Preliminary Feasibility Study on Light Rail Transit in Korea

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1. Introduction to PFS

❑ Overview

- ❑ Preliminary Feasibility Study(PFS) is a system that verifies the feasibility of large scale development projects through a general review of such items as economic analysis, po licy analyses, investment priority, investment timing, and funding methods.
- ❑ These studies have been conducted since 1999 for the purpose of enhancing the fiscal productivity through judicious launching of large-scale projects.
  - o While Feasible Studies examine technical details of projects as well as overall ec onomic feasibility, PFS focuses on overall evaluation of a project from economic, social and political perspectives and decide whether the projects should proceed.
  - o Feasibility Study is conducted by the line ministry, and MPB is in charge of PFS.

❑ Projects subject to PFS

- ❑ All new public investment projects that amount to fifty billion Korean won(≒40 mill. US dollars) or more and that partly or totally rely on the national budget in its funding.
- ❑ Local government projects and private investment that participated in infrastructure projects and the central government subsidy involved thirty billion won or more.

❑ Selection and Implementation of PFS

- ❑ PFS Committee selects PFS projects in discussion with committee members including line ministries.
- ❑ PFS committee members: MPB, line ministry, KDI, and other experts from the private and public domains.
- ❑ KDI Public Investment Management Center(PIMA) plays a leading role in conducting PFS. PIMA organizes a separate team for each project where related experts of scholars, private research organizations and other government think tanks take part in evaluating major issues.

2. Manual and Methodology for PFS

❑ Overview

- ❑ PIMA has attempted to maintain consistency in project evaluations by applying the standardized methodology and common database while ensuring that special natures of individual projects are not undermined seriously.
- ❑ Evaluation is carried out in accordance with the Standard Guidelines for PFS.
  - o General Guidelines
  - o Specific Guidelines by project type : Road, Railroad, Seaport, Airport, Water Resources(Dam construction)
- ❑ PIMA has been conducting broad data collection efforts as well as academic researches on important indicators included in the Guidelines.

The Framework of PFS

- Project Managers:
  - KDI : KDI itself organizes PFS team for each project.
  - Outsourced : Some typical projects such as national highway constructions are subject to outsourcing and the number of outsourced projects are increasing.
- Study Period : 5 - 6 months
- Mid-term and Final Report to PFS Committee
  - The PFS committee discusses PFS methodologies applied and makes suggestions to PFS team.

❑ Study Procedure

Analysis of relevant data and Raising project issues

Economic Analysis

- Cost-benefit Analysis
  - B/C, NPV, IRR

Policy Analyses

- RUI
- Regional economic impacts
- Financial feasibility
- Consistency with related plans
- Environmental impacts
- Other project-specific policy factors

Multi Criteria Decision Making by AHP

- Comprehensive evaluation
- Investment priority
- Funding methods
- Investment timing
- Other policy suggestions

- Analysis of relevant data and Raising project issues
  - Relevant basic data collection : project background, purposes, history and conception by line ministries
  - Brain-storming process is important to review and compare the 'Do-Nothing' alternative with other alternatives, through which purpose statement of the project is closely examined.
- Economic Analysis
  - Cost-Benefit Analysis(CBA) is the backbone of the economic analysis. The results are presented in B/C, NPV, and IRR.
  - CBA is conducted in accordance with evaluation manuals developed by PIMA.

- Policy Analyses
  - Quantitative or qualitative analyses of important factors that are not part of the economic analysis.
  - The common policy factors : regional backwardness index, regional economic impacts, financial feasibility, consistency with related plans, and environmental impacts
  - The Regional Underdevelopment Index (RUI) was devised to prevent 'the rich gets richer, and the poor gets poorer' phenomena and to enhance balanced regional development.
  - The regional economic impacts are computed using the KDI's Multi-Regional Industrial Input-Output model (MRIO).

- Financial feasibility : the feasibility of fiscal planning is qualitatively evaluated based on the mid-term fiscal plan, and fiscal conditions of local government where applicable.
- Consistency with higher-level plans : projects included in the higher-level plans get higher priority.
- Environmental impacts are assessed if necessary.
- Other project-specific policy factors : special features of the project included to determine overall feasibility

❑ Multi Criteria Decision Making by AHP(Analytic Hierarchy Process)

- Group decision of each team members is drawn in a quantitative measure.
- Major policy suggestions such as change in project scope and investment timing are made.

