
Towards More Efficient Infrastructure Management

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1. Introduction

In recent years, disasters affecting bridges and earthwork structures due to torrential rain have increased in frequency and severity (fig. 1). The Road Structures Department collaborates with the Public Works Research Institute to dispatch experts to these disaster sites and provide technical support in site surveys, investigating causes, and stopgap recovery efforts, among other support. We have dispatched experts 56 times just since the current emperor assumed the throne in 2019; 70% of these dispatches related to disaster cases related to precipitation, and nearly 60% of those were primarily caused by scouring (fig. 2). How we should respond to increasingly severe torrential rain damage is a major challenge and a key research topic for road researchers. Our department makes agile use of the national resilience budget with regard to these challenges and feeds the outcomes of research and study back to sites as necessary. This paper presents some representative initiatives and discusses collaboration between infrastructure administrators.

2. Results of disaster survey on road earthwork structures adjacent to rivers

Road earthwork structures that are adjacent to rivers were the subject of detailed surveys of cases of scouring damage, which were adopted as

disaster recovery projects caused by torrential rain, etc. on directly managed national roads (40 locations in total over 31 years from FY1990 to FY2020).

As the result of an analysis that gathered information on the curves and other linear conditions of the rivers, the damage conditions, and other matters and focused on traffic function, cases where the outer curve of a river channel was adjacent to a road were found in 12 locations, and traffic was completely interrupted for over one week in 70% of these, suggesting the trend that damage in sections adjacent to outer curves produces a strong risk of longer traffic interruptions.

To date, among road earthwork structures, cut slopes of 15 m or more and fill slopes of 10 m or more have been inspected approximately once every five years as specific road earthwork structures.



Fig. 1. Damage to National Highway 121 due to torrential rainfall in August 2022 (Yonezawa, Yamagata)

Dispatches, etc. in FY2019–FY2022: 56 in total

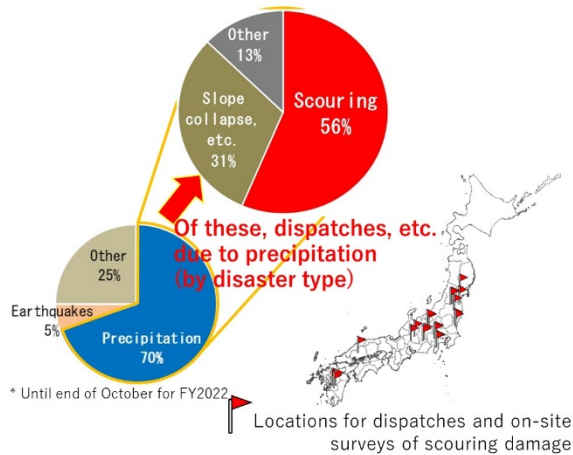


Fig. 2. Dispatching experts to a disaster site

Based on the results of this survey, we have added embankments and retaining walls in sections adjacent to rivers to the scope of inspections for specific road earthwork structures and have decided to place limits on the conditions when doing so, such as the horizontal distance from the road shoulder to the toe of the slope, the river slope, the curve radius, and the curve angle, and to concentrate on managing high-risk locations (fig. 3).

We have also focused on the manner of damage in streambed scouring and conducted on-site fieldwork in five damaged locations. In the on-site fieldwork, we surveyed the characteristics of the river channel in damaged locations (previously damaged locations) and undamaged locations and extracted differentiating conditions.

An analysis of changes to the river channel over time and the history of disaster in locations suffering damage in outer curve sections, with a focus on the streambed scouring mechanism found that a higher proportion of outer curve sections where sandbars have developed on the bank opposite the damaged location suffer damage, compared to locations where sandbars have not developed.

