



# Infrastructure Safety Management & Maintenance in Korea

May 2015



(Korea Infrastructure Safety & Technology Corporation)



# Contents

I . Social Background on Facility Safety in Korea

II . Infrastructure Status

III . Maintenance Policies on Infrastructure

IV . Special Act on Safety Management of Infrastructure(SASMI)

V . KISTEC : Functions & Roles

VI . Concluding Remarks

*\* An Overseas Project on Going – KOICA\_ODA in Indonesia*

# Social Background on Facility Safety in Korea



Major Role for Rapid National Economic Growth  
Insufficient Measure for Construction Management  
Poor Safety and Maintenance Policy

**A Series of Infrastructure Disaster**

# | Social Background on Facility Safety in Korea

*As was ...*

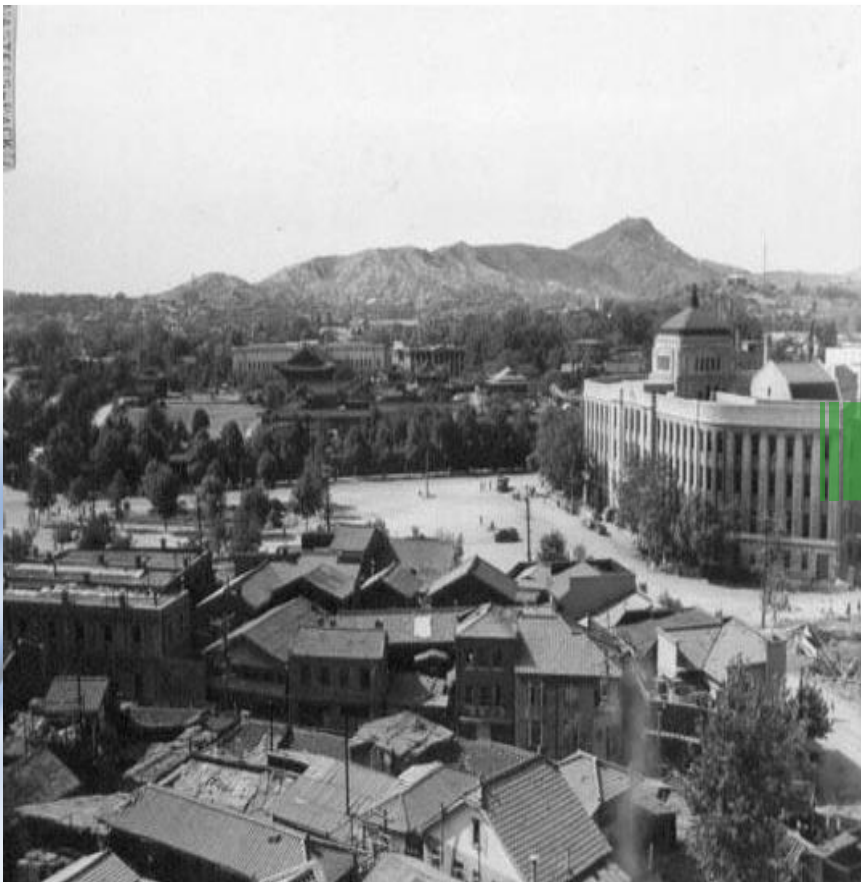


## **Korean War(1950-1953)**

- Two million people were sacrificed.
- Poorest Country in the World

# Social Background on Facility Safety in Korea

*As is ...*



GNI  $\approx$  \$76

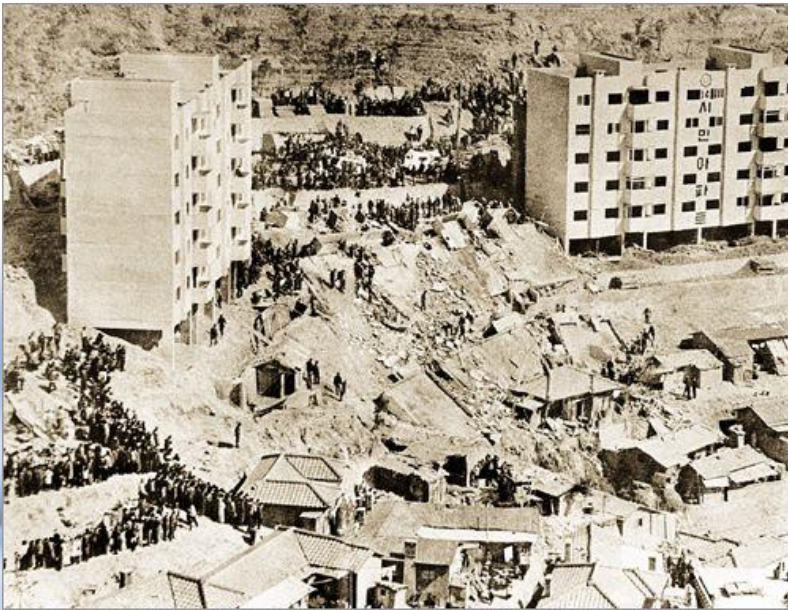


\$30,000

# Social Background on Facility Safety in Korea

*But ...*

- Fast, quick construction
- Faulty and illegal construction practice
- Materialism



**Wa-woo Apt., in Seoul(1970)**

- Total faulty construction
- Weak foundation



**Woo-am Apt., in Chungju(1993)**

- Faulty design & construction
- Insufficient materials used

# | Social Background on Facility Safety in Korea

- Lack on safety awareness of managing entity
- No routine safety inspection
