40%

Note: Value-added tax shall be accounted for separately in accordance with the Value-Added Tax Act.
Source: Standard Cost Estimation for Disaster Prevention Sector (Public Notice No. 2007-22, National Emergency Management Agency)

7) Expenses for Deliberation on Impact on Natural Landscape

With regard to deliberation on the impact on natural landscape, Articles 28 and 29 of the Natural Environment Conservation Act and Articles 20 and 21 of the Enforcement Decree of the Natural Environment Conservation Act require review of the impact of a development plan or a development project on natural landscape.

a) Projects subject to Deliberation

The projects subject to deliberation under the Guidelines for the Deliberation on Natural Landscape in connection with Development Projects, etc. (Ministry of Environment, Jul. 2008) are as specified in Tables Ⅲ-56 and Ⅲ-57 below.

〈Table III-56〉 Projects subject to Deliberation on Impact on Natural Landscape

Area	Projects subject to Deliberation on Impact on Natural Landscape
Around conservation areas (natural parks, wetland conservation areas, ecological landscape conservation areas)	• Administrative plans subject to a preliminary review of environmental impact • Development projects subject to a preliminary review of environmental impact • Development projects subject to the assessment of and consultation on environmental impact
Areas other than those around conservation areas	• Development projects specified by Presidential Decree among development projects subject to a preliminary review of environmental impact and development projects subject to the assessment of and consultation on environmental impact

Source: Ministry of Environment, Guidelines for Deliberation on Natural Landscape in connection with Development Projects, etc., Jul. 2008

〈Table III-57〉 Projects subject to Local Government's Review on Impact on Natural Landscape

Area	Projects subject to Consultation on Impact on Natural Landscape
Around conservation areas (natural parks, wetland conservation areas, ecological landscape conservation areas)	• Development projects not subject to a preliminary review of environmental impact or the assessment of and consultation on environmental impact
Areas other than those around conservation areas	• Projects specified by each local government's ordinance among development projects not subject to a preliminary review of environmental impact or the assessment of and consultation on environmental impact

Note: Excluding projects that have undergone deliberation by the competent local urban planning committee or the local building committee pursuant to relevant law.

Source: Ministry of Environment, "Guidelines for the Deliberation on Natural Landscape in Connection with Development Projects, etc.," Jul. 2008

b) Determination of Expenses

Generally speaking, additional expenses incurred in deliberation on the impact on natural landscape are not necessary, since the expenses for a preliminary review of environmental impact or an environmental impact assessment include such expenses. If it is found as a result of the analysis of costs of the PFI that such expenses are not included or if the competent authority needs additional expenses incurred in deliberation on natural landscape, the PFI calculation standards shall be reviewed and such expenses shall be calculated with quotations from outside specialized business entities, if necessary.

8) Fees for Outsourced Services for Traffic Impact Analysis and Establishment of Measures for Improvement therefor

The scope of projects subject to the traffic impact analysis and the establishment of measures for improvement therefor is prescribed by Articles 13-2 (3) and 13-3 (1) of the Enforcement Decree of the Urban Traffic Improvement Promotion Act, and the scope of road construction projects subject to the traffic impact assessment is as set out in Table Ⅲ-58.

<Table III-58> Scope of Projects subject to Traffic Impact Assessment (Road Projects)

Type of Work	Scope of Projects subject to Assessment
Urban development	Urban planning facility projects for the following facilities among infrastructure facilities under subparagraph 6 of Article 2 of the National Land Planning and Utilization Act: - Interchanges, intersections, and junctions with other main roads among newly built routes with a total length of not less than 5km
Road construction	Construction of a road under Article 8 of the Road Act: - Interchanges, intersections, and junctions with other main roads among newly built routes with a total length of not less than 5km
P P P projects	PPP projects under subparagraph 5 of Article 2 of the PPP Act: - Relevant projects or projects with facilities equivalent to or larger than the specified scale

Fees for outsourced services for the analysis of traffic impact and the establishment of measures for improvement therefor shall be determined in accordance with the Guidelines for the Determination of Fees for Outsourced Services for the Traffic Impact Analysis and the Establishment of Improvement therefor (Public Notice No. 2008-842, Ministry of Land, Transport and Maritime Affairs).

Expenses consist of direct personnel expenses, direct expenses, miscellaneous expenses, and engineering service fees and shall be determined by the cost-plus fixed fee method in accordance with the guidelines for service fees under Article 10 (2) of the Engineering Technology Promotion Act, while direct personnel expenses and direct expenses among components shall be determined in accordance with the items and methods for the analysis of each type of project under the guidelines for the analysis of traffic impact and the establishment of measures for improvement therefor.

a) Direct Personnel Expenses

Direct personnel expenses include salaries, allowances, bonus, retirement and severance benefits, and industrial accident compensation insurance proceeds, and the standards for the levels of and qualifications for engineers, prescribed by the cost-plus fixed fee method in the
Standards for Engineering Service Fees under Article 10 (2) of the Engineering Technology Promotion Act and the standards for the unit wage for engineering services in the construction sector shall apply with respect to the standards for the levels of, and qualifications for technical manpower and the unit wage for each level.

The standards for the determination of manpower required for technical services for the purpose of calculating direct personnel expenses are as set out in Table Ⅲ-59.

〈Table III-59〉 Standards for Determination of Manpower Required for Technical Services

Works	Work Process	Professional Engineers	Specialist Engineers	Advanced-level Engineers	Intermediate-level Engineers	Entry-level Engineers	Assistants
1. Introduction	A. Project overview	0.4	0.3	0.6	0.5	0.4	0.3
	B. Reasons for assessment and appropriateness of timing to assess	0.4	0.6	0.6	0.5	0.3	0.3
	C. Scope of assessment	0.3	0.4	0.5	0.7	0.5	0.4
	D. Summary of results of assessment	0.3	0.4	0.7	0.8	0.6	0.5
	Sub-total	1.4	1.7	2.4	2.5	1.8	1.5
2. Survey and analysis of traffic environment	A. Current status of transportation facilities and traffic flow	0.8	1.0	1.7	3.4	4.6	8.3
	B. Current status of land use in surrounding areas and development plans	0.5	0.6	1.2	2.0	3.1	4.4
	C. Public plans for transportation facilities	0.5	0.6	1.5	2.3	3.6	4.7
	Sub-total	1.8	2.2	4.4	7.7	11.3	17.4
3. Future traffic demand in the project site and its neighborhood	A. Forecast of traffic demand if the project is not implemented	1.1	1.1	1.8	2.8	2.3	1.7
	B. Forecast of traffic demand if the project is implemented	1.3	1.3	2.1	2.9	2.3	1.8
	C. Forecast of demand for parking lots	1.0	1.0	1.4	2.2	2.1	1.5
	Sub-total	3.4	3.4	5.3	7.9	6.7	5.0
4. Problems in implementing the project and schemes for improvement	A Problems in implementing the project						
	A. Nearby streets and intersections	0.8	1.1	1.7	1.6	1.6	1.1
	B. Traffic flow for entry and exit	1.0	1.1	1.3	1.6	1.5	1.2
	C. Public transportation and pedestrians	0.5	0.7	1.2	1.4	1.5	0.9
	D. Parking	0.8	1.0	1.4	1.3	1.4	0.9
	E. Traffic safety and others	0.6	0.8	1.2	1.6	1.5	1.0
	Total	3.7	4.7	6.8	7.5	7.5	5.1
	B. Schemes for improvement						
	A. Scheme for improvement of the project district	1.3	1.3	1.7	1.8	1.9	1.8
	B. Scheme for improvement of surrounding areas	1.3	1.3	1.6	1.7	1.8	1.7
	C. Simulation analysis (if necessary)	2.0	2.0	2.5	3.0	3.5	3.0
	D. Comprehensive improvement plan	1.2	1.4	1.7	1.8	1.9	1.8
	Total	5.8	6.0	7.5	8.3	9.1	8.3
	C. Effects of improvement (quantitative analysis)	0.6	0.8	1.2	1.4	1.2	0.9
	Sub-total	10.1	11.5	15.5	17.2	17.8	14.3
5. Plan for implementation of improvement plans	A. Implementer and timing to implement	0.8	1.0	1.4	1.4	1.2	0.7
	B. Schemes for traffic control during construction works (if necessary)	0.8	1.0	1.3	1.1	0.9	0.7
	Sub-total	1.6	2.0	2.7	2.5	2.1	1.4
6. Preparation of products	A. Preparation of reports	0.9	1.1	2.0	2.6	2.8	2.1
	B. Preparation for deliberation	1.3	1.2	1.2	1.4	1.5	1.3
	Sub-total	2.2	2.3	3.2	4.0	4.3	3.4
Grand total		20.5	23.1	33.5	41.8	44.0	43.0

Source: Guidelines for the Determination of Fees for Outsourced Services for the Traffic Impact Analysis and the Establishment of Measures for Improvement (Public Notice No. 2008-842, Ministry of Land, Transport and Maritime Affairs)

With regard to manpower required in response to an increase in the scale of a project or a facility, the total manpower required shall be calculated by applying the following extra rate:

· Total manpower required $= S \times \alpha \times \beta$

Note: S: Manpower required for the standard scale of a facility

α: Extra rate for the increase in the scale

$$\alpha = \left(\frac{X}{Y}\right)^{2/5}$$

X: Scale of the project subject to assessment

Y: Scope of the project subject to the traffic impact analysis and the establishment of measures for improvement under Table 1 annexed to the Enforcement Decree of the Urban Traffic Improvement Promotion Act

β: Weight for the project subject to assessment and for each region

- Project subject to assessment: A building (1.0), a development project (1.3), a road or railroad project (1.0~1.2)
- Region: An area subject to urban traffic improvement (1.0), a traffic region (0.7)
- Summary traffic impact analysis and measures for improvement (0.7)

b) Direct Expenses

Direct expenses are travel expenses, site survey expenses, printing expenses, rents for vehicles, etc. necessary for outsourced services for traffic impact assessment and shall be calculated by the Guidelines for the Determination of Fees for Outsourced Services for the Traffic Impact Analysis and the Establishment of Improvement therefor (Public Notice No. 2008-842, Ministry of Land, Transport and Maritime Affairs).

c) Miscellaneous Expenses

Miscellaneous expenses are indirect costs excluded from direct costs, including salaries for executives and employees in charge of general affairs or accounting, office expenses, consumables for office work, furnishings, expenses for repairing machines and instruments, depreciation cost of machines and instruments, expenses for telecommunications and transportation, expenses for

meetings, public charges, expenses for operating activities, etc. and shall be calculated by applying a rate of between 110% and 120% of direct personnel expenses.

d) Engineering Service Fees

Engineering service fees are expenses for the use and acquisition of technologies, including expenses for survey and research, expenses for technology development, expenses for technical training, and profits, and shall be calculated by applying a rate of between 20% and 40% of the sum of direct personnel expenses and miscellaneous expenses.

9) Contractors' Insurance Premiums

In principle, risks are quantified in the VFM test to translate risks into costs, and part of the insurance premium included in an item of the total project cost or operating cost for a PPP project is treated as a cost subject to risk quantification.

The insurance premium for loss on construction works included in the project cost of a government-financed project may be deemed equivalent to the contractor's all-risks insurance premium included in the total project cost of a PFI. Therefore, if an additional contractor's all-risks insurance is reflected while the insurance premium for loss on construction works has already been reflected, there is a risk of double reflection. If it is found as a result of a review on the project cost of a proposed project at the time of the VFM test that the insurance premium for loss on construction works is included, the same amount shall be reflected in the project cost of the PSC without further reflecting another contractor's all-risks insurance premium in the cost.

If the insurance premium for loss on construction works in not included in the project cost on a proposal, the contractor's all-risks insurance premium shall be reflected in the total project cost of the PSC, and the insurance premium shall be re-determined in proportion to the project cost by applying the insured subject matters and premium rate on the proposal: *Provided*, That whether to

apply the insurance for loss of expected income, the employer liability insurance, etc. shall be determined, taking the nature of each project into consideration.

<Table III-60> Composition of Insurance Premium (during Construction Period)

Categories	Insured Subject Matters	Remarks
Contractors' all-risks insurance	Construction cost, operation equipment cost	
Insurance for loss of expected income	Fixed cost for 12 months at the initial stage of operation (personnel expense, expenses, interest expense, etc.)	Reflect them, if necessary
Employer liability insurance	Personnel expense of the corporation (SPC) during the construction period	Reflect them, if necessary

(1) Contractors' All-Risks Insurance

Contractors' all-risks insurance is insurance that insures all losses that may be incurred in the subject matter of a project, materials for construction works, temporary building works, etc. including third-party liability insurance (insurance that indemnifies a contractor from damages legally liable as a consequence of an injury inflicted on a third party).

(2) Insurance for Loss of Expected Income

Insurance for loss of expected income is insurance that insures losses that may be incurred as a result of a contractor's failure to commence a project by the expected completion date as a consequence of a delay in the project due to damage to the insured subject matter of the project, and the insured amount of the insurance for loss of expected income is determined either by calculating it based on the operating income for one year after the commencement of operation or by calculating it, based on the fixed expenses (personnel expense, miscellaneous expenses, and outsourced management fees) and interest expense for one year after the commencement of operation.

In principle, insurance for loss of expected income shall not be reflected in a PSC but may be reflected in the aspect that the risk of the extension of the construction period shall be reflected, examining the necessity of the insurance.

(3) Employer's Liability Insurance

Employer's liability insurance is insurance that insures damages for which an employer becomes liable under the Civil Act, if a worker employed in the place of business suffers from a disaster while on duty and the worker's compensation for the disaster exceeds the amount set under the Industrial Accident Compensation Insurance Act or the Labor Standards Act and insures personnel expenses during the construction period.

In cases of employer's liability insurance that insures injuries caused to personnel of a SPC by a disaster during a construction period, it is not necessary in principle to reflect the insurance because there are no SPC personnel in a government-financed project, but the insurance may be reflected, if there is a similar organization involved, examining the necessity of the insurance.

10) Premium for Project Performance Guarantee Insurance

The project performance guarantee insurance is insurance that an implementor of a PPP project shall carry pursuant to Article 12 of the Act on Contracts to which the State is a Party and insures losses from which the State may suffer if the project concessionaire fails to perform its contractual obligations. The amount insured shall be 10% of the total project cost, and the examined discount rate according to the credit rating of each business entity and the discount rate for the amount shall apply to the amount insured. In cases of a PFI, the premium for the project performance guarantee insurance shall be determined by reflecting the guarantee fee rate through a guarantee insurance institution. In cases of a PSC, the insurance premium shall be excluded from the determination of costs since the institution that guarantees the implementation of the project and that is guaranteed for the implementation of

the project is the competent authority itself, and thus, no guarantee is necessary for the implementation of the project.

F. Operation Equipment Cost

Operation equipment cost is the cost invested in equipment required at the early stage for operation, and the equipment for operation is classified mainly into toll collection systems, traffic management systems, and vehicles for maintenance and management. The appropriate scale of equipment shall be determined and systems therefor shall be selected to establish a plan for an efficient operating system and equipment for operation.

The operation equipment cost of a PSC shall be determined with the construction cost of the installation of equipment per lane in accordance with the Study on the Feasibility Assessment of Road Projects and the Establishment of Risk Assessment System (Korea Highway Corporation, Dec. 2007) and quotations from business entities specializing in equipment.

1) Toll Collection Systems (TCS/ETCS)

Toll collection systems for toll roads are divided into the toll collection system (TCS) and the electronic toll collection system (ETCS).

TCS is a system under which vehicles stop to settle tolls through mechanical or electronic devices and an electronic computer system necessary for the collection of tolls in a tollgate zone, while ETCS is a system under which vehicles settle tolls through wireless telecommunications between the antenna installed at a tollgate and the on-board units (OBU) fixed on each vehicle while passing through the tollgate.

At present, construction works for toll collection systems of the Korea Highway Corporation are carried out by selected outside specialized business entities, rather than by the Korea Highway Corporation itself, and the cost of the toll collection system for a PFI is also determined with quotations from specialized business entities. Although it is best to determine the cost of

installing the toll collection system for a PSC with quotations from at least two specialized business entities on the cost required for each lane, the cost is determined by referring to the Study on the Feasibility Assessment of Road Projects and the Establishment of Risk Assessment System (Korea Highway Corporation, Dec. 2007) due to limitations on the budge and period of the VFM test.

〈Table III-61〉 Construction Investment Deflator

Description	1999	2000	2001	2002	2003	2004	2005	2006	2007
Deflator for the construction industry	100.0	101.9	105.4	110.0	119.0	126.9	131.4	135.2	139.8
Calibration value	1.0	1.019	1.054	1.100	1.190	1.269	1.314	1.352	1.398

Notes: 1) The index for each sector is a relative index for conversion into a unit price in 2007.
2) The deflators for the construction industry and data about GNI are based on the amended standards as of 2000.

Source: Bank of Korea. The deflators for the construction industry are based particularly on construction investment items among GDP expenditure items.

<Table III-62> Costs of Installing Toll Collection Systems at TCS Exits (per lane)

Classification of Equipment	Unit	Quantity	Amount (KRW)
Vehicle sensor	set	1	26,734,000
Display indicating types of vehicle and tolls	set	1	2,640,000
Ticket reader	set	1	30,000,000
Lane controller	set	1	15,678,,000
Commutation ticket reader	set	1	12,000,000
Receipt issuer	set	1	4,922,000
Tollgate	set	1	15,000,000
Installation cost	lump sum	1	11,147,000
Total amount			118,121,000

Source: Korea Highway Corporation, "A Study on the Feasibility Assessment of Road Projects and the Establishment of Risk Assessment System," Dec. 2007

<Table III-63> Costs of Installing Toll Collection Systems at TCS Entrances (per lane)

Classification of Equipment	Unit	Quantity	Amount (KRW)
Device identifying types of vehicle (closed type)	set	1	33,341,000
Vehicle sensor	set	1	26,734,000
Three-level automatic ticket issuer	set	1	88,202,000
Installation cost	lump sum	1	15,003,000
Total amount			163,280,000

Source: Korea Highway Corporation, "A Study on the Feasibility Assessment of Road Projects and the Establishment of Risk Assessment System, Dec. 2007

<Table III-64> Costs of Installing Toll Collection Systems at Tollgate Offices (per tollgate office)

Classification of Equipment	Unit	Quantity	Unit Cost (KRW)	Amount (KRW)
Uninterrupted power supply of 10KVA (for 220V only)	set	2	11,682,000	23,364,000
Server at each tollgate office	set	1	55,000,000	55,000,000
Installation of equipment	lump sum	1	44,522,000	44,522,000
Total amount				122,886,000

Source: Korea Highway Corporation, "A Study on the Feasibility Assessment of Road Projects and the Establishment of Risk Assessment System," Dec. 2007

2) Traffic Management System

The traffic management system is a kind of Intelligent Transportation System, which collects, analyzes, and processes information about traffic conditions with equipment installed at places and the Traffic Service Center and provides such information to road users quickly for the smooth traffic flow on roads.

The cost of installing the traffic management system for a PSC shall be determined by examining whether the amount suggested in the PFI meets relevant design standards or is appropriate for operation.

3) Vehicles and Equipment for Maintenance and Management

Where a road is managed and operated by a PPP, a special-purpose corporation (SPC) shall be established for separate maintenance and management, and thus, vehicles and equipment are required for maintenance and management.

An expressway project is maintained and managed by the Korea Highway Corporation, while a national road or a regional road is maintained and managed by the competent Regional Construction and Management Administration or Road Management Office, and thus, the quantity of equipment

required for maintenance and management may vary depending upon the entity responsible for maintenance and management.

Since this Study is based on the assumption that only automobiles are owned for a project as it is considered reasonable to use construction machines and snow-clearing equipment owned by each Road Management Office, whenever necessary, the current status of equipment and vehicles for the maintenance and management of general road projects is illustrated for the purpose of a PSC.

In illustrating the current status of equipment and vehicles owned for the maintenance and management of a PSC, reference has been made to the current status of vehicles and equipment owned for toll roads operated in Gyeonggi-do, Busan Metropolitan City, and Gyeongsangnam-do and the current status of vehicles owned by the Hongjimun Tunnel Maintenance and Management Office and the Namsan Tunnels 1, 2 and 3 Maintenance and Management Office of the Seoul Metropolitan City.

<Table III-65> Illustrative Current Status of Vehicles and Equipment Owned for PSCs

(Unit: millions of KRW)

Type and Model of Vehicle		Unit Price	Number of Units	Useful Life
Multi-purpose passenger car	Actyon Sports for 5 passengers (Toll road patrol)	21.8	1	6 years
Cargo truck	Hyundai Porter II	14.0	1	6 years
Specially-equipped vehicle	Vacuum road cleaning vehicle	191.7	1	7 years
Specially-equipped vehicle	Multi-purpose road management vehicle	108.5	1	7 years
Dump truck	Dump truck (8 tons)	65.2	1	6 years
Total			5	

Notes: 1) The unit prices applied here are based on the price information released by the Public Procurement Service in 2008.

2) The above current status of vehicles and equipment owned illustrates the equipment owned for general maintenance and management, and whether to own vehicles and equipment for a PSC shall be determined based on the scale of the proposed project.

G. Project Implementation Charges

Project implementation charges are various Government levies for the implementation of a project, and the charges in the nature of replacement cost shall be included in the calculation for analysis, if a project is implemented at the initiative of the Government.

The charges imposed on the implementation of a road project are classified mainly into the ecosystem conservation contribution, the charge for damage to a development restriction zone, the farmland development cost, the usage fee for the occupancy and use of public waters, etc. The charges shall be reflected by re-determining them for a PSC.

1) Ecosystem Conservation Contribution

The ecosystem conservation contribution is a charge imposed on a developer in order to minimize damage to the natural ecosystem by a large development project and to raise a fund for restoring damaged area pursuant to Article 46 of the Natural Environment Conservation Act.

a) Projects subject to Imposition

· A project subject to the environmental impact assessment under Article 4 of the Environmental Impact Assessment Act
· A project for prospecting and mining a strip mine in a scale not smaller than the scale specified by Presidential Decree as part of the mining industry under subparagraph 2 of Article 3 of the Mining Industry Act
· A development project subject to the preliminary environmental impact review under Article 25-2 of the Framework act on Environmental Policy, through which an area of not less than 30,000㎡ is to be developed
· Other projects specified by Presidential Decree among projects that have a significant impact on ecosystem or use natural assets

b) Calculation Method

The amount of the charge shall be determined by multiplying the area of damaged ecosystem under Article 37 of the Enforcement Decree of the Natural Environment Conservation Act (Presidential Decree No. 21185, Dec. 24, 2008) by the applicable coefficient and then by the amount imposed per unit area (KRW 250/㎡): *Provided*, That the amount shall not exceed KRW one billion.

· Ecosystem conservation contribution = Damaged area × Amount imposed per unit area × Zone coefficient

Note: Zone coefficient for a residential area, a commercial area, an industrial area, or a planning and management area = 1 (rice paddy, dry field, forest, salt pond, river, water-impounded or marshy land, or public park),

Other land categories = 0
Greenbelt zone = 2
Production management zone = 2.5
Farming and forest zone = 3
Conservation and management zone = 3.5
Natural environment conservation zone = 4

c) Refund and Subsidization of Ecosystem Conservation Contribution

If a natural environment conservation project specified by Presidential Decree, such as the development of substitute natural environment and the restoration of ecosystem, has been carried out, an amount specified by Presidential Decree may be refunded out of the amount already paid.

2) Levy for Damage to Development Restriction Zone

In order to restrain damage to a development restriction zone and secure financial resources for the management of the development restriction zone, the levy for the damage to a development restriction zone is imposed when a permit for an activity in the development restriction zone (a permit to change the form or quality of land or a permit attended by a change in the form or quality of land) is granted or consultation, which is constructively regarded as a permit for such activity, has been made.

The levy for the damage to a development restriction zone shall be determined in the following formula pursuant to the Enforcement Decree of the Act on Special Measures for Designation and Management of Development Restriction Zones (Presidential Decree No. 21139, Nov. 28, 2008), and the levy rates for major items are as set out in Table Ⅲ-66.

· Levy for damage to a development restriction zone = (Average land price for an area outside the development restriction zone - Publicly notified individual land price) × Included area × Levy rate

〈Table Ⅲ-66〉 Rates of Levies for Damage to Development Restriction Zones

Facilities	Levy Rates
Public facilities (if the project concessionaire is a project concessionaire under subparagraph 7 of Article 2 of the PPP Act, a public institution under the Act on the Management of Public Institutions, or a local public enterprise under the Local Public Enterprises Act), outdoor sports facilities (excluding membership golf clubs), citizens' recreation facilities, bus depots and ancillary facilities, and logistics terminals and ancillary facilities	0.1
Public facilities and installations for national defense and military operations	0.2
Schools under subparagraph 7 of Article 2 of the PPP Act	0.5
Facilities other than the above-listed facilities	1.0

Source: Table 1 annexed to the Enforcement Decree of the Act on Designation and Management of Development Restriction Zones (Presidential Decree No. 21139, Nov. 28, 2008)

3) Farmland Conservation Charge

The farm conservation charge is a cost charged when a parcel of farmland is converted into land for any specific use other than farmland and shall be calculated in accordance with Article 38 of the Farmland Act by the following

method.

a) Guideline for Imposition

The amount of the farm conservation charge per square meter under Article 38 (6) of the Farmland Act shall be 30/100 of the publicly notified individual land price for the parcel of farmland under the Public Notice of Values and Appraisal of Real Estate Act.

b) Public Notice of Maximum Amount

If the amount of the farmland conservation charge per square meter under Article 53 (2) of the Enforcement Decree of the Farmland Act exceeds the amount publicly notified by the Minister for Food, Agriculture, Forestry and Fisheries, the amount shall be determined with the amount publicly notified by the Minister for Food, Agriculture, Forestry and Fisheries.

c) Facilities Fully or Partially Exempt from Farmland Conservation Charge and Rates of Exemption

The rates of exemption for essential facilities under Article 57 of the Enforcement Decree of the Farmland Act are as set out in Table Ⅲ-67.

<Table III-67> Facilities Fully or Partially Exempt from Farmland Conservation Charge and Rates of Exemption

Classification of Facilities	Rates of Exemption (%)	
	Inside Agriculture Promotion Zones	Outside Agriculture Promotion Zones
Roads under Articles 2 and 3 of the Road Act and ancillary facilities therefor (excluding rest facilities and waiting rooms)	100	100
Rural roads under Articles 2 and 3 of the Act on the Maintenance and Improvement of Road Networks in Agricultural and Fishing Villages and ancillary facilities therefor	100	100
Roads under subparagraph 6 of Article 2 of the National Land Planning and Utilization Act	100	100
Forest roads under Article 9 of the Creation and Management of Forest Resources Act	100	100
Commercial railroads under subparagraph 4 of Article 2 of the Railroad Enterprise Act	100	100
Urban railroads under subparagraph 1 of Article 3 of the Urban Railroad Act	100	100
National roads or facilities for land preservation, such as embankments and anti-erosion works installed by local governments	100	100
Embankments, submerged districts around a multi-purpose dam under subparagraph 2 of Article 2 of the Act on Construction of Dams and Assistance, etc. to their Environs and ancillary facilities therefor	100	100

Source: Enforcement Decree of the Farmland Act (Presidential Decree No. 20845, Jun. 20, 2008)

4) Usage Fee for Occupancy and Use of Public Waters

The usage fee for public waters shall be determined in accordance with Article 8 (2) of the Enforcement Rules of the Public Waters Management Act (Ordinance No. 89 by the Ministry of Land, Transport, and Maritime Affairs, Dec. 31, 2008), and outlines thereof are as set out in Table Ⅲ-68.

