

# Recommendations for Full-scale Maintenance of Aging Roads

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## **I. Final Warning: "Change the direction toward full-scale maintenance."**

### **There Is a Hidden Crisis Silently Undermining Our Roads.**

In response to the issues around Japan's aging road stock, which had been constructed in an intensive manner during the high-growth period (from late 1950 to 1960s) and now requires a nationwide rehabilitation and reconstruction, the Panel has repeatedly warned since 2002, "Without proper investments in rehabilitation, the result will be a major burden in the near future".

Japanese society, however, has been shifting against our warning due to worsening deflation and financial situations. For example, the privatization of the former public Highway Public Corporations in 2005 resulted in 30% reduction for expressway maintenance budget. The FY2009 screening process concluded 10 to 20% reduction of maintenance budget for national highways under jurisdiction of MLIT. Furthermore, the society has shown little interest in infrastructure maintenance since then. The Committee has a concern if both general public and responsible mayors innocently believe our infrastructure will last forever without proper maintenance.

In the meantime, there is a hidden crisis silently undermining our roads. Road structures are indeed deteriorating over decades, with some 2,000 closures and restrictions for heavy vehicles at municipal bridges, which accounts for 70% of all bridges in the country. And the number of those problematic bridges doubled in the last 5 years. More and more municipalities find themselves incapable of carrying out a mere bridge inspection due to lack of bridge engineers.

The danger level now reaches a point where a bridge can collapse at any time, killing citizens and leaving deep economic and societal scars. Again we have to warn the society, even though it may sound harsh. "Change the direction toward full-scale maintenance of our infrastructure immediately, or we will soon have to face devastating situations such as bridge collapse and other serious failures of our infrastructure that threatens citizens' lives and social system."

## **A Wake-up Call Has Been Ringing.**

In December 2012, a ceiling panel collapse occurred in Tokyo-bound Sasago Tunnel on Chuo Expressway, taking 9 precious lives and causing a long-protracted road closure. This was a signal that we were entering an era of creaky infrastructure. We must listen to the wake-up call given by this accident. In these years, we saw some incidents in other sectors than road that indicated the country would need a fundamental reform of the maintenance framework, the institutional system, technologies and corporate culture as well as the funding system. We need to develop a strong imagination to feel that a crisis like this can happen to our neighborhood any time soon.

In August 2005, a giant Hurricane Katrina struck New Orleans, causing a significant damages. The disaster hit the headlines of many international media. The truth is, however, a disaster like this had been expected long before it actually happened. A group of experts had warned the authority of a potential danger of a giant hurricane in the area several years prior to the Katrina Disaster. In addition, the Federal Emergency Management Agency (FEMA) had predicted the possible disaster in the preceding year. Despite these warnings, the administration did not invest in disaster prevention measures, resulting in 1,330 deaths and 2.5 million affected households. In this example, the administration failed to decide to invest in future safety under an uncertain situation in which a giant hurricane might come or might not. We should learn a lesson from this experience.

Likewise, the Committee is concerned if Japanese people have the similar level of awareness with regard to uncertain future crisis. They tend to think that the bridges and the tunnels may not collapse so soon. Mayors and officials may believe with no rational basis that a disaster will not possibly occur in their terms of service. But, remember the devastating March 2011 quake and tsunami. A natural disaster will happen even if it is as rare as once a thousand years. And the preceding Sasago Tunnel Accident warns that it will happen.

## **This is the last chance to take actions.**

The United States, a leading country in road development, has another important experience that we should learn from. The U.S. arterial highway network that had been constructed since 1920s started deteriorating to a degree that many bridges and roads were practically unusable in 1980s, a situation typified by "America in Ruins: The Decaying Infrastructure". This was blamed for a reduction after reduction in investments in infrastructure. In response to the situation, the federal government quickly allocated the infrastructure budget back and has been improving the infrastructure since then. The social infrastructure was improved and has been supporting the prosperity of the United States.

