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Hospital Accessibility of Istanbul Following an Earthquake

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INTRODUCTION

❖ Transportation networks gain importance to reach the collapsed area and providing various facilities for causalities following an earthquake.

❖ The main objective of this study is to analyse earthquake effects on road functionality and estimate road blockages for hospital accessibility.

PREVIOUS STUDIES

❖ Karim and Yamazaki (2003)developed the fragility curves for highway bridges with respect to adopting analytical approach, while this methods was used to generate fragility curves for Central and South-eastern United State bridges by Nielson (2005).

❖ Werner, Taylor et al. (2000) estimate how earthquake damage to highway systems can affect post-earthquake traffic flows and travel times.

❖JICA and IMM (2002) was analysed vulnerability of the bridges of Istanbul based on Katayama methodology.

❖ Mitropoulos et al. (2006) and Knox (1979) have also constructed mathematical models in order to understand the effect of distance on the geographical accessibility of medical services.

METHOD

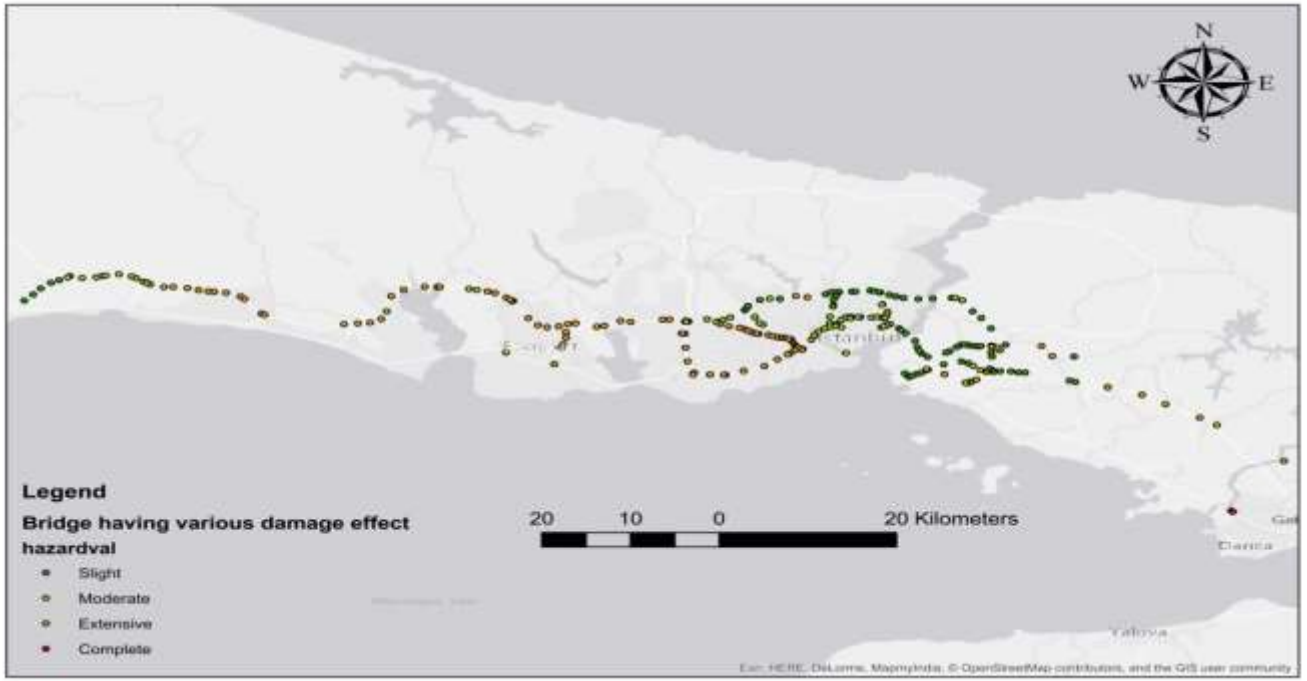
❖ Within the context of this study, bridges having the possibility of mean damage more than 50% were identified and the road network was digitalized in the case of assigned distance of debris around those structures.

❖ ArcMap 10.2 software was used for analyses.