<Table III-68> Formula for Calculation of Usage Fee for Occupancy and Use of Public Waters

Usage fee for installing (including the burial of a pipeline) a quay, a revetment, a wharf (including a stockyard), a breakwater, a building, or any other structure (excluding cases where an area along a river or a ditch is used for residential purposes)	Apply 3/100 of the land price in the neighborhood, but apply 1.5/100 of the land price in the neighborhood to a project under subparagraph 3 of Article 44 of the Road Act (a project implemented by a government-invested institution).
Usage fee for installing a cradle for ship-building or an outfitting quay, a dock, or other facility only for repairing ships	Apply 1/100 of the land price in the neighborhood.
Usage fee for extracting soil, rocks, sand, gravel, or dredged soil (for reclamation)	Apply 30/100 of the average wholesale price of dredged soil, but apply 20/100 if there is no price surveyed for the area concerned. Apply 10/100 of the average wholesale price of dredged soil, if the purpose of collecting dredged soil is to dredge a fishery harbor or a harbor zone at the same time.
Usage fee for growing or collecting vegetation	Apply 0.5/100 of the land price in the neighborhood.
Usage fee for floating materials on the water	Apply 1/100 of the land price in the neighborhood, but apply 0.5/100 if not less than 50% of such materials are for export as raw materials.
Usage fee for extracting minerals under the Mining Industry Act	Apply 15/100 of the land price in the neighborhood, but apply 5/100 if it is intended to dredge a fishery harbor or a harbor zone.

Notes: 1) The land price means the individual land price publicly notified pursuant to Article 11 of the Public Notice of Values and Appraisal of Real Estate Act: *Provided*, That no individual land price is determined and publicly notified, the competent managing authority shall determine the land price, taking into consideration the land prices of similar parcels of land in the neighborhood.

2) If there are many parcels of land abutting on public waters, the land price shall be determined by arithmetically averaging the land prices of the parcels of land abutting on public waters. In such cases, if the land categories of parcels of land in the neighborhood vary, the land price shall be determined by applying a weighted average in proportion to the length by which each parcel of land abuts on public waters.

3) In determining the usage fee, any fraction of days less than one year shall be calculated on a monthly basis and any fraction of days less than one month shall be calculated on a daily basis.

4) A fraction of less than 1㎡ in an occupied area shall not be included in calculation: *Provided*, That the foregoing shall not apply where the total occupied area is less than 1㎡.

5) If it is found as a result of the competent managing authority's calculation that the usage fee is less than KRW 2,000, the usage fee shall be waived.

Source: Enforcement Rules of the Public Waters Management Act (Ordinance No. 89 of the Ministry of Land, Transport and Maritime Affairs, Dec. 31, 2008)

H. Operating Reserves

1) Expenses for Issuing New Shares

Expenses for issuing new shares are fees to be incurred in issuing new shares in order for a corporation to increase its capital and other expenses directly incurred in issuing new stocks, but it does not need to calculate expenses for issuing new shares in cases of a PSC, since no corporation is established for the PSC.

2) Initial Cost of Business

The intial cost of business for a PPP project is the cost of maintaining the organization of the special purpose company (SPC) for the implementation of the PPP project, and thus, it does not need to include the cost in determining the cost of a PSC, since it does not need to establish a separate corporation if the project is implemented as a government-financed project. However, the cost may be reflected, if it is found necessary as a result of a review on the details of the intial cost of business in a PFI or if additional costs, such as the competent authority's monitoring expense, are incurred when a project is implemented as a toll road project.

I. Results of Calculation of Total Project Costs

In principle, the total project cost shall be determined with the designed cost and quoted costs, exclusive of value-added tax. The total project cost is divided into survey cost, design cost, construction cost, compensation cost, incidental cost, operation equipment cost, project implementation charges, etc.

The cost of a PSC shall be determined as at the time of valuation suggested in the proposal, and the total project cost, for the purpose of an economic analysis, shall be analyzed by applying the applicable deflator of the construction industry to translate it into the cost as of the base year. If the

difference between the base time of valuation in the proposal and the base year for the feasibility analysis does not exceed one year, the cost of the PSC shall apply to the feasibility analysis as determined without applying the deflator of the construction industry additionally.

〈Table Ⅲ-69〉 Comparison of Total Project Cost between PFI and PSC

Items	$PFI_{applied\ cost}$	$PFI_{designed\ cost}$(1)	$PSC_{designed\ cost}$ (2)	Increase or Decrease (2) - (1)
Survey cost				
Design cost				
Construction cost				
Compensation cost				
Incidental cost				
Operation equipment cost				
Project implementation charges				
Operating reserve				
Total project cost				

Note: Exclusive of value-added tax

a) Calculation of Total Project Cost for Economic Analysis

<Table III-70> Calculation of Costs for Economic Analysis of PSC (Exclusive of V.A.T.)

(Unit: millions of KRW)

- Total length: _km (Existing route utilized: __km, Extension: __km, New construction: km)
- IC _ places, JCT ___places, Main line tollgate offices ___offices
- Structures: Bridge ____places (__m), Tunnel _ places (m)

Work section	$PFI_{applied\ cost}$	$PFI_{designed\ cost}$ (1)	$PSC_{designed\ cost}$ (2)	Increase or decrease (2) - (1)
A. Construction cost				
A-1. Earthworks				
A-2. Drainage works				
A-3. Structural works				
A-4. Tunneling				
A-5. Pavement				
A-6. Incidental works				
A-7. Architectural works				
A-8. Mechanical works				
A-9. Electrical works				
A-10. Landscaping works				
A-11. Miscellaneous expenses				
A-12. Operation equipment cost				
B. Incidental cost				
B-1. Design cost				
B-2. Design supervision cost				
B-3. Responsible supervision cost				
B-4. Survey cost				
B-5. Design VE cost				
B-6. Cost of traffic impact assessment				
B-7. Cost of environmental impact assessment				
B-8. Cost of follow-up environmental survey				
B-9. Preliminary assessment on impact of disasters				
B-10. Cost of assessment of impact on natural landscape				
B-11. Contractor's insurance premium				
B-12. Insurance premium for loss of expected income				
B-13. Premium for employer liability insurance				
B-14. Insurance premium for guarantee of performance				
B-15. Incidental costs related to financing				
B-16. Project implementation charges				
C. Lot purchase cost				
D. Total project cost				

Note: 1) Incidental costs related to financing, insurance premiums for guarantee of performance, operating reserve, etc. are excluded from the cost of a PSC.

3. Calculation of Operating Costs

Operating costs are incurred during the period of operation and are divided into personnel expenses, miscellaneous expenses, maintenance and management expenses, electricity expenses, insurance premiums, the costs of replacing tangible assets, etc.

A. Personnel Expense

Personnel expense of a PSC includes the personnel expense of personnel required for operation, including general affairs, accounting, toll collection, maintenance and management, on the assumption that the toll road is operated by the Government.

The personnel expense is an item significantly affected by the number of tollgate offices and the number of tollgates, and this Study presents basic data for the determination of personnel expense of a PSC, based on the analysis on the current status of the organization of operating personnel for each road managed by the Korea Highway Corporation, the Busan Metropolitan City, the Gyeongsangnam-do, Gyeonggi-do, and Seoul Metropolitan City and their wages by class.

1) Determination of Number of Operating Personnel

In principle, the number of operating personnel for a PSC shall be determined on the basis of the operating organization of the competent authority, if the competent authority has data about the operation of toll roads, but the scale and operation system of the proposed project and the characteristics of the competent authority shall be taken into consideration in determining the number of personnel, if such data is unavailable.

As a result of the analysis on the current status of manpower in each toll road currently in operation, it is found difficult to present one criterion for the

operating organization because of differences between competent authorities. Nevertheless, the operating organization of the Korea Highway Corporation has been reviewed, because the Korea Highway Corporation has long since operated toll roads with specialized organizations and so its data is considered worth reference in determining the number of operating personnel for a PSC.

As a result of the review on the operating organization of the Korea Highway Corporation, the operating personnel for a PSC are illustrated in two separate divisions: The competent authority's management division and the entrusted management division. For the purpose of the determination of the expense, the competent authority's management division is subdivided into the personnel for management from the Government for each team, such the planning and management team, the road team, and the road toll business team, and the personnel for the direct maintenance and management of roads. The personnel of each regional headquarters of the Korea Highway Corporation are deemed the personnel for management from the Government in the operating organization of a PSC, while the operating organization of each branch office are deemed personnel who actually manage and operate roads. The entrusted management division is presumed to operate roads through an outsourced management agency with collectors at each tollgate office for saving personnel expense.

The number of personnel in each team for management by the Government has been determined specifically with the number of personnel in each regional headquarters of the Korea Highway Corporation depending upon the length of a 4-lane road subject to the maintenance and management, and the number of personnel for maintenance and management has been determined with the average number of operating personnel in each branch office of the Korea Highway Corporation. On the other hand, a result of the analysis on the number of toll collectors in each outsourced tollgate office of the Korea Highway Corporation as of December 2007 shows that the number of ordinary toll collectors is proportionate to traffic volume and that three to four toll collectors at the foreman level are placed at each tollgate office, while one toll collector

at the manager level is placed at each tollgate office.

This Study is based on the assumption that three toll collectors at the foreman level and one toll collector at the manager level are placed at each tollgate office and that ordinary toll collectors are placed in accordance with a straight linear trend line based on traffic volume passing through the tollgate office. The traffic volume passing through a tollgate office, which serves as the basis for the determination of the number of tollgate collectors, shall be adjusted according to the traffic volume of the PSC ten years after opening the road and the number of personnel required shall be also adjusted accordingly.

〈Table Ⅲ-71〉 Guidelines for Calculation of Number of Personnel Required according to Traffic Volume Passing through each Tollgate

Description	Toll Collectors	Toll Collectors (Foremen)	Toll Collectors (Manager)	Remarks
Personnel in service	0.0007(x)+7.699	3	1	per tollgate office

Notes: 1) (x) stands for the average daily traffic volume in both directions around the year based on the traffic volume passing through each tollgate office.

2) The above-stated straight linear trend line for toll collectors is a formula prepared with the traffic volume passing through two regional headquarters and 62 toll gate offices.

〈Table III-72〉 Illustrative Composition of PSC Organizations and Calculation of Number of Operating Personnel

Classification		Class	Number of Personnel	Details of Calculation
Management by competent authority	Planning and management team	Class 2(A)	-	· The number of personnel for management by the Government, who shall work full-time in the management office regardless of the number of tollgate offices. · The number of personnel has been determined by dividing the number of operating personnel in a regional headquarters of the Korea Highway Corporation by the length of a 4-lane road subject to the management.
		Class 2(B)	0.002 person/km	
		Class 3	0.003 person/km	
		Class 4	0.003 person/km	
		Class 6	-	
	Road team	Class 2(A)	-	
		Class 2(B)	0.002 person/km	
		Class 3	0.006 person/km	
		Class 4	0.010 person/km	
		Class 6	-	
	Road toll business team	Class 2(A)	-	
		Class 2(B)	0.002 person/km	
		Class 3	0.003 person/km	
		Class 4	0.007 person/km	
		Class 6	0.004 person/km	
	Maintenance and management	Class 2(A)	1 person	· The number of operating personnel for the maintenance and management of a road. · The number of personnel has been determined with the average number of operating personnel in each branch office of the Korea Highway Corporation.
		Class 2(B)	1 person	
		Class 3	5 persons	
		Class 4	13 persons	
		Class 6	13 persons	
Outsourced management	Operation team	Toll collector (manager)	1 person/office	· The number of operation personnel for the collection of tolls if the project is operated as a PSC. · The number of toll collectors for each tollgate office shall be separately determined.
		Toll collectors (foremen)	3 persons/office	
		Toll collectors	*	
Total number of personnel			37.042+*	

Notes: 1) The scale of the proposed project and the nature of the competent authority shall be taken into consideration in determining the composition of the above-stated organizations and the number of personnel with the minimum number of personnel on the assumption that the road is operated as a toll road.

2) The average length of 4-lane roads managed by each branch office of the Korea Highway Corporation is 77.8km, and the number of personnel shall be calibrated by straight-line interpolation, if the length exceeds the aforesaid average length.

2) Determination of Unit Personnel Expense

The unit personnel expense is as important as the composition of personnel for the operating organization in determining the personnel expense during the period of operation. This Study suggests guidelines for the unit personnel expense on the assumption that the project is operated by the Government.

The data about the personnel expense of tollgate offices of the Korea Highway Corporation and the data about the personnel expense of operating personnel of Busan Metropolitan City, Gyeongsangnam-do, Gyeonggi-do, and Seoul Metropolitan City have been analyzed in order to determine the personnel expense of a PSC.

This Study suggests the personnel expense of a PSC as an example by calibrating salaries of public officials in technical service and in labor service and the unit personnel expense of the Korea Highway Corporation, taking into consideration their classes and duties, and the level of salaries for each class.

The above-stated amount is the amount as of 2008, and thus, the personnel expense shall be re-determined, taking into consideration the operation mechanism proposed as an example of the operation of the minimum organization in operating a toll road, the scale of the project, the nature of the competent authority, etc.

〈Table III-73〉 Illustrative Calculation of Personnel Expense of PSC

(Unit: millions of KRW)

Classification		Class	Number of Personnel	Annual salary per person	Annual salaries	Total salaries	Remarks
Management by the competent authority	Planning and management team	Class 2(A)	-	60.15	-	-	Technician Class 6
		Class 2(B)	0.04	53.45	2.1	64.1	Technician Class 6
		Class 3	0.06	43.15	2.6	77.7	Technician Class 7
		Class 4	0.06	36.6	2.2	65.9	Technician Class 8
		Class 6	-	32.2	-	-	Technician Class 9
	Road team	Class 2(A)	-	60.15	-	-	Technician Class 6
		Class 2(B)	0.04	53.45	2.1	64.1	Technician Class 6
		Class 3	0.06	43.15	2.6	77.7	Technician Class 7
		Class 4	0.06	36.6	2.2	65.9	Technician Class 8
		Class 6	-	32.2	-	-	Technician Class 9
	Road toll business team	Class 2(A)	-	60.15	-	-	Technician Class 6
		Class 2(B)	0.04	53.45	2.1	64.1	Technician Class 6
		Class 3	0.06	43.15	2.6	77.7	Technician Class 7
		Class 4	0.14	36.6	5.1	153.7	Technician Class8
		Class 6	0.08	32.2	2.6	77.3	Technician Class 9
	Maintenance and management	Class 2(A)	1	60.15	60.2	1,804.5	Technician Class 6
		Class 2(B)	1	53.45	53.5	1,603.5	Technician Class 6
		Class 3	5	43.15	215.8	6,472.5	Technician Class 7
		Class 4	13	36.6	475.8	14,274.0	Technician Class 8
		Class 6	13	32.2	418.6	12,558.0	Technician Class 9
Outsourced management	Operation team	Toll collectors (managers)	4	40.9	163.6	4,908.0	Technician Class 7
		Toll collectors (foremen)	12	24.2	290.4	8,712.0	Technician 10
		Toll collectors	59	16.7	985.3	29,559.0	Labor service
Total number of personnel			108.64	%.,	%.,	%.,	

Note: The above example is the personnel expense determined for an expressway of 20km/4 lanes with the closed-type operation mechanism, 4 tollgate offices, traffic volume of 10,000 units/day passing through each tollgate office, and with a period of operation of 30 years.

B. Miscellaneous Expenses

1) General Expenses

Miscellaneous expenses are expenses incurred in operating a toll road, including welfare expenses and premiums for four fringe insurance benefits for employees, travel expense, fuel expense, office maintenance expense, and clothing expense.

In cases of miscellaneous expenses incurred during the period of operation, it is considered reasonable in this Study to redetermine miscellaneous expenses for a PSC by referring to the ratio of other expenses to the personnel expense of each competent authority, since there are many aspects difficult to estimate at the project proposal stage and most of expenses, except electricity expense and maintenance and management expenses, are proportionate to personnel expense. The ratio of miscellaneous expenses to the personnel expense in Gyeonggi-do and Busan Metropolitan City and the ratio of miscellaneous expenses to the personnel expense in the Korea Highway Corporation during the latest seven years have been analyzed to determine miscellaneous expenses for a PSC.

Miscellaneous expenses are determined separately for the management by the competent authority and for outsourced management in the same manner as that for personnel expense. Miscellaneous expenses for management by the competent authority are determined by applying 61.54%, which is the average ratio of miscellaneous expenses during the period from 2000 through 2005, to the personnel expense of the personnel for management by the Government and the personnel for maintenance and management, while miscellaneous expenses for toll collectors in a tollgate office under outsourced management are determined by applying 36.75%, which is the average ratio of miscellaneous expenses for a tollgate office of the Korea Highway Corporation under outsourced management.

<Table Ⅲ-74> Details of Entrusted Management by Outsourced Tollgate Offices on Expressways

Classification		Description	Remarks
Personnel expense	Labor cost	Basic salary	Based on 25 days in service (hourly wage × 226 hours)
		Allowances	Allowances for overtime, night shift, holiday duty, etc.
Miscellaneous expenses	Expenses	Common expenses	12.76% of personnel expense
	Administrative expense		Not more than 5% of (Labor cost + Expenses)
	Profit		Not more than 5% of (Labor cost + Expenses + Administrative expense)
	Value-added tax		Not more than 10% of (Labor cost + Expenses + Administrative expense + Profit)

<Table III-75> Calculation of Expenses for PSC of Expressway Projects

(Unit: millions of KRW)

Classification	Management by Competent Authority	Outsourced Management	Expenses for PSC
Personnel expense	(1)	(2)	(1) + (2)
Miscellaneous expenses	61.54% of (1) ((3))	36.75% of (2) ((4))	(3) + (4)

2) Usage Fees for ETCS

If a concessionaire uses the electronic toll collection system of the Korea Highway Corporation, called "Hi-pass," it shall pay usage fees.

This Study is based on the assumption that the Hi-pass system of the Korea Highway Corporation will be used as an integrated system, if a decision is made to introduce an ETCS system for a project, and that the usage fee shall be paid even for a PSC that will be operated by the competent authority.

Therefore, the usage fee for ETCS for a PSC shall be reflected in operating

costs after reviewing the appropriateness of the fee rate in the PFI and re-determining the rate according to the traffic volume and operating revenue of the PSC.

C. Maintenance and Management Expenses

Maintenance and management expenses are expenses related to the operation of tollgate offices and expenses incurred in the maintenance, management, and repairing of roads and various facilities for safe and comfortable driving of vehicles and may be divided into expenses for ordinary repair works, expenses for repairing structures, expenses for monitoring structures, expenses for snow clearing, expenses for repairing machines and equipment, expenses for repairing electrical facilities, expenses for repairing operating equipment, expenses for the maintenance and management of measuring systems, etc.

This Study presents the results of the maintenance and management expenses determined by analyzing data about the performance of expressways maintained and managed by the Korea Highway Corporation. Since maintenance and management expenses vary significantly depending upon the scale of a project, such as the ratio of structures and the traffic volume in the road and the number of lanes, the expenses shall be estimated and determined properly according to the scale of the project. The appropriate level of maintenance and management expenses for a PSC shall be determined by comparing and reviewing the proposal submitted by a concessionaire with the results presented in this Study. In particular, the nature of a project shall be taken into consideration in determining the expenses, if the project is for an extraordinary bridge or a long tunnel.[10)]

The Korea Highway Corporation divides total operating costs into costs of road management projects and costs of road improvement projects for the purpose of accounting. The costs of road management projects are personnel

10) See: A Study on the Estimation of Maintenance and Management Costs for Road Projects for Preliminary Feasibility Study (KDI, 2008)

expenses and miscellaneous expenses spent for road management for one fiscal year. The costs of road management projects are divided mainly into direct costs incurred by each branch office in charge of the maintenance and management of roads and indirect costs incurred by the head office and each regional headquarters. On the other hand, the costs of road improvement projects include the costs of additional parcels of land for the improvement of roads and the costs of other business facilities as specified in Table Ⅲ-77.

Personnel expenses and miscellaneous expenses, out of the costs of road management projects, are determined separately in determining operating costs of a PSC, and amortization is not taken into consideration, because it is the amortization of the right to manage toll roads. Moreover, the operation fees are expenses incurred in outsourced management of tollgate offices, and thus, are divided into personnel expenses and miscellaneous expenses and reflected them in each item respectively. Consequently, only expenses for repair and maintenance out of the costs of road management projects are determined as maintenance and management expenses.

In cases of the costs of road improvement projects, the re-pavement cost, the expenses for inspecting structures, the cost of replacing ITS systems and toll collection systems, etc. have been reflected, considering characteristics of each item.

<Table III-76> Cost Composition of Road Management of the Korea Highway Corporation

Items			Details
Direct costs	Personnel expense		· Personnel expense of regular employees, temporary employees, road servicemen, safety personnel, etc.
	Expenses	Repair and maintenance	· Expenses for the maintenance and management for preventing deterioration of functions of roads
		Operation fees	· Outsourced service fees for toll collection and other operations · Incentive for sales of expressway cards
		Amortization	· Amortization of the right to manage a toll road, i.e., the right to manage a toll road and collect tolls from users · Amortized amount: Revenue from roads - Expenses for roads
		Other 26 items	· Travel expense, welfare expense, communication expense, electricity and water rates, fuel and maintenance expenses, taxes and public charges, consumables, clothing expense, books and printing expense, rent expense, vehicle expenses, insurance premium, fee expense, transportation and storage expenses, business promotion expense, advertisement expense, education and training expenses, survey and analysis expenses, rewards, expenses for registration and legal proceedings, association membership fees, contributions, ordinary development expense, miscellaneous expenses, sales promotion expense, marketing advertisement expense.
Indirect cost			· Cost of road management projects operated by the head office and regional offices

Source: Korea Highway Corporation, "A Study on the Feasibility Studies of Road Projects and the Establishment of Risk Assessment System therefor," Dec. 2007

〈Table III-77〉 Cost Composition of Road Improvement of the Korea Highway Corporation and Method for Reflecting PSC Maintenance and Management Expenses

Items		Reflecting Method
Road improvement	Re-pavement cost	· Apply the per km cost of re-paving 4 lanes in each type of pavement in accordance with the policy of the Korea Highway Corporation. · Consider life cycle in investing the cost.
	Expenses for inspecting structures	· Calculate the unit requirement by using the results of the latest execution of costs of close safety examination, since periodic inspections and close inspections are carried out by the Korea Highway Corporation itself, while only close safety inspections are carried out by outsourced service providers. · Reflect the expenses according to the inspection cycle under the Enforcement Decree of the Special Act on the Safety Control of Public Structures.
	Cost of replacing ITS systems and toll collection systems	· Reflect the cycle and cost of replacing toll collection systems by the Korea Highway Corporation in determining the cost.
	Reinforcement of slopes	· Exclude the work since it is not the maintenance or management of a road itself or a routine maintenance or repair work (routine maintenance and repair works are included in the expenses for repair and maintenance in the cost of road management projects).
	Landscaping	· Exclude this work since it is not maintenance or management of a road itself.
	Safety facilities	· Exclude these since they have been already reflected in design.
	Tunnels and lighting	· Exclude these since such works are not routine maintenance or repair works (routine maintenance and repair works are included in the expenses for repair and maintenance in the cost of road management projects).
	Improvement of intersections	· Exclude this since the cost is incurred in a project additionally implemented after the construction of a road, mostly such as the extension of a road, the improvement of alignments, the construction of an additional interchange.
	Traffic control facilities	· Exclude such facilities since they have been already reflected in design.
	Operation facilities	· Exclude such facilities since they have been already reflected in design.
	Additional land cost	· Exclude this cost since it is incurred in a project additionally implemented after the construction of a road, mostly such as the extension of a road, the improvement of alignments, the construction of an additional interchange.
	Other facilities	· Exclude such facilities since the installation of noise barriers or the supplementation of drainage facilities have been already reflected in design or such works are not routine maintenance or repair works.
	Expenses for road improvement	· Exclude such expenses, since it is difficult to consider such works as routine maintenance or repair works and the ratio of such expenses is insignificant.

Source: Korea Highway Corporation, "A Study on the Feasibility Studies of Road Projects and the Establishment of Risk Assessment System therefor," Dec. 2007

<Table III-78> Details of Adjustment of Items of PSC Maintenance and Management Expenses

Items	Cost of Road Management Projects	Cost of Road Improvement Projects		
Items of PSC maintenance and management expenses	Repair and maintenance expenses	Re-pavement cost	Expenses for safety examination of structures	Cost of replacing ITS systems and toll collection systems

Notes: 1) Personnel expense and other expenses in the cost of road management projects are determined separately when determining the operating cost of a PSC, and the amortization expense for the amortization of the right to manage a toll road is not taken into consideration.

2) The operation fees are expenses incurred in outsourced management and divided into personnel expenses and other expenses to reflect them in each item respectively.

1) Repair and Maintenance Expenses

Repair and maintenance expenses are expenses incurred in maintaining the performance of a road and providing users with convenience, such as expenses necessary for routine inspections and repair including road cleaning and the improvement of drainage facilities, and expenses incurred in road pavement and the repair and reinforcement of structures.

This Study refers to the current status of the execution of repair and maintenance expenses incurred during the period from 1999 through 2006 by the Korea Highway Corporation in order to determine the repair and maintenance expenses for a PSC option, and the repair and maintenance expenses for 30 years are presented in five-year periods according to its life cycle.

〈Table III-79〉 Annual Standard Repair and Maintenance Expenses for PSC Expressway

(Unit: millions of KRW/㎞/4 lanes)

Item	1~5 years	6~10 years	11~15 years	16~20 years	21~25 years	25~30 years
Repair and maintenance expenses	49.7	47.9	48.1	64.5	47.3	61.6

Note: The above-stated amounts are based on the distance-weighted average traffic volume of 36,490 units/day on the route subject with analysis as at 2007, and the ratio of structures on expressways throughout the country in 2006 is 9.43% for tunnels and 24.61% for bridges respectively.

2) Re-pavement costs

Since appropriate repair works are required according to the years in public use of pavement and the life cycle of pavement varies depending upon the type of pavement, the life cycle and cost of re-pavement for each type of pavement shall be taken into consideration in determining the re-pavement cost.

The maintenance and management expenses incurred in the Jungbu Expressway during 19 years have been analyzed in order to estimate re-pavement cost. Almost no change occurred in the lanes or length of the Jungbu Expressway since its opening in 1988 and therefore it is easiest to ascertain the status of the annual maintenance and management expenses. Moreover, the data about the costs of road management projects for expressways and national roads managed by the Korea Highway Corporation during 24 years have been analyzed in this Study for the determination of re-pavement cost.

The results of the unit requirement of the re-pavement cost per 4 lanes/km, determined by synthesizing the results of the analysis and applicable to each type of pavement and for each period of maintenance and management, are as set out in Table Ⅲ-80 below. The results of the determination are presented in

the form of expression similar to the method for the determination of re-pavement cost suggested by the Study on the Feasibility Studies of Road Projects and the Establishment of Risk Assessment System (Dec. 2007) published by the Korea Highway Corporation.

<Table III-80> Standards for Maintenance and Management Expenses for each Type of Pavement

(Unit: millions of KRW/4 lanes·km)

Types		Cement Concrete Pavement		SMA Pavement	
Period of maintenance and management	5 years				
	10 years			Cutting and overlaying (4 cm)	289.9
	15 years				
	20 years	SMA 4 cm overlaying (reinforcing GLAS GRID joints)	285	Cutting and overlaying (4 cm)	289.9
	25 years				
	30 years	SMA4 cm overlaying (reinforcing GLAS GRID joints)	285	Cutting and overlaying (4 cm)	289.9
Total		570		869.7	

Note: The above-stated costs are amounts translated into constant cost per 4 lanes/km as of 2007.

