

**JSCE's Strategies for Priority Issues at  
Infrastructure Maintenance and Renewal**

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**Study Task Force for  
Infrastructure Maintenance and Renewal**

**Japan Society of Civil Engineers**

## 1. Introduction

Japan's Infrastructure was intensively developed during the years of rapid economic growth to have received severe aging by now. Various damages and relevant accidents have been reported accordingly.

Infrastructure is the base for social and economic activities. It will become difficult to maintain safe and wealthy people's living and to sustainably contribute to vigorous social economic growth if appropriate maintenance is not carried out leaving the said aging keeps going.

To cope with this issue, Japan Society of Civil Engineers (JSCE) established the Study Task Force for Infrastructure Maintenance and Renewal (chaired by Kotaro HASHIMOTO, President, JSCE) in December 2012 to work on JSCE's priority issues, basic approaches, and draft action plans, and has completed classifying the draft coping strategies on 29 March 2013.

JSCE further advanced substantiating the action plans to conclude "JSCE's Strategies for Priority Issues at Infrastructure Maintenance and Renewal" with views on activities and future directions at investigation and research committees.

The priorities are put at the following five (5) issues:

- 1) Systematize the knowledge on infrastructure maintenance and renewal
- 2) Secure and train researchers and engineers
- 3) Establish legal and financial systems to support maintenance and renewal endeavors
- 4) Adjust bidding system and contracts
- 5) Seek people's understanding and cooperation

## 2. Strategy

### **PI 1: Systematize the knowledge on infrastructure maintenance and renewal**

#### a) Background

- The knowledge and technologies on infrastructure maintenance and renewal has been neither well developed nor systematized.
- Differing from the cases of initial construction, maintenance and renewal works have been regarded to contain highly individual characteristics and have not been integrated. In the most cases, the knowledge and technologies have been

accumulated at each category and each operator of facilities and information sharing across them is not sufficient.

- In addition, while integration efforts are supposed to have been undertaken between civil engineering and other industries such as machinery engineering, information has not been sufficiently shared either.

b) Plans set out

- Based on the investigation and research activities, we will address the issue of systematization of knowledge on infrastructure maintenance and renewal (hereinafter referred to as “knowledge systematization”).
- For knowledge systematization, we will promote not only *cross-cutting* efforts in JSCE but also work on collaboration and exchanges with other fields and industries.
- Based on the knowledge systematization, we will establish “Infrastructure Maintenance Engineering” from a perspective of the work flow of infrastructures’ planning, design and construction and the management methodology, thus promote standardization of maintenance and renewal technologies and further clarify the direction of technology development should take.

c) Actions to take

- Classify and systematize basic principles, terminology, technology, assessment methodology and define “Infrastructure Maintenance Engineering”.
- Compile maintenance and renewal knowledge into textbooks/handbooks complying with the knowledge systematization and use them for training through education and on-the-job training.
- Provide opportunities for information exchange across JSCE committees and working groups.
- Organize seminars and workshops with other fields and industries.
- Support reviewing the standards/criteria for inspections, structural diagnosis and judgment methods and the like.
- Promote researches including ones to explore the benefits from the technology development for maintenance and renewal, utilizing the outcomes from the committee activities (e.g. improvement and utilization of inspection/monitoring methodology).

## **PI 2: Secure and Train Researchers and Engineers**

a) Background

- Researchers and engineers who carry out infrastructure maintenance and renewal

are required to have well-versed expertise in specific area such as structural design, construction methodology, maintenance record compilation, environmental constraints and the like; however, such expertise are based on experience in nature to need to work out technology succession.

- In addition, though such researchers and engineers are in need of being qualified with interdisciplinary wide-ranging knowledge and attention, there are not enough resources who meet such demands.
- There is a shortage of in-house engineers of public work sectors who can develop plans for maintenance and renewal, and play leading roles at comprehensive judgments. There are many small municipalities even without such engineers or barely handling administrative matters only. Such shortage expands in researchers in higher academic institutions or public/private research institutions as well as engineers in contractors which execute the works.
- Technical capabilities of maintenance and renewal are not always sufficient on at both public work administrators and contractors, and it makes smooth and steady implementation of the works be difficult.
- Qualification for inspectors is inconsistent among infrastructure administrators including the cases of no qualification implemented.
- In many cases, inefficiency from mismatch between what needs to be technically inspected and who executes such inspection can be seen. In particular, the engineers who can make highly specialized decisions are in short.
- The current discipline and specialization of each maintenance and renewal field and the circumstance in cooperation among academe, government and industry are not necessarily formed in a framework to contribute to enhance "Infrastructure Maintenance Engineering" to train engineers.
- For the above reasons, there are not sufficient researchers and engineers who can take up important roles in maintenance and renewal to practically solve technical matters in any of academe, government and industry.