- Connection bolts breakage, poor welding works



## Sungsoo Bridge in Seoul(1994)

- Many people were sacrificed.
- Turning point to a systematic safety & maintenance policy

# Social Background on Facility Safety in Korea

- Lack on safety awareness of managing entity
- No routine safety inspection
- Faulty and illegal design modification - **overload**



## Sampoong department store in Seoul(1995)

- Five story building was totally collapsed. – more than 500 sacrificed
- Safety policy on facility has been accelerated from this lesson.

# Infrastructure Status

## 1. Infrastructure in Korea

Unit : no. of facility

Classification		Total Facility	Vulnerable facility (Grade D&E)
National major facility <sup>1)</sup>	Public facility	24,800	50
	Building	38,100	1
	Sub-total	62,900	51
Small scale facility <sup>2)</sup>	Public facility	19,700	268
	Building	177,900	1,196
	Sub-total	197,600	1,464
Other facility <sup>3)</sup> (e.g. houses, reservoirs, etc.)	Public facility	71,700	N/A
	Building	6,580,200	N/A
	Sub-total	6,651,900	N/A
Total	Public facility	116,200	318
	Building	6,796,200	1,197
	Sub-total	6,912,400	1,515

Note: 1)~3) Subjected by SASMI, GADSM and specific Acts, respectively

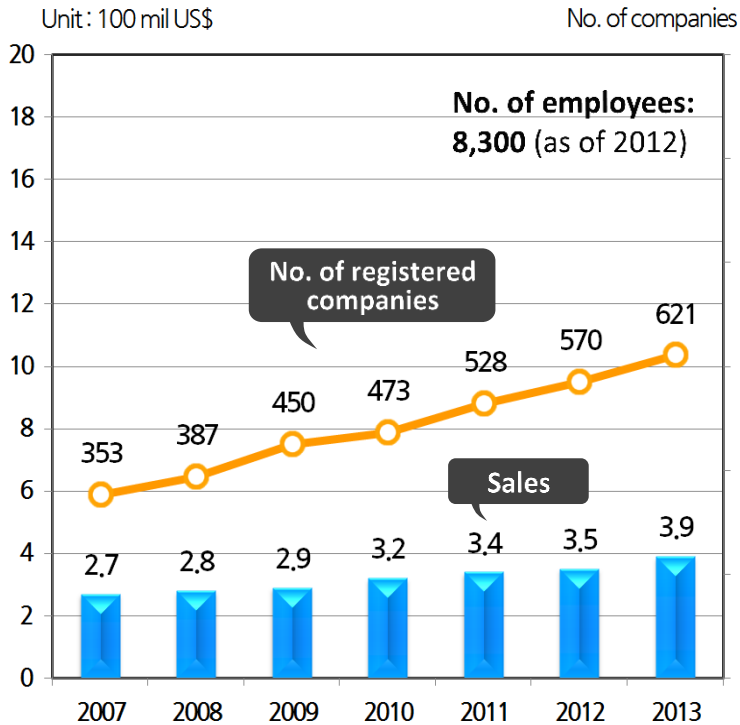
(SASMI - Special Act on the Safety Management of Infrastructure; GADSM - General Act on Disaster & Safety Management)

Source : FMS (Facility Management System, Jul. 2013), NEMA (National Emergency Management Agency, 2013),