3) Expenses for Inspecting Structures

Periodic inspections, close inspections, and close safety examinations shall be conducted on structures (bridges, tunnels, etc.) on roads pursuant to the Special Act on the Safety Control of Public Structures (hereinafter referred to as the "Special Act"), and emergency inspections and close safety examinations shall be conducted if any problem is discovered.

There are various kinds of inspections, such as periodic inspections, initial inspections, close inspections, damage inspections, special inspections, close safety examinations, etc., which shall be conducted in accordance of the inspection cycle set for each kind of inspection.

Since the Korea Highway Corporation conducts periodic inspections and close inspections internally and has external safety examiners provide services only for close safety examinations, expenses for periodic inspections and close inspections that can be carried out with its organization for maintenance and management are excluded in determining expenses for inspecting PSC structures.

The expenses for close safety examinations of a PSC shall be determined by the fixed cost estimation method in accordance with the Guidelines for Service Fees for Safety Inspections and Close Safety Examinations (Public Notice No. 2008-840, Ministry of Land, Transport and Maritime Affairs) and shall be divided into direct personnel expenses, miscellaneous expenses, engineering fees, direct expenses, etc.

a) Direct Personnel Expenses

Direct personnel expenses are expenses including salaries, allowances, bonus, retirement and severance reserves, and industrial disaster insurance premiums for personnel directly engaged in inspections and examinations and shall be calculated by applying the adjustment rate for each facility to the standard number of personnel in Table Ⅲ-82 (translated into the level of advanced-level engineers) for the standard facilities in Table Ⅲ-81. The unit wage for advanced-level engineers conforms to the guidelines for the unit wages for construction and other sectors as surveyed and published by the Korea Engineering and Consulting Association in accordance with the Statistics Act.

〈Table Ⅲ-81〉 Facilities subject to Inspection

Facilities	Standard Specification	Calculation	Adjustment
Bridge	Road bridge, concrete structure, 4 lanes	Calculate for the length of 50, 100, 300, 500, 1,000, 2,000, 4,000, 8,000, and 16,000m, respectively	- Road bridge, urban road bridge, ordinary railroad bridge, urban (express) railroad bridge, covered structures - Concrete bridge, steel bridge, extraordinary bridge - 2 lanes (single track), 4 lanes (double track), 8 lanes
Tunnel	Road tunnel, 2 lanes	Calculate for the length of 300, 500, 1,000, 2,000, 4,000, 8,000, 16,000, 32,000, and 40,000m, respectively	- Road, urban (express) railroad, ordinary railroad, underground motorway - 2 lanes (single track), 3 lanes (double track), 4 lanes
Retaining wall	Concrete retaining wall, 10m high, 200m long, retaining wall for a site	Places	- Concrete, reinforced earth, stonework, gabion - 5～25 m high - 50～1,000 m high - Retaining wall for a site Retaining wall for a road, railroad, or any other facility Retaining wall for coast or a repair facility
Cut slope	Rock slope, 50m high, 200m long, cut slope along a national road (with 2 or more lanes in each direction)	Places	- Earth slope, rock slope - 25～125 m high - 100～800 m long - National expressway national road, regional road, state-subsidized regional road (2 or more lands in each direction) National road, regional road, state-subsidized regional road (1 lane and a shoulder in each direction) National road, regional road, state-subsidized regional road (1 lane in each direction) Railroad slope, Other slopes
Culvert	Common duct, 2.0×2.0×2 layers×1,000m	Calculate for the length of 100, 300, 500, 1,000, 2,000, and 4,000m, respectively	- Common duct, sewage culvert - 1～4 layers in each culvert - Specification of culvert

Source: Ministry of Land, Transport and Maritime Affairs, "Guidelines for Service Fees for Safety Inspections and Close Safety Examinations (Public Notice No. 2008-840)"

〈Table III-82〉 Number of Personnel Based on Direct Personnel Expense for each Facility

(Unit: KRW)

Facilities	Specifications		Close Safety Examination		Close Inspection		Periodic Inspection	
			Overall	Outsource	Overall	Outsource	Overall	Outsource
Bridge	4-lane concrete road bridge	50m	82	15	26	10	5	3
		100m	90	19	28	11	6	4
		300m	124	37	36	16	8	5
		500m	157	55	45	21	11	7
		1,000m	241	99	67	34	17	10
		2,000m	409	188	110	60	29	17
		4,000m	630	365	168	112	46	31
		8,000m	1,067	720	289	216	80	59
		16,000m	1,828	1,431	506	424	140	115
Tunnel	2-lane road	300m	99	25	16	9	6	4
		500m	116	34	19	11	6	4
		1,000m	156	56	25	16	7	5
		2,000m	237	101	39	27	10	7
		4,000m	399	191	66	48	17	12
		8,000m	723	370	120	90	29	20
		16,000m	1,372	729	229	175	54	38
		32,000m	2,669	1,446	446	344	102	72
		40,000m	3,317	1,804	555	429	127	90
Retaining wall	Concrete retaining wall, 10m high, 200m long, retaining wall for a site		64	18	15	11	6	4
Cut slope	Rock slope along a national road, regional road, or state-subsidized regional road with 2 or more lanes in each direction, 50m high, 200m long		92	31	23	13	8	5
Culvert	2.0×2.0×2 layers	100m	71	13	11	6	5	3
		300m	83	18	13	7	5	3
		500m	94	23	14	8	6	4
		1,000m	124	37	19	11	7	4
		2,000m	183	64	29	18	9	5
		4,000m	301	118	47	30	13	7

Note: The standard number of personnel shall be calibrated by straight-line interpolation according to the scale of each facility.

Source: Guidelines for Service Fees for Safety Inspections and Close Safety Examinations (Public Notice No. 2008-840, Ministry of Land, Transport and Maritime Affairs)

b) Miscellaneous Expenses

Miscellaneous expenses mean indirect costs excluded from direct costs (direct personnel expenses and direct expenses), including salaries for executives and employees for general affairs, accounting, etc., office expenses, utility expenses, office consumables, furnishings, communications and transportation expenses, expenses for meetings, public charges, and business activity expenses, and shall be within the range of between 110% and 120% of direct personnel expenses.

c) Engineering Fees

Engineering fees are expenses for the use and acquisition of technologies developed and owned by institutions specializing in safety examination, including expenses for survey and research, technology development expenses, technical training expenses, and profits, and shall be within the range of between 20% and 40% of the sum of direct personnel expenses and miscellaneous expenses.

d) Direct Expenses

Direct expenses include expenses incurred when inspectors and examiners travel to a project site, stay in the site to conduct activities, as may be necessary in carrying out inspections and examinations, and such expenses shall be reflected with actual expenses according to guidelines relevant to each item of expense.

e) Determination of Expenses for Inspecting Structures in PSC

As described above, expenses for inspecting structures in a PSC shall be determined on the assumption that services for close safety examination are outsourced, and an annual distribution schedule shall be established by applying a calibration factor according to the form, degree of complexity, and age of each facility and whether the previous report is furnished.

<Table Ⅲ-83> Calibration Factor according to Age of Facility

Item	15 or fewer years	15~25 years	25~35 years	35-55 years	Over 55 years
Calibration rate	1.00	1.05	1.10	1.15	1.20

Source: Guidelines for Service Fees for Safety Inspections and Close Safety Examinations (Public Notice No. 2008-840, Ministry of Land, Transport and Maritime Affairs)

<Table III-84> Calibration Factor for Furnishing Previous Report

Description	Calibration Factor
The previous service report unfurnished	1.00
Either the previous service report or the field-book CAD file furnished	0.97
Both the previous service report and the field-book CAD file furnished together	0.95

Source: Guidelines for Service Fees for Safety Inspections and Close Safety Examinations (Public Notice No. 2008-840, Ministry of Land, Transport and Maritime Affairs)

4) Cost of Replacing Operating Equipment

a) Cost of Replacing Toll Collection Systems

The cycle for the replacement of toll collection systems may vary depending upon traffic volume, and the cost of replacing traffic control systems varies depending upon the useful life of each item. The results of the analysis on the toll roads in operation in the Busan Metropolitan City and Gyeongsangnam-do show that the replacement cycle is between 5 and 13 years and each facility is repaired or replaced whenever necessary.

It is found that the period for the replacement of a toll collection system in a PPP expressway is between 7 and 12 years and the replacement rate is between 50 and 100%. Based on the finding, it is determined to apply the replacement cycle of 7 years for the toll collection system for a PSC and the replacement rate of 50% in this Study.

<Table III-85> Replacement Cycle of Toll Collection Systems

Description	Daegu~Busan	Cheonan~Nonsan	Seoul~Chuncheon	Seoul~Pocheon	Applicable Value
Cycle (years)	10	12	7	7	7
Replacement rate (%)	100	100	50	50	50

Source: Korea Highway Corporation, "A Study on the Feasibility Studies of Road Projects and the Establishment of Risk Assessment System," Dec. 2007

b) Expenses for Maintenance and Management of Vehicles and Replacement of Equipment

In cases of a road managed and operated by a concessionaire, a special-purpose company (SPC) shall be established for separate maintenance and management, and thus, vehicles and equipment are needed for the maintenance and management.

In cases of a PSC, the Korea Highway Corporation maintains and manages a route, if the route is an expressway, while the competent Regional Construction Management Administration or the competent Road Management Office takes charge of the maintenance and management of a route, if the route is a national or regional road, and thus, the types and quantity of equipment for maintenance and management may vary depending upon the competent authority. In order to determine the cost of replacing vehicles and equipment for the maintenance and management of a PSC, reference has been made to the current status of vehicles and equipment for toll roads operated in Gyeonggi-do, Busan Metropolitan City, and Gyeongsangnam-do and the current status of the vehicles owned by the Hongjimun Tunnel Maintenance and Management Office and the Namsan Tunnels 1, 2 and 3 Maintenance and Management Office of the Seoul Metropolitan City.

The results of the analysis on the current status of vehicles and equipment owned by each competent authority show that an authority owns only the

equipment for ordinary repair works, such as the replacement of lamps or the cleaning of tunnels, if it manages only tunnels and that an authority owns relatively more equipment for maintenance and management, if the scale of a project is larger and the length of the managed road is longer. The nature and scale of a project at issue and the current status of the equipment owned by the Road Management Office of the competent authority shall be taken into consideration in re-determining the appropriate quantity of vehicles and equipment to be owned for the maintenance and management of a PSC.

In this Study, the current status of the equipment and vehicles owned for the maintenance and management of a general PSC road project has been determined, and it is also determined that each project owns vehicles only, because it is considered reasonable to use construction machines and snow-clearing equipment owned by each Road Management Office, whenever necessary.

With regard to the cost of replacing vehicles and equipment for a PSC, the appropriate replacement cycle has been determined by referring to the Useful Life published by the Public Procurement Service (Public Notice No. 2008-7, Public Procurement Service), and the prices of vehicles and equipment have been determined by referring to market prices.

〈Table Ⅲ-86〉 Costs of Replacement of PSC Vehicles and Equipment

(Unit: millions of KRW)

Type and Model of Vehicle		Unit price	Unit	Useful Life	Replacement Cycle	Replacement Cost for PSC
Muiti-purpose passenger car	Actyon sports for 5 passengers (Toll road patrol)	21.8	1	6 years	3 times/30 years	65.4
Cargo truck	Hyundai Porter Ⅱ	14.0	1	6 years	3 times/30 years	42.0
Specially-equipped vehicle	Vacuum road cleaning vehicle	191.7	1	7 years	3 times/30 years	575.1
Specially-equipped vehicle	Multi-purpose road management vehicle	108.5	1	7 years	3 times/30 years	325.5
Dump truck	Dump truck (8 tons)	65.2	1	6 years	3 times/30 years	195.6
Total			5			1,203.6

Notes: 1) The unit prices applied here are based on the price information released by the Public Procurement Service in 2008.

2) The above-stated current status of vehicles and equipment owned illustrates the equipment owned for general maintenance and management, and whether to own vehicles and equipment for a PSC shall be determined based on the scale of the proposed project.

〈Table III-87〉 Table of Useful Life

Category	Sequential No.	Product Listing System (Korea On-line E-Procurement System)		Unit	Useful Life (years)
		Product Classification No.	Product Classification Name		
25. Transportation devices	89	25101503	General passenger car (for the head of an institution) General passenger car (for business)	Unit	5 6
	90	25101505	Mini bus	"	6
	91	25101510	Multi-purpose automobile	"	6
	92	25101512	Large-size bus	"	8
	93	25101513	Medium-size bus	"	6
	94	25101601	Dump truck	"	6
	95	25101611	Cargo truck	"	6
	96	25101703	Ambulance	"	6
	97	25101801	Motorcycle	"	5
	98	25101802	Motor scooter	"	5
	99	25101901	Agricultural tractor	"	10
	100	25101910	Road cleaning vehicle	"	7
	101	25101913	Snow removers	"	7
	102	25101923	Anti-riot vehicle	"	9
	103	25101927	Agricultural transport vehicle	"	8
	104	25111601	Rescue boat or rescue raft	"	10
	105	25111604	Rubber boat	"	5
	106	25173108	Navigator for vehicle	"	5
	107	25173813	Automatic transmission	"	7
	108	25173829	Air cleaner for engine of vehicle	"	6
	109	25174801	Air-conditioner for vehicle	"	7
	110	25174902	Cargo box for vehicle body	"	8
	111	25174912	Sand blaster	"	7
	112	25174914	Snow removers attachable to truck	"	7

Source: See the Useful Life (Public Notice No. 2008-7, Public Procurement Service).

D. Electricity Expense

The electricity expense is an expense for electricity incurred in operating facilities during the period of operation and may be divided mainly into the electricity expense for lighting fixtures in tunnel sections, the electricity expense for other facilities in tunnel sections, the electricity expense for street lamps on interchanges, junctions, and bridges in road sections, and the electricity expenses for tollgate booths, resting places, and management offices, and the rate of electricity expense applicable to calculation varies according to the type of contract.

The electricity expense for a PSC shall be determined by reviewing the size of each kind of lighting fixture for the proposed project (tunnel, street lamp, tollgate booth, resting place, etc.) and the electricity use hours and applying the table of monthly electricity rate for each type of contract (Korea Electric Power Corporation, Dec. 31, 2007).

〈Table III-88〉 Classification of Electricity Rates for Road Projects by Type of Contract

Classification	Applicable Rate	Remarks
Rate for lighting equipment in tunnel sections	Electricity for street lamps (B)	Pursuant to Article 62 of the Standard form supply contract of the Korea Electric Power Corporation
Rate for other equipment in tunnel sections	High-tension electricity (A) in the category of electricity for ordinary use (A)	Pursuant to Article 57 of the Standard form supply contract of the Korea Electric Power Corporation
Rate for street lamps	Electricity for street lamps (B)	Pursuant to Article 62 of the Standard form supply contract of the Korea Electric Power Corporation
Rate for tollgate booths, resting places, and management offices	High-tension electricity (A) in the category of electricity for ordinary use (A)	Pursuant to Article 57 of the Standard form supply contract of the Korea Electric Power Corporation

Source: Korea Electric Power Corporation, See the "Standard Basic Supply Contract of the Korea Electric Power Corporation," Dec. 2007

<Table III-89> Table of Monthly Electricity Rates for Ordinary Use (A)

(Unit: KRW)

Classification		Basic Rate (per kW)	Rate for Wattage (per kWh)			Remarks
			Summer	Spring · Fall	Winter	
Low-tension electricity		5,160	91.40	60.90	67.90	Standard voltage 110V~380V
High-tension A	Option Ⅰ	5,320	91.10	60.70	67.60	Standard voltage 3,300V~66,000V
	Option Ⅱ	6,120	87.10	56.60	63.00	
High-tension B	Option Ⅰ	5,320	88.50	58.90	65.60	Standard voltage 154,000V or higher
	Option Ⅱ	6,120	84.50	54.80	61.10	

Note: The optional rate system is an advanced rate system under which each customer can choose a rate favorable to the particular needs in the use of electricity. Option Ⅰ is favorable if monthly use is less than 200 hours, while option Ⅱ is more favorable if monthly use is between 200 and 500 hours.

Source: Korea Electric Power Corporation, See the "Standard Basic Supply Contract of the Korea Electric Power Corporation," Dec. 2007

<Table III-90> Table of Monthly Electricity Rates for Street Lamps

(Unit: KRW)

Classification	Basic Rate (per kW)	Wattage Rate (per kWh)	Remarks
A (fixed amount)	KRW 24.10 per W (KRW 780 minimum per month)		
B (meter rate)	4,030	55.30	

Notes: 1) The rate for street lamps (A) applies to customers who have equipment that consumes electricity of less than 1kW or who have difficulty in installing an electricity meter due to circumstances in the site.

2) The rate applies to customers who are not eligible for the rate for street lamps (A) and is calculated according to the amount of electricity used and measured by an electricity meter installed.

Source: Korea Electric Power Corporation, See the "Standard Basic Supply Contract of the Korea Electric Power Corporation," Dec. 2007

E. Operation Insurance Premium

It can be said that the operation insurance premium is a private countermeasure to mitigate losses incurred by an unexpected accident during the period of operation. In cases of a government-financed project, the project is insured in connection with construction during the period of construction, but it is general practices that there is no insurance covering a natural disaster or *force majeure*, excluding fire insurance, during the period of operation.

In principle, a VFM test quantifies risks to translate them into costs and applies part of insurance premiums included in the project cost or operating cost of a PPP project as risks-quantified costs.

In cases of a government-financed project, the Government takes the burden of losses related to the occurrence of an actual accident with its fund, and thus, it is appropriate to reflect insurance premiums for covering injuries and damages to facilities and the users of such facilities in the aspect of quantification of risks.

There is insurance for completed civil engineering works, business liability insurance, and employer's liability insurance in the kinds of insurance for the period of operation. The insurance coverage and insurance premium rates for operation insurance for a PSC shall be determined by applying the same coverage and rates as those for the PFI by referring to projects on which negotiations have been recently closed, unless such application is unreasonable. The employer's liability insurance shall cover operating personnel. The premiums for business suspension insurance, a kind of operation insurance for a PFI, shall be excluded from the premiums for operation insurance for a PSC, since business suspension is almost unlikely to occur when a project is implemented at the initiative of the Government.

〈Table III-91〉 Insurance Premiums during Period of Operation of PSC

Kind of Insurance	Insurance Coverage	Remarks
Insurance for completed civil engineering works	Cost of restoring facilities damaged by an accident	
Employer's liability insurance	Cost of compensating employees for injuries caused by a disaster	
Business liability insurance	Cost of compensating a third party for injuries caused by an accident in a facility	

Note: Insurance premiums shall be determined by applying the applicable rate to the current price, which shall be translated again into a constant price.

〈Table III-92〉 Coverages and Applicable Rates of Operation Insurance for Projects Recently Negotiated

(Unit: %/year)

Project Name	Insurance for Completed Civil Engineering Works		Employer's Liability Insurance		Business Liability Insurance	
	Coverage	Applicable rate	Coverage	Applicable rate	Coverage	Applicable rate
A	Construction cost	0.1%	Personnel expense	0.1%	KRW 1 billion	1%
B	Construction cost	0.1%	Personnel expense	0.28%	KRW 100 million per person	KRW 4 million
C	Construction cost + Operation equipment cost + Supervision cost	0.1%	Personnel expense	0.04%		KRW 40 million
D	Construction cost	0.1%	Personnel expense	0.04%		KRW 5 million

F. Cost of Replacing Tangible Assets

The cost of replacing tangible assets may be represented by the cost of replacing furnishings and fixtures during the period of operation, and the useful life of each item that may be classified as a tangible asset shall be determined by referring to the public notice given by the Public Procurement Service each year pursuant to Article 25 of the Enforcement Rules of the Commodity Management Act.

The cost of replacing furnishings and fixtures is a cost of replacing furnishings and fixtures in tollgate offices and maintenance and management offices, and the cost of replacing furnishings and fixtures for a PSC shall be determined by reviewing the appropriateness of the proposal or by determining the ratio to personnel expense for projects on which negotiations have been closed and applying the determined ratio to the re-determined personnel expense for the PSC.

<Table III-93> Determination of Ratio of Replaced Furnishings and Fixtures to Personnel Expense for Negotiated Projects

(Unit: millions of KRW)

Project Name	Personnel Expense	Cost of Replacing Furnishings and Fixtures	Ratio (%)
A	11,190	162	1.44%
B	87,276	2,343	2.68%
C	62,563	352	0.56%
Total	161,029	2,857	1.77%

G. Annual Distribution Schedule of Operating Costs in PSC

An annual distribution schedule of operating costs during the period of operation shall be established on the basis of the above-calculated operating costs for a PSC. If the annual distribution schedule for the PFI is appropriate,

the schedule shall be applied in establishing the distribution schedule.

〈Table III-94〉 Annual Distribution Schedule of Operating Costs in PSC

(Unit: 100 millions of KRW)

Items	Considerations in Scheduling Annual Distribution
Personnel expense and miscellaneous expenses	
1.1 Personnel expense	• Distribute total personnel expense during the period of operation to each year.
1.2 Miscellaneous expenses	• Distribute miscellaneous expenses determined at the ratio to personnel expense to each year.
Maintenance and management expenses	
2.1 Expenses for repair and maintenance	• Distribute the expenses according to the schedule for the distribution of expenses for repair and maintenance.
2.2 Re-pavement expense	• Disburse such expenses in the 10th or 30th year depending upon the type of pavement.
2.3 Expenses for inspecting structures	• Disburse such expenses according to the age and grade of each structure.
2.4 Cost of replacing operating equipment	• Cost of replacing toll collection systems: Disburse 50% of the cost periodically once every 7 years, referring to cases of PPP expressways. • Cost of replacing vehicles and equipment: Disburse the cost according to the replacement cycle determined by considering useful life.
Electricity expense	• Disburse an equal amount each year as electricity expense determined per year.
Operation insurance premiums	
3.1 Insurance for completed civil engineering works	• Translate the insurance premiums determined with current prices into constance prices and allocate the prices to each year.
3.2 Employer's liability insurance	• Translate the insurance premiums determined with current prices into constance prices and allocate the prices to each year.
3.3 Business liability insurance	• Disburse an equal amount as a fixed amount spent for each year.
3.4 Business suspension insurance	• Exclude business suspension insurance for a PSC.
Cost of replacing tangible assets	
5.1 Cost of replacing furnishings and fixtures	• Allocate the cost to each year by applying the ratio of the replacement of furnishings and fixtures to personnel expense.
Total operating cost (exclusive of V.A.T.)	

Section 5 Estimation of Traffic Demand

1. Overview

Feasibility analysis on a transportation investment project can be made by analyzing the cost incurred in the construction of the transportation facility in comparison with the benefits generated by the project, and traffic demand is a factor that has the greatest impact on the estimation of the cost and benefits in assessing such feasibility. Through the estimation of traffic demand, whether to implement the project and the priority of investment are assessed, the proper scale of supply of transportation facilities is calculated, and the impact of the construction of a transportation facility on the region can be analyzed. The results of estimated traffic demand for a PPP project become important basic data not only for feasibility analysis but also for determining user fees, construction subsidies, the minimum revenue guarantee, etc.

Traffic demand may be estimated by utilizing a model based on individual data about individual passengers or households or by utilizing a model based on aggregate data about each zone analyzed. In the Republic of Korea, four-step models are mostly utilized in estimating traffic demand for interregional transportation as well as for metropolitan areas, but it is considered that the reason why such models are utilized is because the consistency of such four-step models between steps in the process of estimating traffic demand is easier even for non-experts to understand, rather than because such models are proper for all cases.

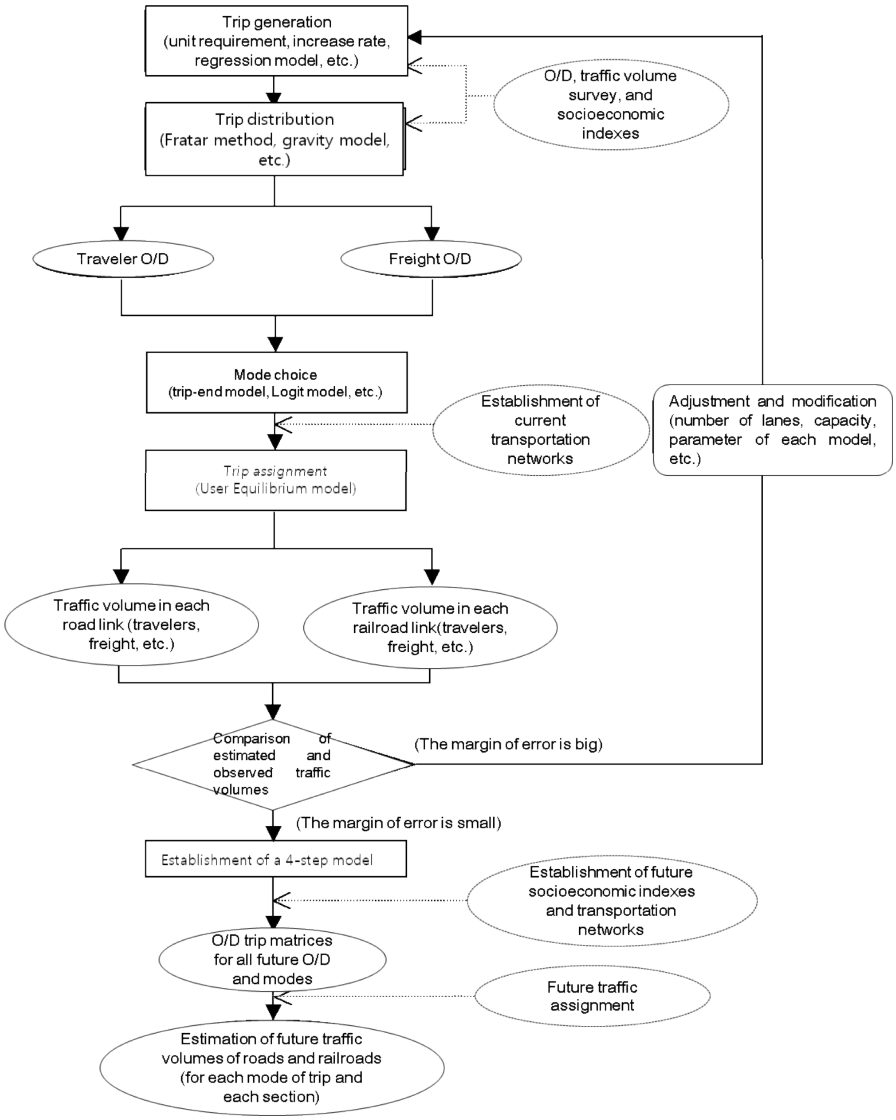
Figure Ⅲ-3 shows the process of estimating traffic demand with a conventional four-step model. The steps of the trip generation, the trip distribution, and mode choice in a four-step model are basically omitted in the feasibility assessment of most projects for transportation facilities by utilizing the

data about the estimation of traffic volume from the origin to the destination of each kind of the future trip modes, set up by the Center for Korea Traffic Database.[11)]

Looking more closely into the process of the estimation of traffic demand in the road sector, the settlement for the base year is carried out on the basis of the origin/destination (O/D) and network given in advance. The settlement for the base year is a work for setting up a model that shows the present trip pattern within a margin of error, and so the less the deviation of the results of trip assignment in the network within an impact zone from the results of a factual survey, the better it can be said that the settlement has been carried out. Once the settlement for the base year is complete, the future trip pattern according to changes in the origin/destination (O/D) and network shall be forecasted on the assumption that the behavior of traffic assignment in the base year remains unchanged, and then the changes in the trip pattern, such as changes in traffic volume and speed as a consequence of the implementation of the project, shall be forecasted by comparing the trip pattern with the trip pattern in the year when the project is implemented.