DATA COLLECTION AND STUDY AREA

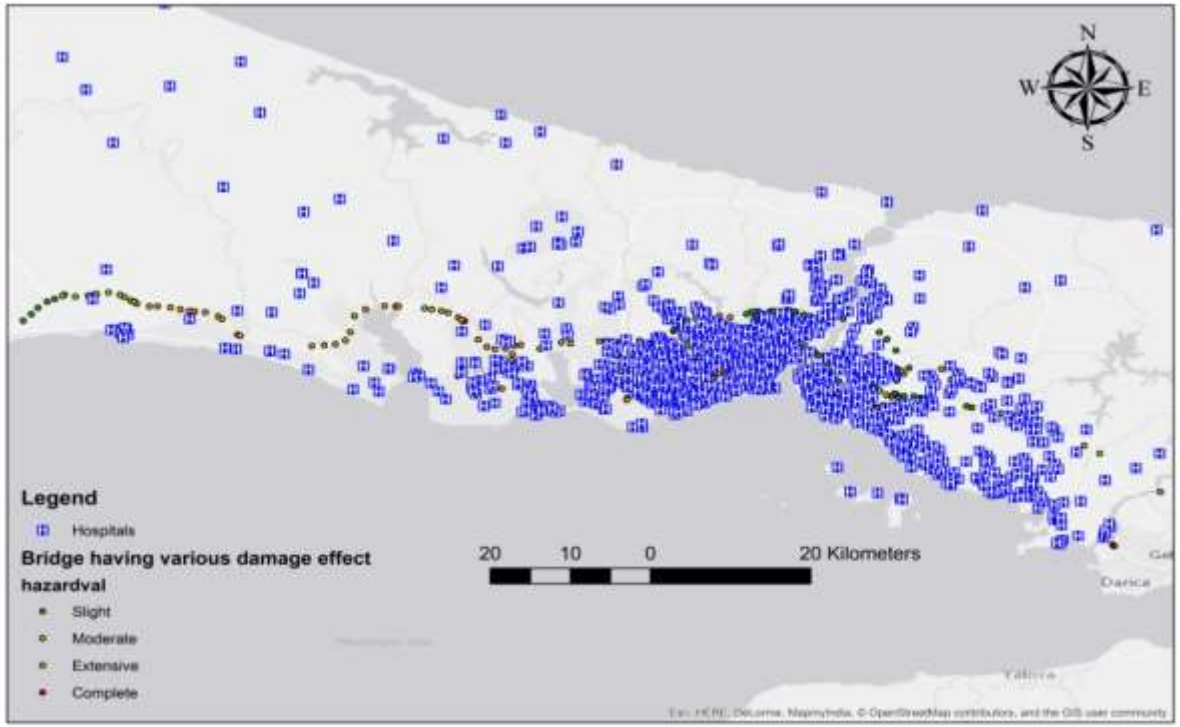
❖ Istanbul has been under earthquake threat is known for many years. Istanbul and the surrounding areas have been affected destructive earthquakes in the historical period (Ambraseys and Finkel 1991).

❖ There are 293 bridges having complete, extensive, moderate and slight possibility in Istanbul shown in Figure below:



DATA COLLECTION AND STUDY AREA

Medical service management that provides an essential facility following a disaster is one of the main parts of disaster management. There are 1173 hospitals in Istanbul that shown in Figure below:



SOME STATISTICS

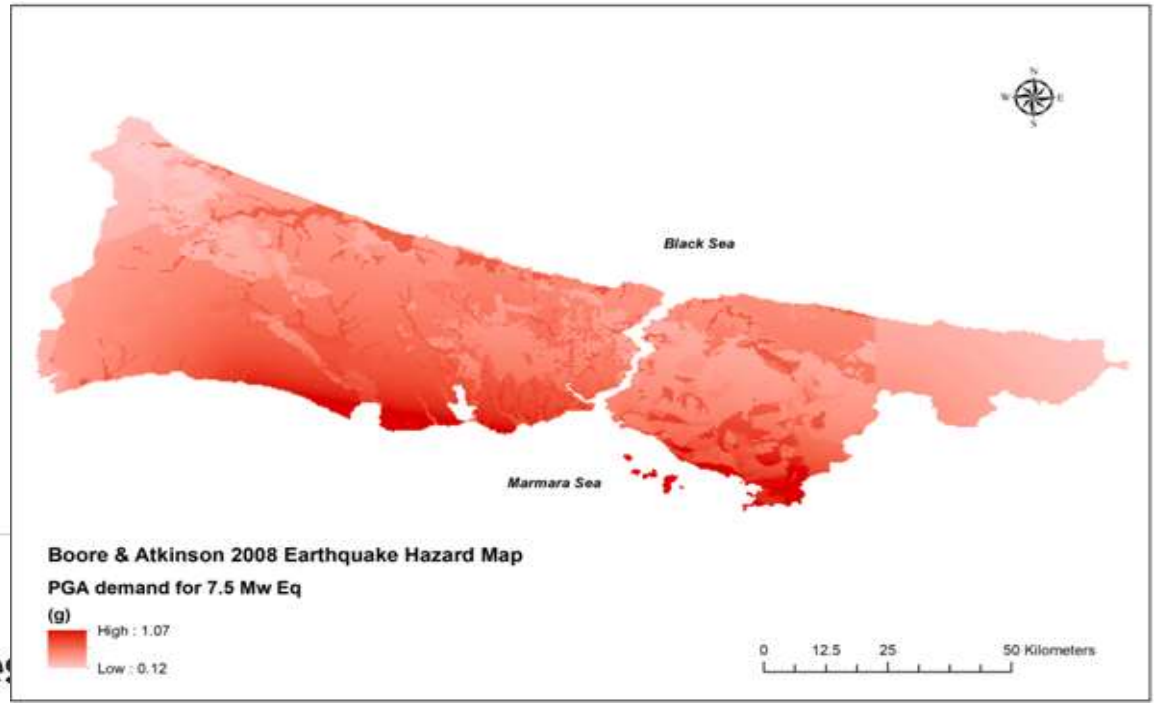
- Based on the official reports after the 1999 Kocaeli earthquake (ERC 2000) the number of injured people in Kocaeli and Sakarya urban areas was 14.297 while the population at that time in the city of Kocaeli and Sakarya was 960.764 people.

- This shows us the ratio of injured people to the total population is 1.5%.

- If we extrapolate the statistics to todays, the approximate number for injured people could be 215.655, while the total number of bed capacity of hospitals in Istanbul is 21380 and 232 operation room number.

HAZARD MAP

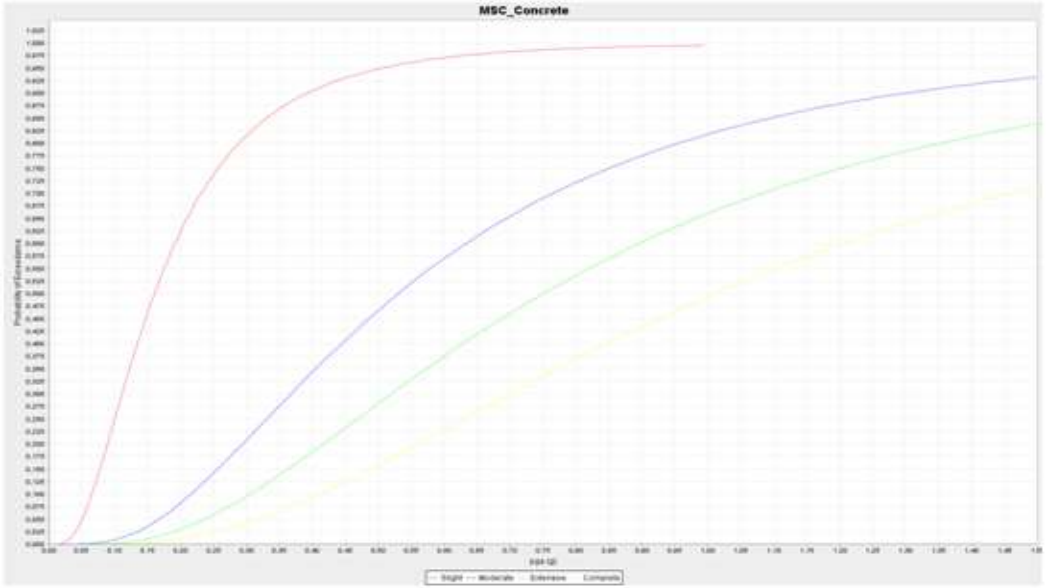
In this research, Hazard map is simulated for Istanbul with the help of using Boore and Atkinson (2008) ground motion estimation equation as indicated in Figure below:



FRAGILITY CURVES

❖ Vulnerability function is defined by means of integration of hazard map and types of inventory in Geographical Information System (GIS). Fragility curves and capacity curves are constituted the function of vulnerability.