MOLIT (Ministry of Land, Infrastructure & Transport) Statistics (2012), KRCC (Korea Rural Community Corporation, 2013)

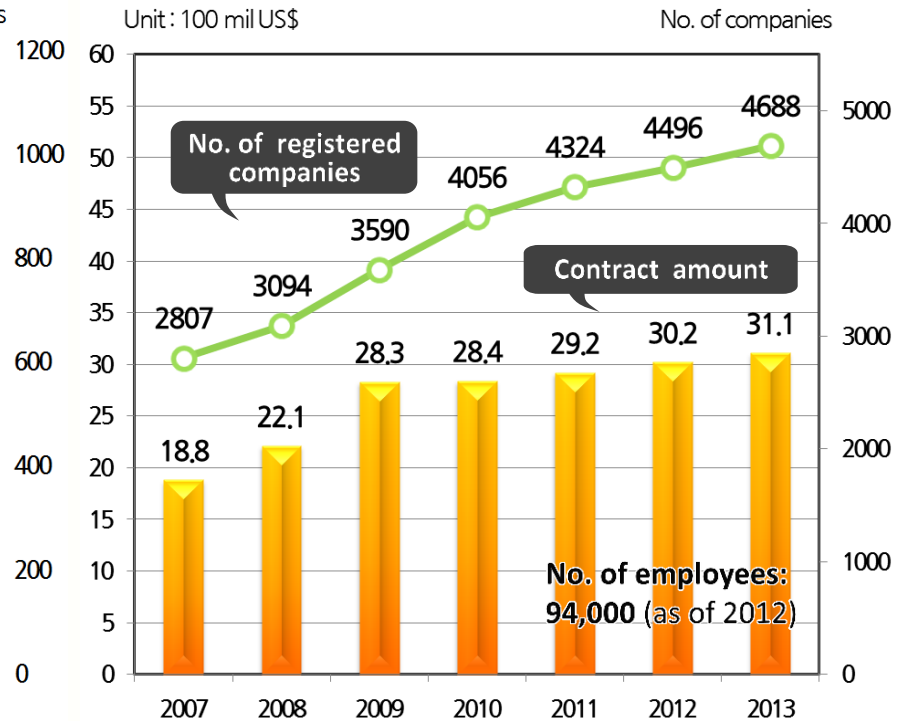
## 2. Safety Inspection & Maintenance Markets