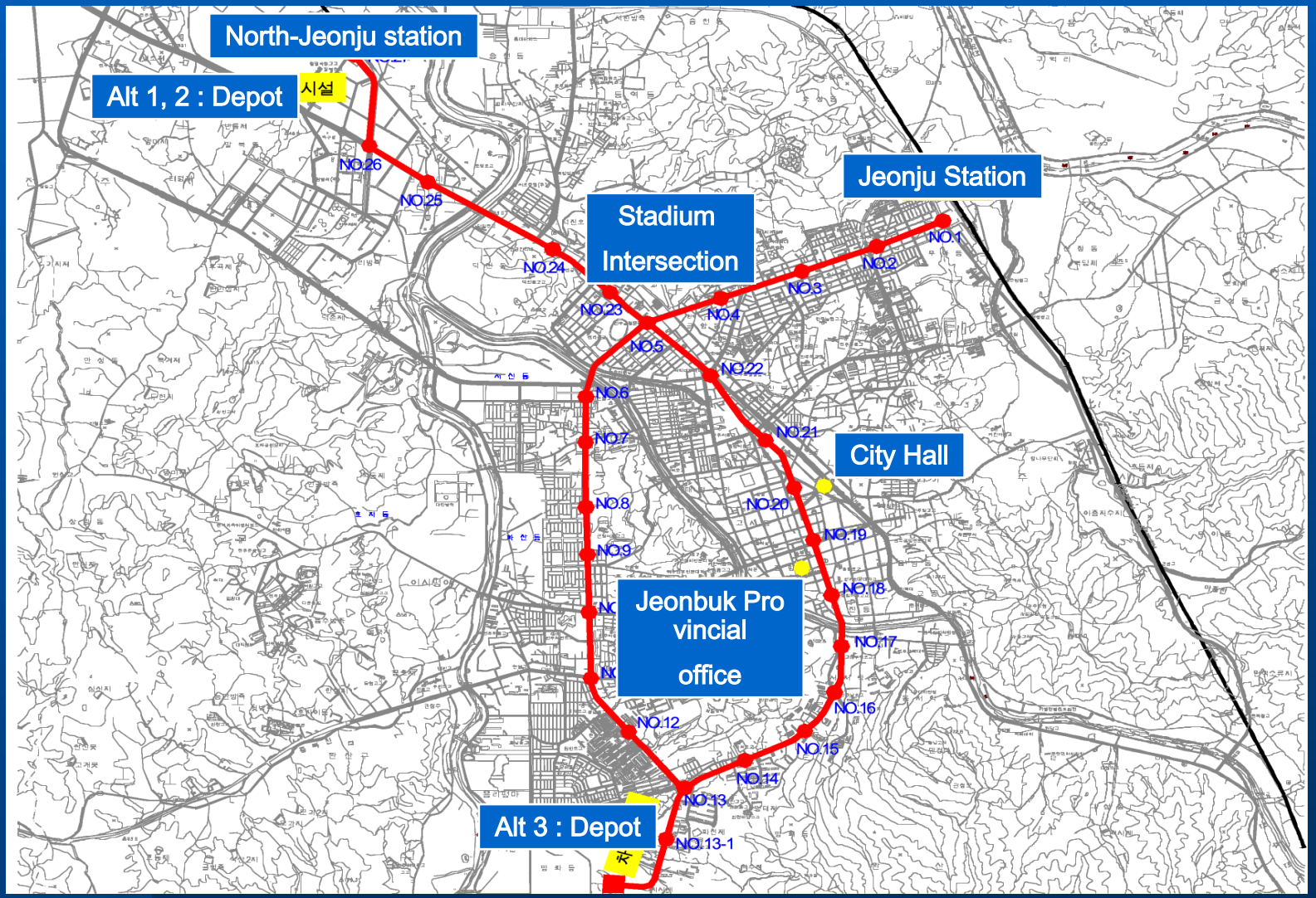
❑ PFS conducted

Category	Road	Rail	Seaport	Others	Sum
1999	11	2	1	5	19(30)
2000	11(6)	7(1)	5(2)	7	30(9)
2001	20(6)	14(3)	1(1)	6(1)	41(11)
2002	9(4)	9(3)	6(2)	4(1)	28(10)
Sum	51(16)	32(7)	13(5)	22(2)	118(30)