❖ HAZTURK uses the fragility curves of Nielson and DesRoches (2007a) to estimate the bridge damage, based on the peak ground acceleration demand typed earthquake hazard maps as shown in Figure

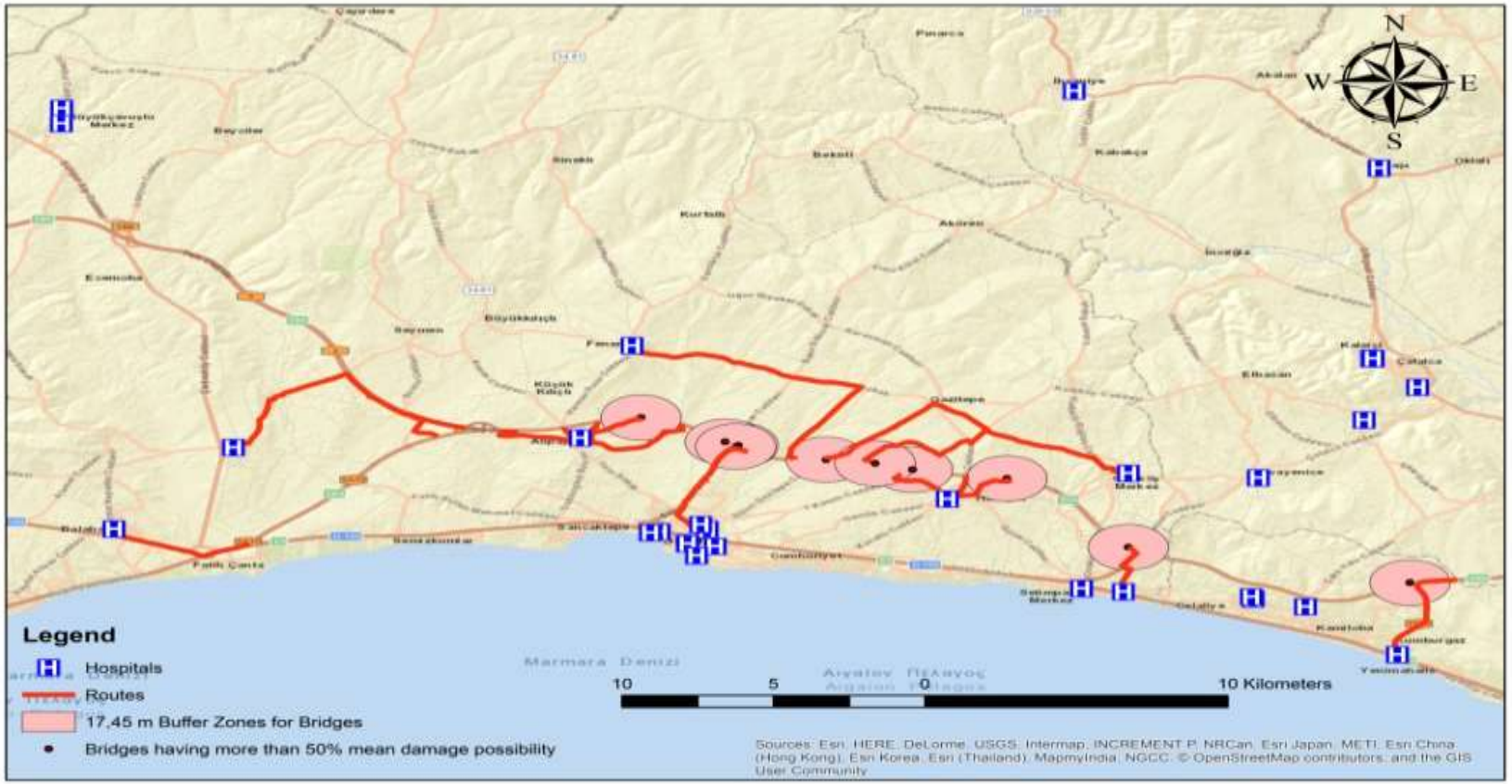


ROAD FUNCTIONALITY

❖ Debris from collapsed buildings and bridges can lead to road blockages and reduce road functionality after an earthquake; thus, emergency and rescue services become unable to reach the affected area. In this context, the debris distance for collapsed bridges needs to be determined, in order to find the closest possible routes to the medical services.

