# Survey of impact of road disasters on traffic and countermeasure effectiveness

KIMURA Yuji, Senior Researcher KANEKO Masahiro, Head MABUCHI Toshiaki, Senior Researcher Earthquake Disaster Prevention Division, Research Center for Disaster Management

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#### 1. Introduction

Road managers work to implement efficient countermeasure projects with limited budgets based on documents such as the results of comprehensive inspections of road disaster prevention, in order to maintain and manage roads in ways appropriate to the harsh natural conditions found in Japan. This survey collected and analyzed cases of disasters caused by road slope disasters to organize conditions that cause road disasters at the same time as it studied a method of evaluating the impacts of road disasters on road traffic and the effectiveness of road disaster prevention countermeasures, in order to provide information that will contribute to the efficient implementation of disaster prevention countermeasure projects

# 2. Estimating distances to roads and evaluating impact on traffic

To study the impact of road slope disasters on traffic, the relationship between the state of occurrence of disasters and road disaster prevention inspection items on roads operated by the national government from 1990 to 2004 was organized, and an effort was made to use an existing formula<sup>1)</sup>to calculate the soil traveling distance at two locations where it is hypothesized based on the organized conditions that a complete road closure would occur, revealing that in all cases, the discharged soil would cover the entire road surface.

The above formula was used to calculate the distance the discharged soil would travel to reach the road and at the same time, its impact on closure of the road to traffic was evaluated considering the road width, and the distance between the slope and the road (Fig. 1). The result reveals that at slope height of 20m or less, regardless of the depth of the collapse (zone [1]), and even at slope height higher than 20m, at collapse depth of 1m or less (zone[2]), the collapsed soil would stop by one lane of the road.



Figure 1. Relationship of Average Slope Height with Road Arrival Distance

Next, the relationship of the quantity of collapsed soil with the road closure time in past disaster cases was organized by selecting 54 cases from past disasters on national government operated roads throughout Japan, revealing that although scattered, as the approximate quantities of collapsed soil increases, the length of time the road is closed tends to increase (Fig. 2).



Figure 2. Organization of Relationship of Quantity of Discharged Soil with Traffic Closure Time

### 3. Evaluation of countermeasure effectiveness

From the disaster cases selected in 2 above, focusing on the quantity of soil reduced by countermeasures, the state of appearance of effects of various countermeasure works and the reduction of the quantity of soil that can be counted on to occur were organized. As examples, for "protective net works" and "safety barrier works + revetment works", it was observed that they do prevent some of the soil from being discharged onto the road, but in the case of a huge quantity of soil that would cover the entire road surface, it is impossible to capture it all. So to select countermeasure work methods, it is considered to be necessary to also consider adding conditions such as the estimated quantity of collapsed soil shown in 2, its impact on traffic, etc.

## 4. Summary

Methods of estimating the scale of a disaster and its impact on road traffic, selecting countermeasure works, and evaluating the effectiveness of the works were successfully studied by collecting and analyzing cases of road slope disasters. In the future, we will analyze cases focusing on topographical and geological conditions for example to continue to study the improvement of the method and its applicability to various types of locations.

#### [Sources]

1) Notification stipulating the method etc. that the Minister of Land, Infrastructure, Transport and Tourism stipulates based on the provisions of Article 2 item (2) of the Enforcement Order of the Act on Sediment Disaster Countermeasures for Sediment Disaster Prone Areas, 2001