### Safety inspection Services



Source: FMS, etc

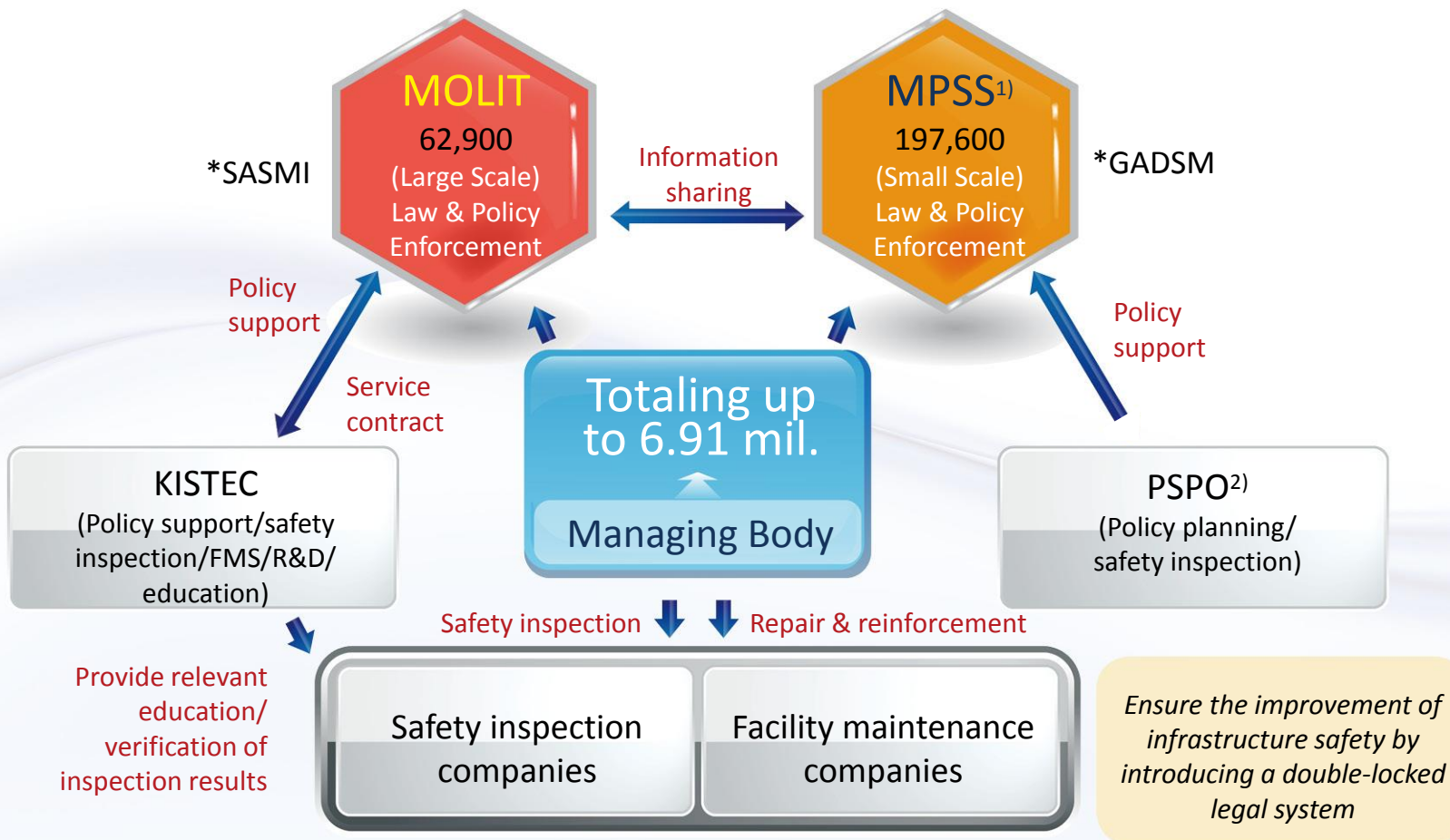
### Maintenance Services



Source: Statistical Annual Report issued by FMA

# Maintenance Policies on Infrastructure

## 1. National Safety & Maintenance System



Note : 1) MPSS - Ministry of Public Safety and Security, 2) PSPO – Public Safety Policy Office

# Maintenance Policies on Infrastructure

## 2. Safety & Maintenance Strategy

To improve the safety management of Infrastructure within SASMI

Utilize ICT applications

- Ensuring the **precise safety inspection & maintenance practices**:  
Development & provision of safety inspection, maintenance guidelines, etc.
- Introducing FMS-based **smart & intelligent management**  
- Implementing **mobile safety inspection system**
- Pursuing **real-time safety monitoring** for long span bridges and other

To build safety management for small-scale vulnerable facilities

- Building up a safety inspection & management system of living based urban facility **vulnerable to abnormal climate and aging**
- Operating the Real-time Disaster Management System (**#4949**)
- Emergency Support System on duty (**Safety Inspection Task-Force Team**)