❖ Konukcu (2016) performed a study of the Gölcük region before and after the 1999 Kocaeli Earthquake and, as a result of spatial and statistical analyses, found the average distance of the debris from the collapsed buildings to be 17.45 m.

ROAD BLOCKAGES



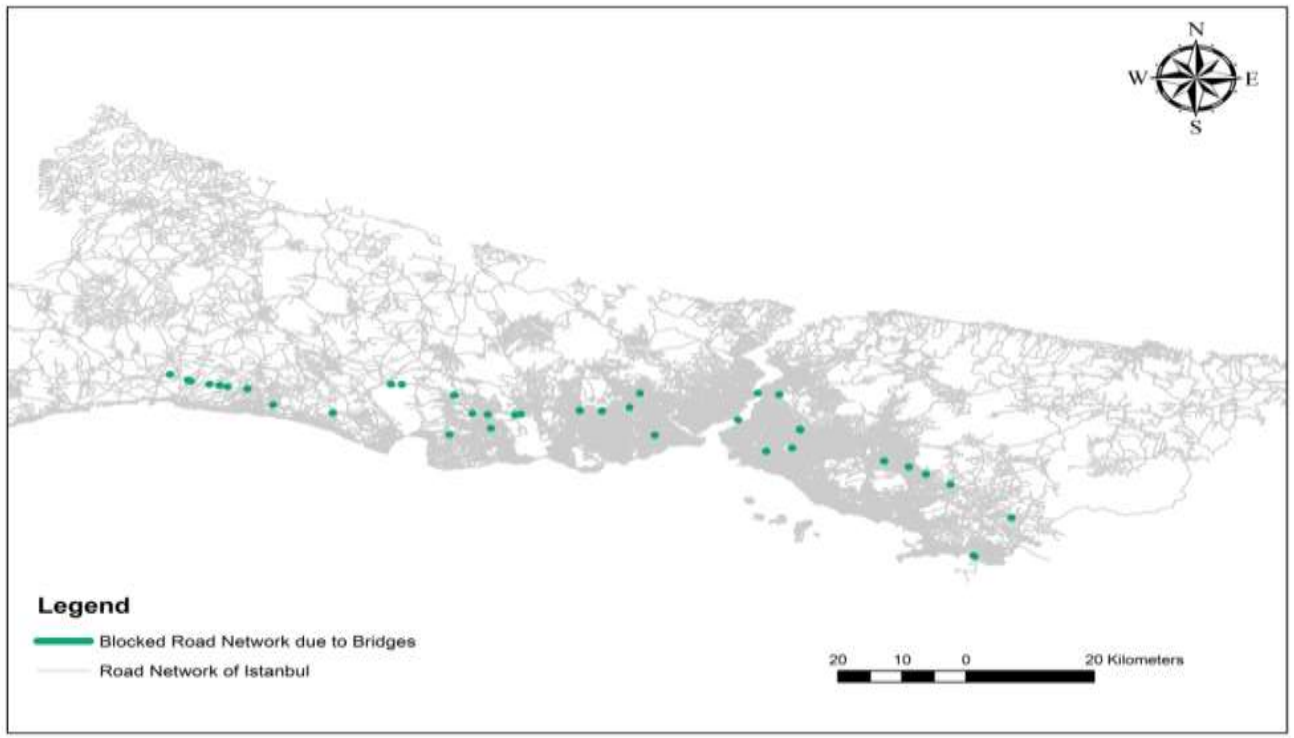
ROAD BLOCKAGE ESTIMATION

❖ As a result of this analysis, road blockages after a possible earthquake were identified, and an analysis of the ways to reach emergency services as fast as possible was performed.