Sasago Tunnel collapse was a sign that warned us that this would be the last chance for us to take actions for protecting our infrastructure, the very foundation of citizens' every day life. Any actions will no longer be effective once ever-decreasing funding and engineers reach a breaking point and crisis erupts here and there at the same time. Like the United States in 1980s, Japan's current situation is alarming to a degree that a crisis can result in more devastating crisis and further collapsing society. With a stern lesson from Sasago, we have to establish a full-scale maintenance system as early as possible before "Japan becomes in Ruins".

In consideration of the above, the Road Committee recommends that the national government obligate road administrators to carry out a rigorous inspection program for the nationwide infrastructure, establish a sufficient institutional framework to invest financial, human and technical resources from all sectors, and make every effort to gain understanding and supports from politicians, mass media and the general public.

It is true that changing a direction is a difficult thing to do. However, the Committee is certain that the public benefits will be lost if a sense of crisis in this science-based recommendation is not shared with the leading elements of this country, such as politics, mass media and business community. If the public benefit is lost, then all responsible persons will have to take the blame for that.

## II. Toward a Full-scale Maintenance of Aging Roads

### 1. Current situation surrounding our road infrastructure

#### (1) Road Infrastructure

Currently, we have some 700,000 road bridges and some 10,000 road tunnels across the country. Of the 700,000 road bridges, 500,000 bridges, accounting for 70% of all bridges across the country, are situated on the municipal roads and mostly managed by municipal governments.

Many of those municipal bridges and tunnels were intensively constructed during and after our high-growth period (in late 1950s to 1960s) and about 40% of all bridges are indeed expected to be over 50 years old in 10 years from now.

- Percentage of road bridges over 50 years old is expected to rise from 18% in 2013 to 43% in 2023.
- Percentage of road tunnels over 50 years old is expected to rise from 20% in 2013 to 34% in 2023.

Deterioration is surfacing especially in some infrastructure, which were hurriedly constructed for 1964 Tokyo Olympic Games and 1970 Osaka Expo, and other infrastructure under severe environments, such as coastal and under-water locations. On the other hand, a number of bridges maintain good conditions despite the fact they are over 80 years old owing to proper rehabilitation and reinforcement at a proper time,

However, a typical municipally-managed bridge is not in a good condition; the number of the municipal bridges that are closed or restricted for heavy vehicles increased more than double in the last 5 years.

- Number of road bridges that are closed or restricted for heavy vehicles increased from 977 in 2008 to 2,104 in 2013.

In addition, accidents such as concrete block fall and roll-over induced by a corrosion of support for lighting occur almost every year.

Historically, Japan used to construct bridges with woods and it was considered normal to replace a new bridge when it is lost by a flood or a fire. It was around

1955 when steel- or concrete-bridges became widely available. Back then, people considered these new bridges as "permanent bridges", which would require only re-painting. People were not aware that these "permanent bridges" needed proper maintenance and management.

- Ratio of wooden bridges to steel- or concrete-bridges dropped from 50% in 1950 to 31% in 1960.

## (2) Issues around aging road maintenance

### 1) Funding

Budget allocated for maintenance and rehabilitation of national highways under jurisdiction of MLIT has dropped by 20% in the last decade. On the contrary, the budget should have increased to deal with aging road infrastructure in keeping with reducing national budget for public works.

- Maintenance and rehabilitation budget for national highways under jurisdiction of MLIT decreased from 320.2 billion JPY for the initial budget for FY2004 to 251.5 billion JPY for the initial budget of FY2013

As for municipally-managed roads, the national government created a Subsidy for Disaster Damage Prevention and Safety Programs in FY2012 to financially support municipal governments by allocating priority budget for their bridge inspections and rehabilitation projects. However, the current national supports need to be enhanced further, because 90% of municipalities still request more subsidies to tackle with their aging infrastructure.

With their financial constraints, 70% of municipalities find new investment difficult and 90% express their concerns with the safety of unrepaired aging roads due to insufficient funding.

Also, the existing single-year subsidy does not allow multi-year funding, which is essential to large-size projects involving rehabilitation or reconstruction of a bridge.

