SUBWAY INUNDATION AND WHHELCHAIR USER EVACUATION DURING TSUNAMI BY NANKAI TROUGH EARTHQUAKE

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Introduction & Purpose

- Japanese government issues that Nankai-Trough earthquake occurs within 30 years with 70% probability.
- In urban area, there are subway line. It is assumed that these are likely to be inundated by water related disaster.
- Wheelchair users need help by someone in the case evacuate from subway.

The purpose of study is to investigate safe evacuation of wheelchair users from subway in the case of tsunami inundation.

Fig.1 inundated subway in Fukuoka by heavy rain ;MILTT

Study Area

Study area is Osaka city. Fig. 2 shows topography of Osaka city based on data issued by Geospatial Information Authority of Japan. Ground elevation of the west side area is below the mean sea-level . Osaka city is very vulnerable to tsunami inundation. Fig. 3 shows subway network in Osaka and station numbers.

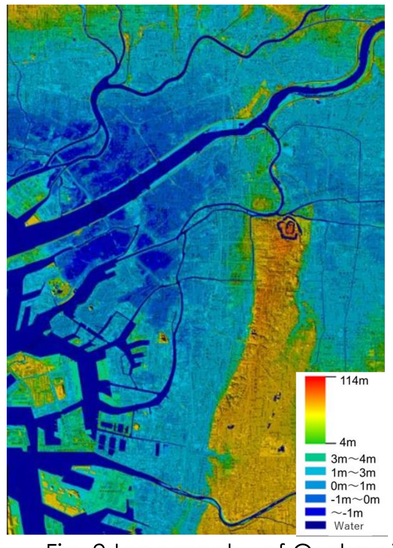

Fig. 2 topography of Osaka city

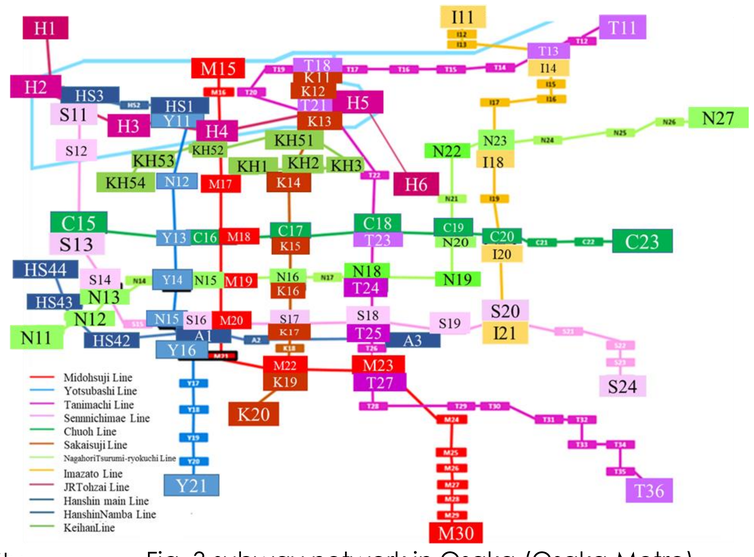

Fig. 3 subway network in Osaka (Osaka Metro)

Method

In this study, 2D shallow flow model was used. Cabinet office issued 11 tsunami model and the four severe cases were investigated were calculated. Finest resolution of topographic data is 30m. The water level of Osaka Bay is set T.P+1.20m in this study. Levees of the simulation model are neither destroyed nor sank down. The overflow discharge is calculated by using Honma's formula.

Result

- Comparing the results of the four cases, result of the case 10 shows the deepest and the largest inundation area. Fig.4 shows Inundation area and almost all of the west part of Osaka city was inundated. According to the result, 16 subway stations were inundated.
- If the subway is flooded, it is difficult for handicapped people to move in a wheelchair. Thus, people must evacuate from underground space by the time when subway station inundated. Fig.5 shows timeline of evacuation. In this study, it is presumed they decide to evacuate from there at stage 1 (110 minutes after the earthquake). The time between stage 1 and stage 3 is defined as lead time(LT). And, evacuation time of wheelchair users (EW)is the time between stage 1 and stage 2. In the case of earthquake, elevator is not available so that people must use stairs. In this survey, it takes a second for 4 people to climb a step of stair with wheelchair and its users, and speed of wheelchair is 0.5m/sec on the floor of subway stations in the case with assistant.
- Fig.6 shows LT and EW of inundated stations.LT of the N11, N13 and N23 station was only 9 minutes. It was not enough for wheelchair users to evacuate from these subway stations. From the results, it is concluded that people should evacuate from subway stations after shaking of the earthquake finishes.

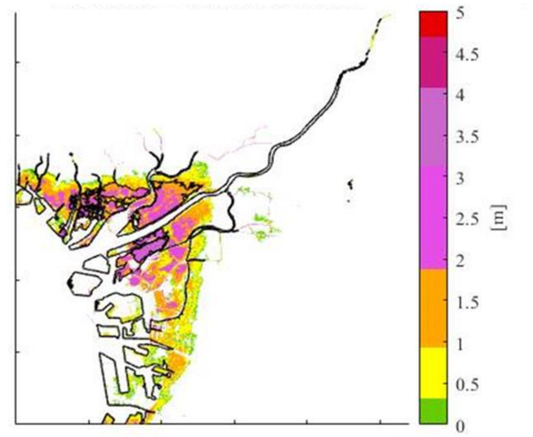

Fig.4 maximum inundation depth of study area

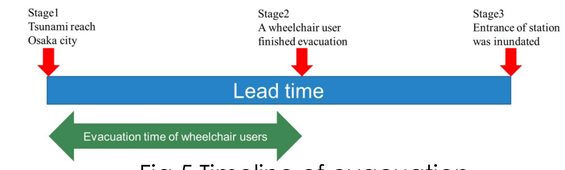

Fig.5 Timeline of evacuation

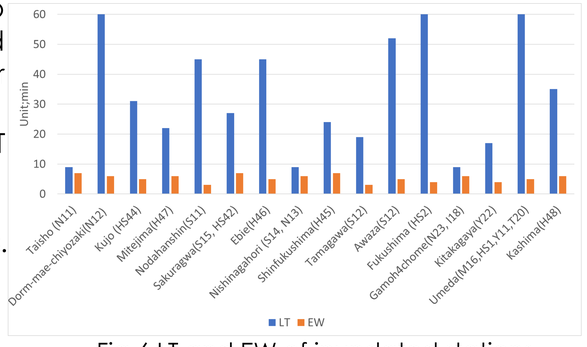

Fig.6 LT and EW of inundated stations

conclusion

- ◆LT of several stations was not enough to evacuate for wheelchair users.
- ◆Thus, people should decide to evacuate from subway stations after the shaking of mega earthquake finished.
- ◆In order to execute safe evacuation of people, station staff should be trained to guide people including wheelchair users and other disabled persons.

Reference
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