❖ The length of the road network in Istanbul is 30325,21 kilometers, and as a result of the road blockage analysis, approximately 13,65 km of the roads would suffer a decrease in functionality following an earthquake.

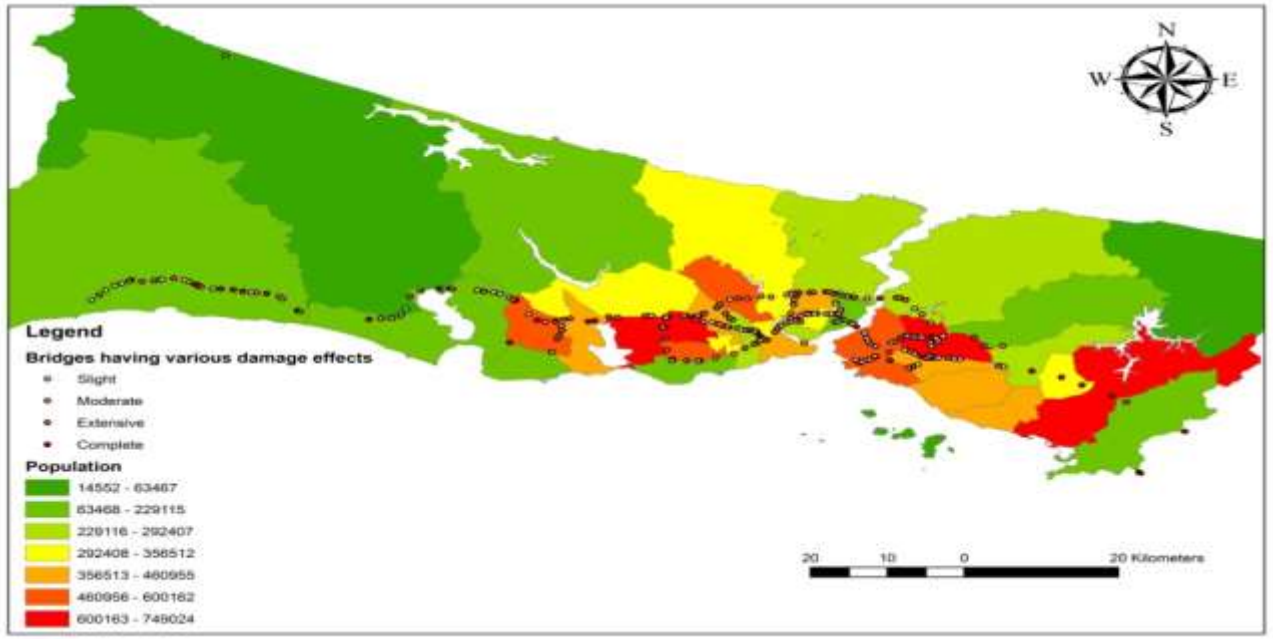
ROAD BLOCKAGE ESTIMATION ON THE ACCESSIBILITY TO THE HOSPITALS

Possible road blockage place following an earthquake in Istanbul is illustrated figure below;



ROAD BLOCKAGE AFFECTING PEOPLE

People would be affected by the road blockages and unable to receive help during the response phase. It is estimated that road blockages caused by debris from bridges would affect approximately 2 million people around non-functional roads.



CONCLUSION -1

It is expected that ;

- 215655 of people could be injured
- 13,65 km of the roads would suffer a decrease in functionality
- affecting 2 million people around non-functional roads following an earthquake…

CONCLUSION -2

- Road blockages due to collapsed bridges and substructures would mainly be concentrated on the European side of Istanbul.

- Numerous precautions must be taken by the government and individuals, in order to diminish the risks of a probable earthquake.

- The results presented in this paper can be used as an input for decision-making processes regarding road blockage estimation on the accessibility to the hospitals after possible Istanbul earthquake in order to take strategic precautions against the disaster hazards during preparedness and mitigation phases.

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