

A Study on the Improvement Plan for Securing Safety of Infrastructure Facilities in Korea (R Project)

Kwa Sup Lee / ksulee@kdi.re.kr

**Public and Private Infrastructure
Investment Management Center**



C O N T E N T S

Part 1. Background and Objectives

Part 2. Infrastructure Status in Korea

Part 3. Foreign Policy and Efforts in Infrastructure

Part 4. Countermeasure for Aging Infrastructure

Part 5. PPP program for Aging Infrastructure

Part 6. Conclusion

Part 1

Background and Objectives

KDI

Part 1. Background and Objectives

1-1. Rehabilitation concept

- To prepare for **obsolescence and aging** of infrastructure
(‘Infra Graying’)

* Infra Graying : In comparison to the ‘Population Graying,’ the facility has been **aged for 30 years** after the completion of construction

- Need to distinguish between **rehabilitation and maintenance**
- Meaning **restoration of safety and continuous service** of facilities.
- To make **in state of completion of construction**
- Including **seismic retrofit** against earthquakes

Part 1. Background and Objectives

1-2. Rehabilitation Performance in Korea

- The **RTO projects** are carried out in **approx. 20 or more**, among approx. 300 projects.
 - * Rehabilitation projects of facility are divided into RTO(Rehabilitate-Transfer-Operate) and RTL(Rehabilitate-Transfer-Lease)
- In case of **RTL projects**, **approx. 140 projects or more** among approx. 420 projects
 - **Architectural facilities** : **primary and secondary school**, military officers and military facilities and cultural tourism facilities, etc.
 - **Infrastructures** : **sewage networks**, etc.

Part 2

Infrastructure Status in Korea

KDI

Part 2. Infrastructure Status in Korea

2-1. Infrastructure stock status

- **Major infrastructure** in Korea is divided into **seven categories**
 - Roads, railroads, airports, dams, water supply facilities, rivers, and ports
- Estimated to **approx. 1,352 facilities** among the overall of approx. 15,000 facilities (**9.3% graying rate**)
 - Graying rates : Water resources (20.5%, **dams 55.9%**), river facilities (20.1%), transports (6.3 %), ports (13.1%), retaining wall (12.7%), **industrial complex facility 50%**(area basis)
 - Required to **maintain investment** for the **performance and safety against deterioration** of facilities

Part 2. Infrastructure Status in Korea

2-2. Aging infrastructure stock status

<Table 1> 'Graying rate' of infrastructures

(Unit: %, number)

Transport			Energy and Public Facilities					Total
Bridge	Tunnel	Port	Retaining Wall	Dam	River Facilities	Water & Wastewater	Industrial Complex *	
Railway 28.5	Railway 8.8	Lock Gate 50.0	12.7 (109)	55.9 (292)	20.1 (232)	7.7 (109)	54.2 (-)	9.3 (1,352)
Road 3.1	Road 3.1	Berthing Facilities 12.8	Road 0.7	Multipurpose Dam 25.1	Estuary Bank 18.2	Industrial 16.7		
Covered Structure 14.6	Underground Structure 3.5		Railway 60.5	Power Supply 42.1	Sluice Gate 20.3	Local Water Service 12.4		
			Building 0.8	Water Supply 57.6	Embankment 18.4	Central Water Service 5.1		
				Local Water Supply 42.9		Sewage 0.0		

Note :