b) Plans set out

- Sort out the needs for employment of civil engineers and carrying out on-the-job training for them, especially, in local governments.
- Clarify capabilities and responsibilities required for engineers and draft new policies for training them, ushering in a new era of infrastructure maintenance and renewal.
- Establish "Infrastructure Maintenance Engineering" to educate students and researchers and train engineers utilizing continued professional development (CPD) to secure resources. This requires to train to procure not only many site engineers for inspection with minimum qualification but highly qualified engineers

who can make the final decisions at site engineers' no decision cases.

- Train engineers by mutual technology enhancement in collaboration among academe, government and industry including the owners/operators of the structures, because "Infrastructure Maintenance Engineering" is developed by examining actual structures.
- Enhance organizational capabilities for infrastructure maintenance and renewal by securing and training resources in the manner described above.

c) Actions to take

- Develop the program and scheme of school and continuing education and high qualification training.
- Work out on a framework for civil engineers with sufficient knowledge on "Infrastructure Maintenance Engineering" to work on contributing for the society through infrastructure maintenance and renewal.
- Work out another for the same to easily participate in JSCE activities, especially in the ones at JSCE Chapters, thus provide opportunities for technological improvement and enhancement.
- Promote classification and integration of qualifications in the maintenance and renewal field, especially, for needing higher technical decisions and disseminate it to utilize the qualified engineers.
- Decide on a framework to consult specialists with knowledge and experience for planning and reviewing maintenance and renewal of infrastructures among academe, government and industry, and for intending mutual improvement and enhancement of technology.
- Obtain additional participation and support from retired engineers, for example, in addition to public-private-academia formation up till now. Also, discuss among the above plus New Public each roles for maintenance and renewal efforts.

**PI 3: Establish legal and financial systems to support maintenance and renewal endeavors**

a) Background

- Legal and institutional obligations under existing circumstances for inspection, diagnosis, soundness decisions and the like are not sufficient for some infrastructure. Needed financial source for maintenance and renewal is not duly secured.
- Organizational approaches are not sufficient for establishing system, framework and mechanism to duly implement maintenance and renewal.
- Initial construction works have been the main business in any organizations. Authorization given at maintenance and renewal sections is very limited in

promoting their works.

- In local governments, the number of civil engineers are not adequate in each organization where they manage disproportionately many infrastructural facilities. In addition, the system to secure needed fund is not well established.

b) Plans set out

- Establish systems and support organizations in order to maintain asset values of infrastructure.
- As to systems, take aim to establish and manage organizations and their systems for surely executing maintenance and renewal for all infrastructure by examining the enforcement of legal and systematical obligations.
- As to organizations, without enough resources and established systems, propose the arrangements which enable receiving technical supports from the outside, implementing the works via larger area administration, and transferring them to other organizations and so on.
- Through these efforts, secure budgets with system endorsed and enhance organizational capabilities for infrastructure maintenance and renewal.

c) Actions to take

- Examine the approaches to disseminate international management standardized skills like ISOs and asset management skills complying with corporate accounting system. Review and introduce on that account overseas examples and innovative domestic examples towards the institutionalization of ISO registry at tenders and the obligation of implementing certified public accountant system.
- Research organizational structure which facilitates technological know-how on initial installation through maintenance and renewal to be efficiently utilized including the followings:
  - Research and analysis on present situation and institutional difficulties in maintenance and renewal, and examples of innovative approaches
  - Research on institutional approaches for securing funds for maintenance and renewal (e.g. expansion of government funding, review on budgetary system, and utilization of private funds)
  - Research on organizational management and administrative procedures for enabling maintenance and renewal
  - Research on enforcing legal obligation for maintenance of infrastructure, and database compilation and updating inventory
- Assess the structure and roles of the following supporting organizations for maintenance and renewal of regional infrastructure:
  - System for securing support to maintenance and renewal by local

- governments such as enhancing set up of Technical Centers at prefectures.
- Establishment of a new qualification system to enhance bringing up capable consultants for maintenance and renewal
  - Inquiry counters at JSCE, especially, JSCE Chapters to support local governments and private companies
  - System to maintain facility developed by different regional administrations, such as local roads, farm roads, forestry roads, etc. in larger area management
  - System to carry out wide-range support by appointing local people, NPOs, and retired engineers, and by collaborating with universities

#### **PI 4: Adjust bidding system and contracts**

##### a) Background

- Compared with new development projects, maintenance works are relatively small and complicated. It makes efficient implementation difficult for contractors.
- Since the project's individuality is high, it is difficult for public works administrators to draw up specifications and to properly evaluate the engineers' capability. Thus, even in a case where a high level technical judgment is required, there may be the cases appropriate evaluation is not made.
- In competitive bidding in a single fiscal year, it is difficult for contractors to get skilled for providing high quality outcome and secure profits.