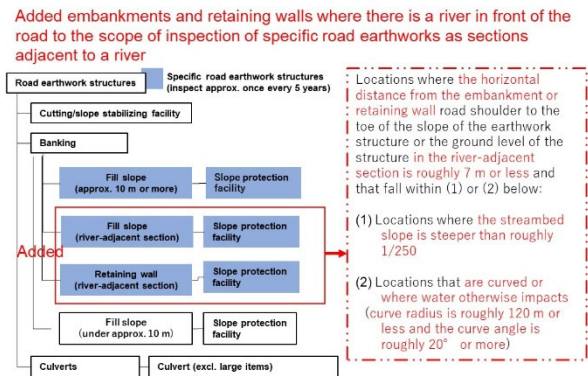


Fig. 3. Addition to the scope of inspections of road earthwork structures

Figure 4 shows aerial photographs of National Highway 41 and the Hida River. Comparing the waterways 45 years ago and today reveals that the river channel has moved to the outer curve section with the development of sandbars, narrowing the river. Observing changes in sandbars over time appears to be an effective means of selecting locations at high risk of damage due to streambed scouring. This analysis is written in the Outline for Inspecting Road Earthwork Structures (Provisional Version) as a matter requiring attention and is to be notified on work sites.

3. Conclusion

The December 2022 meeting of the Technical Section of the Technical Subcommittee of the Council for Infrastructure and the Council for Transport Policy reviewed infrastructure maintenance initiatives over the previous ten years and created a summary as a new opinion on how maintenance should be conducted in future, Next-Generation Strategic Management to Revitalize Regional Infrastructure Groups to be Worked On at Full Strength: Towards Phase 2 of Infrastructure Maintenance. It proposes regarding multiple pieces of infrastructure in

several fields as regional infrastructure over a wide area, rather than locally, and managing them from a comprehensive, multifaceted perspective. For example, it proposes regarding several bridges managed by adjacent municipalities as a single group and generally entrusting them to the private sector.

Following this thinking even further, perhaps it would be possible to manage a river and the several bridges that cross it more effectively by regarding these as a single infrastructure group and ensuring coordination between river management and road management.

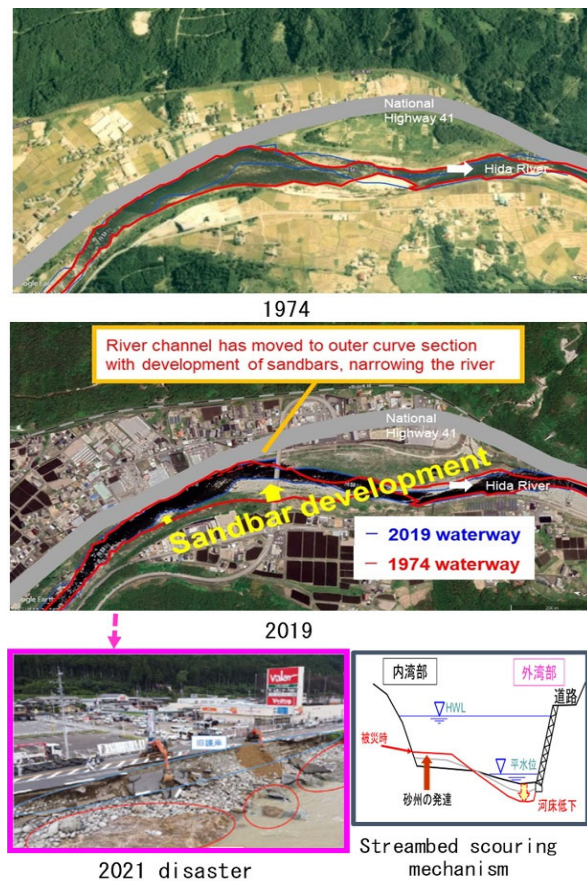


Fig. 4. Aerial photographs of National Highway 41 and the Hida River and conditions after disasters

Proceeding with the research described above may be one strategy for coordination between river management and road management.

As its name suggests, NILIM, which has researchers and experts in various fields, is a “place for researching policy based on technology relating to land comprehensively (in an interdisciplinary manner),” and we wish to make the most of our strengths to fulfill our role.

☞ See here for detailed information

- 1) Outline for Inspecting Road Earthwork Structures (Provisional Version)
http://www.mlit.go.jp/road/sisaku/yobohozen/tenken/tenken-yoryo_202209.pdf
- 2) Analysis of the Impact of Scouring of Road Earthwork Structures and Slope Collapses, Etc. Due to Torrential Rain on Traffic Functions, p. 59 herein
- 3) Next-Generation Strategic Management to Revitalize Regional Infrastructure Groups to be Worked On at Full Strength,
https://www.mlit.go.jp/policy/shingikai/kanbo08_s_g_000282.html