- Percentage of municipalities who expressed their needs for subsidy from national government: 90%
- Percentage of municipalities who expressed their concerns with new investment because they have to allocate their resources to aging roads: 70%

- Percentage of municipalities who expressed their concerns with safety of unrepaired aging roads due to insufficient funding: 90%

## **2) Institutional framework**

50% of all towns and 70% of all villages in the country have no civil engineering technicians for bridge maintenance in their workforce.

Also, most (80%) of municipalities use a problematic guideline for bridge inspection that instructs only distant visual inspection.

- Percentage of municipalities that has no bridge maintenance engineers: 50% of towns and 70% of villages.
- Percentage of prefectures and ordinance-designated cities that obligate distant visual inspection as a bridge inspection method in the guidelines: 80%

Also, about half of all municipal bridges are unknown of their ages and it is pointed out that inventories of road bridges are insufficient and a significant number of road administrators do not maintain/manage the original documents of bridge design. This means that some municipalities do not know the sizes and conditions of the road facilities which they are responsible for. It is fair to say that these municipalities are not sufficiently aware the importance of bridge repair and rehabilitation.

- Municipally-managed road facilities that are unknown of ages: 46% of bridges (=300,000 bridges/660,000 bridges).

Expressway overpasses tend to be overlooked and are not inspected by road administrators in some cases, because they are rarely used. However, overpasses can cause a significant damage to the third party if they are not properly maintained.

- Municipal overpasses that do not undergo inspections or are unknown of inspection history: 140 out of 3,300 overpasses.



### **3) Maintenance industry**

The construction industry argues that a typical maintenance project takes extra labour/equipment costs, because it usually takes more work than a new road construction project. Depending on the project size, the industry says, maintenance projects can be unprofitable. Also, they sometimes require re-designing or alteration of a contract, because infrastructure is sometimes constructed differently from the initial design.

- Percentage of municipalities that are concerned with finding contractors who is willing to do maintenance work: 50% or more

### **4) Public acceptance**

Although the Sasago Tunnel ceiling panel collapse in Dec 2012 temporarily caught the attention of the public at the time, road administrators failed to continually raise public awareness because they did not disclose information about the aging road facilities' conditions as often as they should have.

- Percentage of road users who are not aware that about 1,400 bridges (with 15m width) across the country are closed or restricted to some degree: 90% (as of April 2012).
- Percentage of road users who feel unsafe to use the road facilities because of their ages: 30% for bridge and 50% for tunnel.

### **(3) Current status (2 fundamental issues)**

Issues around aging road facilities are not new. Several reports have already covered these issues and recommended to take actions for them. Things are better for expressways and national highways under jurisdiction of MLIT. They have been properly maintained in consideration of their critical roles in supporting Japan's socioeconomic activities.

On the other hand, municipalities have been maintaining a significant number of their road facilities only to a limited extent due to 3 constraints (i.e. resources shortage in finance, specialists and technology).

Legal framework alone would not work even if it required extensive inspections with a specified frequency and methodology for the aging road facilities, because the municipalities lack necessary funding and technology to conduct such inspections.

In consideration of the above, we need to tackle with the following 2 fundamental issues.

**i) The current system has no established rules or standards for proper maintenance**

- The current system has no established rules or standards for repair and reconstruction of road structures. It also lacks legal framework that specifies frequency and methodology of inspection.
- Lack of rules/standards resulted in some problematic technical standards for municipal road facility inspection.
- Inspection results and repair history are not always recorded/archived, which prevents from carrying out repair and reconstruction work in a systematic manner.

**ii) The current system has no mechanism to facilitate "maintenance cycle"**

- Due to constraints of financial and human resources, many municipalities find it difficult to follow a "maintenance cycle", which consists of inspection, evaluation, actions and data-recording.
- In some cases, it is difficult to contract out inspection, repair/reconstruction work (e.g. setting price per unit and changing the initial contract) and to carry out oversight. In addition, some municipalities simply do not have sufficient technological capability to repair/reconstruction of large-sized structures.