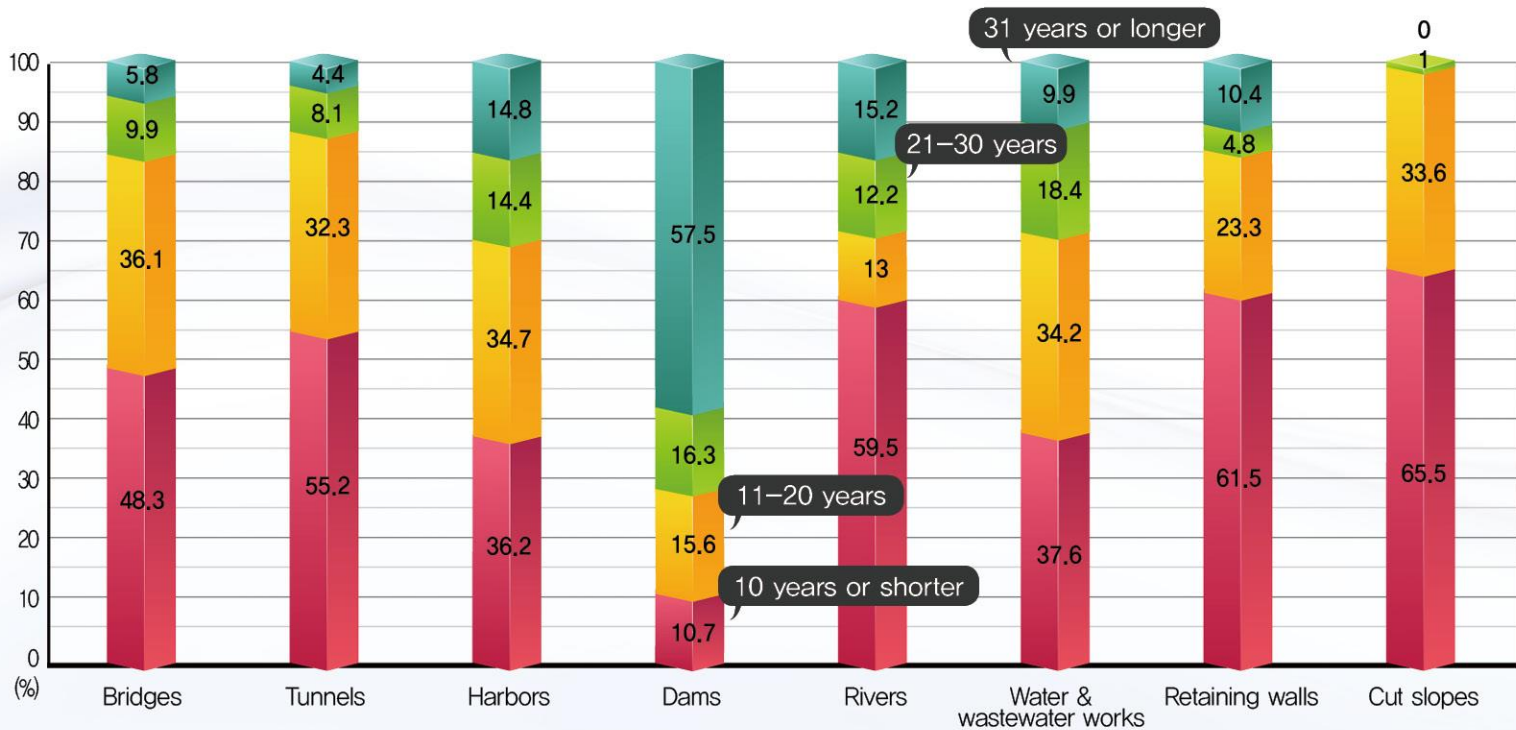
## 3. Outcomes from the System

- Well-organized safety management regulations & systems, facility management DB (i.e. FMS) and safety education since the SASMI having been enacted
  - Enabled **safety accidents free and safety grades A & B for 95%** of 1<sup>st</sup> & 2<sup>nd</sup> class facilities
- Currently, strong demands for intensification of **safety management on small-scale vulnerable facilities**
- **Convenient & efficient infrastructure maintenance** Integrating ICT
- Pursuing maintenance enabling the **prolonged durability**

# Maintenance Policies on Infrastructure

## 4. Environment Changes in Korea (1)

Distribution of service age by type of facility



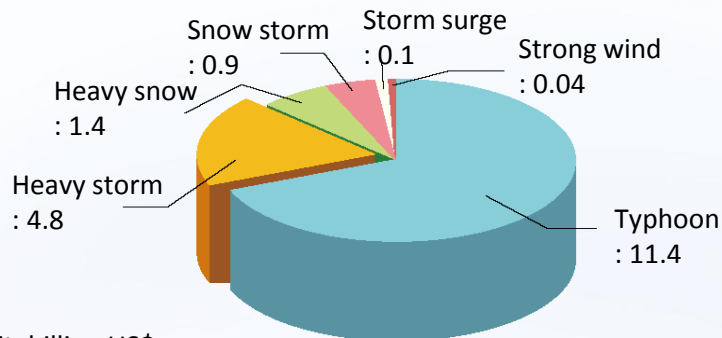
Present rate of agedness: 9% ; expected rate of agedness in 10 years: 20%

\* Facilities are deemed as "aged" when at least 30 years have passed since their construction.

## 4. Environment Changes in Korea (2)

- The rising occurrence of **extreme weather events by climate change**
  - A severe threat to the safety of infrastructure, especially living based urban facilities

### Damages by natural disasters for the past 10 years



Unit: billion US\$

Source : Adapted from data as provided by KMA (Korea Meteorological Administration)

### Trends in the rising intensity of typhoons & rainfalls

- Six of the top 10 typhoons for the past 100 years occurred within the recent 10 years.
- For the recent 10 years, the frequency of heavy storms has increased 2 times as many as that of heavy storms in the 1970's.