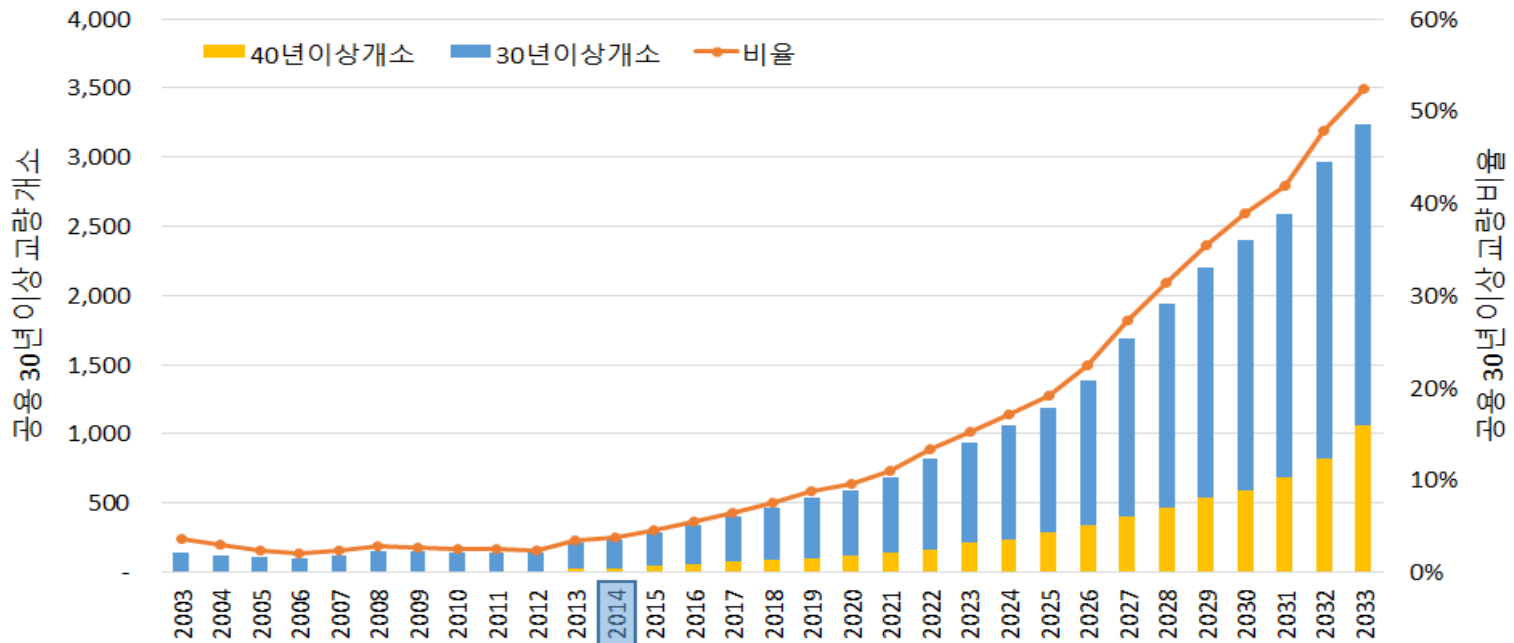
1. Rate of aging = (30 years of facility / whole facility) * 100%
2. () : number of place
3. * : The overall 'graying rate' of the infrastructure is calculated based on 7 infrastructures excluding 'Industrial Complex'

Part 2. Infrastructure Status in Korea

2-2. Aging infrastructure stock status

➤ The **other** infrastructures are similar to aging trend of case of bridges as below

< Figure 1 > 30 years of trend of general national highway bridge



Note :

1. Number of places over 30 years' bridge(Y axis on left), rate of number of places over 30 years' bridge (Y axis on right), Year(X axis)
2. Yellow bar : number of more than 30 years, blue bar : number of more than 40 years

Part 2. Infrastructure Status in Korea

2-2. Aging infrastructure stock status

- Typical types of infrastructure : bridges, roads and tunnels
 - Categorized according to the degree of deterioration

<Table 2> Bridges' status of highway and road (nationwide)

(Unit: number)

Classification	Total	High Speed National Highway	General National Highway					Metropolitan City	Local Road by National Subsidy	Local Road	City Road	Gun Road	Gu Road
			Sub Total	Management by Ministry of Land, Infrastructure and Transport			Management by Local Government						
				Sub Total	Direct Management	Delegated Management							
Total	1,578	775	421	393	371	22	28	146	67	72	73	21	3
Less than 10 years (Since '02)	1,043	531	309	298	286	12	11	47	48	54	40	12	2
Less than 10 to 20 years (From '92 to '01)	422	218	91	82	75	7	9	53	14	14	29	2	1
Less than 20 to 30 Years (From '82 to '91)	62	19	15	8	7	1	7	18	5	3	1	1	-
Over 30 years (prior to 81')	51	7	6	5	3	2	1	28	-	1	3	6	-

Data: Yearbook of Bridges and Tunnels of General National Highway in 2013

Part 2. Infrastructure Status in Korea

2-2. Aging infrastructure stock status

➤ Typical Architecture facilities : Schools

- Rated as below grade "D" according to 'disaster ratings'

< Figure 2 > Hazard risk ratings school facilities (e.g.)