11) Database for the whole country and 5 metropolitan areas shall be set up by the Center for Korea Traffic Database, while database for the Seoul Metropolitan Area shall be established by the Seoul Metropolitan Traffic Headquarters.

[Figure III-3] Process for Estimation of Traffic Demand in Conventional Four-Step Models



Rough guidelines are presented herein in connection with the estimation of traffic demand for a transportation facility project by referring to the Study to Amend and Supplement Standard Guidelines for Preliminary Feasibility Studies of Road and Railroad Projects. Refer to the guidelines for the specific methodology for each sector.

2. Basic Preconditions

A. Use of Officially Recognized Data

The database about O/D and networks, set up by the Seoul Development Institute, the Gyeonggi Research Institute, and the Incheon Development Institute, are used as basic data for traffic demand estimation for the Seoul Metropolitan Area, while the database about O/D and networks between regions throughout the country and 5 metropolitan areas, set up by the Center for Korea Transport Database in the Korea Transport Institute, are used for other regions throughout the country and other areas.

In principle, the data corresponding to the O/D and network adopted shall be used for major parameters used in the traffic demand estimation for the project subject to the analysis, but data from an officially recognized institution shall be used, if such data are not furnished.

B. Invariability of Total Traffic Volume

In principle, the total traffic volume in an impact zone in implementing a transportation facility project shall be the same before and after the implementation of the project, unless extenuating circumstance arises.

If a future development plan is not reflected in the existing database, the O/D for each zone may change by adding such plan, but the total traffic volume shall remain unchanged. In other words, if the traffic volume in a zone is additionally generated as a consequence of the development plan, the traffic volume in another zone within the impact zone shall decrease instead. If the

total traffic volume is significantly changed as a consequence of the implementation of a project for a bridge between islands or a bridge between main land and an island, however, the total volume may be changed by reflecting the traffic volume generated therein.[12)]

The precondition of the invariability of total traffic volume applies only within the zoning system of the data furnished. If the zoning system is changed through subdivision or aggregation, the total traffic volume with the changed zoning system naturally differs from the total traffic volume within the existing zoning system. More details of this issue are discussed in Section 5 "Modification of Basic Data" of the "Study to Amend and Supplement Standard Guidelines for Preliminary Feasibility Studies of Road and Railroad Projects (5th ed.)."

C. Omission of Step of Mode Choice for Road Project

It is unnecessary to conduct four-step analysis on every project, since the O/D for each mode already established for the present and future is furnished. When almost all road projects are implemented, traffic volume shifted from a railroad is insignificant, and thus, the feasibility of a project mostly affects the change in route selection in the course of trip assignment. Since determining the traffic volume that changes a route due to a change in travel cost is important in such cases, the analysis at the step of mode choice may be omitted, and the analysis shall be mainly focused on the attributes of the network, the link impedance function, and the trip assignment method.

However, the analysis at the step of mode choice shall be included in cases of a large-scale expressway project, because the demand for railroad will be significantly affected.

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12) In the preliminary feasibility study of the Project for the Construction of Three Bridges connecting between the main land to an island and between islands in Sinan-gun, there was a case where an analysis was conducted on the assumption that induced traffic volume would be generated if the project for the bridge connecting between the main land and an island was implemented.

3. Establishment of Basic Data

Officially recognized basic data shall be set up based on the location and nature of a project. There are data interregional throughout the country, data about the Seoul Metropolitan Area, and six other metropolitan areas in the basic data. In cases of data about the 6 metropolitan/provincial areas, data verified as the latest ones as of the time of analysis shall be used, because some of data are updated once every two years, but the time to update O/D data varies.

In principle, traveller trip O/D and freight trip O/D shall be combined for the use in traffic analysis.

The current status of O/D established as of October 2008 is as follows:

〈Table III-95〉 Current Status of Nationwide Interregional O/D

Description		Composition of Zones	Subject Matters	Year of Establishment	Base Year
KTDB	Nationwide	248 zones	Traveller means/purposes Freight means/tonnage/items	2006, 2011, 2016, 2021, 2026, 2031, 2036	2008

Note: The number of zones becomes 249 in 2011 from 248 in 2006 when the Multi-Functional Administrative City (Sejong-si) is added.

Source: Korea Transport Institute, presentation data distributed by KTDB in Apr. 2008 in connection with the National Traffic DB Establishment Project in 2007

〈Table III-96〉 Current Status of O/D in Data about Seoul Metropolitan Area

Description		Composition of zones	Subject Matters	Year of Establishment	Base Year
Data about Seoul Metropolitan Area	Seoul Metropolitan Area	1,142 zones	Passenger means/purposes	2006, 2011, 2016, 2021, 2031	2008

Source: Seoul Development Institute, the 4th data distributed in connection with the "Study on the Factual Survey on Trips of Households in Seoul, the Estimated Future Traffic Demand, and Countermeasures therefor (2004)"

〈Table III-97〉 Current Status of O/D in KTDB Data about Metropolitan Areas

(Unit: zone)

Subject Matter	Area		Composition of Zones			Year of Establishment	Base Year
			Total	Internal zones	External zones		
Traveller means/purposes	6 metropolitan/ provincial zones	Busan, Ulsan	665	446	219	2006, 2011, 2016, 2021, 2026, 2031, 2036	2006
		Daegu	490	258	232		
		Gwangju	404	168	236		
		Daejeon	441	209	232		
		Jeonju	367	124	243		
Freight means/tonnage/items	5 metropolitan areas	Busan, Ulsan	411	397	14	2003, 2006, 2011, 2016, 2021, 2026, 2031	2003
		Daegu	245	230	15		
		Gwangju	169	154	15		
		Daejeon	210	195	15		

Note: The Multi-Functional Administrative City (Sejong-si) is added in 2011.

4. Establishment of Scope of Analysis

A. Establishment of Timeframe

The end of the year immediately preceding the time of a VFM test shall be set as the base year for the feasibility analysis. The analyzed period consists of the planned project period, including the period of design and construction, and 30 years after the opening of the road.

The time to analyze traffic demand is classified into the initial year of analysis (opening year), the interim years of analysis, the final year of analysis, and the additional year of analysis. The initial year of analysis is the year when a transportation facility begins to be open for use. The interim years of analysis shall be set up basically at an interval of five years beginning in the initial year, but the year of analysis for the basic data established every five years may be used in order to reduce errors that may occur in the course of establishing interim years by interpolation, if the O/D established does not match with the year of analysis. The final year of analysis is the final year of the period of analysis. If a trip pattern is significantly changed due to the construction of a new competing transportation network in the impact zone during the period of analysis, the research team shall conduct an additional analysis for the relevant year. The time when such situation arises is called an additional year of analysis.

B. Spatial Scope

A spatial scope is divided mainly into the zone subject to analysis and an impact zone, and the impact zone is subdivided into the direct impact zone and the indirect impact zone.

The zone subject to analysis means the scope of the O/D and network used in estimating the actual demand in the future, and the area excluded from the

zone subject to analysis is expressly treated as an external zone.

The impact zone is a concept with the narrower scope than the zone subject to analysis and the scope of an area included in the calculation of benefits from the implementation of a project as an area in which a "significant change in a trip pattern" occurs before or after the implementation of the project. The direct impact zone means the scope to which a change in a trip pattern occurs directly due to the implementation of a project and the spatial scope necessary in establishing the O/D and network in detail in order to analyze the effects of the implementation of the project. The indirect impact zone means the geographical scope that shall be included in the scope of the calculation of benefits as a consequence of a change in a trip pattern.

Two standards, the PV rate or RV rate, shall be applied with regard to the impact zone of a road project to set up the impact zone subject to traffic analysis, and the grounds for setup shall be described in the report. The PV rate is the rate of the arriving traffic volume to the generated traffic volume of an O/D within the project zone and is presented with a trip distribution table for the area subject to analysis. The RV rate is the rate of change in traffic volume in a road section due to the implementation of a project and is presented with a map.

5. Modification of Basic Data

Basic data shall be modified to make the data consistent with traffic analysis by reviewing the basic data and reflecting any network omitted, the current traffic status, the plan revised, etc,. therein. Each research team shall compare the data finally established with the O/D and network of the basic data and describe differences in the data in the report.

If it is difficult to analyze changes in a trip pattern due to the implementation of a project under the zonal system of basic data because the project section is short, the traffic analysis of the direct impact zone shall be conducted by subdividing the zone. When the direct impact zone is subdivided,

the networks shall be also subdivided correspondingly, and the attributes of the network shall be established in detail by using data about observations.

The network in the base year shall be modified by reviewing the attributes of the network, whether any network is omitted, the appropriateness of the connection of Centroid connectors, etc. in accordance with relevant detailed guidelines. The future network shall be established by including the transportation facility plan for the future based on the network in the base year.

The future O/D shall be established by reflecting additional future plans, which shall be certainly realizable under the principle of the invariability of total trip O/D. If a development plan has not been specifically prepared, and thus, is not adequate for the standards for reflection but it is considered that whether or not the future development is reflected will significantly affect feasibility and that the implementation of the plan is highly probable, the effects of the implementation of the development may be analyzed through scenario analysis. The details of generated trips and distributed trips adjusted by reflecting a development plan shall be described in the report.

On the other hand, tourism demand may be additionally reflected only for the areas[13] with propensity for recreation along an expressway or national road, if the maximum coefficient for months or holidays is not less than 1.2. In principle, induced traffic flow volume shall not be reflected. However, such traffic volume may be reflected only for an extraordinary project, such as a project for a bridge connecting an island to mainland or between islands, but more discreet analysis is necessary in such cases.

6. Mode Choice

For a model for mode choice, the logit model shall be applied among models for the travel behavior of individuals, which forecast modal share by

13) Yeongil Kim et al. (2004), "A Study on the Identification of Road Sections with Propensity for Recreation in an Expressway by Principal Component Analysis," Journal of the Korea Society of Transportation, Volume No. 22, Issue No. 2, Apr. 2004

analyzing the characteristics of the travel behavior of individual travellers.

The probability that travellers choose a specific mode of K in a logit model is determined in the following formula:

$$P(K) = e^{U_K} / \sum_{i}^{n} e^{U_i}$$

Where, U_K = Utility of mode K, U_i = Utility of mode i, n = Number of modes

A utility function appears in the following form:

$$U_{ijk} = \alpha_1 (T_{TIME})_{ijk} + \alpha_2 (T_{COST})_{ijk} + (Constant\ term)_k$$

Where, U_{ijk}: Utility function between traffic zones i and j of mode k

$(T_{TIME})_{ijk}$: Total travel time between traffic zones i and j of mode k

$(T_{COST})_{ijk}$: Total travel cost between traffic zones i and j of mode k

$(Constant\ term)_k$: Dummy of mode k

The utility function shall estimate considering the travel time and access time of each transport means, the fare for each transport means, and the dummy that expresses the attributes of each transport means, and the variables and unit requirement applied thereto shall be consistent with the assumptions applied in setting up the model. Regarding the method of establishing basic data for the establishment of the utility function, such as travel time and travel cost, the guidelines for preliminary feasibility studies shall be referred to.

The process for the adjustment of the utility function is necessary to make the modal share of the O/D forecasted with data from an actual survey equal to the modal share estimated by applying the utility function. In cases of a road project, it may be unnecessary to adjust the mode choice model, because most of traffic volume is transferred from an identical mode when a project is implemented, but in cases of a railroad project, in which the determination of

the traffic volume shifted between modes is an important issue, it is necessary to undergo the process for determining the mode choice model that shall reflect the accurate modal share at present by conducting the mode choice analysis directly.

When a model is adjusted, the general criteria for the assessment of rationality, such as codes of coefficients and the relative ratio of time to cost, shall be met, and the types of variables shall be determined, considering attributes of data, purposes of trips, traffic hours, etc.

In the past, a mode choice model was generally calibrated by using a calibrating dummy, but problems, such as the impact of a dummy constant, have arisen. Therefore, it is intended in this VFM test to use an incremental logit model as a basic model to mitigate problems of a calibrating dummy and ensure more simplicity and consistency.

An additive logit model may be applied to cases where a new mode has been introduced but it is impossible to calculate or a meanless result is produced because there is no existing share available or cases where a rapid change is expected to occur due to changes in the land use in an underdeveloped area.

7. Trip Assignment

The trip assignment in the road sector is based on the assumption of user equilibrium that utilizes the deterministic trip assignment approach under Wardrop's first principle, and the value of such user equilibrium is computed by the Frank-Wolf algorithm.

A. Auto Occupancy and Passenger Car Equivalent

In principle, the unit requirement that coincides with the one on the data used for traffic analysis shall be applied to the auto occupancy and passenger car equivalent (PCE) used in trip assignment. For example, when the O/D and

network in the Seoul Metropolitan Area are used, the trip assignment shall be made by applying the auto occupancy and passenger car equivalent in the Seoul Metropolitan Area.

B. Basic Time Unit for Trip Assignment

The basic time unit for trip assignment may be carried out mainly by two methods: The first method is to carry out trip assignment by using peak and off-peak O/D and the second method is to carry out trip assignment by using the full-day O/D.

If an area suffers from severe congestion or an urban road shows peak/off-peak variability, it is desirable to compute benefits after carrying out trip assignment by using the peak/off-peak O/D, while trip assignment may be carried out by using the full-day O/D, if a road has a slight peak hour variability.

When an analysis is conducted by separating peak from off-peak, the continuous peak hours on a interregional road shall be assumed as 10 hours and the concentration rate of traffic volume for 1 peak hour as 7%, while continuous off-peak hours shall be assumed as 9 hours and the concentration rate of traffic volume for 1 off-peak hour as 2.5%.[14] In cases of a road in the Seoul Metropolitan Area, continuous peak hours shall be assumed as 4 hours and the concentration rate of traffic volume for 1 peak hour as 8.9%, while continuous off-peak hours shall be assumed as 15 hours and the concentration rate of traffic volume for 1 off-peak hour as 3.9%.[15]

With respect to approximately 5 hours late at night, no traffic analysis is

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14) This is a result of surveys on interregional roads, and thus, it may be improper to apply the peak concentration rates and concentration rates presented above to metropolitan areas. In cases of an urban zone in a metropolitan area, it may be possible to apply peak concentration rates and continuous hours that reflect the characteristics of the traffic in the city, whenever necessary, if any data from a separate survey are available.

15) Seoul Development Institute (SDI). See the "Computation of Traffic Indexes of the Seoul City in 2005." It defines the continuous peak hours and concentration rates of traffic volume based on the morning peak hours (07:00~09:00) and the afternoon peak hours (18:00~20:00).

carried out because public transportation services, such as railroads, are unavailable, and thus, it is deemed that there is no effect of improving speed or shifting modes by implementing a project.

However, if the effect of a road project to late-night hours is considered not ignorable, the analysis on 5 late-night hours may be included. Moreover, if a PPP project is operated during 5 late-night hours, the VFM shall be analyzed by estimating revenue.

C. Trip Assignment of Buses and Trucks

The trip assignment of buses and trucks may be carried out as follows: First, the trip assignment of buses and trucks shall be basically carried out by multi-class trip assignment; secondly, if the shares of buses and trucks are not high, assignment of buses and trucks by user equilibrium shall be made prior to trip assignment of passenger cars, and the result values may be saved and treated as background traffic or pre-loading traffic when trip assignment of traffic volume for passenger cars is made;[16] and thirdly, trip assignment may be made after converting the O/D of buses and trucks into PCU and integrating it to passenger cars. In cases of the third method, the composition ratio of O/D for each class of vehicle or the composition ratio of observed traffic volume of each class of vehicle shall be taken into consideration in determining the composition ratio of traffic volume of each class of vehicle.

D. Reflection of Internal Traffic in Road Projects

Analyzing by creating traffic zones is based on the assumption that all trips depart from one traffic zone and arrive in another traffic zone and that there is no trip generated from inside of the same traffic zone. In other words, the

16) Under the existing guidelines, preferred assignment has been made by the all-or-noting method on the assumption that intercity buses, express buses, and trucks operating along a fixed route use the shortest route, but preferred assignment shall be made by the equilibrium assignment method because there is a problem that excessive delay occurs in a specific section in the course of actual assignment.

internal trips in a traffic zone are not assigned to the traffic network. However, in cases of a national road, a regional road, or a downtown road, except expressways, the internal trips in a traffic zone actually take a certain portion. As a result, if trip assignment is made by using the O/D data between traffic zones, the traffic volume assigned to any road other than an expressway is generally less than the traffic volume actually observed.

In order to solve such problem, a certain ratio of the link capacity (30% maximum) may be reflected as internal trips on the assumption that some of internal trips in a traffic zone exist in a road other than an expressway. If zones have been subdivided into sub-zones, internal trips in a zone shall not exceed 30%, and the ratio of internal trips shall be determined according to the size of subdivided zones.

E. Volume-Delay Function (VDF)

A trip assignment model is an approach for analyzing changes in trip patterns generated throughout a network before and after the implementation of a project on the assumption that individual travelers choose a route that minimizes their travel costs. In such cases, the travel cost of a road user is expressed as "generalized cost," which is the sum of time-expense and fare, and the Volume-Delay Function (VDF) is as follows:

$$\text{Generalized cost } T = T_0[1 + \alpha(V/C)^{\beta}] + \text{Distance} \times \text{Weight}$$

Where, T: Link Travel time (generalized cost, minutes), T_0: Link free travel time (time cost, minutes)
V: Link traffic volume (PCU/hour), C: Link capacity (PCU/hour)
α, β: Parameters, Weight: (Fare/km)/[Value of time for each class of vehicle]

The term $T_0[1+\alpha(V/C)^{\beta}]$ in the above formula is the "BPR formula," developed by the U.S. Bureau of Public Road, and shows how travel time changes according to the ratio of traffic volume to road capacity. The BRP formula explains the portion of time-expense out of overall costs (generalized

cost) required for trips.

The second term (Distance × Weight) is a formula for translating monetary costs for travelling through a toll road into time. This is to reflect how a road user's choice of a route is affected not only by travel time but also by toll rates.

Among toll roads, including expressways, there are closed-type and open-type expressways managed by the Korea Highway Corporation and other PPP toll roads. Therefore, in order to reflect the impact from not only travel time but also toll rates in toll road users' route choice, the volume-delay function shall apply, taking into consideration differences in the level and system of toll rates between the open-type and closed-type expressways of the Korea Highway Corporation and PPP toll roads. In particular, it is necessary for an individual research team to reflect the current status of PPP toll roads implemented within the impact zone, such as the neighborhood of the project site, after conducting surveys thereon, since there are many cases where PPP toll roads are not reflected in KTDB basic data.

The value of time for each class of vehicle shall be computed by dividing trips into business trips and non-business trips for the base year of the basic data on hand and analysis and referring to respective values. In other words, values of time for different classes of vehicle shall be applied in conformity with basic data because the auto occupancy of each class of vehicle in a zone differs from the auto occupancy of the same class of vehicle in another zone according to the basic data furnished by KTDB in 2007.

The volume-delay function and weights for reflecting toll rates are distributed in a package by PIMAC, and therefore prior consultation is required when it is intended to apply any parameter or capacity different from the given volume-delay function or a different weight to toll rates, and then the details thereof and the ground therefor shall be described in the report.

8. Adjustment of Trip Assignment Model

A traffic demand analysis model's capability of simulating reality is evaluated by comparing and analyzing the observed traffic volume and the traffic volume assigned by the traffic demand model.

The error rate, which indicates a difference between observed traffic volume (f_l^{obs}) and assigned traffic volume (f_l^{est}), is defined in the following formula:

$$Error\ rate \quad \epsilon(\%) = 100 \times \frac{f_l^{est} - f_l^{obs}}{f_l^{obs}}$$

Where, f_l^{est} = Estimated traffic volume on the Link according to the results of the analysis on trip assignment

f_l^{obs} = Observed traffic volume on the Link

The adjustment shall be made in accordance with the standards of the tolerance for each level of traffic volume on major roads within the impact zone.

For the purpose of limits on allowable errors in observed traffic volume and assigned traffic volume, roads are divided into project sections, nearby roads, and other major roads, and a relatively greater error is permitted for a link with less traffic volume, while more accurate estimation is demanded for a link with large traffic volume. R value shall exceed 0.8 in overall by calculating the correlations between observed traffic volume and assigned traffic volume. Table Ⅲ-98 presents the standards of the tolerance for each level of traffic volume.

<Table III-98> Standards of Tolerance for each Level of Traffic Volume

(Unit: Units/day, %)

Annual average traffic volume per day	Standards of Tolerance for each Type of Road		
	Project section	Nearby road	Other major road
Less than 5,000	20	25	40
5,000 or more	15	20	30

9. Estimation of Future Traffic Demand

The traffic volumes and attributes of trips when the project is implemented and when the project is not implemented shall be estimated by making trip assignment to each mode for an O/D pair.

The essential results of the traffic demand estimation shall be presented by referring to the forms for the preliminary feasibility study. The traffic volumes on the project route and major roads within the impact zone when the project is implemented and when the project is not implemented shall be presented. In particular, the traffic demand shall be presented separately in regard to the user fees in the PSC and the user fees in the PFI.

The changes in the trip pattern due to the implementation of a project shall be analyzed in the following manner. First, the characteristics of traffic volume in the opening year when the project is not implemented shall be analyzed. The characteristics of traffic volume changed in the opening year when the project is not implemented, in comparison with the traffic volume in the base year shall be ascertained and described. Secondly, the characteristics of the demand for using the project route shall be analyzed. The origins and destinations of the demand using the project route and from which route the traffic demand has been shifted to the project route shall be analyzed and described. And then the changes in the travel distance and travel time on major routes shall be analyzed. Thirdly, the traffic demand and elasticity according to changes in toll

rates shall be presented.

10. Comparison of Traffic Demand with Project Proposal

The contents of a project proposal shall be reviewed to examine each stage of traffic demand estimation, including the scope of analysis, the establishment of basic data, the modification to basic data, mode choice, and trip assignment. And the essential results of the VFM test shall be presented in comparison with the project proposal.

In cases of O/D pairs and networks, particularly, future development plans or road plans reflected in the analysis shall be compared, and the total traffic volume on an O/D pair of travellers and freight, used in the traffic demand analysis, shall be compared and presented. In addition, the traffic demands on the project sections shall be compared and the reasons why there is a difference shall be described.

Each stage shall be compared and presented in detail by referring to the essential details of comparison presented as an example.

〈Table III-99〉 Illustrative Comparison of Major Standards for Analysis

Description	Project Proposal	This Study
Base year	2005	2006
Year of analysis	2015, 2024, 2034	2015, 2021, 2031
Impact zone	Entire Seoul Metropolitan Area	Entire Seoul Metropolitan Area
Benchmark network	Network in the Seoul Metropolitan Area according to the 3rd edition of data distributed by SDI	Network in the Seoul Metropolitan Area according to the 4th edition of data distributed by SDI
Benchmark O/D	- Passengers: O/D according to the 3rd edition of data distributed by SDI - Freight: O/D pairs for freight in the Seoul Metropolitan Area and throughout the country in 2003 according to KTDB	- Passengers: O/D according to the 4th edition of data distributed by SDI - Freight: O/D pairs for freight in the Seoul Metropolitan Area and throughout the country in 2003 according to KTDB
Traffic zones	1,142 zones	1,142 zones
Value of time (VOT)	Value of travel time in the Seoul Metropolitan Area (KRW 9,089/unit, passenger car)	Value of travel time in the Seoul Metropolitan Area (KRW 8,349/unit, passenger car)
Trip assignment	Multi-Class Assignment	Multi-Class Assignment

〈Table III-100〉 Illustrative Comparison of Housing Site Development Plans

Region		Name	Area (㎢)	Population (persons)	Number of Households	Period of Project	Year of Reflection	Whether Reflected	
								Proposal	VHM Test
Incheon	Nam-gu								
	Seo-gu								
Seoul	Yangcheon-gu								

〈Table Ⅲ-101〉 Illustrative Comparison of Future Road Network Plans

Classification	Project Name	Section	New Construction/ Extension	Period of Project	Year of Reflection	Whether Reflected	
						Proposal	VFM Test
PPP expressway							
Expressway							
National road							

〈Table Ⅲ-102〉 Illustrative Comparison of Passenger O/D Traffic Volume

(Unit: Trips/Day)

Classification			Seoul	Gyeonggi-do	Yeongdeungpo	Bucheon	Incheon	Others	Total
2015	Seoul	Proposal							
		VFM Test							
	Gyeonggi-do	Proposal							
		VFM Test							
	…								
	Others	Proposal							
		VFM Test							
	Total	Proposal							
		VFM Test							

Note: Passenger O/D is the sum of passenger cars, buses, and taxis.

〈Table Ⅲ-103〉 Illustrative Comparison of Estimates of Future Traffic Volume of the Project Route

(Unit: Units/Day)

Section	Proposal	VFM Test	
		PFI Toll Rate	PSC User Fee

SECTION 6 Calculation of Benefits

1. Overview

The calculation of benefits from a transportation investment project is the process of translating changes in trip patterns due to the implementation of a project into monetary values.

Benefits generated by implementing a transportation investment project are divided into common benefits and project-specific benefits from a specific project. Common benefits are benefits included in all road and railroad projects, while project-specific benefits are benefits that shall be determined only through the assessment of a specific project.

For more details of the methodology for determining each benefit item, refer to the Study to Amend and Supplement Standard Guidelines for Road and Railroad Projects (5th ed.) (KDI, 2008).

〈Table III-104〉 Items of Benefits from Implementation of Road and Railroad Projects

Classification	Benefit Items
Common benefits	• Benefit of vehicle operating costs savings • Benefit of travel time savings • Benefit of traffic accident expense savings • Benefit of environmental costs savings (pollution and noise)
Project-specific benefits from a specific project	• Negative benefit from traffic congestion during the construction period • Benefit of improving railroad crossings • Negative benefit from the reduction of road space due to a railroad project • Benefit of reducing parking cost

Source: KDI, "A Study to Amend and Supplement Standard Guidelines for Road and Railroad Projects (5th ed.)," 2008

2. Methods of Determining Benefits

A. Benefit of Vehicle Operating Costs Savings

Costs of operating vehicles in an individual link shall be computed by multiplying the traffic volume of each class of vehicle in the link, calculated with the results of trip assignment, by the unit requirement of the costs of operating each class of vehicle, based on the length of the link and the average speed on the link. The results computed by such formula shall be aggregated for all links within the road network subject to the analysis and then the difference obtained by comparing the case where the project is not implemented, with the case where the project is implemented shall be calculated as the benefit of Vehicle Operating Costs Savings.

The formula for the Valuation of Vehicle Operating Costs Savings (VOCS) for each year of analysis is as follows:

$$VOCS = VOC_{without\,project\,implemented} - VOC_{with\,project\,implemented}$$

Where, $VOC = \sum_{l}\sum_{k=1}^{3}(D_{lk} \times VT_k \times 365)$

D_{lk} = Link (l), Class of vehicle (k) Unit·km

VT_k = Vehicle operating costs per km at the driving speed on the link for each class of vehicle (k)

k = Class of vehicle (1= passenger car, 2= bus, 3= truck)

Taking into consideration cases in Japan and the fuel improvement rates, etc. surveyed by the Korea Research Institute for Human Settlements, vehicle operating costs on ordinary roads are assessed as 125% for passenger cars, 115% for buses, and 120% for trucks in comparison with the costs on expressways. Vehicle operating costs for each class of vehicle in 2007 are as

set out in Table Ⅲ-105.