##### b) Plans set out

- Propose procurement schemes which ensure efficient and effective technical implementation from private sectors.
- Propose practical plans to secure such implementation; 1) private fund procurement, 2) blanket contracts throughout survey/investigation, design, execution and maintenance works, 3) contracts with locality consideration, 4) contracts during multiple fiscal years, 5) fair technical evaluation, etc.
- Incentivize expansion of securing trained engineers and technical development, and promote private sector's sound to be sustainable development

##### c) Actions to take

- Understand public works administrators' needs against infrastructure aging and private sector's potential technologies to contribute to them. Also, research practical procurement system to introduce such technologies in accordance with not only the scale of the works but the feature of each technology.
- Create the guidelines for the contracts of comprehensive maintenance projects

applying PPP/PFI schemes.

- Create the guidelines for the contracts of infrastructure maintenance extending over certain long enough periods for local contractors to take up by creating the system with locality consideration.
- Create the guidelines for multiple-year contracts which enable consistent implementation such as 1) design-build-maintenance or 2) inspection, diagnosis, survey/inspection, repairs and evaluation.
- Train and procure competent engineers of advanced technical judgment as to inspection, diagnosis, repairs and reinforcement. Also, examine institutional and methodological approaches for appropriate mobilization of them such as qualification system and insurance.

#### **PI 5: Seek people's understanding and cooperation**

##### a) Background

- Japan's infrastructure was intensively developed during the years of rapid economic growth. It has been widely recognized that new installation is the major and only stream of construction.
- Accordingly, maintenance and renewal projects for already-built infrastructure have not gained people's sufficient understanding although the efforts in that regard have actually been undertaken.
- Especially, social recognition that infrastructure is the people's assets is still insufficient, and maintenance and renewal projects have been badly dealt with.
- Further, it is not well known that infrastructure's maintenance and renewal is different from that of machinery equipment and about the culmination of high technologies such as deterioration assessment, external force assumption, future forecast and so on.
- Importance of infrastructure maintenance and renewal has just recently started to gain people's understanding. The understanding is not sufficient and the evaluation is in low appraisal.

##### b) Plans set out

- Recognizing infrastructures as our common asset that support our life, advertise that to attain and to improve asset values leads to secure people's safety and beneficial life.
- Cause people understand that the efforts for infrastructure maintenance and renewal are attractive and prideful works and get broad supports from the society.
- Keep people be informed that technology necessary for maintenance and



renewal is the culmination of high level technologies and get supports from companies and organizations interested in such technologies.

- Enhance attractiveness of maintenance and renewal works by obtaining people's understanding and cooperation widely through the above mentioned plans and, consequently, aim at securing human resources.

c) Actions to take

- Evaluate the situation of infrastructure maintenance and utilize them for appealing to as well as sharing the information with the people as to the necessity of maintenance and renewal including source of funds issue (take examples of the "Report Card for America's Infrastructure" by ASCE ).
- Work on drawing up concrete measures for publicity strategy of maintenance field.
- Establish award system for maintenance field (e.g., leave out from established award targets, grant awards for high level technology development).
- Enhance attractiveness by creating a story of the maintenance world (e.g., focus on people in maintenance field and transmit the story of his/her experience through various media including the JSCE journal).
- Propose easy ways of explanation when we ask for people's understanding and cooperation as follows,
  - An analogy between maintenance and renewal, and medical service.
  - Simulate inconvenience in the case where appropriate maintenance and renewal is not provided

### 3. To conclude

Implementing efficient and systematic maintenance and renewal of Infrastructure as a national asset is an important role of civil engineers. JSCE will put 5 Priority Issues examined by the task force at the heart of its activities and further carry its program forward. This includes i) research and study committees cooperate with to take over the taskforce's coping strategies, and ii) a special committee is set up to promote a cross-cutting approach in compiling the textbook of "Infrastructure Maintenance Engineering" and in training and procuring human resources.

JSCE will try through these activities to make maintenance and renewal works attractive to get more support from the people.