4월 현재 학교 재난위험시설 등급 (단위:건)

	초·중·고교		국립대		합계
	공립	사립	대학	부설학교	
D~E등급 건물	77	27	21	4	129
사용 중	61	22	15	4	102
사용 중지	16	5	6	0	27

2014년 서울 지역 재난위험시설(D등급) 건물의 학교급 및 설립 형태 (단위:건)

	공립		사립	
	기관	2(E등급)	사용 중	사용 중지
초등학교	7	0	22	14
중학교	7	7	3	1
고등학교	9	8		

2014년 재난위험시설(D등급) 건물의 최초 D등급 지정 연도 (단위:건)

	이전	2004년	2005년	2006년	2007년	2008년	2009년	2010년	2011년	2012년	2013년	2014년	계
소계	3	1	1	2	1	21	8	6	9	36	29	12	129
교육청	0	1	1	0	1	21	5	5	5	31	23	11	104
국립대	3	0	0	2	0	0	3	1	4	5	6	1	25

(자료: 교육부)

Data: Ministry of Education (MOE), 2014

Part 2. Infrastructure Status in Korea

2-3. Budget for Aging Transport

- **Maintenance investments in domestic roads and railways : Approx. 0.26 % of GDP(Approx. 0.85 % of new construction)**
 - Road budget : **Approx. 0.19 % of GDP**
 - Railway budget : **Approx. 0.07 % of GDP**

<Table 3> Estimation of transport investment in Korea (e.g.)

Classification	GDP	Road			Railway			Total	
		Build	Maintenance	Sub Total	Build	Maintenance	Sub Total	Build	Maintenance
Investment (Billion \$)	1,054	5.03	1.99	7.02	3.95	0.73	4.68	8.98	7.72
Rate of GDP(%)	100.00	0.48	0.19	0.67	0.38	0.07	0.44	0.85	0.26

*Data : Remake data from 'Basic Safety and Maintenance Basic Plan (2013 - 2017), Ministry of Land, Transport and Maritime Affairs, 2012

* Rate of exchange : \$1.0=\1,113

Part 3

Foreign Policy and Efforts in Infrastructure



Part 3. Foreign Policy and Efforts in Infrastructure

3-1. Advanced Countries

- **Each advanced country** reflect each country's budget based on **infrastructure evaluation report** ('Infrastructure Report Card')
 - * **Infrastructure Report Card** : **Comprehensive evaluation of social infrastructure**, increased management efficiency, and promoted publication of the **United Nations in the United States in 1988**
 - **Advanced countries** averagely spend **20 % to 40 % of new construction funds** on their budgets
 - **United States** : **Aging of transport infrastructure**(roads, bridges, tunnels, and so on) being **considered serious**, **estimated at approx. \$129 billion annually** for aging costs.
 - **Japan** : **Recognizing the seriousness** of the **financial problems caused by aging facilities**, to establish a **basic plan for infrastructure long-term life saving plans**