〈Table Ⅲ-105〉 Vehicle Operating Costs for each Class of Vehicle at each Speed (Prices in 2007)

(Unit: KRW/km)

Class of Vehicle	Speed	Fuel	Engine Oil	Tire	Maintenance and Management	Depreciation Expense	Total
Passenger car	10	77.92	7.91	0.54	9.13	245.76	341.26
	20	46.98	6.58	1.00	10.78	209.46	274.80
	30	39.96	5.71	1.54	12.78	178.74	238.73
	40	36.09	4.82	2.24	13.27	150.81	207.23
	50	36.87	4.82	2.85	14.94	128.46	187.95
	60	38.27	4.82	3.62	15.77	115.89	178.38
	70	40.38	4.82	4.47	16.59	106.12	172.39
	80	41.38	4.39	5.39	18.26	94.95	164.38
	90	45.00	3.95	6.55	18.75	87.97	162.24
	100	48.52	4.82	7.79	19.91	81.83	162.87
	110	52.49	6.15	9.48	22.07	74.85	165.05
	120	58.85	9.22	11.26	24.07	66.18	169.59
Mini bus	10	92.87	8.03	0.42	9.17	573.94	684.43
	20	61.32	7.27	0.77	10.35	474.13	553.85
	30	47.86	6.50	1.25	11.40	389.29	456.30
	40	46.44	5.73	1.74	11.76	324.41	390.08
	50	38.99	5.73	2.24	12.93	279.49	339.37
	60	42.39	5.35	2.79	13.52	247.05	311.11
	70	44.80	4.98	3.49	14.12	222.09	289.47
	80	46.44	4.60	4.26	15.29	199.64	270.23
	90	50.93	4.21	5.16	16.82	183.17	260.29
	100	54.46	4.21	6.14	18.11	169.69	252.59
	110	61.32	4.60	7.46	19.64	154.72	247.74
	120	68.65	5.35	9.07	21.16	142.24	246.48
Large-size bus	10	225.58	15.72	1.11	14.24	356.41	613.07
	20	157.90	13.42	1.79	16.34	310.42	499.88
	30	103.54	11.47	2.63	18.22	252.94	388.79
	40	75.20	10.48	3.66	18.85	206.95	315.15
	50	70.97	9.50	4.90	21.57	175.90	282.84
	60	73.45	8.84	6.35	24.08	155.21	267.94
	70	83.10	8.18	8.02	25.13	141.41	265.85
	80	92.87	7.53	10.23	29.32	126.46	266.42
	90	103.54	8.51	12.78	32.04	111.52	268.39
	100	119.18	10.15	15.82	34.13	100.03	279.31
	110	140.35	12.44	19.21	36.23	90.82	299.05

Table Ⅲ-105 continued overleaf

Class of Vehicle	Speed	Fuel	Engine Oil	Tire	Maintenance and Management	Depreciation Expense	Total
Mini truck	10	91.55	8.50	0.63	12.92	257.69	371.28
	20	61.32	7.69	1.16	14.57	212.87	297.61
	30	47.50	6.88	1.89	16.06	174.78	247.12
	40	45.11	6.07	2.63	16.56	145.65	216.02
	50	50.93	6.07	3.37	18.21	125.47	204.06
	60	58.48	5.67	4.22	19.04	110.91	198.32
	70	70.97	5.27	5.27	19.86	99.71	201.07
	80	97.18	4.86	6.43	21.53	89.63	219.63
	90	101.86	4.46	7.79	23.68	82.23	220.02
	100	121.47	4.46	9.27	25.50	76.18	236.87
Medium-size truck	10	91.55	11.67	2.39	27.95	365.48	499.02
	20	61.32	10.54	3.78	29.78	309.24	414.65
	30	47.50	9.41	5.37	31.61	271.76	365.65
	40	45.11	8.28	7.35	33.60	229.59	323.94
	50	50.93	7.53	9.74	37.11	201.48	306.78
	60	58.48	6.78	12.11	39.70	180.38	297.45
	70	70.97	6.40	14.70	44.59	164.00	300.66
	80	97.18	5.64	18.27	48.87	149.93	319.90
	90	101.86	6.40	21.85	54.21	137.29	321.61
	100	121.47	7.16	26.22	58.04	127.91	340.80
Large-size truck	10	287.09	14.24	2.82	33.34	336.03	673.52
	20	225.58	12.73	4.90	42.11	276.02	561.34
	30	161.95	10.91	7.41	50.01	228.01	458.29
	40	119.18	9.70	10.53	52.65	192.02	384.07
	50	114.85	8.94	13.80	55.27	159.61	352.48
	60	128.90	8.03	18.25	61.42	138.01	354.61
	70	146.88	7.12	22.84	61.42	123.61	361.88
	80	170.70	5.91	29.08	70.19	108.01	383.89
	90	203.75	6.36	36.65	81.60	105.61	433.97
	100	242.92	7.12	44.96	90.37	94.81	480.17

B. Benefit of Travel Time Savings

The benefit of travel time savings is determined by multiplying the travel time on a link within the direct impact zone, by the traffic volume of each class of vehicle, as calculated with the results of trip assignment. In other

words, the total travel time expenses are computed by applying the total travel time calculated for each mode to the value of travel time by each class of vehicle for the case where a project is not implemented and for the case where the project is implemented, respectively, and then the difference between two cases shall be determined as the benefit of travel time savings. Changes in the revenue of tolls from a toll road in such case shall be excluded from the determination of the benefit of travel time savings.

The formula for the Valuation of Travel Time Savings (VOTS) for each year of analysis is as follows:

$$VOTS = VOT_{without\ project\ implemented} - VOT_{with\ project\ implemented}$$

Where, $$VOT = \left\{ \sum_{l} \sum_{k=1}^{3} (T_{kl} \times P_k \times Q_{kl}) \right\} \times 365$$

$T_{kl} = Travel\ time\ of\ each\ class\ of\ vehicle\ on\ a\ link\ l$

$P_k = Value\ of\ time\ of\ each\ class\ of\ vehicle$

$Q_{kl} = Traffic\ volume\ of\ each\ class\ of\ vehicle\ on\ a\ link\ l$

$k = Class\ of\ vehicle (1:\ passenger\ car,\ 2:\ bus,\ 3:\ truck)$

The value of travel time for each type of basic data in 2007 is as follows. The value of travel time for each class of vehicle shall be used after calibrating it to make it consistent with the auto occupancy in the basic data used, the ratios of business travel and non-business travel, and the base year of analysis. In particular, note that the updated data on the auto occupancy in the Seoul Metropolitan Area has been recently distributed subsequent to the "Study to Amend and Supplement Standard Guidelines for Preliminary Feasibility Studies of Road and Railroad Projects (5th ed.)."

<Table III-106> Value of Travel Time (in 2007)

(Unit: KRW/Unit, Hour)

Classification	Passenger car	Bus	Truck	Railroad per person
Nationwide	14,990	58,561	16,571	5,602
Seoul Metropolitan Area	10,844	53,681	16,571	4,867
Busan & Ulsan Metropolitan Area	9,497	64,870	16,571	4,407
Daegu Metropolitan Area	9,569	49,086	16,571	3,988
Gwangju Metropolitan Area	10,088	36,306	16,571	4,185
Daejeon Metropolitan Area	9,362	40,694	16,571	4,249
Jeonju Metropolitan Area	9,890	33,540	16,571	4,189

C. Benefit of Accident Costs Savings

The benefit of accident costs savings shall be determined by using the difference in traffic accident expenses between the case where a project is implemented and the case where the project is not implemented. In order to compute traffic accident expenses, the distance travelled (100 million units-km) on each type of road, such as an expressway, a national road, and a regional road, shall be computed by using the results of trip assignment and then the distance travelled shall be multiplied by the number of traffic accidents on each type of road, the number of casualties, and traffic accident expenses per casualty.

The benefit of accident costs savings for each year of analysis (the Valuation of Accident Costs Savings: $VACS_{road}$) is calculated in the following formula:

$$VACS_{road} = VAC_{without\ project\ implemented} - VAC_{with\ project\ implemented}$$

Where, $VAC_{road} = \sum_{t=1}^{3}\sum_{s=1}^{2}(A_{ts} \times P_s \times VL_t)$

A_{ts} = Number of casualties per accident per 100 million units per km for each type of accident on the road sector

P_s = Accident expenses for each type of accident
VL_t = 100 million units per year for each type of road, km
t = Type of road (1: Expressway, 2: Ordinary road, 3: Regional road)
s = Type of accident (1: Death, 2: Injury)

In cases of a road in the Seoul Metropolitan City or other Metropolitan Cities or a road in a *Si* or *Gun*, the traffic accident expenses shall be computed by applying the type of the directly connected road (limited to ordinary national roads and regional roads). If it is possible to collect data later about the number of persons killed and wounded separately per 100 million units per km by accidents on the roads in the Seoul Metropolitan City or other Metropolitan Cities or the roads in a *Si* or *Gun*, traffic accident expenses shall be computed by applying the standards applicable to the road at issue.

The number of accidents on each type of road and the traffic accident expenses on the road are as set out in the following table:

〈Table III-107〉 The Number of Traffic Accidents and the Number of Casualties on each Type of Road

Type of Road	Number of Accidents per km	Number of Persons Killed per 100 Million Units per km	Number of Persons Wounded per 100 Million Units per km
Expressway	1.09	0.79	16.97
Ordinary national road	2.49	3.11	107.27
Regional road	0.94	2.40	73.61
Road in Seoul or other Metropolitan Cities	4.86	-	-
Road in a *Si*/*Gun*	1.32	-	-

Note: Other roads excluded
Sources: 1) The National Police Agency, Traffic Accident Statistics, 2008
2) Ministry of Construction and Transportation, "Annal of Statistics of Road Traffic Volume in 2006," 2007

<Table III-108> Road Traffic Accident Expenses (in 2007)

(Unit: 10 thousands of KRW)

Classification		Killed	Wounded
Per person killed	Excluding PGS	41,944	519
	Including PGS	52,741	2,156
Per accident	Excluding PGS	2,595	
	Including PGS	4,159	

Notes: 1) Expenses, exclusive of PGS = Average net expenses (solatium, funeral expense, production loss, medical expense, and other expenses) + Traffic police expense + Insurance administrative expense
2) Apply the price index in 2007 (1.0257) to the standard expenses in 2006 for expenses per person killed or wounded, and apply the price index in 2007 (1.0488) to the standard expenses in 2005 for expenses per accident and PGS expenses.
3) For persons wounded, apply the average weight of PGS expenses.

Sources: 1) Road Traffic Safety Authority, "Estimation and Assessment of Road Traffic Accident Expenses in 2007," 2008, p.81
2) Korea Transport Institute, "Estimation of Traffic Accident Expenses in 2005," 2007, p78, p82

D. Benefit of Environmental Costs Savings

1) Valuation of Air Pollution Costs Savings

Air pollution costs shall be valuated by applying the unit requirement of air pollution costs depending upon the driving speed by using the driving speed and traffic volume computed as a result of trip assignment to each link within the direct and indirect impact zones of the project subject to analysis. In other words, air pollution costs for an individual link shall be determined by multiplying the results, obtained by multiplying the traffic volume of each class of vehicle on each link underlying the road network subject to analysis by the length of the link, by the unit requirement of air pollution costs for each class of vehicle based on the average speed on the link. In such cases, however, the driving speed on an expressway shall be determined again on the basis of the actual travel time, excluding toll rates. The results calculated in the above formula for all links shall be aggregated, and then the difference in the costs where a project is implemented and those where the project is not implemented

shall be determined as air pollution costs savings. The Valuation of Pollution Costs Savings (VOPCS) for each year of analysis is expressed in the following formula:

$$VOPCS = VOPC_{\text{without project implemented}} - VOPC_{\text{with project implemented}}$$

Where, $VOPC = \sum_{l} \sum_{k=1}^{3} (D_{lk} \times VT_{k} \times 365)$

D_{lk}= Units · per km per link (l), per class of vehicle (k)

VT_k= Air pollution costs for each class of vehicle (k) at the driving speed (km) on the link at issue

k= Class of vehicle (1= Passenger car, 2= Bus, 3= Truck)

The followings are the air pollution costs estimated for each class of vehicle at different driving speeds by applying coefficients of air pollutant emissions and the unit requirement of air pollution costs of each class of vehicle:

<Table III-109> Air Pollution Costs of each Class of Vehicle at Different Speeds (in 2007)

(Unit: KRW/km)

	Speed	CO	NOx	HC	PM	CO_2	Total
Passenger car	10	34.19	10.69	6.55	0.00	16.14	67.57
	20	15.09	6.13	2.25	0.00	10.91	34.38
	30	9.35	4.43	1.21	0.00	8.69	23.68
	40	6.65	3.52	0.77	0.00	7.39	18.32
	50	5.11	2.94	0.55	0.00	6.52	15.11
	60	4.13	2.53	0.41	0.00	5.88	12.96
	70	3.44	2.24	0.32	0.00	5.39	11.39
	80	2.94	2.01	0.27	0.00	5.00	10.21
	90	2.56	1.83	0.22	0.00	4.68	9.29
	100	2.25	1.69	0.19	0.00	4.41	8.54
Mini bus	10	8.75	16.96	2.04	6.13	16.83	50.71
	20	6.07	11.35	1.19	4.39	11.54	34.54
	30	4.90	8.97	0.87	3.60	9.33	27.68
	40	4.21	8.21	0.69	3.14	8.16	24.41
	50	3.74	7.59	0.58	2.99	7.41	22.31
	60	3.40	7.50	0.50	3.20	7.10	21.71
	70	3.14	7.97	0.45	3.43	7.20	22.17
	80	2.92	8.98	0.40	3.65	7.73	23.69
	90	2.75	10.56	0.37	3.88	8.68	26.24
	100	2.60	12.67	0.33	4.13	10.07	29.80
Medium-size bus	10	31.98	68.17	11.84	18.65	21.40	152.04
	20	20.80	44.81	7.56	10.81	16.47	100.45
	30	16.18	35.05	5.81	7.86	12.60	77.51
	40	13.54	29.45	4.82	6.27	9.79	63.87
	50	11.78	25.72	4.17	5.75	8.04	55.47
	60	10.52	23.05	3.71	5.38	7.35	50.01
	70	9.56	20.99	3.36	5.38	7.72	47.02
	80	8.81	19.36	3.08	5.75	9.15	46.15
	90	8.18	20.74	2.86	6.50	11.65	49.92
	100	7.67	26.80	2.67	7.61	15.20	59.94
Large-size bus	10	57.92	239.01	16.25	41.23	44.87	399.28
	20	40.69	180.62	10.18	29.90	34.95	296.34
	30	33.10	153.33	7.75	24.78	30.20	249.15
	40	28.58	136.50	6.38	21.68	27.23	220.38
	50	25.51	124.74	5.49	19.55	25.12	200.41

Table Ⅲ-109 continued overleaf

(Unit: KRW/km)

	Speed	CO	NOx	HC	PM	CO_2	Total
Mini truck	10	10.79	23.25	2.11	6.43	18.34	60.91
	20	8.26	14.26	1.47	5.42	12.42	41.84
	30	7.06	10.71	1.19	4.91	9.89	33.77
	40	6.32	8.27	1.04	4.58	8.50	28.70
	50	5.79	7.05	0.92	4.34	7.87	25.97
	60	5.40	6.20	0.84	4.15	7.63	24.23
	70	5.09	5.71	0.77	4.00	7.78	23.35
	80	4.83	5.60	0.73	3.86	8.33	23.35
	90	4.62	5.85	0.68	3.76	9.26	24.17
	100	4.43	6.46	0.65	3.66	10.59	25.79
Medium-size truck	10	51.85	113.73	21.63	23.92	27.98	239.10
	20	32.61	77.61	13.79	15.96	22.96	162.92
	30	24.86	62.90	10.60	12.60	18.80	129.77
	40	20.51	54.64	8.79	10.66	15.52	110.13
	50	17.67	48.01	7.61	9.35	13.11	95.75
	60	15.65	43.04	6.76	7.93	11.58	84.97
	70	14.11	39.72	6.12	7.10	10.93	77.96
	80	12.90	38.04	5.61	6.63	11.14	74.33
	90	11.93	38.02	5.20	6.54	12.22	73.91
	100	11.12	39.64	4.85	6.82	14.17	76.60
Large-size truck	10	63.23	315.68	21.81	70.21	133.26	604.19
	20	37.83	242.86	14.73	52.49	101.71	449.63
	30	28.01	208.33	11.71	44.26	86.85	379.16
	40	22.63	186.85	9.59	39.23	77.63	335.93
	50	19.18	171.72	8.77	35.72	71.17	306.57
	60	16.76	160.28	7.91	33.09	66.28	284.32
	70	14.95	151.20	7.25	31.01	62.42	266.84
	80	13.54	143.75	6.72	29.32	59.25	252.57
	90	12.41	137.49	6.28	27.91	56.59	240.69
	100	11.47	132.11	5.93	26.69	54.32	230.52

2) Valuation of Noise Costs Savings[17)]

In order to estimate the value of noise, it is essential to acquire information about variances in the noise caused by the implementation of a project and the unit requirement per unit noise. After obtaining the difference at the level of noise generated without and with the project implemented, the impact of noise caused by the implementation of the project is translated into a monetary value by multiplying the unit requirement of the costs of maintenance and management (costs of installing noise barriers) as necessary for the reduction of the unit noise volume (1dB), applying the maintenance cost approach.

The Valuation of Noise Costs Savings (VONCS) for each year of analysis for a project is expressed in the following formula:

$$\text{VONCS} = \text{VONC}_{\text{without project implemented}} - \text{VONC}_{\text{with project implemented}}$$

Where, $VONC = \sum_i \sum_j (P \times l_{ij} \times L_{ij})$

P: Unit requirement of noise costs presented before
l_{ij}: Length of the route at issue
L_i: Predicted level of noise
i: Category of road or railroad (ordinary road, expressway, ordinary railroad, high-speed railroad, or such)
j: Individual link in the impact zone

In order to apply this formula, it is necessary to acquire information about the unit requirement of the value of noise, the length of the route at issue, and the level of noise. In principle, the unit requirement of the value of noise, presented by the guidelines, shall be applied depending upon whether the section is an urban section or a rural section, but the average value shall be applied if

17) For more discussion on the valuation of noise costs savings, see "A Study on Environmental Cost Estimation in Preliminary Feasibility Study of Public Investment Projects" (Korea Development Institute, 2001).

it is unclear whether the section is an urban section or a rural section. The values presented by technical analysis of the project can be used as the information about the length of the route of the project, and the data about attributes at the time of the traffic demand analysis can be utilized for the length of each link.

Finally, the estimates obtained by applying the above-mentioned data about the traffic demand analysis and the formula for the estimation of the level of noise can be used as information about the estimated level of noise. The formula for the estimation of the level of noise shall be carefully applied, because there are differences between an ordinary road and an expressway or between an ordinary railroad and a high-speed railroad. For more details about the formula for the estimation of noise and the method of estimation, refer to the guidelines for the preliminary feasibility study.

On the other hand, if a project is for the construction of a new road or railroad, it is impossible to apply the formula because it is impossible to observe traffic without the project implemented. In such cases, apply 45 dB to a rural section as the level of noise without the project implemented and 55 dB to an urban section. The noise costs applied in these Guidelines are based on the estimated costs of reducing the probable maximum level of noise, and thus, only the level of noise of traffic volume at peak hours shall be estimated.

SECTION 7 Economic Analysis

1. Overview

B/C (Benefit/Cost ratio), NPV (Net Present Value), IRR (Internal Rate of Return), etc. are adopted as criteria for the assessment of economic efficiency.

First, B/C is the ratio of discounted benefits and costs valuated for each item. In other words, it is the value computed by translating the costs and

benefits that may be incurred or generated in the future into present values in the base year and then dividing the present value of the benefits by the present value of the costs, and it is generally assessed as economically efficient if the B/C $\geq$ 1.

$$B/C = \sum_{t=0}^{n} \frac{B_t}{(1+r)^t} \; / \; \sum_{t=0}^{n} \frac{C_t}{(1+r)^t}$$

Where, B_t: Benefits in year t, C_t: Costs in year t, r: Discount rate (interest rate), n: Useful years of the traffic project (period subject to analysis)

Secondly, NPV is a value computed by discounting all accompanying costs and benefits to present values in the base year and then subtracting gross costs from gross benefits, and it is generally assessed as economically efficient if the NPV $\geq$ 0.

$$NPV = \sum_{t=0}^{n} \frac{B_t}{(1+r)^t} - \sum_{t=0}^{n} \frac{C_t}{(1+r)^t}$$

Thirdly, IRR is a discount rate that makes the present value of benefits equal to the present value of costs, and it is assessed as economically efficient if the IRR is greater than social discount rate.

$$IRR = \sum_{t=0}^{n} \frac{B_t}{(1+r)^t} = \sum_{t=0}^{n} \frac{C_t}{(1+r)^t}$$

〈Table III-110〉 Comparison of Approaches for Economic Analysis

Analysis Approach	Assessment	Advantage	Disadvantage
Benefit/Cost ratio (B/C)	B/C ≥ 1	• Easy to understand, possible to consider the scale of project	• Possibility of creating an error of choosing mutually exclusive options
Net Present Value (NPV)	NPV ≥ 0	• Presents clear criteria for choosing options • Presents the present value of benefits that may be generated in the future • Considers marginal net present value • Possible to use for other analysis	• Hard to understand • Possibility of creating an error in determining the priority of options
Internal Rate of Return (IRR)	IRR ≥ r	• Possible to measure profitability of a project • Easy to compare with other options • Easy to understand the process and results of assessment	• Discounts the absolute scale of project • Probable to produce several internal rates of return simultaneously

2. Key Assumptions in Economic Analysis

□ Social discount rate

Like the preliminary feasibility study, the real discount rate of 5.5% shall apply.

□ Period of analysis

For the purpose of the economic efficiency assessment, all benefits and costs shall be discounted to be translated into values at an identical time. Since the

time when a benefit or cost accrues differs from the time when another benefit or cost accrues, benefits and costs shall be translated into values at an identical time by applying the discount rate to make it possible to compare them with one another.

The period of analysis that shall be applied to a road project is 30 years after opening. However, the analysis shall be based on the assumption that the traffic demand and benefits from the last year through the final year of analysis, furnished by the basic data used in the analysis, are equal. For example, the period of analysis of a road project that opens to the public in 2015 in a region ends in 2044, 30 years after opening, and the data available about regions throughout the country in October 2008 are furnished until 2036, and thus, the analysis shall be based on the assumption that benefits from 2036 through 2044 are equal.

□ Annual distribution schedule of project costs and operating costs

In order to conduct the economic analysis, a schedule for distribution of project costs, operating costs, and other expenses shall be established. The time schedule proposed by the concessionaire shall be taken into consideration in establishing the annual distribution schedule of project costs. If the concessionaire has not presented a plan for the investment of lot purchase costs, it shall be planned to disburse 30% and 70% of the lot purchase costs in two years at the early stage of the project, respectively, in accordance with the guidelines for preliminary feasibility study. If it is found, as a result of a review on the time schedule proposed by the concessionaire for the project, that the time schedule for the investment of lot purchase costs is not appropriate, the plan shall be analyzed after distributing the costs reasonably.

As regards operating costs, the annual operating costs determined by the VFM test shall be applied.

□ Treatment of residual value, taxes, and transfer payments

The acquisition cost of land, invested as lot purchase costs for a road

project, except compensation for obstructions, shall be accounted for as a residual value, which shall be deducted from costs in the final year of analysis. Only the acquisition cost of land out of the residual value shall be reflected in the final year of analysis as a negative (-) cost.

In the economic analysis, only pure economic costs, excluding transfer payments, such as taxes, shall be determined as costs. Transfer payments are payments transferred from one place to another place, and thus, may be costs or benefits in financial profitability analysis depending upon who the business entity is but do not have any impact on the State's financial resources in the economic analysis. Since it is difficult to determine details of taxes assessed on each type of investment in the VFM test, the project costs, exclusive of value-added tax, shall be regarded as economic costs and shall be reflected as costs of the economic analysis.

3. Findings of Economic Analysis

The findings of the economic feasibility assessment shall be presented in a specified form to secure consistency between projects and make it easy to compare with other projects.

A summary and details of the findings of the economic analysis shall be presented by referring to the following example.

〈Table III-111〉 Summarized Findings of Economic Analysis (Example)

Description	Proposal	VFM Test	
		PSC User Fee	PFI Toll Rate
Base year			
Discount rate (%)			
B/C			
NPV (KRW 100 million)			
IRR(%)			

<Table III-112> Findings of Economic Analysis (Example)

(Base year: 0000)

Year	Cost					Benefit					Present Value		
	Cons-truction cost	Inci-dental cost	Lot purchase cost	Operating cost	Sub-total	Vehicle operating costs	Travel time expenses	Traffic accident expenses	Environ-mental costs	Sub-total	Cost	Benefit	Benefit /Cost
2007													
2008													
....													
2044													
Total													

B/C= NPV= IRR=

Note: The residual value of the acquisition costs of land out of lot purchase costs shall be reflected as a negative (-) value in the final year.

4. Sensitivity Analysis

There are many uncertainties in the calculation of benefits and costs in the economic efficiency assessment used for assessing feasibility. Sensitivity analysis, widely used in order to address with such uncertainties, is a method for ascertaining how economic efficiency changes, when an essential variable that may affect invested costs or economic efficiency, such as total project costs, operating costs, traffic demand, and discount rate, changes in a certain amount.

The sensitivity analysis on such variables are also conducted in the VFM test. However, the scope and method of the sensitivity analysis may vary according to the characteristics of the project at issue.

SECTION 8 Policy Analysis

Although the policy analysis is not included in the economic analysis, the policy analysis may be conducted, if necessary in the nature of an individual project, as an element of analysis that shall be taken into consideration in assessing the feasibility of the project.

In principle, the policy analysis shall be conducted in accordance with the guidelines relevant to the preliminary feasibility study. The subject matter and details of assessment presented by the "Study to Amend and Supplement General Guidelines for Preliminary Feasibility Studies (5th ed.)" are briefly introduced as follows.

According to the General Guidelines, the subject matter of assessment subject to the policy analysis is categorized into four subcategories to form the structure of assessment: Balanced regional development; consistency with and commitment to policy; risk factors in implementing the project; and the subject matter of assessment specific to the project.

〈Table Ⅲ-113〉 Categorization of Subject Matter in Policy Analysis

Sub-category	Subject Matter of Assessment
Balanced regional development	▪ Level of regional underdevelopment ▪ Ripple effects on regional economy ▪ Additional subject matter of assessment (optional)
Consistency with policy and commitment to implementation	▪ Consistency with relevant plans and the direction of policy ▪ Commitment to and preference for the implementation of the project ▪ Degree of preparedness for the project ▪ Additional subject matter of assessment (optional)
Risk factors in implementing the project	▪ Possibility of procuring financial resources ▪ Environmental impacts ▪ Additional subject matter of assessment (optional)
Subject Matter of assessment specific to the project	▪ Additional subject matter of assessment (optional)

Source: Korea Development Institute, "A Study to Amend and Supplement General Guidelines for Preliminary Feasibility Studies (5th ed.)," 2008

The subject matter of assessment in the sub-category "Balanced regional development" includes the level of regional underdevelopment and the ripple effects on regional economy. In addition, the subject matter of assessment relevant to the balanced regional development and specific to the project is included. The main purpose of the analysis is to prevent exacerbating imbalance between regions by making it possible to implement a public investment project that has great ripple effects on an underdeveloped region, although the economic efficiency of the project is rather low. The level of regional underdevelopment can be analyzed by using regional underdevelopment indexes, while the ripple effects on a region by the implementation of a project can be analyzed by using the Multi-Regional Input-Output Model (MRIO).