# Maintenance Policies on Infrastructure

## 5. Direction of Policy – Master Plan(2013-2017)

### National Vision & Goals



## 5. Direction of Policy – Master Plan(2013-2017)

### Objective & Strategy

- To establish an **advanced safety management** system
- To realize safety management practices **together with people**
- To shift safety management into **pro-active response** to an environmental change:
  - Building an integrated emergency response system against natural disasters
  - Building a managing body-friendly maintenance system
- To pursue **smart & intelligent maintenance** and improve their efficiency:
  - Developing safety inspection & maintenance technologies based on ICT convergence
  - Building up the sophistication & utilization of facility information system

# Special Act on Safety Management of Infrastructure(SASMI)

National Measures for People's Life and Property(1995 ~ )



\* KISTEC: Korea Infrastructure Safety & Technology Corporation

## 1. Overview

### Major Contents

- Establishment & operation of a **Master Plan**(5yrs) for safety & maintenance
- Guideline and execution of safety/ in-depth safety inspection, and maintenance
- Role of KISTEC and specialized inspection company

### Facility Classification

- The 1<sup>st</sup> and 2<sup>nd</sup> class: with **importance and scale of facilities**
- Facility group: bridge, tunnel, port, dam, building, river/water works, etc...
- All managing bodies know **how to classify their facilities.**

## 1. Overview

Facility	First class facility
1. Bridge	<ul style="list-style-type: none"> <li>• Specific bridge (cable-stayed bridge, suspension bridge, arch bridge)</li> <li>• Bridge over 500m of span</li> <li>• High speed railway bridge</li> </ul>
2. Tunnel	<ul style="list-style-type: none"> <li>• Tunnel over 1,000m of span</li> <li>• High speed and urban railway tunnel</li> </ul>
3. Harbor	<ul style="list-style-type: none"> <li>• Lock gate facility</li> <li>• Mooring facility of pile structure (over 50,000DWT)</li> </ul>
4. Dam	<ul style="list-style-type: none"> <li>• Multi-purpose, power generation dams</li> <li>• Water supply dams (over 10million tons reservoir capacity)</li> </ul>
5. River/ Water works	<ul style="list-style-type: none"> <li>• River embankments, Watergate of National River</li> <li>• Inter-regional &amp; industrial water supply system</li> <li>• Local water supply system over 30,000 tons/day</li> </ul>
6. Building	<ul style="list-style-type: none"> <li>• Building over 21th floors or <math>A \geq 50,000\text{m}^2</math></li> </ul>

## 1. Overview

### Inspection Guideline and Cost Standard

- KISTEC provides guideline and cost standard
- Minister of MOLIT approves & notices in the official gazette