Part 3. Foreign Policy and Efforts in Infrastructure

3-1. Advanced Countries

<Table 4> 'Infrastructure Report Card' by advanced countries

Classification	U.S.	Canada	Australia	United Kingdom	South Africa
Evaluation Facility	14 types (Airport, Dam, Water, Sewage, Energy, Hazardous Waste, Solid Waste, Sluice Way, Parks, Railway, Road, Bridge, School, Transit)	4 types (Water, Sewage, Rain Water, Road)	11 types (Road, Railway, Airport, Port, Water, Sewage, Rain Water, Irrigation Facility, Power, Gas, telecommunication)	6 types (Energy, Transit, Water & Sewage, Flood Management, Solid Wastes & Resources Management)	10 types (Water, Sanitation Facility, Solid Waste, Road, Airport, Port, Railway, Electricity, Health Facility, School)
Evaluation Element	Capacity, Physical Status, Financial Procurement, Future Demand, Operations, Maintenance	Physical Status, Management Status and Capacity	Physical Conditions, Safety, Sustainability (economic, environmental, etc.)	Social Issues, Resilience, Physical Status and Capacity, Sustainability, Financial Cuts, Forecast for Next 5 Years	Physical Status, Maintenance Level, Capacity and Incident Occurrence, Readiness for Subjectivity Institution
Institution	ASCE	Project Committee	ENGINEERS AUSTRALIA	ICE	SAICE
Name of Report	2009 Report Card for America's Infrastructure	Canadian Infrastructure Report Card Volume 1 : 2012 Municipal Roads and Water Systems	Infrastructure Report Card 2010 Australia	The State of the Nation Infrastructure 2011	SAICE Infrastructure Report Card 2011
Year Published	1988, 1998, 2001, 2003, 2005, 2009, 2013	2012	1999, 2001, 2005, 2010	2003, 2004, 2005, 2006, 2009, 2010	SAICE Infrastructure Report Card 2011

Part 3. Foreign Policy and Efforts in Infrastructure

3-2. Developing Countries

- **For developing countries, investment in SOC for 10 years(2008 to 2015) is estimated to be average of 2.3 % of GDP**
 - Investment for **maintenance** : **approx. 1.8 % of GDP**, more than 3 times **higher** than **new construction(0.5 % of GDP)**
 - Approx. **7 times higher** than **0.26%** of GDP in **domestic roads and railways**

<Table 5> Estimation of SOC (traffic) investment in developing countries (2008-2015)

SOC Investment (% of GDP)						SOC Investment by Type (% of GDP)		Total (% of GDP)
Eastern Asia	Eastern Europe	Latin America	North Africa	South Asia	South Africa	Build	Maintenance	
1.7	3.1	1.5	3.0	4.0	3.0	0.5	1.8	2.3

*Data : Safety and maintenance basic plans for tertiary structures (2013 to 2017),
Ministry of Land, Transport and Maritime Affairs, 2012

Part 3. Foreign Policy and Efforts in Infrastructure

3-3. Viewpoint and Outlook in Korea

➤ Viewpoint

- **Investment is essential** for the safety of **domestic facilities** including the **development of technologies** in comparison with **foreign countries**

➤ Outlook

- Need to **focus on investment of existing facilities to maintain safety** than investment of **new infrastructure construction**
- **Investment for aging facilities** is assumed to be **bigger than** investment for the maintenance of the facilities.
- It is **urgent to secure investment budget** for aging facilities.
- Need to consider **the limitations of the government budget** for **fiscal soundness**

➤ So what !

- Need to prepare **funds and project execution methods (PPP)** for **reinforcement(including seismic retrofit)** and **safety** of aging facilities

Part 4

Countermeasure for Aging Infrastructure



Part 4. Countermeasure for Aging Infrastructure

4-1. Definition of Rehabilitation

- Rehabilitation : To achieve **benefits and safety** for aging facilities **by restoring**
 - To **reassure** the safety of facilities and to contribute in **protecting environment**
 - **Cases of applicable facility (e.g.)**
 - Aging facilities(**Including seismic retrofit**)
 - **Reduction of benefit and service** due to increasing demand
 - **Difficulty of new investment** due to much maintenance cost
 - Improving services **after the termination of PPP projects**
 - **Recovering** service level with **small investment**
 - Expected to **increase benefit** in comparison to **investment cost**
 - Facilities with **similar backgrounds and objectives** above

Part 4. Countermeasure for Aging Infrastructure

4-2. Investment for Rehabilitation

- Need PPP program for **budget soundness and lack of budget**
 - To overcome **limitation of budget from conventional** procurement
 - For creativity and efficiency of private sector in construction and operation
- Need **the urgency of investment** for aging infrastructure
 - To prevent **time overrun** and **cost overrun** in conventional procurement