❑ Note : the number in parenthesis is PFS outsourced

- ❑ 54 out of 118 projects accepted during 1999-2002
- ❑ PIMA conducted 5 PFS for LRT projects including Jeonju Street LRT

Line Map


North-Jeonju station
Alt 1, 2 : Depot
시설
Jeonju Station
Stadium
Intersection
City Hall
Jeonbuk Pro
vincial
office
Alt 3 : Depot
차
NO.1
NO.2
NO.3
NO.4
NO.5
NO.6
NO.7
NO.8
NO.9
NO.12
NO.13
NO.13-1
NO.14
NO.15
NO.16
NO.17
NO.18
NO.19
NO.20
NO.21
NO.22
NO.23
NO.24
NO.25
NO.26

1. Overview of Jeonju LRT

- The project outline
  - Route : North Jeonju Station-> Paldal-Ro Blvd. -> Stadium Intersection -> Jeonju Station
  - Scale : 19.3km, 27stations, 1 depot
  - System : Street Light Rail Transit
  - To be implemented by inducing private investment projects
    - Funding sources : Central Government(20%),Local Government(20% (except land acquisition)), private investment(the rest)
  - Preparation by the Jeonju City
    - Collecting relevant data for LRT introduction
    - Workshops by experts and stakeholders
    - Feasibility Study for LRT project by KOTI

- Project purposes
  - Maximizing operation efficiency of Jeonju transportation system
  - Relieving traffic congestion and enhancing the level of public transportation service
  - Introducing a new system which is environment-friendly, reliable, safe, and future-oriented

2. Evaluation

- System : Street LRT
  - Street LRT is an optimum system in terms of contribution to city growth, costs, operating route, and domestic technical level.
- Alternatives Evaluated

	Construction period	Way of Crossing at The Stadium Intersection	Train Depot
Alt 1	One-Step	Underpass	North-Jeonju Station Suggested by KOTI
Alt 2	One-Step	Ground pass	North-Jeonju Station
Alt 3	Two-Step	Underpass	Daejeon-Dong

3. Travel Demand Forecast

- Traffic Zone : 60(45 internal zones, and 15 external zones)
- Methodology : Conventional four-step travel demand model
  - Modal Split : Seoul's Modal Split Model is adjusted to reflect Jeonju's transportation pattern.
    - Direct impact area : Jeonju LRT stations' vicinities
    - Indirect impact area : Jeonju Jurisdictional Area
  - Time Scope
    - Initial year : 2006 of the opening year
    - Final year : 2035, 30 years after opening year

Results

- The per-kilometer travel demand of LRT
  - 6,497(2006) -> 11,283(2021) (trips/day·km)
- LRT's share is 7-8% of all the trips in Jeonju

		Auto	Bus	Taxi	Other	LRT	Total
2006	Trip	827,415	562,882	263,842	57,885	125,522	1,837,546
	(%)	(45.0)	(30.6)	(14.4)	(3.2)	(6.8)	(100.0)
2011	Trip	1,018,069	582,713	303,349	59,126	146,761	2,110,018
	(%)	(48.2)	(27.6)	(14.4)	(2.8)	(7.0)	(100.0)
2016	Trip	1,133,885	637,501	354,127	60,752	176,288	2,362,553
	(%)	(48.0)	(27.0)	(15.0)	(2.6)	(7.5)	(100.0)
2021	Trip	1,214,427	698,349	411,185	61,388	217,995	2,603,344
	(%)	(46.6)	(26.8)	(15.8)	(2.4)	(8.4)	(100.0)

4. Cost Estimation

❑ Construction costs

Unit : 100 million Won

Category	Alt 1	Alt 2	Alt 3	KOTI
Length(km)	19.32	19.32	20.32	19.32
Construction	2,484.68	2,238.68	2,588.04	2,564.96
Vehicle	870.00	870.00	960.00	1,125.40
Others	446.07	434.54	473.89	299.01
Total	3,818.75	3,588.22	4,021.93	3989.37

o Others include cost for design, land acquisition and test drive

- Operating and maintenance costs
  - labor, electricity and maintenance costs included