#### Guideline contains following inspection method & procedure

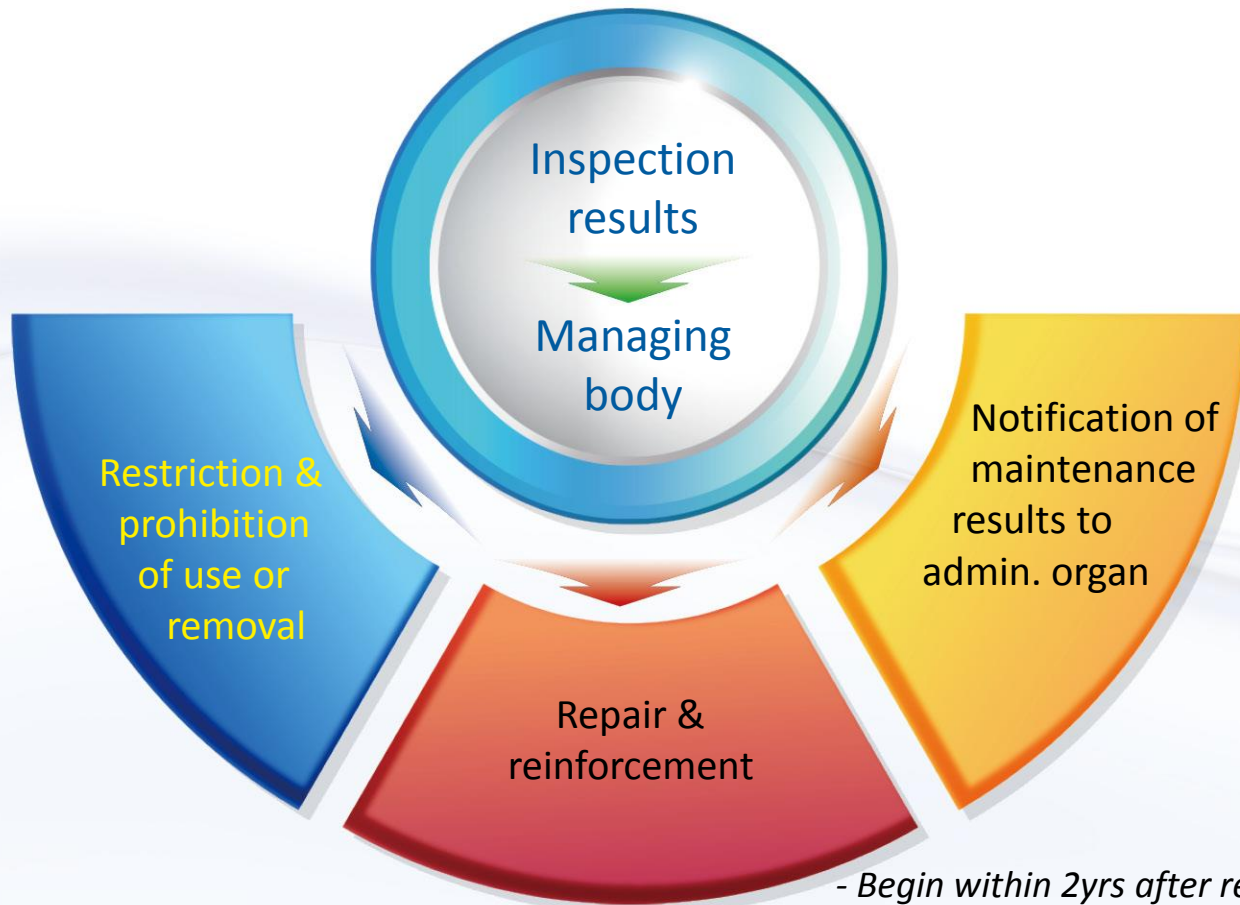
- ✓ Establishment and operation of inspection plan
  - ✓ Visual inspection method and material test
  - ✓ Evaluation method and cause analysis of a defect
  - ✓ Evaluation criterion and method for structural condition and safety
  - ✓ Matters about inspection report
- Managing body is charged with inspection cost
  - Cost estimation should follow notified standard

# Special Act on Safety Management of Infrastructure(SASMI)

## 2. Inspections - levels of execution



## 3. Safety Measure and Enforcement of Inspection Results



- Begin within 2yrs after reporting
- Complete within 3yrs after beginning

## Organizational Status

KISTEC was established in 1995 with the Special Act as a government agency  
→ for ensuring people's life and property

- **No. of workforce:** 450 in total
  - Out of which 80% are doctoral engineers, specialists or experts
- **Components of organization:**
  - 5 offices, 21 departments, 1 secretariat, 1 research institute, 3 centers
- **Annual budget:** 50 mil. US\$
  - Government subsidy: 30% / Self-finance: 70%
- **Inspection equipment:** 717 units(150 kinds) & 64 inspection vehicles



## Key Functions & Roles (1)

### 1. To secure the safety of national major infrastructure

- Performing **in-depth safety inspection** of national major infrastructure
- Developing & providing relevant **guidelines, manuals and the best practices**, etc.
- Building smart DB & converting into **intelligent FMS** to ensure scientific & preventive facility maintenance & safety management
- Integrated maintenance of **long span bridges** : Real-time monitoring & standardized integrated maintenance
- Evaluating the inspection results(3,300cases/yr)  
- **Preventing poor inspection** in market
- Providing **education** for inspection & relevant engineers



## Key Functions & Roles (2)

### 2. To improve the safety management of small scale vulnerable facility

- Expanding safety inspection to **living based urban facility**
  - Social welfare facilities, small-scale bridges & reservoirs, retaining walls and traditional markets, etc.
- Providing safety management services for **aged flat & school**
- Operating a year round **Safety Inspection Task-force Team**
  - Securing infrastructure safety and improving people's awareness
- Operating the Real-time Disaster Management System (**smart phone app. #4949**)



## Key Functions & Roles (3)

### 3. To shift safety into serviceability with performance

- **Green Remodeling** of Existing Buildings  
→ Project planning, design consulting, structural safety evaluation, energy performance evaluation
- Energy Performance and Green Building Certification  
→ Building energy efficiency rating system & G-SEED  
(*G-SEED: Green-Standard for Energy & Environmental Design*)
- Greenhouse Gas & Energy Target Management System for construction industry & existing building, etc.
- **Mediation work for apartment defect disputes** between contractor and residents