<Table 6> Comparison between conventional procurement and PPP(PFI)

Classification	Conventional Procurement	PPP(PFI)
Resource of Investment	Fiscal of Central or Local Government	Private Capitals(fund, loan, etc.)
Finances	Difficulty of Finances Timely by Central or Local Government	Ease of Finances Timely by Central or Local Government
Ownership	Central or Local Government	Central or Local Government
Obligation of Construction and Operation	Central or Local Government	Private
Obligation of Facility Safety	Central or Local Government	Private(Under Supervision of Central or Local Government)
Risks of Time Overrun and Cost Overrun	Exited	None
Method of Progression	Construction Procurement, Turn-key, Etc.	RTO(Rehabilitate-Transfer-Operate), RTL(Rehabilitate-Transfer-Lease)

Part 5

**PPP program
for Aging Infrastructure**



Part 5. PPP program for Aging Infrastructure

5-1. Review for PPP project

- Need to **secure the possibility** in accordance with the **legal and policy** of each **PPP project** for aging facility
 - At first, **feasibility** of ageing facility need to be **secured** by **B/C ratio test**
 - Secondly, **eligibility** need to be **secured** as a **PPP project** of aging facility by **VfM(Value for Money) test**

- Divided into **RTO**(Rehabilitate-Transfer-Operate) and **RTL** (Rehabilitate-Transfer-Lease) **according to demand risk**
 - RTO project : Investment recovery **from a fee**(or tariff, toll, etc) **from beneficiary**
 - RTL project : Investment recovery from **‘Government payment’**; **central or local government**

Part 5. PPP program for Aging Infrastructure

5-2. Comparison of RTO and RTL in PPP project

<Table 7> RTO and RTL Comparison

Classification	RTO	RTL
Demand Risk	Concessionaire	Central or Local Government
Ownership	Central or Local Government	Central or Local Government
Investment Recovery	From Beneficiary (Direct toll)	From Central or Local Government (Shadow toll)
Service Penalty	None	Penalty According to Service
Suitable Facility	New Facility with Demand Risk	Existing Facility with Lower (or No) Demand Risk
Operation Revenue	Beneficiary Fee	Government Payment (Lease Payment + Operation Cost)
Land Acquisition Cost	Necessity for New Facility	Needlessness for Existing Facility
Subsidy	Fiscal Support during Construction Period	Almost None
Method of Proposal	Solicited and Unsolicited	Solicited and Unsolicited

Part 5. PPP program for Aging Infrastructure

5-2. Comparison of RTL and RTO in PPP project

- Need to select **RTO and RTL** according to **demand risk, operating revenue and profitability**
 - RTL project : **Suitable** for projects with less demand risk, less beneficiary fee and less profitability, such as **dam, water & sewage, school, environmental facility, etc.**
 - RTO project : **Suitable** for projects with demand risk, beneficiary fee and profitability, such as **road, bridge, railway, etc.**

<Table 8> Capable method by facility type

Classification	Demand Risk	Beneficiary Fee	Profitability	Capable Method
Road	○	○	○	RTO
Bridge	○	○	○	RTO
Railway	○	○	×	RTO/RTL
Dam	×	×	×	RTL
Water & Sewage	×	×	×	RTL
School	×	×	×	RTL
Environment	×	×	×	RTL

Part 6

Conclusion and Future Review



Part 6. Conclusion

- Need to establish a classification **standard for aging facility** according to safety and of **proceedings as PPP projects**
 - For example, **safety degree of D or E** among the facilities existed **over 30 years**
 - Selection of **applicable type** of aging facilities to proceed as **PPP projects**
- Need to secure **economic feasibility** ($B/C \geq 1.0$, $AHP \geq 0.5$) and **PPP eligibility** ($VfM \geq 1.0$) of aging facility by '**National Finance Act**' and '**PPI Act**'
 - It is **Difficult to obtain benefits** for aging facility due **to its existing benefits**
 - Need to establish a method of **economic feasibility analysis** to obtain **more benefits**

Thank you

Korea's Leading Think Tank

