Analysis of road bridges damaged in the 2016 Kumamoto earthquakes (Research period: FY 2016–2018)

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1. Introduction

The National Institute for Land and Infrastructure Management (NILIM) has been analyzing the effects of the earthquake-proofing of road bridges focusing on the effects of reducing the damage realized through various types of earthquake-proofing work, as well as socioeconomic effects obtained through the quick restoration of road network functions using the 2016 Kumamoto earthquakes as the subject of the study.

This paper introduces the outcome of the analysis of road bridges damaged in the Kumamoto earthquakes, part of the fundamental data used in the above analysis.

2. Analysis of damaged road bridges

The authors analyzed the relationship between earthquake motion distribution and damaged road bridges using the earthquake motion distribution (SI value)[1] that the NILIM had estimated and released. The analysis targeted 537 bridges longer than two meters that were identified as damaged by earthquake motion in the emergency inspections that the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), NEXCO West Japan, the prefecture of Kumamoto, and the prefecture of Oita conducted. The SI values used in the analysis are the larger between the largest foreshock (Apr. 14, 2016) and the main shock (Apr. 16, 2016) of the Kumamoto Earthquakes.

The organized relationship between damaged road bridges and SI values indicated a trend that the ratio of midlevel or more serious damage increased as the SI value increased (Figure 1).

Next, the relationship between the degree of damage and applicable standards is organized (Figure 2). The figure indicated that the ratio of significant and midlevel damage was lower among road bridges to which the 1971 Road Bridge Earthquake Resistant Design Guideline (the 1971 Road Guideline) was applicable compared to road bridges to which the 1980 Road Bridge Instructions (the 1980 Road Instructions) were applicable. This is because the Three-year Road Bridges Earthquake-proofing Program for Emergency Transportation Roads (2005-2007) prioritized in earthquake proofing road bridges to which the 1971 Road Guideline had been applicable.

3. In the end

This paper introduced the effects of earthquake motion intensity and applicable standards among the outcome of the analysis of road bridges damaged in the Kumamoto earthquakes.

The authors are going to continue the statistical analysis of damaged road bridges administered by regional public organizations, analyze socioeconomic effects brought by the improvement of the earthquake resistance of road bridges, and examine how road bridges should be earthquake proofed in the future.

The digital data of earthquake motion distribution introduced in this paper are available in the website below.

[Reference]

1) Earthquake Disaster Management Division, NILIM website: Kumamoto Earthquakes information, http://www.nilim.go.jp/lab/rdg/index.htm

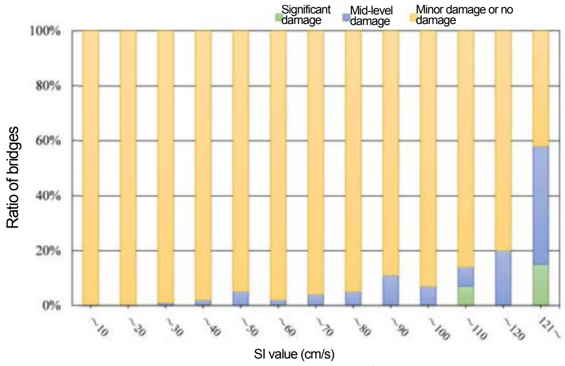

Figure 1: Relationship between SI values and level of damage

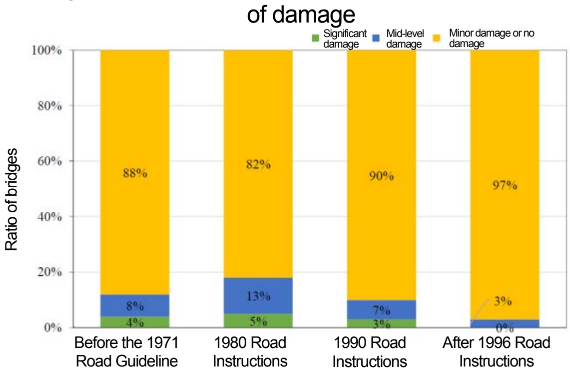

Figure 2: Relationship between the degree of damage and applicable standards