## Korea has built & operated well-organized infrastructure safety & maintenance systems

- Develop & operate advanced systems through **ICT convergence**
  - FMS, mobile inspection system, #4949, etc.
- **Reform safety & maintenance strategies** for environmental and climate change:
  - The rising of rainfall and typhoon intensity in densely populated area
  - Entrance into an era of aged
- **Change of weak basis** of facility maintenance:
  - Lack of budgets for maintenance & repair(M&R), poor work environment
  - Shortage of skillful M&R engineers due to frequent changing job, low salary, etc.
  - Incapacity of a high level of technologies as required for data analysis, etc.
- **Improve the safety management** of small-scale vulnerable social infrastructure
- Securing safety → Securing safety + **[performance + serviceability]**
  - **Prolonging the service life & energy saving** of infrastructure

### The Capacity development for safety management of the public facilities in Indonesia

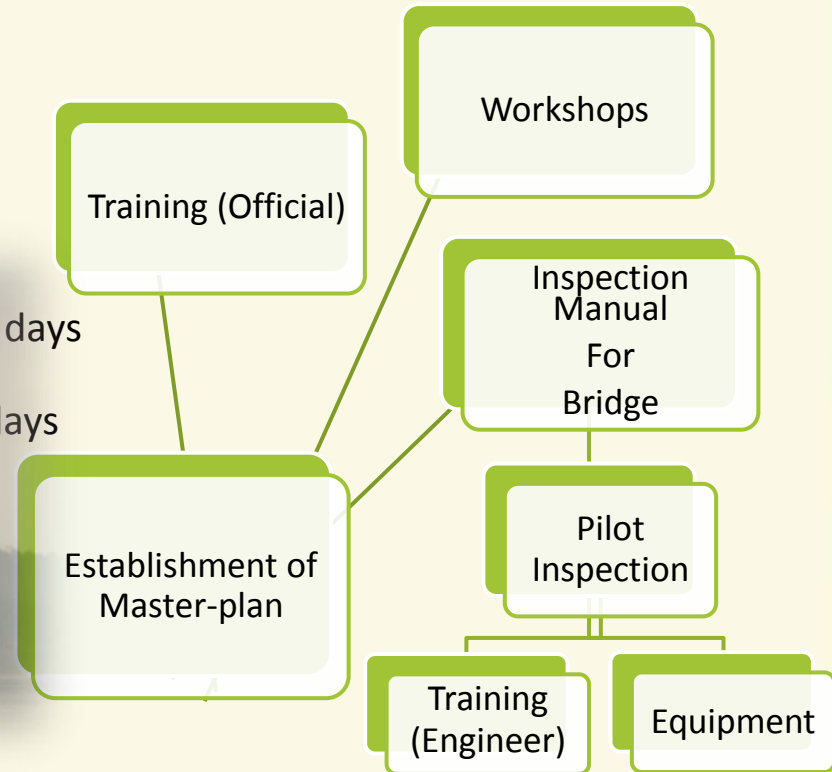
- ✓ **Objective:** Enhancing the safety management capacity of facilities in Indonesia
- ✓ **Implementing Organization:** KOICA, Ministry of Public Works(Indonesia)
- ✓ **Budget:** US\$1,850,000
- ✓ **Period:** 12/30/2014 – 12/29/2016
- ✓ **Consultants:** KISTEC in association with “Daum Engineering Co.”
- ✓ **Target Beneficiaries:**
  - The general public using the public facilities in Indonesia
  - The government officials and operators who are responsible for maintenance of public facilities
  - The related contractors, consultants and professional engineers

# An overseas project on going in KISTEC

## - KOICA\_ODA in Indonesia -

### Project Details

- ✓ Establishment of the master-plan for infrastructures safety management
- ✓ Holding workshops (6 times)
- ✓ Pilot inspection on Fisabilillah Bridge
- ✓ Training programs in Korea
  - Managerial-level officials: 10 officials / 7 days
  - Structural engineers: 10 engineers / 21 days
- ✓ Provision of inspection guidelines and inspection equipment



# Thank You !

*Cheol Shik Shin*  
T) 010-3259-8932  
E) [csshin@kistec.or.kr](mailto:csshin@kistec.or.kr)