## **2. MLIT's effort and its direction ahead**

### **(1) Efforts in the First Year of Maintenance Era**

In response to the Sasago accident, the MLIT sees FY2013 as "the First Year of Maintenance Era" and has carried out urgent and intensive inspections for roads to ensure the minimum safety from the aspects of protecting the third party. To

facilitate full-scale maintenance cycle, in consideration of the recommendations from the Social Infrastructure Maintenance Strategy Committee and the Road Maintenance Technique Committee of the Panel on Infrastructure Development, the MLIT also has

- amended the Road Act in 2013, which provides legal requirement for inspection standards and introduces a new system that allows national government to carry out maintenance work on behalf of a municipality.
- prepared a timetable of immediate actions at the "Task Force for Aging Infrastructure" in March 2013.
- been looking at ways to develop "Action Plan to Prolong the Life of Our Infrastructure", based on the "Basic Plan to Prolong the Life of Our Infrastructure" prepared by the liaison meeting among relevant ministries and agencies for aging infrastructure in November 2013.

## (2) Directions ahead

The MLIT should start the full-scale maintenance cycle for aging roads, particularly in an attempt to facilitate maintenance of municipal roads by focusing on the following 2 components;

### **i) Establish a maintenance cycle (i.e. road administrators' responsibilities to be clarified)**

- Establish the inspection and evaluation standards based on the amended Road Act to clarify road administrators' responsibilities for providing safety for citizens.

### **ii) Establish a mechanism to facilitate the maintenance cycle**

- Establish a mechanism to facilitate the maintenance cycle considering financial, institutional and technical aspects.

In addition to the above, the MLIT should make efforts to receive understanding and supports from the public with regard to the current conditions of our aging roads, road administrators' ongoing countermeasures, their responsibilities for maintenance and reconstruction of the roads and necessary funding.

With these, the governments need to create a sustainable society with long-lived infrastructure, in which road users continually enjoy the safe roads.

### **3. Actions to be taken**

#### **(1) Basic concept**

A full-scale maintenance cycle requires clear responsibility held by road administrators, a mechanism to facilitate the cycle and the public consensus.

It is necessary to devote financial, human and technical resources from every sector to start the full-scale maintenance cycle.

Bringing private technologies, skills and dynamism is a good way to enhance effectiveness of countermeasures for aging infrastructure. In this regard, it is desirable to support maintenance industry which is the main element of inspection and repair work. Note that upcoming road network development plan should be developed so as to provide redundancy, which enables inspection and repair work even if a part of network is forced to be closed in the event of emergency situation.

#### **(2) Establish a maintenance cycle (i.e. road administrators' responsibilities to be clarified)**

With the understanding that responsibility of each component of maintenance cycle, inspection, evaluation, actions and data-recording, is held by road administrators, the following actions should be taken.

##### **1) Inspection**

##### **i) Implement reasonable inspections based on the characteristics of the facilities**

- Implement once-a-five-year close visual inspections for all bridges and tunnels according to the uniform national standard.
- Pavement and other simple-structured elements, such as lighting support, may be inspected or replaced based on an appropriate renewal period depending on their deterioration level.

##### **ii) Implement priority-based inspections in order of importance (i.e. priority given to emergency routes and expressway overpass) and soundness of road facilities.**

## **2) Evaluation**

Evaluate the bridges across the nation by a uniform standard so that their soundness can be compared according to the "road health checkup".

## **3) Actions**

### **i) Take the following actions in response to the inspection/evaluation results.**

- Develop a repair plan based on the causes of damage, expected functions and lifecycle costs of the facility, and start repairing work in a systematic manner.
- The facilities in need of repairs should be closed or restricted for traffic, if they cannot be immediately repaired due to financial or technical constraints.
- Combine or remove unnecessary bridges according to changing demands as population declines and land use changes.

