Consideration of Technological Requirements and Evaluation　Disaster Detection Technologies in the Road Field

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1. Introduction

Plans are to proactively introduce both new technologies and technologies from other fields in order to collect damage information promptly. To develop and introduce technologies appropriately, it is important to clarify technological requirements. However, technological requirements in the disaster prevention field are unclear because of the variety and complexity of disaster scenarios.

NILIM has been making efforts to clarify the technological requirements of disaster prevention based on the systematized information needs of road managers since 2016, in order to develop and introduce technologies appropriately based on the arranged information needs of disaster response sites.

2. Presentation of technological requirements

In order to evaluate the level of information needed by road managers in disaster response and the level of information grasped by various technologies in terms of "promptness", "coverage" and "reliability", the level of information necessary for making decisions in disaster response has been set to five levels, from S to D. Figure 1 shows an example of the technological requirements for "Reliability". These technological requirements have been improved by conducting a survey of road managers. Figures 2 and 3 show examples of the level of information needed by road managers in disaster response and the level of information grasped by various technologies in experimental trials. These evaluations help clarify which technologies to use and the technological goals to achieve. For example, in the case of disconnection optical fibers, the Reliability evaluation as a disaster prevention technology is "D", which means it is difficult to utilize for making decisions as more detailed information is needed, but useful for initial response and wide area cooperation disaster response.

3. Future efforts and issues

In this research, we organized the technological requirements for disaster response in the road field, and constructed a framework for evaluating the suitability of information needed in disaster response and obtainable by various technologies. In the future, we will explore effective combinations of technologies and their utilization in other fields.

Fig-1 Example of technological requirements

Technological requirements（Reliability）	
S	Information confirmed by visual inspection in the field or information equal to it
A	Image information taken by cameras in the field or information equal to it
B	Information that makes it possible to roughly estimate the location and scale of damage
C	Information that makes it possible to roughly estimate the location and scale of damage
D	Information that makes it possible to identify that something unusual has happened

Fig-2 Evaluation of information level needed for decision-making in disaster response

Decision-making situation	Promptness	Coverage	Reliability
Estimate the scale of damage immediately after disaster occurrence and decide whether or not to establish an initial system and request wide regional cooperation.	S	S	D
Based on the damage information of all national roads, decide whether or not to close traffic in damaged areas and areas where secondary damage is possible.	B	A	S
Estimate the amount of work to restore areas where secondary damage is possible and determine the priority of road clearance.	D	D	S

Fig-3 Information level that can be grasped by various technologies

Technology	Features and characteristics	Promptness	Coverage	Reliability
UAV	Provides relatively high mobility compared to satellites and airplanes. Enables research from various angles and heights.	B	C	S
SAR imagery (Satellite)	Capable of wide area observations at night and in bad weather. Observation timing and area depends on satellite's orbit.	C	S	C
CCTV camera	Used for monitoring infrastructures in normal times and for detecting damage at the time of a disaster.	S	B	A
Disconnection Information of optical orbit	Immediately after the disaster, about few hundred meters discrepancy level 38000km in nationwide.	S	S	D

☞ more information

1) 道路地震防災研究室HP
http://www.nilim.go.jp/lab/rdg/