Aomori Prefecture

Bridge Maintenance through Asset Management Systems

Background

Aomori Prefecture manages around 2,300 bridges (bridges that are 2m or longer), and as many of them were constructed during the period of rapid economic growth after WW2, it is expected that the need for repair and replacement on many will come about at the same time. Thus, the prefecture anticipates a possible shortage of funds for maintenance costs.

In addition, Aomori Prefecture is an extremely harsh environment for bridges. The prefecture is situated at the northernmost point of Honshu, encompasses the Mutsu Bay in the middle, and is surrounded by sea on three sides, with the Tsugaru Strait to its north, the Pacific Ocean to its east, and the Sea of Japan to its west. It is a cold region with the heaviest snowfall in Japan. Additionally, cold, wet seasonal winds blow in from the Sea of Japan during wintertime, bringing salt from the seas, damaging concrete structures, corroding the steel materials, and causing salt damage. Furthermore, as there is heavy snowfall on the west side of the Ou Mountains, antifreeze materials employed on roads, causing further salt damage. Finally, the cold, dry air blowing in from the Pacific Coast causes the moisture in the concrete to freeze and expand, bringing significant frost damage.

In this environment, in order to maintain the road network and ensure that the citizens of the prefecture can live safely and securely, there is a need to minimise and stabilise maintenance costs by shifting over from corrective maintenance management to preventative maintenance management.

Project Aims

1 Maintain a robust road network to ensure that the citizens of the prefecture live safely and securely

2 Continue operation and maintenance using the pioneering Bridge Asset Management System

3 Make more progress shifting over from corrective maintenance to preventative maintenance

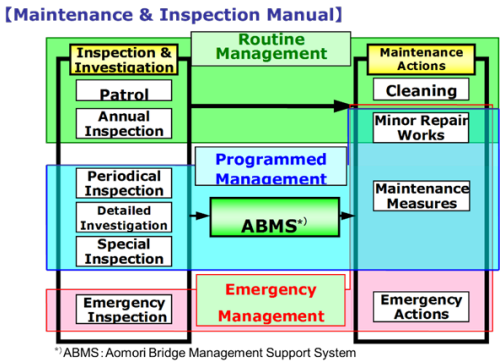
4 Implement sharp reductions in bridge maintenance and renovation costs.

5 Transmit this ideal way of maintaining social capital to the whole country

Project Outline

1. What is the Bridge Asset Management System?

The Bridge Asset Management System is a total management system that involves treating roads as assets; objectively assessing and evaluating the condition of the structures on the road; predicting the mid-to-long-term condition of those assets; and deciding the best time, method, and place to carry out countermeasures under the budgetary constraints.



2. Outline of the Total Management System

Aomori Prefecture introduced the Asset Management System for Bridge Maintenance in order to achieve its aims. Continuation is the key to the Asset Management System, so in order to make this possible, a Total Management System was constructed and utilised including people (cultivation of human resources), things (IT systems), and structures (manuals and organisations).

The Total Management System brings together the three aspects of, capable people with expertise and knowledge of bridges that is essential for bridge maintenance, IT systems that link together inspections and measures based on the thinking of Bridge Asset Management, and manuals and organisations to utilise those things. This system makes the continuous execution of Bridge Asset Management possible.

3. Outline of IT system

The IT system was developed to support all of the PDCA elements of the Bridge Asset Management

It is utilised consistently for all aspects, including predictions of deterioration from inspection data gathered from periodic inspections of each component, LCC calculations, budget simulations, mid-to-long-term budget plans, and medium-term project plans. Also, road network management is enhanced by selecting maintenance and management scenarios (management aims) for each bridge and reflecting it in budget simulations, mid-to-long-term budget plans, and medium-term project plans. In other words, it's become possible to reflect both the current condition of individual bridges and the purpose of network management, while formulating feasible medium-term project plans and conforming to budget constraints.

Strengths and Innovations

1. Continuity of the system

Bridge Asset Management has been utilised continuously since 2006.

The construction and installation of an IT system without structures and people to use it will leave the database obsolete, and the project will not be sustainable. This was understood from the beginning so all aspects were systemised, including the cultivation of human resources, the IT system, the manuals, and organisations. This has enabled the continuous implementation of Bridge Asset Management.

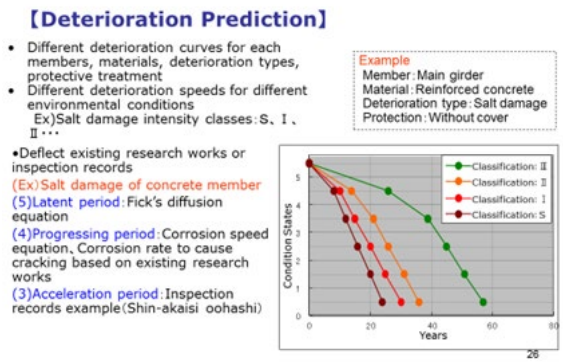
2. Innovations and features of the IT system

(1) Inspection data for deterioration predictions and LCC calculations

Inspection data is gathered not just to record the current condition, but for deterioration predictions and LCC calculations. Inspections gather data to evaluate the level of robustness of the structure by specifying what mechanisms of deterioration are causing deterioration, and determining the stage of the deterioration process.