### **ii) National government should look at ways to support municipalities to take necessary actions.**

- Recommend or instruct non-compliant municipalities to take necessary actions for infrastructure in need of immediate repair, after employing a necessary procedure.
- Launch a standing third-party "Committee of Road Infrastructure Safety", which is responsible for investigation into the cause and future preventive measures upon request of road administrator in the event of serious accident.

## **4) Data-recording**

Visualize all results from the inspections, evaluations and actions taken for road facilities across the country with evaluation by national government.

### **(3) Establish a mechanism to facilitate the maintenance cycle**

Establish a mechanism to facilitate the maintenance cycle considering financial, institutional and technical aspects.

### **1) Stable funding for maintenance and reconstruction**

- i) Secure stable funding that enables swift and systematic renewal project to tackle with aging Tokyo Metropolitan Expressway and other expressways, in

conformity to the "Interim Findings" of the Arterial Road Committee of the Panel on Infrastructure Development.

- ii) Give a priority to funding to implement proper inspections and repairs for the National highways under jurisdiction of MLIT.
- iii) Look at ways to provide prioritized subsidies for municipalities based on the facility's importance and soundness and multi-year financial support system for intensive rehabilitation and reconstructions.

## **2) Institutional framework support for municipalities**

- i) Consider the following supports for municipalities with "a triple constraints" (i.e. financial, human and technical resources shortage), and launch a "Road Maintenance Panel" at each prefecture.
  - Introduce an efficient system including area-wide lump sum ordering and multi-year contract for maintenance projects.
  - Establish technical assistance system such as dispatching a "road maintenance specialist team", comprised of national government officials, to evaluate bridges of social importance or with complicated structure and record the results. This includes financial support from the national government.
  - Utilize a new system that allows national government or expressway companies to immediately carry out technically-difficult maintenance work on behalf of a municipality.
  - Combine or remove unnecessary bridges according to changing demands. For important bridges (e.g. expressways and other arterial road network and overpass of bullet train and other arterial railway network) or bridges in need of immediate repair, national government and expressway companies should carry out periodical inspections and repairs on behalf of municipalities.
  - Provide a series of extensive training courses for municipal government officials and private business employees for better maintenance framework.

- ii) Support national institutes, regional development bureaus, such as technical offices and national highway offices, and cultivate staff with technical background. In addition, facilitate use of human resources for maintenance work by registering a technicians who has some experiences in bridge inspections and repairs.

### **3) Mechanism to bring private sector's technological capabilities**

- i) Establish a proper estimation standard for practical inspection/repair work so that private companies can provide inspection/repair services and develop technologies without constraints.
- ii) Look into a qualification system to keep the pool of technicians who have special knowledge of inspection and evaluation along with necessary skills and experiences. iii) Undertake an initiative in joint research program in a strategic manner, which involves try-out and evaluation of new technologies (e.g. non-destructive testing, monitoring methods, and new materials/work methods), to ensure reliability of inspections/evaluations, reduce burdens and costs, shorten repair work period and increase durability of facilities by involving business, academia and government entities.

### **4) Building public consensus**

- i) Be proactive in sharing the information of conditions and inspection/evaluation results of bridges and actions taken for the damages. The information is initially processed at a "Road Maintenance Panel", then disclosed to the public to foster their understanding of necessity to tackle with aging road infrastructure.
- ii) Facilitate a bridge tour for the local residents, students and the press, and enhance existing volunteer system for conserving bridges in cooperation with other sectors in each area in order to build public consensus about the current situation of aging infrastructure and ongoing measures.

#### **5) Other**

Provide better traffic service for heavy-duty truck drivers by improving the examination process and quickly issuing the permit for use of special vehicles on roads, while strengthening enforcement of vehicle weight regulation with reporting and on-site inspections in cooperation with other authorities.

### **4. Conclusion**

This recommendation was developed to give a new direction for aging infrastructure management based on the municipal governments' reality and latest findings. It is necessary to continually review the inspection standards and national supports to municipal governments in consideration of their current efforts, because new issues and technologies will emerge as the system follows the maintenance cycle.