The subject matter of assessment in the sub-category "Consistency with policy and commitment to implementation" includes consistency with relevant plans and the direction-setting for policy, the commitment to and preference for

the implementation of the project, the degree of preparedness for the project, and additional relevant subject matter of assessment. "Consistency with relevant plans and the direction of policy" is the item for assessing whether the project at issue has been implemented with consistency to policy by analyzing whether the project is reflected in the higher-level or relevant plan. The "commitment to and preference for the implementation of the project" is to assess the degree of preference for or objection against the project of the competent ministry or agency, the local government, local residents, and other entities who have interest in the project.

The subject matter of assessment in the sub-category "Risk factors in implementing the project" includes the possibility of procuring financial resources, environmental impacts, and additional relevant subject matter of assessment. The following matters are taken into consideration in assessing the "possibility of procuring financial resources." Generally, financial resources necessary for the implementation of a public investment project are procured from national funds by issuing bonds or inviting private investment. If the State is able and willing to provide adequate financial resources necessary for the implementation of a project, and the main concessionaire has an adequate financial standing to issue bonds in the market or the project has attractive incentives to induce private enterprises to participate in the project, any big problem will not arise in the possibility of procuring financial resources.

Considering financial conditions of local governments, a problem, such as the suspension of a project or delay in construction, may arise, if the project is expected to become a financial burden. In cases of a project implemented with national funds, if the amount of the project cost is excessively great in comparison with the scale of the budget for the relevant sector, whether or not the plan for procuring financial resources can be realized as expected shall be reviewed based on the scale of the budget for the relevant sector. If a project is implemented as a PPP project, Government subsidies, such as construction subsidies and compensation costs, are required. Thus whether or not such Government subsidization can be realized as expected shall be reviewed based

on the scale of the budget for the relevant sector.

The assessment of "environmental impacts" is to roughly assess the environmental effects of the implementation of the project at issue. It is to make a decision on whether to implement a project, recognizing the probability of the occurrence of environmental problems, and to encourage to carry out an in-depth analysis at the same time, informing of the probable occurrence of environmental problems at subsequent stages.

Finally, the subject matter of assessment in the sub-category "Subject matter of assessment specific to the project" includes the subject matter of assessment that shall be specially taken into consideration in the assessment of the project at issue, although they are excluded from the preceeding three categories.

SECTION 9 Overall Feasibility Assessment

1. Standards for Feasibility Assessment

As discussed above, feasibility assessment, stage 1 of the VFM test of a PFI, is conducted basically by applying the methodology for the preliminary feasibility study applicable to government-financed projects. Feasibility assessment is the process of assessing whether the project at issue can ensure socioeconomic feasibility of the State by aggregating the results of the economic analysis and those of the policy analysis. The most important ground for assessment in the economic analysis at this stage is whether the B/C ratio is at least 1.0. If the B/C ratio is at least 1.0, it is interpreted to ensure socioeconomic feasibility.

According to the "Study to Amend and Supplement Standard Guidelines for Preliminary Feasibility Studies of Road and Railroad Projects (5th ed.)," however, if the B/C ratio of the best option is at least 0.9 as a result of the economic analysis, it is permitted to review the potential for a public-private

partnership. In other words, if the B/C ratio is at least merely 0.9, not 0.1, it is permitted to select a project as one eligible for the checklist of the review on the potential for a public-private partnership and to assess the feasibility in the legal and strategic aspects and the possible type of public-private partnership.[18)]

The reason why the potential for a public-private partnership in a project, where the B/C ratio is at least 0.9, is reviewed in the preliminary feasibility study is that there is still some possibility to ensure feasibility because the project at issue can probably secure the B/C ratio of at least 1.0 actually in the future, although the B/C ratio of the project fails to reach or exceed 1.0 due to an "uncertainty or error" in the test that may occur in the course of analysis, if it is taken into consideration that the margin of "uncertainty or error" is approximately 10%. If social or economic situation changes, the period of analysis, social discount rates, and various development project, which are utilized in the feasibility analysis, and assumptions applied to the analysis may possibly change as well, and thus, the possibility of securing the feasibility of a project is reviewed, if the B/C ratio of the project is at least 0.9, in order to be more circumspect in the feasibility assessment.

Even without expressly mentioning the uncertainty of analysis, since proposals made by PPP project concessionaires are generally accompanied with highly specific plans, it is highly probable that the costs may be lower than the costs applied to the feasibility assessment and there is a relatively lower risk of variation in costs in the course of the implementation of the project in the future. From this point of view, declaring right away that a PPP project fails to ensure the feasibility for the implementation of the project on the ground that the B/C ratio in the economic analysis fails to reach or exceed 1.0 may lead to an imprudent conclusion. In particular, if the project at issue has a high feasibility in the aspect of policy, more discreet attitude is required in assessing the feasibility for the implementation of the project.

Conclusively, if the results of the economic analysis shows the B/C ratio of

18) KDI, "A Study to Amend and Supplement Standard Guidelines for Preliminary Feasibility Studies of Road and Railroad Projects (5th ed.)," 2008, p409

a project is at least 0.9 in conducting the feasibility assessment of any PPP project, the policy analysis and AHP analysis shall be conducted and the feasibility for the implementation of the project shall be assessed finally by aggregating the results from such analyses. Since the preliminary feasibility study of a government-financed project at present includes the policy analysis and AHP analysis, irrespective of the B/C ratio, the results therefrom are reflected in the feasibility assessment, and the potential for a public-private partnership in a project is reviewed if the B/C ratio of the project is at least 0.9. Therefore, it is desirable in the aspect of consistency to conduct an overall assessment of the feasibility of a project through the AHP analysis also in the feasibility assessment of a PPP project.

In order to assess the feasibility of a project in accordance with more stringent standards, the policy analysis and AHP analysis shall be conducted only if the B/C ratio of a PPP project is at least 0.9, and then the final feasibility assessment shall be conducted by aggregating the results of such analyses. If a project is assessed as feasible as a result of the overall assessment, stage 2, the VFM assessment of the PFI, shall follow.

2. Overall Feasibility Assessment through AHP Analysis

In order to make a final decision on the overall feasibility regarding whether to implement a project by aggregating the results of the economic analysis and the policy analysis, the AHP presented in the Study to Amend and Supplement Standard Guidelines for Preliminary Feasibility Studies of Road and Railroad Projects (5th ed.) is used at this stage.

The AHP is carried out through the process of (1) conceptualizing of assessment, (2) establishing criteria for assessment and structuring the hierarchy, (3) weighting criteria for assessment, (4) scoring priorities of alternatives, (5) synthesizing overall priorities, (6) feedback, and (7) concluding overall assessment and recommendations of policy.

The selection of assessors who will participate in the AHP assessment is very important to secure expertise and objectiveness in the results of assessment. Each assessor shall be an expert in relevant areas with adequate expertise in the project subject to assessment and shall be able to assess the project as objectively as possible from the viewpoint of public interests in the PPP project implemented in accordance with the PPP Act.

Specialists from KDI PIMAC and a group of experts that participate in the analysis of the project at issue, for example, the project manager (PM) of the research on the project and a group of experts in demand, costs, finance, and accounting, shall participate in the assessment like the cases of preliminary feasibility study. Generally, seven to eight specialists shall participate in the AHP assessment, and the weighted sum shall be extrapolated from the assessment with results answered by five to six persons, except grades given by assessors who give the highest grade and the lowest grade.

The outcome obtained finally through the AHP analysis is the weighted sum calculated for each alternative by multiplying the weight under the assessment criteria for the alternative "project to be implemented" and the alternative "project not to be implemented" by the grades of the alternative for the criteria. If the alternative "project to be implemented" receives a relatively higher weighted sum (a grade exceeding 0.5) than the alternative "project not to be implemented," a conclusion that the project is feasible can be reached. The reason why a conclusion is drawn in such mechanical way is that the final results of the test has the nature of basic data that can be utilized in making a binary decision on whether or not to allocate a budget for implementing the project continuously.

Even where the alternative "project to be implemented" receives a relatively higher weighted sum (a grade exceeding 0.5) than the alternative "project not to be implemented," a decision shall be made by taking the following constraints additionally into comprehensive consideration. First, there is a case where assessors fail to reach a consensus. In such cases, it is considered more desirable to describe each assessor's opinion and the causes of differences in

assessors' opinions on the report, rather than to draw a binary conclusion on whether to implement the project. Secondly, there is a case where it fails to secure the robustness in decision-making because the difference between the alternative "project to be implemented" and the alternative "project not to be implemented" in the results of weighted sums is insignificant. The question often raised when it is intended to decide whether to implement a project on the ground of the weighted sum of AHP is "whether the difference between 0.51 and 0.49 in the weighted sum of AHP is a significant difference enough to justify a binary conclusion on whether or not a project is feasible." Likewise with preliminary feasibility study, a shadowed zone shall be set up in order to make a careful approach in making a final decision, considering such question.

$$0.5 - 0.05 < \text{AHP weighted sum} < 0.5 + 0.05,$$
$$\text{That is, } 0.45 < \text{AHP weighted sum} < 0.55$$

The shadowed zone means a zone that shows that the results of the weighted sum at present may be overturned, if the composition of the research team changes. In other words, the research team needs a careful approach in drawing an overall conclusion through the AHP analysis when the results fall on the shadowed zone in Table Ⅲ-114. For details relating to this issue, refer to the Study on the Standard Guidelines for the Preliminary Feasibility Studies of Road and Railroad Projects (5th ed.).

〈Table III-114〉 Conclusion according to Level of Assessors' Consensus and AHP Grades

Weighted Sum / Implemented : Not Implemented	AHP < 0.45	0.45 ≤ AHP <0.5	0.5≤ AHP <0.55	0.55 ≤ AHP
4 : 0	-	-	Feasible	Feasible
3 : 1	Feedback	Very cautious	Slightly cautious	Feasible
2 : 2	AHP<0.42 Not feasible AHP>0.42 Slightly cautious	Cautious	Cautious	AHP>0.58 Feasible AHP<0.58 Slightly cautious
1 : 3	Not feasible	Slightly cautious	Very cautious	Feedback
0 : 4	Not feasible	Not feasible	-	-

Notes: 1) "Implemented : Not Implemented" shows the ratio of the number of assessors for the project to be implemented to the number of assessors for the project not to be implemented (based on 4 persons).

2) AHP shows the AHP weighted sum for an alternative for the project.

3) "-" shows that there is nothing relevant.

CHAPTER IV

DETAILED GUIDELINE FOR VALUE-FOR-MONEY TEST OF PRIVATE FINANCE INITIATIVE

If it is found at stage 1, "feasibility assessment," that a project ensures feasibility, stage 2, "value-for-money test of the private finance initiative," begins. The value-for-money (VFM) test is the process of choosing the best set of costs and the quality of services for a specific project by comparing a public sector comparator (PSC), in which case the project is to be implemented by the Government, with a private finance initiative (PFI), in which case the project is to be implemented by the private sector. The VFM test is for selecting a reasonable and economic alternative for costs through comparative analysis of the Government share of costs in two alternatives on the assumption that two alternatives provide services of equal quality. The alternative selected as reasonable and economic at this stage is defined as the "alternative with VFM."

The VMF test consists of the quantitative VFM analysis and the qualitative VFM analysis. The quantitative VFM analysis is to translate total costs of a PSC and a PFI into present values and compare the costs on the government's position. The qualitative VFM analysis is to analyze qualitative effects that can be obtained through a project when a PPP project is implemented. The VFM of a public-private partnership is assessed by aggregating the results of the quantitative VFM analysis and the results of the qualitative VFM analysis.

SECTION 1 Quantitative VFM Analysis

1. Basic Assumptions for Analysis

In order to conduct the quantitative VFM analysis, it is necessary to determine two alternatives. The alternative based on the assumption that the project at issue is to be implemented directly by the Government is called the Public Sector Comparator (PSC), while the alternative based on the assumption that the project at issue is to be implemented as a PPP project is called the Private Finance Initiative (PFI).

The revenue from the operation of a PSC is determined by applying PSC user fees to the demand applied in the feasibility assessment, while the costs are determined by applying the successful bid rate to the costs for the feasibility assessment. In cases of a PFI, the figures on the project proposal presented by the project proposer are used as they are as many as possible, and the demand re-estimated in this test based on PFI toll rates is applied as forecasted demand.

The time extent of the quantitative VFM analysis consists of the construction period and the free use period suggested in the proposal. In cases of a road project, the free use period under the proposal is applied as the free use period for the VFM quantitative analysis, which is generally 30 years. The amounts that the Government shall pay in cash for two alternatives are calculated item by item, based on the life cycle cost (LCC) during the entire project period, including the construction period and the period of operation, then compared with one another after they are translated into present values.

The basic assumptions for a PSC and a PFI in determining the LCC for 30 years item by item are as set out in Table Ⅳ-1.

<Table Ⅳ-1> Basic Assumptions in Analysis

Description	PSC	PFI
Construction period	Applies the terms proposed	Applies the terms proposed
Operation period	Applies the terms proposed	Applies the terms proposed
Discount rate	5.5% (real)	5.5% (real)
Amount procured with national bonds	Construction cost	Government subsidies during the construction period
Interest rate for national bonds	Weighted average interest rate for national bonds maturing in 5 years for 1 year after the filing date of an official letter	Weighted average interest rate for national bonds maturing in 5 years for 1 year after the filing date of an official letter
Conditions of redemption	Coupon bonds maturing in 5 years	Coupon bonds maturing in 5 years
Price index	Applies the terms proposed	Applies the terms proposed

The costs required during the construction period, out of the government's share of costs in a PSC and a PFI, are assumed to be procured by issuing national bonds. National bonds are assumed to mature in five years, and the amount of national bonds issued shall be equivalent to the amount of the project cost (for the PSC) or the Government subsidies (for the PFI) invested each year. Based on the assumption that national bonds are issued, the interest expense is incurred from the time of issuance until the principal is paid off after maturity, and cash flow therefrom occurs at the time interest is paid and the time the face value is repaid, not the time of investing the project cost. Since all costs procured by issuing national bonds are invested at the end of each year, the interest for national bonds accrues at the end of the following

year, and thus, no interest expense accrues in the first year of the project.

The weighted average rate calculated by applying the rates of 4/10, 3/10, 2/10, and 1/10 respectively from the latest quarter shall be used as the interest rate for national bonds, dividing the previous one year from the day on which the competent authority requests the review on the proposal into 4 quarters.

Since the cash flow used in the VFM analysis is based on constant amounts, it is necessary to determine ordinary costs and then translate the prices into constant amounts, if it is necessary for determine ordinary costs. The price indexes on the proposal shall apply as price indexes applicable to the determination of ordinary costs. The financing cost of issuing national bonds shall be also presented after determining ordinary costs and then translating the costs into constant amounts.

A. Setting Discount Rates

Setting a discount rate is an important issue in the quantitative VFM analysis. The Detailed Guideline for the VFM Test, which was amended in January 2007, presents that the LCC of each alternative for the purpose of the VFM analysis is determined with constant amounts and the present value of the government's total share of costs in each alternative is discounted by applying the financial real discount rate suggested by the preliminary feasibility study.

The Guidelines for the Preliminary Feasibility Studies, published in 2004, presents the method of determining financial real discount rates as follows, and the financial real discount rates are adjusted by reflecting the economic situation.

<Table Ⅳ-2> Determination of Nominal Financial Discount Rates

Discount Rate	Calculation Process
Cost of capital for liabilities	• Long-term risk-free interest rate (r_f) = 6.8% (reflect long-term liquidity premium of 1.1%) • Cost of capital for liabilities (r_b) = r_f + Additional interest rate for liabilities (2.0%) = 8.8%
Cost of capital for equity shares	• Long-term risk-free interest rate (r_f) = 6.8% • Market risk compensation rate ($r_m - r_f$) = 6% • Assets beta (β_u) = 0.515 • Target ratio of liabilities = 200% (Ratio of liabilities = 66.7%) • Equity shares beta(β_s) = $\beta_u \times [1 + (1 - T) \times (\text{Target ratio of liabilities})]$ = 0.515 × (1 + (1-0.275) × 2.0) = 1.262 • Cost of capital for equity capital (r_s) = $r_f + \beta_s \times [r_m - r_f]$ = 6.8% + 1.262 × (6%) = 14.4%
Weighted average cost of capital	• Weighted average cost of capital (r_0) = $[(1 - T) \times r_b \times L] + [r_s \times (1 - L)]$ = (1-0.275)×(8.8)×(0.667) + (14.4)×(1-0.667) = 9.1%

In the quantitative VFM analysis, the financial discount rate determined for the preliminary feasibility study is applied. The real discount rate of 5.5% is applied by applying the inflation rate of 3% to determine constant prices. The financial discount rate for the preliminary feasibility study is the rate of return on investment by the private sector, determined by applying the Capital Asset Pricing Model (CAPM) and can be said to be a concept similar to the rate of return on a PPP project, and real rates of return on the latest PPP projects are formed at the level of 5% to 6%. Also in Australia, discount rates determined by CAPM are applied to general projects as shown in the following table.

〈Table Ⅳ-3〉 Discount Rates in Australia (General Rule)

- Project rate = Risk-free rate + (R_m- R_f) X beta
- Risk-free rate: Average rate for Commonwealth Bond maturing in 10 years during the latest 6 months
- Risk premium (R_m- R_f): 6% suggested by Professor R. Officer
- Beta: The guidelines suggest betas for 3 different bands, but mention that differential considerations are required for each project.

B. Assumptions on Government Financing

In the VFM analysis, the government's share of costs in a PSC and a PFI during the construction period are determined and compared with one another. The determination of the government's share of costs during the construction period is based on the assumption that the Government raises funds by issuing national bonds maturing in five years. Since a PPP project is implemented, when a project is subordinate to a government-financed project in the priority in the government's investment, the analysis is based on the assumption that national bonds are issued without investing the government's funds. The financing cost incurred in such case is an interest expense in addition to the principal to be borne by the Government. Since the Government raises funds through taxes + bonds (with various maturities) + charges, etc. actually when it implements an investment project and grants subsidies for the project with such resources, it is reasonable to calculate an accurate financial cost in connection with such financial structure of the Government. Where a local government was the competent authority for a project in the past, the financial cost was calculated by applying the interest rate for bonds issued by the local government. However, there are the following limitations in applying the interest rate for local government bonds.

Part of subsidies for a project of a local government is also financed by the central government with national funds, not with the local expenditure. The

interest rate for bonds issued by a local government is higher than the interest rate for national bonds, because the credit rating of the local government is reflected in the interest rate. Bonds issued by a local government have lower marketability because there are few records of issuance,[19] and the interest rate applicable to a nearby local government is applied *mutatis mutandis*, if the competent authority has no record of issuance.

Moreover, the interest on national bonds is paid by coupon bonds (applying simple interest), while the interest on local government bonds is paid by compound bonds, and thus, there is a difference in the method of calculating interest. The Guidelines for the VFM Test provides that financing costs are determined by the method of coupon bonds, showing a disparity in actual practice and application. National bonds are traded through competitive bids in the Bank of Korea and there is no issuance fee, while issuance fees are charged on local government bonds and local government bonds have a disadvantage that it is impossible to fix a certain level of fees, because issuing expenses may vary depending upon the bond market conditions, the volume of issuance, the issuing local government, etc.

In order to reflect realities accurately, the government's share of costs shall be divided into national funds and local expenditures, and then the amounts calculated by applying coupon bonds and compound bonds at the ratio of the division shall be aggregated, assuming national funds as national bonds and local expenditures as local government bonds. However, this method needs an additional assumption regarding the timing to invest, etc., as the amount is determined by dividing it into national bonds and local government bonds. Moreover, analysis shows that there is slight impact on analysis because the difference in the VFM due to a difference in the manner of paying interest is not significant.

Taking into consideration the fact that the impact on results is insignificant in comparison with the complexity of the calculation method, the competent

19) The share of national bonds in the bond market was 32.9% in 2008, but the share of local government bonds is 1.5%.

authority, even if it is a local government, may determine financing costs based on the assumption of national bonds. A PSC is a hypothetical cost alternative for comparison with a private proposal, it is desirable to apply national bonds uniformly, taking into consideration the representativeness, marketability, and the difference in issuance fees. If national bonds are applied and so the calculation of financing costs can be based on coupon bonds, the calculation method becomes simple, and both a local government's projects and the central government's projects can be assessed with the same standards.

The operating cost of a PSC and the Government subsidies (payments of user fees) for a PFI during the period of operation are determined on the assumption that a certain amount is paid from Government funds each year.

2. Determination of PSC and PFI

Both a PSC and a PFI are prepared in the form of cash flow based on the time of accrual of each cost and finally determined with the present value in the base year of analysis. For equal comparison, a cost alternative is determined based on the construction period and free use period suggested in the project proposal.

A. Unsolicited Projects

In the general type of an unsolicited project, the project under the proposal is set as the reference project, and a PSC_P is prepared as the public sector comparator matching with PFI_P,[20] the project proposal presented by the private sector to conduct the VFM test.

With respect an unsolicited project for which the government's alternative is available, however, not only PSC_P and PFI_P with the reference project based on the proposal but also PSC_G and PFI_G[21] with the reference project based on

20) As explained in Section 3 of Chapter Ⅱ, the subscript "P" stands for "Private" and means that the reference project is set according to the proposal presented by the private sector.

21) The subscript "$_G$" stands for "Government" and means that the reference project is established by

the government's alternative shall be estimated, as mentioned in Chapter Ⅱ.

Although the method of estimating PSC_P and PFI_P is presented first here, part of the method can also be applied equally to PSC_G and PFI_G. The different part in the application of the method will be presented in "B. Solicited Projects."

1) Determination of PSCP

In order to determine PSC_P, the facility investment cost and the operating cost, required if the Government executes a road project as a government-financed project, shall be determined. Because the facility investment cost is assumed to be financed by issuing national bonds maturing in 5 years, the interest expense for national bonds is added to the government's share of costs. The operating cost is assumed to be financed directly from Government funds, and accrued costs are reflected at the time of accrual. Since the VFM analysis is based on the assumption that the road project is for a toll road, operating revenue accrues even in cases of PSC_P. The government's share of costs in PSC_P is finally determined by aggregating the facility investment cost and operating cost and then subtracting the operating revenue from the aggregate.

The items and composition of costs of a PSC and a PFI in the VFM test of a PPP project are as set out in Table Ⅳ-4. The sub-items of the project cost and operating cost of PSC_P shall be determined in accordance with relevant guidelines regarding engineering service fees, the government's standard cost estimation, unit prices, etc., but the data about the results of similar facilities built as government-financed projects shall be referred to in the determination, if such data are available. The method of determining the design value of each cost item of PSC_P is presented in Chapter Ⅲ. Cost items of PSC_P, the final amount of which is expected to be determined through a bid, such as construction costs, shall be determined by applying the successful bid rate to the

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the Government.

design value. As costs of PFI_P are calculated by applying the proposal ratio[22] set by the proposer itself, considering the ratio of the private sector, the successful bid rate is applied to PSC_P, considering bids.

In allocating the project cost and operating cost of PSC_P to each year, if the standards for the allocation of costs on the project proposal are found appropriate as a result of a review, the standards shall be applied as they are proposed. If the standards for the allocation of costs on the project proposal are found unreasonable, the standards may be adjusted properly to meet the nature of each project.

22) It refers to a rate applied to design value to lower the proposed price like the successful bid rate for a government-financed project.

<Table IV-4> Cost Computation Methods for Alternatives

Item		PSC	PFI
Facility investment costs	Total project costs	(1) Survey costs (2) Design costs (3) Construction costs (4) Compensation costs (5) Incidental costs (6) Operation equipment costs (7) Project implementation charges (8) Operation reserves	(1) Survey costs (2) Design costs (3) Construction costs (4) Compensation costs (5) Incidental costs (6) Operation equipment costs (7) Project implementation charges (8) Operation reserves
	Financing costs	(9) Financing costs	(9) Financing costs
	Sub-total		
Operating costs		(10) Personnel expenses and miscellaneous expenses (11) Maintenance and management expenses (12) Electricity expenses (13) Operation insurance premiums (14) Costs of replacement of tangible assets (15) Expenses for management and monitoring by the Government	(10) Personnel expenses and miscellaneous expenses (11) Maintenance and management expenses (12) Electricity expenses (13) Operation insurance premiums (14) Costs of replacement of tangible assets (15) Expenses for management and monitoring by the Government

Taking into consideration the fact that it is generally difficult to modify a design or increase cost after the concession agreement of a PPP project is made, the successful bid rate for a turn-key project or an alternative tender project with similar nature shall apply as the successful bid rate for a government-financed project. The method of applying the successful bid rate for each cost is as follows.

Although the successful bid rate for a PSC shall be, in principle, determined by using the competent authority's data about the average successful bid rate,

local governments, except the central government, have insufficient data about contracts on alternative tender or turn-key projects, and therefore the data about the successful bid rates throughout the whole country, including data of local governments and the central government, shall be used.

2) Determination of PFI_P

PFI_P means the costs that shall be borne by the Government, that is, the Government subsidies requested by a concessionaire when a PPP project is implemented, except the life cycle cost (LCC) of the PPP project. In principle, the total project cost, operating cost, rate of return, user fees, and Government subsidies for the determination of PFI_P shall be the same as those suggested in the proposal.

The matters in which assistance from the Government is demanded in the proposal, such as Government subsidies, are essential components of PFI_P, and thus, it is necessary to check the practicality of the amount of Government subsidies and the appropriateness of the ratio through inquiries to and responses from the competent authority. Government subsidies for most road projects consist of construction subsidies and lot purchase costs. As lot purchase costs and construction subsidies are assumed to be financed by issuing national bonds like the facility investment cost of PSC_P, PFI_P consists of the principal of national bonds for Government subsidies and the interest expenses therefor. If Government subsidies are incurred during the period of operation, such costs shall be assumed to be financed from Government funds, not by issuing national bonds. The amount of construction subsidies for the determination of PFI_P shall be the same as the amount on the project proposal, and lot purchase costs shall be determined by applying the method presented in Chapter Ⅲ.

B. Solicited Projects

With regard to a solicited project, the competent authority shall establish a reference project and estimate both PSC_G, as a public sector comparator, and

PFI_G, as a private finance initiative. Although there is no substantial difference in the determination method from the method for PSC_P and PFI_P based on a proposal, costs are determined in most cases without detailed designing and detail works, and thus, it can be said the method differs in that costs are determined by relying on guidelines and data about past records.

1) Determination of PSC_G

With regard to a solicited project, the competent authority shall establish a reference project, carry out basic planning and basic designing based on the scope of the project, and conduct the VFM test according to those plans and design.

If a basic plan is available, the accuracy of the determination of costs can be improved. The construction cost of PSC_G can be determined by determining details based on the basic plan. Once the construction cost is determined, survey costs, design costs, incidental costs, and miscellaneous costs can be determined by applying the methodology for the determination of costs in Section 4 of Chapter Ⅲ. After costs are determined based on the design price or quoted prices, the total project cost of PSC_G can be finally determined by using the successful bid rate applied in determining the PSC for an unsolicited project. If it is difficult to determine a successful bid rate applicable separately to incidental costs, etc., the successful bid rate for the construction cost shall be applied, and the design cost and supervision cost shall be determined by applying the rate determined with the construction cost to which the successful bid rate is applied as a parameter. The operation cost of PSC_G shall be also determined by applying the methodology for the determination of costs in Section 4 of Chapter Ⅲ.