Unit : 100 million Won

Category	2006	2011	2016	2021
Alt 1	88.1	94.4	112.5	126.1
Alt 2	88.1	102.3	112.5	126.1
Alt 3	47.4	95.5	112.0	127.3

5. Benefit Estimation

❑ Summary

Unit: million won

Category	2006	2011	2016	2021
VOTS	23,962	23,539	24,763	50,909
VOCS	13,985	16,486	19,611	23,070
TACS	422	5,758	3,660	3,789
Sum	38,369	45,783	48,034	77,768

* VOTS : Value of Time Saving; VOCS : Vehicle Operation Cost; TACS : Traffic Accident Cost Saving

o VOCS and TACS increase continuously, but VOTS fluctuates according to traffic conditions.

6. Economic Feasibility

- Bases
  - Base year : 2000
  - Social discount rate : 7.5%
  - Evaluation period : 35 years(5 years of construction + 30 years of operation)
- Results

	B/C	NPV	IRR(%)
Alt 1	1.17	762.7	9.17
Alt 2	1.12	493.3	8.65
Alt 3	1.25	954.0	10.03

7. Financial Feasibility

- Bases
  - Base year : 2000
  - Price increase rate : 5%
- Results

category	WADR(%)	RFDR(%)	FIRR(%)	FNPV	Subsidy(%)
Alt 1	15	9.52	10.10	73.33	55
Alt 2	15	9.52	10.04	59.97	50

WADR : Weighted Average Discount Rate; RFDR : Real Financial Discount Rate

  - If WADR is 15%, public sector should subsidize 55% of construction costs except land acquisition of Alt 1 to make this project financially viable.

8. Policy Analyses

❑ Regional economic impacts

- ❑ Model : KDI MRIO(Multi-Regional Industrial Input-Output Model)
- ❑ Results
  - o Production induced within Jeonbuk Province amounts to 360.5-407.1 billion won, which is 45% of production induced nation widely.
  - o Total number of employment induced amount to 4,132-4,670 within Jeonbuk Province, which is 46% of total domestic employments induced by this project.
  - o Wage increase occurred in Jeonbuk Province amounts to 53.3-60.3 billion wons, which is 46.2% of total domestic wage increase.

❑ Regional Underdevelopment Index(RUI)

- ❑ The regional Underdevelopment in terms of RUI is 17 out of 170 jurisdictions.
- ❑ The regional Underdevelopment is not an important factor in evaluating this project.

❑ The Region's Attention to the Project

- ❑ Citizens : According to the Jeonju Comprehensive Development Plan(2000) 58% of citi zens are in favor of LRT project.
- ❑ City government
  - o The Comprehensive Transportation Improvement Plan incorporates LRT construc tion.

- A SWOT analysis shows “congestion is a key threat to city’s future development and LRT construction is an effective solution”.

❑ Other Stakeholders

- The owners and labor unions of taxi and bus companies strongly oppose to LRT construction.
- NGOs are supportive to the plan on one hand, but they are concerned about fiscal prudence of local government on the other hand.

❑ Transition in Urban Railway Policy

- ❑ Urban Railway Policy should be changed because :
  - o Heavy rail was provided only in 6 largest metropolitan areas with substantial subsi dy from the central government ; and
  - o The subsidy scheme put little emphasis on fiscal accountability and thereby result ed in large amount of debts from operation as well as construction.
- ❑ The wide spectrum of LRT make it possible for a city to choose an appropriate system i n response to travel demand and fiscal condition.
- ❑ Jeonju is a good candidate for LRT construction instead of heavy rail system.

9. Comprehensive Evaluation and Policy Suggestions

❑ AHP Analysis

- ❑ An AHP model is used to combine the results of economic and policy analyses and to evaluate overall feasibility of the project.
- ❑ According to AHP analysis, PFS team members think:
  - o Policy analyses is more important than economic analysis;
  - o Financial plan is most important among the items of policy analyses; and
  - o The consideration of “transition in urban railway policy” is more important than reg ional economic impacts.
- ❑ Evaluation summary
  - o Jeoju LRT project is feasible in economic and policy perspectives.

❑ Policy suggestions

- ❑ Appropriate fiscal plan should be devised to minimize fiscal burden of local government. Inducement of private investment is a key to the realization of the projects.
- ❑ The conflicts among stakeholders should be resolved to implement the plan.