
Approaches of the Road Structures

Department for National Land Resilience

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1. Introduction

Road structures, such as bridges, tunnels, earthworks, and pavements, contribute to safe, secure, and smooth road traffic, and support local life and socioeconomic activity. In order to support the efficient maintenance and proper management of these structures, the Road Structures Department drafts technical standards, conducts surveys and research necessary for them, and provides technical consultation on the problems that arise at the site of damaged structures, etc. This paper introduces the efforts of the Road Structures Department for the maintenance of structures and national land resilience.

2. Issues in the second stage of maintenance

The statutory inspection of road structures that started in 2014 finished its first round in FY2018, and the second round of inspection started in FY2019. In September 2020, the annual report on road maintenance (data for FY2019 / First year of the second round) was released, clarifying the issues in the second stage of maintenance, increased deterioration from the first round of inspection, and progress with countermeasure implementation. For example, of the bridges that were diagnosed as Judgment Category I or II (sound / preventive maintenance stage) in the first round of inspection, 5% shifted to Category III or IV (stage requiring action) in the second round of inspection. In addition, the percentage of bridges for which repair work was started on the bridges diagnosed as Judgment Category III or IV in the first round of inspection was 69% for those under management by the national government and 34% for those managed by local governments. This suggests that local governments have made progress in inspections, but repairs have not kept pace with the inspection. In order to provide systematic and intensive support for repair, renovation, and removal, a road maintenance project subsidy system was established in FY2020, but there are still issues to be solved not only with budgeting but also with human resources and technology.

3. Five-year accelerated measures for national land resilience

In FY2020, the heavy rain event of July 2020 caused severe damage throughout the country. Particularly, many bridges over the Kuma River and its tributaries in Kumamoto Prefecture were washed away, and there was also damage to road earthwork structures and natural slopes along roads in Nagano, Gifu, Miyazaki, and Nagasaki Prefectures.

In order to deal with the increasing frequency and severity of natural disasters, in December 2020, the government approved by Cabinet Decision "Five-Year Accelerated Measures for Disaster Prevention, Disaster Mitigation, and National Land Resilience," and decided to promote additional projects worth about 15 trillion yen over the next five years.

Previously, "Three-Year Emergency Measures for Disaster Prevention, Disaster Mitigation, and National Land Resilience" had been implemented from FY2018 to 2020. In the latest "Five-Year Accelerated Measures," it is very significant that not only measures against windstorms, floods, earthquakes, etc., but also "measures against aging as part of a shift to preventive infrastructure maintenance" was positioned as one of the pillars to be focused on.

As measures to address the aging of road facilities, the "Five-Year Accelerated Measures" suggests focusing the implementation of measures on bridges, tunnels, road accessories, and pavements in need of repair as identified in periodic inspections. One of the specific numerical targets stated in the Measures is to increase the repair rate of bridges on roads managed by local governments that require urgent or early action (Category III / IV) from the current 34% to 73% in five years. Since it is estimated that about 6,000 bridges managed by local governments are recategorized from Category I/II to Category III/IV every year, the "Five-Year Accelerated Measures" aim to shift from after-the-fact maintenance to preventive maintenance by taking focusing measures where best served during the period. In the future, the efforts of local governments will become increasingly important.

4. Measures and field support

In order to respond to the aforementioned needs, the Road Structures Department continues to provide measures and field support through the following activities.

(1) Survey research for repair and reinforcement of existing structures

For the repair and reinforcement of existing structures that differ according to traffic conditions, environmental conditions, and aging conditions, it is necessary to systematize standards that take into account the unique issues of each structure, so we are continuing to research these issues. Parallel to that, in order to facilitate work execution, we have been collecting information on the application of typical materials and construction methods, and in July 2020, published the "Collection of Details for Consideration in Improving the Reliability of Road Bridge Durability,"¹⁾ as a collection of devices and simple techniques used in the field.

(2) Survey research for the third stage of maintenance (third round of statutory inspection starting in FY2024)

In periodic inspections, it is necessary to achieve two objectives at the same time, i.e. better quality and greater labor-savings in field work. Accordingly, we are considering establishing rules on how periodic inspections should be planned so that the items, methods, and accuracy of grasping the condition can be planned in consideration of the characteristics of each structure. We also support on-site monitoring and use of non-destructive testing techniques.

(3) Survey research for performance evaluation of roads

To enable emergency transportation in the event of a disaster, it is necessary to ensure the disaster-resistant performance of all road structures such as bridges, tunnels, and earthworks so that they can function as a road network when the need arises. Based on the results of recent disaster site surveys, such as the heavy rain event of July 2020, we are developing methods to assess the risk of damage to individual structures and the performance of roads in the event of disaster. (See Closeup of the Road Structures Department at the beginning of the book).

(4) Survey research on grasping road conditions in disasters and predicting road surface conditions when snowfall is expected

As seen in the earthquake off the coast of Fukushima in February and a series of heavy snowfalls, a quick grasp of road conditions and reliable forecast information are essential for accurate disaster response. Accordingly, we are conducting survey research to establish and implement automatic UAV navigation technology for disasters and road condition prediction technology for snowfalls.

In addition, we directly visit the sites to provide technical consultation and advice on individual issues raised by the sites. The following is an example of

technical consultation about the restoration method for Route 41 in Gero City, Gifu Prefecture, which was damaged by the heavy rain event of July 2020.



Fig. Photographs of damage to National Route 41 and the state of restoration

On July 8, in the Kadosaka district of Osaka-cho, Gero City, a long stretch of road was washed away by rising water in the adjacent Hida River. The section of damage is adjacent to the JR Takayama Line, and restoration work was carried out in cooperation with the road, railroad, and river sectors. Consequently, the JR Takayama Line was restored on July 23 and National Route 41 was temporarily restored on August 17.

On the other hand, since priority was given to the restoration of the adjacent JR Takayama Line, work to remove the collapsed retaining walls was kept to a minimum, which became an issue in proceeding with the permanent restoration. NILIM provided technical advice on the restoration method including the handling of earth pressure of the remaining retaining walls, and construction work is progressing steadily at the site (See Fig.).

We will continue to promote the above-mentioned survey research and provide support for measures and fieldwork, with the aim to achieve national land resilience.

☞ See the following for details.

- 1) Technical Note of NILIM No.1121 Reference 1 http://www.nilim.go.jp/lab/bcg/siryou/tnn1/tnn1_121.htm