If there is no basic design, the costs of PSC_G shall be determined by calculating the project cost and operation cost by applying the methodology for the preliminary feasibility study *mutatis mutandis* and then applying the successful bid rate.

2) Determination of PFI_G

In order to determine the government's share of costs in PFI_G, the total project cost and operation cost of PFI_G shall be determined. In determining the total project cost, it is necessary to determine the design value, etc., but the design value, etc. of PSC_G are utilized as they are without separately calculating them. The total project cost and operation cost of PFI_G shall be finally determined by applying the proposal ratio of the PPP project to the determined design value, etc. The proposal ratio of a PPP project is the ratio of the design value to the proposed price on the proposal for the PPP project, and the average ratio presented in the proposals during the latest three years for similar PPP projects shall be applied as the proposal ratio for the determination of PFI_G. If it is difficult to determine a separate ratio for incidental costs, etc., the proposal ratio for construction costs shall be applied to incidental costs, etc. However, design costs and supervision costs shall be reflected by determining the ratio with the construction costs to which the successful bid rate is applied as a parameter.

Insurance premiums, performance guarantee insurance, incidental costs related to financing, operation reserves, etc. are also determined by applying proposals during the latest three years for similar PPP projects *mutatis mutandis*. Attributes specific to a PFI may be also reflected in personnel expense and other expenses, out of operation costs, and thus, the average level of such expenses in proposals during the latest three years for similar PPP projects shall be surveyed and applied. Besides, the proposal ratio may be applied to cost items in which attributes specific to PPP projects may be reflected. The timing to distribute costs of PFI_G and applicable price indexes are same as those for PSC_G.

In order to determine PFI_G, the financing structure of the private sector shall be established. Financing by the private sector shall be based on the assumption that the equity capital is 15% and the borrowed capital is 85%, reflecting the Basic Plan for the PPP project, and the borrowed capital and construction

subsidies are invested according to work progress after investing equity capital first. The structure of procuring the borrowed capital shall be assumed by applying the latest cases of PPP projects.

In order to establish PFI_G, it is necessary to determine the rate of return, the level of Government subsidies (construction subsidies, compensation costs, etc.), and user fees additionally. The rate of return shall be determined by applying the average value of the rates for similar projects during the latest three years, as presented by the private proposal, and the Government subsidies shall be determined by considering the cases of similar PPP projects or the level of subsidies that the competent authority is able to provide. The user fee of PFI_G may be adjusted and set by considering the rate of return, the level of Government subsidies, the particulars of the demand in the project section, local features, etc. after establishing the user fee for PSC as the basis. If it is difficult to increase or decrease the user fee in light of the nature of the project, the rate of return and the user fee may be determined first, then the ratio or amount of Government subsidies may be determined based on the rate of return and the user fee. As explained above, the Government subsidies determined on the basis of the structure of costs of PFI_G, the financing structure, the rate of return, the user fee, etc., shall be determined as the final PFI_G.

C. Adjustment for Fair Comparison

1) Essential Adjustment Items

Adjustments for the following items are necessary for fair comparison between PSC and PFI.

□ Revenue from User Fees

In the PSC, revenue from user fees (tolls) collected from road users are reflected directly by subtracting it from costs. In the contrary, in the PFI, the

determined operation revenue is reflected indirectly in the determination of Government subsidies.

The demand for the level of tolls for the PFI is re-estimated for the use in the VFM test of an unsolicited project. Revenue from user fees shall be determined based on the re-estimated demand and the proposed toll rates, and the level of the rate of return at this time shall be determined. The determined rate of return may be higher or lower than the proposed rate of return due to a difference in demand. After determining an additional Government subsidy to make the determined rate of return equal to the proposed rate of return, the government's share of costs in the PFI shall be determined by adding the Government subsidies suggested in the proposal.

□ Revenue from Ancillary (Auxiliary) Projects

Revenue from ancillary projects suggested by a concessionaire can be also applied as it is to the PSC, and thus, the net income from the ancillary projects expressly stated in a private proposal shall be applied to the PSC and the PFI equally. If the details of ancillary projects for a solicited project are conclusive, such projects shall be applied to both the PSC and the PFI.

□ Payment of Taxes, Charges, etc. for Private Proposals

Taxes, charges, etc. under relevant Acts and regulations may vary depending upon who the main concessionaire is, the Government or the private sector. Since the private sector is not able to save the expenses of taxes, charges, etc. by exercising its creativity and efficiency in light of the nature of the expenses, it is necessary to make an adjustment in order to conduct a comparative assessment between the PSC and the PFI.

Contributions for ecosystem conservation, the charge for damage to a development restriction zone, the cost of the development of farmland, the usage fee for the occupancy and use of public waters, and other charges shall be re-estimated, if any item is inappropriate or omitted as a result of the review on the details of costs determined in the PFI. Costs shall be re-determined

based on the PSC, but the reduction or exemption rate shall be the same as the rate applied to the PFI to make comparison equal as much as possible.

Further explanation about value-added tax and other taxes will be given separately below.

□ Compensation Cost

The compensation cost is a cost incurred in both PSC and PFI, and thus, the same amount and the same time schedule shall be reflected in both alternatives.

□ Government's Monitoring Expense

When a project is implemented as a PFI, expenses for the government's management and monitoring are incurred separately. Likewise, personnel expenses for related public officials and other expenses are also incurred in a PSC. Thus, such expenses shall be basically excluded from cost items of both the PFI and the PSC. If it is clearly acceptable that manpower and resources are substantially required in addition to existing manpower and resources when a project is implemented as a PFI, however, additional costs may be reflected in the PFI.

□ Demand for Additional Government Subsidies

If a demand in a project proposal for Government subsidies in addition to compensation costs and construction subsidies imposes a financial burden actually on the Government, the amount of the financial burden shall be estimated and included in both the PSC and the PFI. The construction and operation of a connecting road and the grant of an additional subsidy for the charge for damage to a greenbelt are examples of such cases.

2) Value-Added Tax and Corporate Tax

a) Value-Added Tax

If a road project is implemented as a government-financed project (PSC), the Government[23] shall purchase materials for construction during the construction period and shall also purchase goods for operation during the period of operation. The government's expenditure during the construction period includes value-added tax on purchases, but the government's net income from value-added tax becomes 0, because value-added tax on purchases is the government's revenue. The Government shall not collect the value-added tax on sales during the period of operation in accordance with the Value-Added Tax Act, and the government's net income from value-added tax on purchases in connection with operation becomes 0 on the same ground as that for the construction period.

On the contrary, if a road project is implemented as a private-financed project (PFI), a supplier can recover value-added tax on purchases that the supplier has paid through the refund process, and value-added tax collected from users at the time of sale shall be paid to the Government. A project concessionaire has no benefit or loss from value-added tax, and the project concessionaire merely carries out the role of a middleman who shall collect the tax from users (citizens) and pay it to the Government. From the viewpoint of Government revenue and expenditure, value-added tax on sales accruing from a PFI becomes Government revenue.

If value-added tax on sales is regarded as Government revenue, the government's share of costs in a PFI will decrease, and the VFM may significantly increase. If a substantial portion of the VFM accrues from value-added tax, the purpose of the quantitative VFM analysis, which shall measure the VFM accruing from the efficiency of the private sector, will not be properly achieved, and thus, the revenue of value-added tax and other taxes shall not be reflected in the analysis.

The purpose of an adjustment made for the like-for-like comparison, which is

23) It is a concept of government in a broad sense, including all competent authorities and the central government, not simply referring to the competent authority.

implemented in the United Kingdom or Australia, is to make a like-for-like comparison between a PSC with a PFI by adjusting favorable or unfavorable conditions arising from the position of the Government or the private sector.[24] Such cases can be found in the United Kingdom and Australia where taxes borne only by the private sector are determined as costs and also included in the PSC. Since the value-added tax is an extra cost incurred by the system, rather than an essential cost item that can be compared in measuring the efficiency of a PSC and a PFI, it is necessary to adjust it so that two alternatives can be compared at an equal position.

In cases of a road project, it is almost impossible to adjust a PSC and a PFI equally due to the elasticity of demand to tolls. If the toll rates of a PSC and a PFI are the same, value-added tax on sales is applied equally to tolls, or the elasticity of demand to tolls is low, the effect of value-added tax may be adjusted by excluding value-added tax from two alternatives or by reflecting it equally. Generally speaking, however, there is a difference between toll rates applied to a PSC and a PFI, the difference in demand due to the difference between toll rates is not inconsiderable, and there is also a difference in the value-added tax actually applied depending upon who the main operating entity is. Due to such differences, equal adjustment is made in cases of a road project by reflecting value-added tax on purchases in costs when determining costs of the PSC without making an adjustment on the PFI to make costs same as the costs actually applied in implementing the project.

In the VFM analysis on any project other than a road project, it is considered desirable to reflect or not to reflect value-added tax in a PSC and a PFI equally, unless there is any matter that shall be specially taken into consideration in the project. In other words, the analysis shall be conducted by reflecting value-added tax also in the PSC or by determining values exclusive of value-added tax for both the PSC and the PFI in regard to cost items on the proposal in which value-added tax has been reflected.

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24) See: Cases in the United Kingdom, in Chapter Ⅵ, and cases in Australia, in Chapter Ⅷ in Part Ⅱ "Overseas Cases"

b) Corporate Tax

Corporate tax is an operating cost, but has great variability. The environmental variability is inherent in the tax due to amendments of tax laws, and the tax is a cost for which the project concessionaire can adjust cash flow artificially. It is easy to find changes in corporate tax through the introduction of subordinated debts or changes in interest rate in projects for which re-financing has been recently promoted. As explained above, it is highly probable that corporate tax estimated by a concessionaire at the time of proposal may differ from the amount of corporate tax at the time of actual payment.

Since corporate tax is a cost item with very high variability and is not a cost item with which the intrinsic efficiency of a PPP project can be measured like value-added tax, it is desirable to conduct the VFM analysis without considering the effects of corporate tax. If the effects of corporate tax is reflected in the analysis, the proposer can probably pervert cash flow of the proposal to secure the VFM, and thus, it is desirable to conduct the VFM analysis without considering corporate tax.

3) Analysis of Impact on Linked or Competing Projects

A government-financed project or a PPP project located near another PPP project may suffer a loss of operating revenue or have the operating revenue guarantee accruing as a consequence of the implementation of the latter PPP project. If a PPP project is overlapped with an existing project in its route or such, it might cause the waste of budget.

Since it is difficult to reflect a decrease in the revenue for a nearby government-financed or PPP road, which might be caused as a consequence of the implementation of the project at issue, in the VFM analysis, it is necessary to clearly state considerations relating to the matter in the VFM test report. If there is a likelihood of overlapped investments, it is also necessary to clearly state relevant facts in the report. If there is a nearby PPP or government-financed project operated by a different entity and the relationship of

rights and obligations between the operating entities are not clear, a dispute might occur. In particular, if there is a nearby PPP project, a serious problem might occur, and thus, analysis on the mutual impact of the projects on one another may be carried out in the aspects of demand, the level of toll rates, and the relation of rights.

If the operating revenue guarantee or transfer subsidies for a linked PPP project is obviously anticipated to be given as a consequence of the implementation of the project at issue and shall be inevitably reflected in the analysis, such guarantee or subsidies may be included in determining the government's share of costs of the project at issue. Since the amount of the operating revenue guarantee is reflected in a PSC and a PFI at an identical time with an annual amount estimated to actually accrue, it will not have a significant impact on the results of the VFM test, but it will be helpful for ascertaining the government's share of costs.

D. Risk Quantification

After making an adjustment for the like-for-like comparison, a risk cost shall be determined and reflected in each alternative. Various risk factors that can be considered in a PSC and a PFI may be brought up depending upon the project at issue and its nature, and quantifiable risks shall be basically quantified to the maximum and reflected in the VFM analysis.

In road projects, the average construction period is approximately 3 years, and thus, there are not many cases where the construction period is extended due to limitations on budget and administrative procedures. At present, the successful bid rate of alternative tender or turn-key projects is applied to the VFM test to reflect the risk of an increase in construction cost or an extension of construction period.

A tender for design and construction in a package, that is, a turn-key basis means a contracting method by which a contract for design and construction is made with one contracting party in a package, and there is a difference between

the turn-key basis and an alternative tender basis in which there is an original design, but the alternative tender basis is treated in the same manner as the turn-key basis in the actual system.

The following table shows the results of the analyses conducted by the Public Procurement Service on the successful lowest bid rates for road projects[25] for past 7 years and the successful bid rates for turn-key and alternative tender projects.

<Table Ⅳ-5> Current Status of Average Successful Bid Rates under Lowest Bid System (Road Projects)

(Unit: %)

Year	Average Bid Rate (%)				Number of Cases
	50 billion ~ less than 100 billion	100 billion ~ less than 200 billion	200 billion or more	Average	
2001	80.57	72.62	84.80	79.33	25
2002	80.08	64.10	59.71	67.96	51
2003	81.63	52.15	83.34	72.37	28
2004	68.44	54.92	52.79	58.71	46
2005	72.61	55.67	54.14	60.81	22
2006	68.02	54.42	60.06	60.83	18
2007	67.10	66.76	67.69	67.18	29
Average	74.06	60.09	66.08	**66.74**	31

Source: Public Procurement Service, Report for Inspection of State Administration, Jul. 2007

25) The lowest bid system has been implemented as part of the scheme for the enhancement of competitiveness and restructuring of the construction industry and was introduced in 2001 to contracts for government projects for purposes of relaxing regulation and operating a tender method conforming to international norms. In January 2001 when the lowest bid system was introduced, it began to be implemented to projects subject to PQ (Pre-qualification Examination) with an estimated cost of KRW 100 billion or more, was extended in December 2003 to projects subject to PQ (Pre-qualification Examination) with an estimated cost of KRW 50 billion or more, and has been implemented to all projects with an estimated cost of KRW 30 billion since May 2005.

<Table Ⅳ-6> Current Status of Average Successful Bid Rates for Turn-key and Alternative Tender Projects (Road Projects)

	2001	2002	2003	2004	2005	2006	2007	01-'07
Successful bid rate	86.26	87.79	87.63	88.47	90.04	86.82	80.26	**87.36**
Number of samples	9	8	14	11	17	10	7	76
Standard deviation	4.50	6.84	6.05	6.11	5.52	7.87	3.58	6.48
Variable	0.052	0.078	0.069	0.069	0.061	0.091	0.045	0.074

Sources: Central Ministries and Agencies, including the Public Procurement Service and the Ministry of Land, Transport and Maritime Affairs, and local governments

As a result of the comparison between the average successful bid rate for projects with a construction cost of KRW 50 billion or more under the lowest bid system and the average successful bid rate for alternative tender and turn-key projects, it was analyzed that the average successful bid rate under the lowest bid system is approximately 20.62% lower, but a project cost under the lowest bid system can be adjusted on the ground of design changes, and thus, the risk of increasing total project cost is inherent in the lowest bid system. Once the total project cost is determined, it is difficult to change the cost in a turn-key or alternative tender project, and thus, the successful bid rate is formed relatively higher but can be applied to the VFM test, because the risk of increasing total project cost is considered to have been translated into costs.

In a PSC, the risk cost is reflected by applying the successful bid rate for turn-key and alternative tender projects to the risks of increasing the total project cost and extending the construction period. As a project concessionaire manages the risk of extending the construction period with the insurance for loss of expected income, the risk of extending the construction period for a PSC can be also reflected as a cost by applying the insurance, if necessary.

Although additional risks may also arise in connection with an increase of

interest rate, the termination of contract, and changes in performance and specifications, a substantial part of which arise to both two project alternatives, it is not easy to quantify such risks item by item, and thus, the risk cost of such risks is not determined separately in this test.

Moreover, part of insurance premiums recognized as the project cost of the PFI is reflected as a risk-quantified cost in the PSC. Although the kinds of insurance carried for the PSC are not as various as those for the PFI, costs of curing a risk are disbursed from the Government funds, if such risk arise, and thus, part of insurance premiums for the PFI shall be reflected as a risk-quantified cost for the PSC.

If a Government subsidy is required for a solicited project due to a shortfall in the demand for the project, the amount of such subsidy shall be reflected in the PFI. In addition, if it is obviously anticipated that operating revenue guarantee will be required for a nearby PPP project as a consequence of the project at issue and an amount of the operating revenue guarantee will accrue, the relevant amount of the operating revenue guarantee shall be added to both alternatives in conducting the analysis. The items of costs to be borne by the Government for each alternative may be presented finally as Table Ⅳ-7 below.

<Table IV-7> Cost Items Borne by Government in each Alternative

Item		PSC	PFI
(1) Government's Base Cost	Facility investment cost	○	-
	Operating cost	○	-
	Government subsidies	-	○
	Additional Government subsidies (connecting roads, etc.)	○	○
	Government subsidies for compensation for the rate of return		○
	Operating revenue	○ (subtract)	-
	Profit from ancillary project, etc.	○ (subtract)	-
(1) Risk adjustment cost		An increase in total project cost, an extension of construction period, operating revenue guarantee, etc.	Operating revenue guarantee, etc.
Total amount to be borne by the Government		① + ②	

3. VFM Assessment of PFI

A. Comparison between PSC and PFI

If the total amount of Government subsidies determined in present value for the PSC is greater than the government's total share of costs in the PFI on the assumption that the levels of services are equal, it will be efficient to implement the project at issue as a PPP project.

The quantitative VFM analysis is to assess the VFM (Value for Money) of a

PFI by comparing the PFI with a PSC. The terms and conditions of a proposal shall be applied as they are to the PFI for an unsolicited project, and re-estimates shall be applied only to the demand for the project. If the re-estimated demand is applied to the construction subsidies or user fees proposed by a project proposer, the outcome drawn out may differ from the profitability expected originally by the proposer due to a difference in demand. The difference in demand under the situation where the rate of return and user fees are fixed as proposed can be reflected as an increase or decrease in Government subsidies. Therefore, the government's additional share of costs shall be determined in the VFM analysis on the basis of the re-estimated demand and the profitability (rate of return) proposed by the business entity, and the PFI shall be determined by reflecting the amount. If the proposed demand fails to meet the re-estimated demand, an amount increased over the proposed amount is reflected in the PFI as the amount of Government subsidies. If the costs of the PFI_1, determined with Government subsidies in which the re-estimated demand is reflected and with which the proposed rate of return for the project can be achieved, are lower than those of the PSC, the PFI_1 is assessed to have the VFM.

Government's share of costs in PSC > Government's share of costs in PFI_1 : The project has a VFM.

Government's share of costs in PSC < Government's share of costs in PFI_1 : The project has no VFM.

B. Review of Financial Profitability

Although it is necessary to measure costs of and benefits from the project at issue for the whole society in order to determine whether to implement the project as a PPP project, considering its nature as public goods, it is also necessary to consider its financial profitability on the side of an individual business entity.

The review on the financial profitability of an unsolicited project is the

process of assessing the financial profitability of the project at issue, based on the rate of return on the PFI determined by reflecting the re-estimated demand in the terms of conditions proposed for the project (such as user fees, Government subsidies, and costs). The assessment of financial profitability shall be based on the proposed rate of return, and if an additional amount of Government subsidies is required for achieving the proposed rate of return, such amount shall be determined and reflected in the VFM analysis. The results of a review on financial profitability can be summarized as Table Ⅳ-8 below. The figures in the table are given at random to help understanding.

<Table Ⅳ-8> Results of VFM Analysis

(Unit: 100 millions of KRW)

Description	PSC	PFI_0	PFI_1	Remarks
1. The government's total share of costs (constant)	3,934	1,039	2,181	
A. Total construction subsidies (repayment of principal)	-	821	1,791	
Initial construction subsidy		821	821	
Additional (decreased) construction subsidy[1)]		-	970	
Compensation cost		-	-	
B. Financing cost		218	390	
2. Present value of the government's total share of costs	2,534	705	1,918	
3. Amount of VFM		1,829	616	(PSC - PFI_{1-1})
4. VFM ratio		72%	24%	$[\frac{PSC_1 - PFI_1}{PSC_1} \times 100]\%$
5. Real rate of return before taxes		1.1%	6.54%	Proposed rate of return: 6.54%

Note: An additional (decreased) construction subsidy means an amount to be borne additionally by the Government in order to maintain the real rate of return before taxes on the proposal.

According to Table Ⅳ-8, the real rate of return before taxes is determined as 1.1% as a result of applying the re-estimated demand to the proposal. The analysis shows that an additional Government subsidy is required to secure the proposed rate of return. The Government subsidy additionally required to secure the proposed rate of return amounts to KRW 97 billion, and the financial profitability of the project based on the proposed rate of return can be ensured when Government subsidies of approximately KRW 179.1 billion are granted as construction subsidies, based on the fact that the Government subsidy originally requested amounts to KRW 82.1 billion. Although the VFM ratio before investing the additional Government subsidy was 72%, the VFM ratio is decreased to 24%, when the additional Government subsidy for securing the proposed rate of return is included.

In order to keep the rate of return, which is lowered down by applying the re-estimated demand, to the proposed level, either Government subsidies, including construction contributions, shall be increased or user fees shall be raised. If the level of user fees is changed in a road project, the demand for the project is also changed, and thus, Government subsidies during the construction period, including construction subsidies and compensation costs, are adjusted upward or downward to meet the proposed rate of return.

A review on the financial profitability of a solicited project is the process of establishing a financial model of a PFI. In the financial profitability analysis, the rate of return, user fees, and the ratio of Government subsidies, fit for the nature of a project, will be determined through sensitivity analysis of the rate of return, the ratio of Government subsidies, user fees, etc., based on proposals for similar PPP projects during the latest three years and the costs of the PFI, and the appropriateness thereof will be also assessed.

C. Determination of VFM Ratio

The quantitative VFM analysis is to determine the present values of the government's share of costs in the PSC and the PFI and compare two values

with one another, the results of the analysis are expressed in the following two values.

- Amount of VFM = The government's share of costs in PSC - The government's share of costs in PFI
- VFM ratio = [(The government's share of costs in PSC) - (The government's share of costs in PFI)] / [(The government's share of costs in PSC)] × 100%

In particular, the VFM ratio is an important factor in the VFM test, since it is applied to the determination of the ratio of bonus points. The ratio of VFM, applicable to the determination of the ratio of bonus points, is determined on the basis of the PSC, determined by applying the re-estimated demand and costs, and the PFI_1, determined by reflecting the re-estimated demand with the terms and conditions of the private proposal (user fees, the rate of return, project costs, and operating costs in the private proposal).

A VFM ratio may have a negative (-) value, which appears when the government's share of costs in the PSC is smaller than that in the PFI or the revenue from the project at issue is more than costs to be recovered. If the revenue of user fees from the PSC is more than the costs during the project period to be recovered, the PFI may be re-established at the stage of the establishment of the PFI.

If the PSC has a negative (-) value due to good financial profitability of the project at issue, while the value of the PFI is 0 because Government subsidies, including construction contributions, are not requested, the VFM ratio can be determined as -100%. In such cases, the denominator applicable to the calculation of the VFM ratio shall be an absolute value, because an unreasonable result with an positive value will be drawn out, if both the denominator and the numerator are negative.

- VFM ratio = $\frac{PSC - PFI}{|PSC|} \times 100\%$

If the amount or ratio of the VFM of a project is a great negative (-) value, it can be concluded that the project is highly financially profitable. If a project is highly financially profitable, the competent authority can carry out the project directly, but the reduction of Government subsidies, negative Government subsidies, the reduction of the free operation period, the reduction of user fees, etc. can be considered in a PFI as a scheme for raising the VFM to a certain level on the assumption that the project is implemented as a PPP Project.

SECTION 2 Qualitative VFM Analysis

1. Role and Limitations of Qualitative VFM Analysis

The qualitative VFM analysis can be defined as a cost-effectiveness analysis for searching for an alternative that requires less costs for the same performance. Through the analysis, a PSC will be determined for the level of performance suggested by a proposal to be compared with a PFI, and the alternative with a lower share of costs borne by the Government will be chosen out of the two alternatives. Through the financial analysis in the course of the qualitative VFM analysis, the government's share of costs will be also determined to make it possible to implement a PPP project.

However, the qualitative VFM analysis performs the analysis in the state where the main framework of the proposal is accommodated with the reference project established in accordance with the scope of the project as proposed, but is not able to closely assess whether the project is qualifiable as a PPP project. The qualitative VFM analysis has a nature of supplementing the quantitative

VFM analysis. Through the qualitative analysis, whether a project is qualifiable as a PPP project is assessed and the effects expected from the implementation of the project at issue is analyzed.

Also in the United Kingdom, the qualitative analysis is conducted along with the quantitative analysis. The qualitative assessment in the United Kingdom is comprised of questions on the appropriateness of a public-private partnership. With questions on whether the project at issue satisfies the following subject matter of assessment, the appropriateness of a public-private partnership is assessed:

◦ Is the level of services demanded in the PFI adequate for the contract?
◦ Are there no issues in the aspects of efficiency, accountability, and equitableness of the PFI?
◦ Is it desirable to implement a project according to a PFI option, when comprehensively considering advantages and disadvantages in the aspects of incentives, risk transfer, fund raising, long-term contracting, etc.?
◦ Is the competent authority capable of implementing and managing the project?
◦ Is the market situation suitable for implementing the project according to a PFI option?

〈Table Ⅳ-9〉 Qualitative Assessment Elements in the U.K.

Description	Main Issues	Detailed review items
Viability	Whether the goals and results of investment are in the form of outputs definable by a contract and whether the PFI option poses no issues for the aspects of strategy and norms.	• Suitability of goals and results • Flexibility at the stage of operation • Efficiency, accountability, equitableness
Desirability	Whether the PFI option is favorable, when the positive side (risk transfer, reduction of construction period, etc.) and the negative side (additional costs, etc.) of the PFI option are compared with one another.	• Risk management • Innovation • Supply of services • Incentives, management, and monitoring • Life cycle costs and residual value
Achievability	Whether the implementing entity is capable of managing and monitoring the PFI project continuously and whether the market situation is suitable for implementing the PFI project.	• Transaction costs and the business entity's competence • Competition
Indirect factors	Other indirect VFM factors	• Qualitative level of plans • Environmental factors • Whether innovations that can be applied to other areas of the Government can be created, etc.

Source: HM Treasury, see the details of the VFM Assessment Guidance.

The guidelines for the VFM test in the Republic of Korea also clearly require the conduct of the VFM analysis and provide for the subject matter of assessment as follows:

○ Improvement of the quality of services
○ Efficiency in the execution and management of contracts
○ Effects of risk sharing
○ Efficiency in management and economic ripple effects
○ Distinctive characteristics of the project

The current guidelines for the VFM test recognize that a qualitative VFM could be generated, because, if a PFI provides services lower than a certain level, a penalty will be imposed by the Government on the service provider, while if the creativity and efficiency of the private sector are introduced actively, the level of services is expected to be improved higher than the PSC and it is highly probable that incidental effects, such as technical innovations and industrial ripple effects, will arise, although it is difficult to quantify the services.

However, the qualitative VFM analysis is focused only on recognizing the potential for the generation of the qualitative VFM and analyzing the route of the generation until sufficient empirical data about qualitative effects are accumulated and actually limits the scope of analysis and utilization to be used as reference data for assessing whether there is VFM.

