■R&D Topics : Asset Management Technologies
■R&D Theme : Development of Life-Cycle Management System for Port and Harbour Facilities
- Integrated Framework from Inspection to Assessment
■Principal Investigator : Ema Kato (Port and Airport Research Institute, MPAT)
■Collaborative Research Groups : Tokyo Institute of Technology, Tokyo University of Science, Toa Corporation, Nakabohtech

R&D Objectives and Subjects

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Objectives

Implementation of maintenance and management support tools for port facilities based on a life-cycle management system

- Development of inspection and monitoring technologies for port concrete/steel structures
- Proposal of appropriate maintenance and management techniques for individual port facility management bodies
- Improvement of formulation methods of maintenance and management plans for the optimization of life cycle costs

The proposed tools contribute to simplifying maintenance work and reducing maintenance cost, aiming to enhance the international competitiveness of Japanese ports and improve disaster prevention functions of port facilities.

Subjects

Development of inspection and monitoring technologies for piled piers

- ✓ Development of 4 types of inspection devices; 1. ROV equipped with a camera system for visual inspection of concrete superstructures, 2. Non-contact ultrasonic thickness gauging system, 3. Sensor for anti-corrosive coatings, and 4. Sensor-aided maintenance system with IT
- ✓ Proposal of an inspection scheme according to requirements of maintenance and management

Improvement of evaluation and prediction of performance for piled piers

- ✓ Development of performance evaluation methods for anti-corrosive coatings of steel piles
- ✓ Development of performance evaluation methods for concrete superstructures

Improvement of the Life-Cycle Management system for open-type wharves

- ✓ Methodology establishment of maintenance and management plans for optimization of life cycle costs

Current Accomplishments (1/2)

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Problem

- Limited working hours due to tidal actions
- Possible accidents during inspection work
- Hazardous underwater work
- Operation restrictions due to inspection work

Development of inspection and monitoring technologies for piled piers

Visual inspection of concrete superstructures

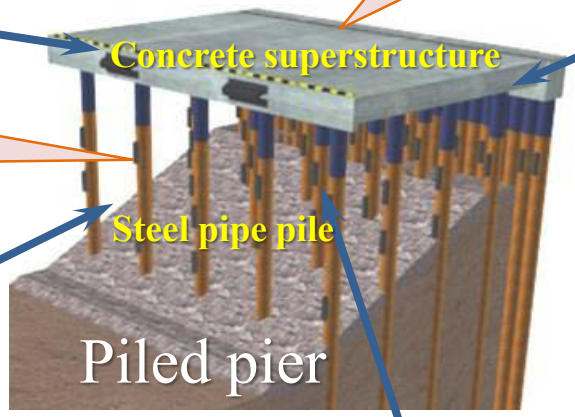
under development

ROV equipped with a camera system

Deterioration of concrete

NDT for steel bar corrosion

Corrosion of steel



under development

Thickness measurement of a steel pipe pile

under development

Non-contact ultrasonic thickness gauging system

Potential measurements for cathodic protection system

under development

Sensor for anti-corrosive coating
Sensor-aided maintenance system

Current Accomplishments (2/2)

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For implementation of efficient inspection and diagnosis of piled piers

ROV equipped with a camera system for visual inspection
- ✓ Improvement of location identification and operation-supporting systems
- ✓ Promotion of demonstration tests

Non-contact ultrasonic thickness gauging system
- ✓ Enhancement of precision by improving detection of multiple reflection waves

Sensor for performance evaluation of anti-corrosive coating
- ✓ Examination of the threshold value of sensors for corrosion
- ✓ Promotion of demonstration tests

Sensor aided maintenance system with information technology
- ✓ Development of monitoring systems for protection against corrosion of steel piles and superstructures

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Conventional inspection technology for marine structures

Cooperation with the Society of Maintenance Engineers for Maritime, Port and Harbor Infrastructure

Conventional inspection technology for land structures

Inspection, Monitoring and Diagnostics Technologies developed by SIP

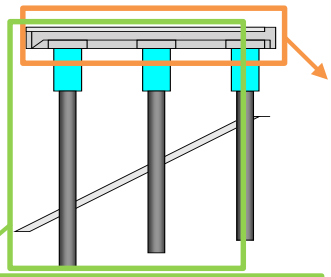
Investigation for inspection schemes according to requirements of maintenance and management

Inspection data

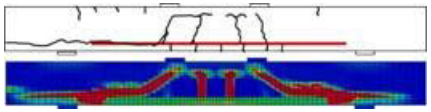
Accuracy of data for performance evaluation

Threshold of performance degradation detection

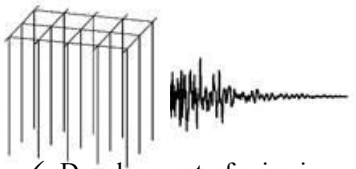
For enhancement of performance evaluation techniques with accuracy evaluation of inspection data



✓ Evaluation of deterioration variation in concrete structures



✓ Development of performance evaluation methods for deteriorated RC



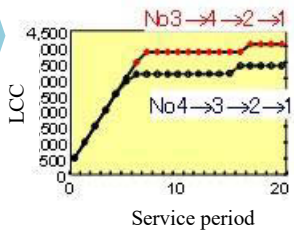
✓ Development of seismic performance evaluations

✓ Improvement of constitutive models based on a deterioration mechanism

Improvement of performance evaluation

For implementation of practical maintenance and management based on an LCM system

- ✓ Improvement of maintenance and management planning methods for reducing LCC in an open-type wharf
- ✓ Development of maintenance prioritization methods for open-type wharves



Ex. LCC simulation

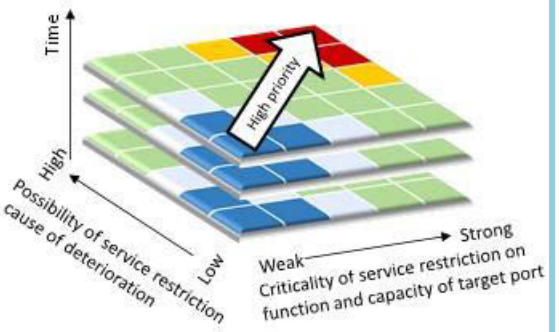


Image of maintenance prioritization

Goals

Enhancement of practical maintenance and management technologies

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S I P R&D

- ✓ Development of inspection and monitoring devices
- ✓ Proposal of inspection schemes according to requirements of maintenance and management

Verification experiments

Development of performance evaluation methods for steel pipe piles and concrete superstructures

- ✓ Improvement of maintenance and management planning methods for reducing LCC in an open-type wharf
- ✓ Development of maintenance prioritization methods for open-type wharves

Verification experiments

Examination of applicability of developed technology to other structural types in port and harbor facilities

Discussion of the reflection of R&D technologies in Technical Standards

PARI

Inspection and diagnosis

Assessment

Countermeasures

Recording

Maintenance and management plan

Reflection in Technical Standards for maintenance and management of Port and Harbour facilities

Technical Standards and Commentaries for Port and Harbour Facilities in Japan
Manual on Maintenance and Rehabilitation of Port and Harbour Facilities
Guidelines on Strategic Maintenance for Port Structures