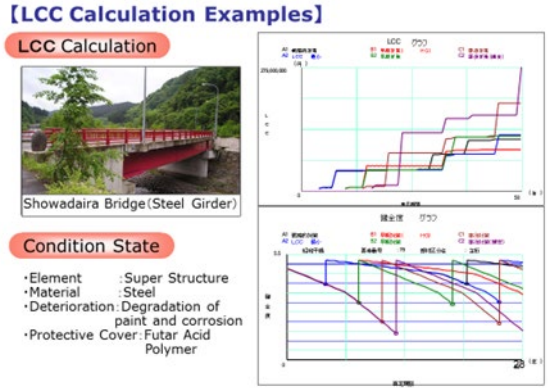
(2) Automatic revisions of deterioration predictions

Deterioration predictions are calculated using a deterioration prediction model based on each aspect involved, such as the components, materials, methods, deterioration mechanisms, and environmental conditions. Moreover, if the result of an inspection does not show the state of deterioration that was predicted by the model, the prediction model automatically revises its predictions to reflect the inspection results, and to increase the accuracy of the deterioration predictions.



(3) An essential database for LCC calculations

In addition to the deterioration prediction model being needed for LCC calculations, a database has been set up detailing management standards, construction methods for countermeasures, costs, and levels of robustness for restorations after countermeasures have been carried out.

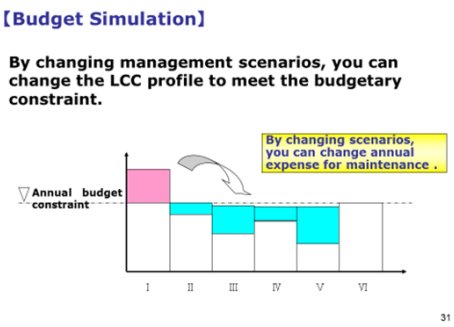


(4) Maintenance and management scenarios

Maintenance and management scenarios involve creating a package of set management standards to achieve the management aims for each component of the bridges' composition. In road network management, it's important to reflect the importance of the bridge, and to select the maintenance and management scenario that realises this.

(5) Budget simulations

A maintenance and management scenario is set up for each bridge, but multiple scenarios will be set up for bridges of lower importance. Budgets can be adjusted by changing scenarios.

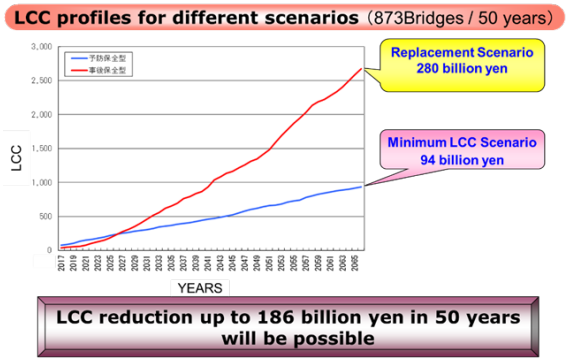


Results of the Project

The results of this initiative from 2006 to present have been an improvement in the robustness of bridge management and a minimisation and stabilisation of maintenance management costs. It has also demonstrated that both of these features are sustainable.

In addition, this Total Management System has enabled a shift over from corrective maintenance management to preventative maintenance management.

With the division of bridges for systematic renovations and bridges for increased longevity measures, and the continuous implementation of efficient repair planning centred on preventative maintenance management, it is estimated that it will be possible to reduce total costs by 186 billion yen over 50 years, when compared with the conventional corrective maintenance management system.



Problems and Responses

With the introduction of the Bridge Asset Management System, maintenance of a continuous

and stable system becomes an issue.
The following considerations were made to deal with these issues.
(1) Continuous training is implemented to cultivate human resources
(2) A project was set up to get compensation from the IT system users for maintenance of the IT system and to popularise its development
(3) Periodic appropriate revisions of manuals, etc.

Future Developments

The Bridge Asset Management System is an excellent method for bridge maintenance, and we want it to be implemented throughout Japan and in municipalities around the world as well.

Reference URL

http://www.pref.aomori.lg.jp/soshiki/kendo/doro/kyouryou-asset.html

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Definitions of Technical Terms

Asset management: This means the effective management and operation of assets, and an Asset Management System is a computer system to do that
LCC: Life Cycle Cost