Even in overseas cases, items of VFM analysis are clearly mentioned, but it is difficult to find specific analysis methods. As the term "qualitative analysis" implies, the qualitative analysis is an analysis on the items that are difficult to quantify, but necessary, or about which the main concessionaire should have knowledge in making a decision on whether to implement the project.

This Study specifies and sub-categorizes qualitative analysis items further than the Detailed Guideline for the VFM Test but fails to systemize the methodology for the qualitative VFM analysis as adequately as the methodology for the quantitative VFM analysis. As cases of the operation of PPP projects increase and the results of researches and surveys thereon are accumulated, the details of the qualitative VFM analysis will be possibly systemized more specifically in the future.

2. Specificly Defining Subject Matter of Assessment of Qualitative VFM Analysis

A. Suitability of Public-Private Partnership

In order to implement a PPP project, it is necessary to assess first whether the facility at issue is one of facilities (44 types) defined as eligible for a public-private partnership under Article 2 of the PPP Act.

A PPP project can be defined as an appropriate type of project where a project is consistent with the government's policy but it is difficult to invest in the project due to the government's inadequate finances. In other words, a project can be assessed as having high suitability for a public-private partnership, if it is urgent to extend a facility earlier in the light of relevant policies but investment in the facility is tardy due to the government's finances. Under such conditions, it shall be assessed whether the project at issue meets the direction of the government's policies. In cases of a road project, it shall be reviewed whether the project conforms to the State's high-level plans, such as the comprehensive land plan, the plan for the national main traffic networks, and the basic plan for the improvement of roads, and the directly or indirectly related plans of the central government and local governments. In addition, it shall be analyzed whether the project is consistent with the direction of policies of the competent authority who implements the project. The goals of a policy established by the competent authority actually affect the decision on whether to implement an individual project, because sometimes the validity of a long-term investment plan already established might be deteriorated due to a change in the direction of policies as time passes by. Considering such circumstances comprehensively, the consistency with relevant plans and the direction of policies shall be reviewed.

Since a PPP project is implemented in accordance with a contract with the competent authority, it is possible to implement the project in an efficient manner when the scope of the project and the level of services provided are clearly stipulated in the contract, and thus, it can be assessed whether a project meets such requirements. Moreover, since the suitability of a public-private

partnership for a project can be achieved sufficiently when the quality of services achieved by implementing a PPP project reaches or exceeds the level of the quality expected from a government-financed project, an assessment of this aspect is also required. It shall be also verified whether the regulations and provisions relevant to the construction and operation of the project at issue are enforceable to a contract between a concessionaire and the Government.

〈Table Ⅳ-10〉 Assessment of Suitability of PPPs

Subject Matter of Assessment	Detailed Issues
Suitability of PPPs	- Whether a facility is eligible for a pubic-private partnership under Article 2 of the PPP Act.
	- Whether a project conforms to national long- and medium-term plans and national investment policies relating to SOC.
	- The competent authority's willingness to implement: Whether a project conforms to policies and whether the Government agency is capable of managing and monitoring the project.
	- Whether the goals and scope of the project are clear and the level of services demanded for the facility at issue can be stipulated clearly.
	- Improvement of the quality of services: Whether the quality of services is expected to be improved higher than the quality of services expected from a government-financed facility.
	- Easiness in execution and management of contracts: Whether regulations relevant to construction and operation are enforceable to contracts between private business entities and the Government.

B. Efficiency and Publicness in Implementation of Projects

Creativity and efficiency in PPP projects can be ensured through competition. If the structure of a project is exclusive and so competition is difficult, the efficiency in the PPP project can be reduced, and therefor it is necessary to assess whether a project can induce competition.

If a project is, physically and in accounting, independent from a nearby project or an existing project, competition can be invigorated to increase the efficiency in a PPP project, and therefore whether operation independent of an existing project is possible is also the subject matter of assessment.

Moreover, whether users can have an option to use in addition to the project at issue is also an important factor in the aspects of publicness and profitability. If the level of user fees is not appropriate, it is more probable that civil petitions will be raised due to a lack of publicness, although the more difficult it is to find an alternative means, the more probable it is that the profitability of a project will be enhanced,

<Table Ⅳ-11> Assessment of Efficiency and Publicness in Implementation of Projects

Subject Matter of Assessment	Detailed Issues
Efficiency in Implementation of Projects	- Whether a project can induce competition between private enterprises
	- Whether operation independent of an existing project is possible
	- Whether consumers have no or limited choice of any other alternative, if tolls/user fees for a facility are charged

C. Easiness in Implementation of Projects

A PPP project tends to be affected significantly by circumstances, compared with government-financed projects implemented under the initiative of the Government. Sometimes a development plan relating to a PPP project is not implemented as expected, and consequently a substantial difference in the actual demand and the estimated demand occurs after implementing the project or the project faces difficulties in raising funds due to a decline in economic or financial conditions. Therefore it is necessary to assess whether any environmental (political, social, economic, etc.) constraint exists in the project at

issue.

Sometimes a PPP project is also affected by civil petitions in the course of the selection of or compensation for the project site. The bigger impact a project has, the more interested parties are involved in the project, and the more sharply interested parties' interests are likely to be confronted. Ascertaining whether there is an interested party who will get benefits or suffers a loss excessively due to the implementation of the project at issue might be also an important measure for assessing the easiness in the implementation of the project. It is necessary to ascertain environmental factors and causes of civil petitions in order to make a decision on whether to implement a project in the future, although it is not easy to predict such factors and causes through the VFM test, which is a stage of planning.

<Table Ⅳ-12> Assessment of Ease in Implementation of Projects

Subject Matter of Assessment	Detailed Issues
Ease in implementation of projects	- Whether an environmental (political, social, economic, etc.) constraint in the implementation of the project at issue exists
	- Whether there is an interested party who will get benefits or suffer a loss excessively due to the implementation of the project at issue

D. Risk-Sharing Effects, Ripple Effects, and Distinctive Characteristics of Projects

The main reason why the Government promotes a PPP project is that risks that are likely to arise in the course of implementing a project can be shared with the private sector. Major risks that the private sector are likely to face are risks in the course of construction, including work progress, and risks in the course of operation. Although risks relating to the business environment, systems, etc. during the periods of construction and operation shall be taken by the Government, the private sector shall take responsibilities for the performance

of construction and operation. Particularly in a BTO project, the private sector shall also take demand risk. Through the qualitative assessment, it can be assessed whether a project can deliver VFM in the aspect of risk sharing by ascertaining the current status of major risks to be assumed by the concessionaire in addition to whether demand risk, construction risk, and operational risk in the project at issue are assumed by the concessionaire.

If creative methods are applied to the design and construction of a PPP project and the inefficiency in operation is removed through the project, the benefits therefrom will be extended not only to users but also to local communities. Through the qualitative analysis, ripple effects of creativity pursued for the technology, management, and financing of a PPP project can be assessed. In addition, an assessment on whether a project can deliver VFM will be possibly necessary, even where the nature of the project is unique and the uniqueness of the project is reflected in the test, although such assessment is limited to extraordinary cases.

〈Table Ⅳ-13〉 Risk-Sharing Effects, Ripple Effects, and Distinctive Characteristics of Projects

Subject Matter of Assessment	Detailed Issues
Risk-sharing effects	- Whether it is possible to share demand risk, construction risk, and operational risk in the project with the private sector - Ascertain other risk factors shared with the private sector
Ripple effects	- Whether ripple effects of technology and management skill to the public sector are expected from the participation of concessionaires - Whether effects boosting the financial market are expected as a consequence of the introduction of highly advanced financing techniques
Distinctive characteristics of project	- Whether there is any limitation on the project implementation method in the aspect of security, etc. - Whether there is a domestic or international exclusive right or a construction method or technology protected by an intellectual property right is included, etc.

CHAPTER Ⅴ

DETAILED GUIDELINE FOR ESTABLISHMENT OF PFI ALTERNATIVE AND DETERMINATION OF BONUS POINTS

SECTION 1 Establishment of PFI Alternative

1. Guidelines for Preparation of PFI Alternative

Article 7 (8) of the Enforcement Decree of the PPP Act currently in force provides that the Public and Private Infrastructure Investment Management Center (PIMAC) may, if it finds from reviewing a private proposal that it is appropriate to implement a project as a PPP project, present an opinion (a modified alternative) different from the initial proposal with regard to terms and conditions for the implementation of the project, such as appropriate project costs, user fees, and the rate of return. In other words, if it is concluded as a result of the VFM test of a public-private partnership that it is appropriate to implement a project by the pubic-private partnership, a PFI alternative in which

the government's position is reflected may be established in addition to the project plan of the initial proposer, and the project may be implemented on the basis of the PFI alternative.

The government's share of costs, the level of user fees, etc., calculated in a PFI alternative, may be used as basic data, when the competent authority determines the appropriate scale of the project in the future and implements the project efficiently; and may be also utilized as guidelines in the course of assessment and negotiations.

A. Financial Assumptions

A PFI alternative for an unsolicited project is established on the basis of financial assumptions in the proposal. If the terms and conditions of a private proposal are unreasonable or an additional assumption is required for analysis, different financial assumptions may be established in addition to proposed assumptions. In cases of a solicited project, financial assumptions are reviewed at the time a PFI of VFM analysis is determined, additional financial assumptions for an alternative are unnecessary.

Financial assumptions include all financial assumptions necessary for analysis, such as the inflation rate, the financing structure (the ratio of equity capital and borrowed capital, etc.), the interest rate on borrowed capital, the project period (construction and operation period), the time of accrual of revenue and costs, etc.

B. Determination of Costs of PFI Alternative

A PFI alternative shall ensure minimum financial feasibility, and the level of the government's share of costs shall be lower than that of the PSC. A PFI alternative shall be an alternative scenario made for reasonable costs by comparing and reviewing the PSC and the PFI. The project cost and operation cost of a PFI alternative shall be determined with reasonable costs by comparing the PSC determined through qualitative VFM analysis and the terms

and conditions of the proposal.

Since the terms and conditions of a proposal are applied as they are to the PFI, which is used in the qualitative VFM analysis of an unsolicited project, a cost omitted or an excessive design in the proposal, if any, might cause a subsequent problem in implementing the project later. As the VFM analysis is to determine and compare a PFI and a PSC under equal conditions, the omission of a small cost or a matter that can be supplemented by modifying part of the design can be reflected in the determination of the PSC for comparison and analysis. However, it is difficult to conduct a like-for-like comparison, if there is the omission of a cost that is likely to affect the entire project, and thus, the PSC may be determined under the same conditions as those of the PFI for analysis.

The assessment of the omission of a cost or excessive design in the PFI shall be reflected in the assessment of the appropriateness of the proposal, and an omitted or excessive part may be adjusted at the stage of the establishment of a PFI alternative. If it is inevitable to adjust the scale of a facility for the implementation of a project, the LCC may be re-determined in a PFI alternative.

C. Analysis of PFI Alternative

In the analysis of a PFI alternative, the level of the rate of return and the VFM ratio are determined by applying the project cost and operation cost of the alternative, toll rates of the PFI, and re-estimated demand. Also in a PFI alternative, the government's share of costs shall be determined by applying the demand re-determined by the research team in charge of the VFM test, rather than the proposed demand, in the same manner as the VFM analysis.

〈Table Ⅴ-1〉 Results of PFI Alternatives

(Unit: 100 millions of KRW)

Description		Project Proposal (PFI_1)	PFI Alternative	Remarks
Real rate of return before taxes (proposed rate of return)		%	%	
Present value of the government's share of costs	Construction subsidy			
	Compensation cost, etc.			
	Additional government subsidy[1)]			
	Financing cost[2)]			
	Government's share of costs			
	Present value of the government's share of costs			
	VFM(*)			
	VFM ratio	%	%	$[\frac{PSC-PFI}{PSC}]$

Notes: 1) This refers to an additional government subsidy for achieving the proposed rate of return.
2) The financing cost means the interest expense for national bonds.

In cases of a solicited project, the overview of the project can be prepared through the review on various alternatives in the course of the review on the feasibility of the implementation of the project, while in cases of an unsolicited project, constraints on time and costs are not unavoidable in conducting the review on alternatives in the course of the VFM test, because there is a proposal already submitted and the level of the proposal is more thorough than the basic plan. As the purpose of the VFM test is to assess the VFM of the PPP in the proposal, it is unavoidable that qualitative VFM analysis is limited to the terms and conditions of the proposal. Although the scope of analysis is limited, it is possible through the analysis of alternatives to present alternatives

helpful when the competent authority make a decision on whether to implement a project. In particular, in cases of a solicited project, the role of the sensitivity analysis is very important in establishing a PFI alternative, because the PFI alternative so determined might be the same as the PFI.

Furthermore, although the demand for and costs of a PFI alternative are determined based on the results of various estimations in the VFM test and data about similar facilities, statistical data, and experts' advice, an error in the estimates might exist, and thus, the sensitivity analysis of various estimates is necessary.

The sensitivity analysis on the construction cost, total project cost, operating cost, demand, user fees, the ratio of construction subsidies, etc. shall be conducted with regard to PFI alternatives, and the VFM ratio or the level of the rate of return for each alternative shall be determined and presented.

The following tables are examples of the sensitivity analysis, and the items or level of the sensitivity analysis may be varied, based on the characteristics of each project.

<Table V-2> Results of Sensitivity Analysis (Construction Costs)

Ratio of Construction Subsidy	Applicable Ratio of Construction Cost	Rate of Return Before Taxes	Amount of VFM	VFM Ratio
40% (Proposed applicable ratio)	100%			
	90%			
50%	100%			
	90%			
60% (Applicable ratio of an alternative)	100%			
	90%			

Notes: 1) The ratio of construction subsidy is applied based on the total project cost, exclusive of the compensation cost, and the applicable ratio of 100% means the construction cost of an alternative.
2) The applicable ratio of an alternative means the ratio of the construction subsidy necessary for securing the proposed rate of return.

In Table Ⅴ-2 above, it is possible to see by how many percent the rate of return on the project increases and by how many percent the VFM ratio changes, when the construction cost decreases by 10%, if the ratio of the construction subsidy is 40% of the construction project cost. The analysis can be conducted by applying the total project cost or operating cost instead of the construction cost.

The analysis above can be conducted in further detail as the following table, based on a specific ratio of construction subsidy. The following table shows an additional analysis on the level of the real rate of return before taxes and the level of the government's share of costs depending upon a decrease in costs, based on a specific ratio of construction subsidy (50% of the construction project cost).

〈Table Ⅴ-3〉 Government's Total Share of Costs and Rate of Return: Applying 50% as Ratio of Construction Subsidy

Ratio		Operating Costs			
		100%	95%	90%	85%
Construction cost	100%	708,000 (3.45%)			
	95%				
	90%				
	85%				650,000 (5.25%)

Note: Each figure on the table represents the total amount to be borne by the Government (constant), which is the sum of construction subsidies and compensation costs, and the figure in each parenthesis represents the real rate of return on a project before taxes.

Although the sensitivity of demand to toll rates can be also presented by interpolation, based on the demand estimated in the course of the feasibility assessment or VFM assessment, its accuracy might be inferior, because it is not a result directly estimated.

2. Review on VFM of New Alternative

A PFI alternative is established by determining costs based on a PFI or a PSC alternative and conducting a financial analysis additionally and mainly consists of conditions presented for the implementation of a project, such as an appropriate Government subsidy and user fees. The VFM test of an unsolicited project is conducted with a rather rigid framework due to various systematic factors, such as the confidentiality of the terms and conditions of the proposal, the determination of the ratio of bonus points, and restrictions on changes in the scope of the project, and a review on alternatives aside from the proposal is not generally conducted because the reference project is limited to the proposal.

A review on various alternatives is necessary for the efficient management of a project, and the importance of the review on other alternatives is emphasized in the preliminary feasibility study as well. Since the VFM test is nearly the only process of reviewing a project comprehensively in detail on the side of the Government, a PPP project also needs a process of reviewing the project for the same object as that for a government-financed project.

If it is found inevitable, in the course of the feasibility assessment, the VFM assessment of a PPP project, and the review on the appropriateness of a proposal, to modify the private proposal in order to implement the PPP project efficiently, a PFI alternative may be established by reflecting such modification to the alternative. When it is intended to establish an alternative aside from the proposal, such alternative shall be established by applying the provisions of the Guidelines for the Preliminary Feasibility Studies [26] *mutatis mutandis*, and the features, advantages, and disadvantages of the new alternative shall be compared and described.

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26) KDI, "A Study on the Revision and Supplementation to the General Guidelines for the Preliminary Feasibility Studies of Road and Railroad Projects (5th ed.) (2008)," apply the contents in pp. 15-16.

In the following cases, an alternative different from the initial proposal may be established by utilizing the results of a scenario analysis applied to the feasibility assessment or the qualitative VFM analysis.

◦ Where the future time schedule for the implementation of a transportation facility affecting the feasibility of the project at issue is not fixed at the time when the preliminary feasibility study is conducted.

◦ Where a future development plan affecting the demand is still fluid.

Costs of a new alternative is determined by extending the application of the standards for the unit prices and quantity applied to the costs of the proposal and by applying the successful bid rate of proposals. If it is difficult to apply the standards for costs of the proposal, such costs shall be determined by applying the cost standards or PSC cost standards in the Guidelines for the Preliminary Feasibility Studies.

SECTION 2 Determination of Ratio of Bonus Points[27)]

1. Review on Appropriateness of Proposals

A. Necessity of Reviewing Appropriateness of Proposals

Through the VFM test, the appropriateness of the terms and conditions of the project in the proposal and major financial factors (user fees, Government subsidies, the rate of return) are assessed by using the measures, such as the B/C analysis and the qualitative VFM analysis. Since the process of two kinds of analysis is focused on the assessment of the big frame of a project, it is difficult to assess the appropriateness of a proposal in detail, such as the

27) This Section shall not apply to the VFM test of a solicited project.

technical fidelity of a proposal and the financial ability of the project proposer.

The competent authority shall conduct the review on the appropriateness of a proposal to ascertain precautions and relevant knowledge about the proposal necessary in implementing the project, grade the fidelity of the private proposal and the ability to implement the project by A, B, C, D, or F, and give high bonus points to a proposal, the appropriateness of which is assessed to a high grade, on the ground that the proposed project is more appropriate for the government's medium- and long-term plans and PPP plans.

At present, the review on the appropriateness of a proposal is mainly comprised of the following six items, and the assessment is carried out by in-house and outside research teams and advisors of PIMAC who participate in the VFM test.

(1) The government's medium- and long-term plans and priority of investment (out of 10 points)
(2) Appropriateness of the composition of investors (out of 10 points)
(3) Appropriateness of construction and operation plans (out of 30 points)
(4) Appropriateness of estimated demand (out of 30 points)
(5) Appropriateness of consultation with related ministries and agencies and plan for processing civil petitions (out of 10 points)
(6) Level of project plan documents (out of 10 points)

B. Modification to Subject Matter of Assessment of Appropriateness of Proposals

The subject matter of assessment of the appropriateness of a proposal shall consist mainly of items not reflected in the economic analysis or the VFM analysis. It is necessary to specify the details of part of items of the review on the appropriateness of a proposal, which are provided for in the Detailed Guideline for the VFM Test, and additions and an adjustment of points are required.

1) Subject Matter of Assessment that Needs to be Specified

□ Appropriateness of Estimated Demand

As the demand is reflected in the economic analysis and the VFM analysis, it is necessary to change the details to the appropriateness of the demand estimation method and lower the allocation of points.

□ Appropriateness of Consultation with Related Ministries and Agencies and Plan for Processing Civil Petitions

Since it is difficult to establish a plan for processing civil petitions at the planning stage, it is necessary to limit the appropriateness of the results of the consultation with related ministries and agencies.

□ Level of Project Plan Documents

If a proposer negligently or intentionally omits a cost, such omission might favorably influence the VFM analysis, and thus, it is necessary to assess whether there is any omission in design or costs, rather than assessing the level of project plan documents.

2) Additional Subject Matter of Assessment

□ Appropriateness of Substance of Project

There is no item for assessing the substance of a project in detail in the current subject matter of assessment. The feasibility assessment or the quantitative VFM analysis is unable to assess the substance of a project in detail, because the analysis is conducted with the given substance of the project. Although the qualitative analysis also assesses the suitability of a PPP for a project, the analysis is unable to review the appropriateness of the scale of the project, the appropriateness of the applicable construction method, the appropriateness of the selection of a route, whether the design is excessive, etc. In the subject matter of assessment of the appropriateness of the substance of a project, the appropriateness of the substance of the proposed project is assessed,

and the opinion on the review thereon is presented.

□ Appropriateness of Financial Plan

At present, there is no subject matter of assessment for assessing the financial plan of a proposal, except the "appropriateness of the composition of investors." It is necessary to expand the scope of the assessment to the "appropriateness of the financing plan," when considering the fact that the composition of investors is limited to equity capital and the financing structure in which the ratio of the borrowed capital is high, and subordinated bonds and similar instruments are introduced. The "appropriateness of the financing plan" is to review a plan for raising the fund for entire investment, through which plans for procuring equity capital and borrowed capital are reviewed in detail. In cases of a plan for procuring borrowed capital, the appropriateness of the method of procurement, interest rate, etc. are reviewed.

The key issues on a project proposal are user fees and the rate of return. The appropriateness of the level of user fees shall be assessed by comparing with the levels in nearby roads or similar projects, while the appropriateness of the rate of return shall be assessed by considering interest rates, the rates of return in similar projects, etc.

The appropriateness of Government subsidies is reviewed through quantitative VFM analysis, but it is difficult to reflect the appropriateness of requests for government's assistance in the analysis, although it is an important issue. In particular, since it is difficult to assess the appropriateness of such requests quantitatively, it is necessary to review the potential for the implementation by the competent authority through a review opinion.

〈Table Ⅴ-4〉 Modification to Subject Matter of Assessment for Bonus Points and Adjustment of Distributed Points

Current Subject Matter of Assessment	Improved Subject Matter of Assessment
Whether a proposal conforms to the government's medium- and long-term plans and priority of investment (out of 10 points)	To be excluded (it is assessed through the qualitative VFM analysis)
Appropriateness of the composition of investors (out of 10 points)	Appropriateness of the composition of investors and the financing plan (out of 10 points)
Appropriateness of plans for construction and operation (out of 30 points)	Appropriateness of the scope of the project (out of 15 points)
	Appropriateness of plans for construction and operation (out of 20 points)
Appropriateness of estimated demand (out of 30 points)	Appropriateness of the method of estimating demand (out of 10 points)
	Appropriateness of the rate of return and user fees (out of 15 points)
Appropriateness of consultation with related ministries and agencies and the plan for processing civil petitions (out of 10 points)	Appropriateness of demands for Government subsidies (out of 10 points)
	Appropriateness of matters subject to consultation with related ministries and agencies (out of 10 points)
Level of project plan documents (out of 10 points)	Assessment of omissions (costs, etc.) (out of 10 points)

The guidelines for the allocation of points for each subject matter of assessment are hereby established equally to ensure the points for each item correspond to the total sum of points in the results of assessment. The adjusted points (10, 15, and 20 points) are as set out in the following table.

<Table V-5> Guidelines for Allocation of Points to each Subject Matter of Assessment (Presenting Points Allocated to Three Items)

Subject Matter of Assessment	Allocated Points	Grade
Appropriateness of the composition of investors and the financing plan (out of 10 points)	90% (9 points) 80% (8 points) 70% (7 points) 60% (6 points) 50% (5 points)	Highly appropriate Appropriate Moderate Inappropriate Highly inappropriate
Appropriateness of the substance of the project (out of 15 points)	90% (13.5 points) 80% (12 points) 70% (10.5 points) 60% (9 points) 50% (7.5 points)	Highly appropriate Appropriate Moderate Inappropriate Highly inappropriate
Appropriateness of plans for construction and operation (out of 20 points)	90% (18 points) 80% (16points) 70% (14points) 60% (12points) 50% (10points)	Highly appropriate Appropriate Moderate Inappropriate Highly inappropriate

The full points in the assessment of the appropriateness of a proposal are 100 points, and the weight of each item may be adjusted partially according to the nature of each project, whenever necessary. 90 points or more in total is rated as Grade A, 80 points or more as Grade B, 70 points or more as Grade C, 60 points or more as Grade D, and less than 60 points as Grade F, respectively.

2. Determination of Ratio of Bonus Points

According to the Basic Plan for PPP projects, the initial proposer of an unsolicited project is entitled to bonus points in assessment. If a private proposal contains a complete basic design, the competent authority may grant bonus points up to 10% maximum, while a private proposal contains a complete basic plan, the competent authority may grant bonus points up to 5%. The ratio of bonus points shall be determined by considering the VFM ratio calculated through the VFM test and the results of the review on the appropriateness of the proposal.

The VFM ratio applicable to the determination of the ratio of bonus points shall be determined based on the PFI_1 alternative determined by reflecting the demand re-estimated in the VFM test in the private proposal. Not only the VFM but also financial profitability are taken into account in deciding the VFM ratio applicable to the determination of the ratio of bonus points. It is essential to consider financial profitability because bonus points will serve as an essential element in the assessment of PPP projects in the future. The ratio of bonus points shall be determined by applying the VFM ratio in which Government subsidies necessary for achieving the proposed rate of return are reflected.

In principle, the terms and conditions of a private proposal shall be applied as they are, except those about demand, in determining the costs of PFI_1 alternative. However, the costs may be re-determined to apply them in determining the VFM ratio, if it is necessary to adjust the scale of a facility because there is a significant omission in the proposed design or costs or there is a difference between the re-estimated demand and the proposed demand. The VFM ratio shall be calculated according to the ratio of the difference between the PSC and the PFI in the government's share of costs.

VFM ratio = [(Government's share of costs in the PSC alternative) - (Government's share of costs in the PFI alternative)] / | (Government's share of costs in the PSC alternative) | × 100%

The results of the assessment carried out by in-house and outside research teams and advisors of PIMAC who participated in the VFM test are applied to the review on the appropriateness of a proposal. Each evaluator gives fair points in five grades for the "improved subject matter of assessment" in Table Ⅴ-4. Points given by each evaluator for each subject matter of assessment are aggregated to determine the average points for each subject matter of assessment. The average points determined for each subject matter of assessment are aggregated to convert the points into Grade A, B, C, D, or F. Ninety points or more in total is rated as Grade A, 80 points or more as Grade B, 70 points or more as Grade C, 60 points or more as Grade D, and less than 60 points as Grade F, respectively.

The ratio of bonus points is given according to Table Ⅴ-6 by comprehensively assessing the VFM ratio and the appropriateness of the proposal. For example, if the VFM ratio is 15% and the points for the appropriateness of the project proposal correspond to Grade C, the ratio of bonus points is 2%. However, the ratio of bonus points is given only where it is possible to find a PFI alternative in which the VFM exceeds zero.

<Table Ⅴ-6> Determination of Ratio of Bonus Points in Detailed Guideline for VFM Test

Grade	VFM Ratio	Appropriateness of Project Proposal					Remarks
		A	B	C	D	F	
1	30% or more	10%	8%	6%	4%	2%	
2	20% ~ less than 30%	8%	6%	4%	2%	1%	If the VFM does not exceed zero, it
3	10% ~ less than 20%	6%	4%	2%	1%	0%	is possible to implement a project
4	0% ~ less than 10%	4%	2%	1%	0.5%	0%	only where it is possible to find an
5	-10% ~ 0% less than	2%	1%	0.5%	0%	0%	alternative with VFM≥0.
6	Less than -10%	0%	0%	0%	0%	0%	