

# Digital map arrangement of Hamamatsu City for the prediction and restoration of the earthquake disasters

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**Abstract:** The purpose of this study is to arrange the digital maps of Hamamatsu City and to construct the map information system to support the prediction and restoration of Tokai earthquake disasters. The authors arrange the land condition map and compute the populations of each land surface conditions and revealed that 37% of the whole population lives in the safe land, but 63 % lives in the rather unsafe surface condition.

The authors also arrange the digital map of the main lines of water supply pipe lines in corporation with the Hamamatsu City Water Supply Department and revealed the rather dangerous pipe line area in case of Tokai earthquake.

**Keywords:** GIS, Tokai earthquake, Hamamatsu City, Digital maps, ReSIA Project.

The purpose of this study is to arrange the digital maps of Hamamatsu City and to construct the map information system to support the prediction and restoration of Tokai earthquake disasters. The authors arrange the land condition map and compute the populations of each land surface conditions. The authors also arrange the digital map of the main lines of water supply pipe lines in corporation with the Hamamatsu City Water Supply Department and reveal the rather dangerous pipe line area in case of Tokai earthquake.

Finally the authors construct the map information system of Hamamatsu City, which enables to retrieve and display local land condition.

## 1. Introduction

Hamamatsu City is located in the central part of Japan and in the west of Shizuoka Prefecture. The west-east length is 22km, the north-south length is 26km(fig. 1), and the population is 602,461 in April, 2004. It is commonly predicted that a giant earthquake could occur in and around Shizuoka Prefecture in the near future.

Due to the urgent need in developing a system that prevents a secondary disaster Our faculty members started a project whose goal is to develop a restoration support system in a disaster by image processing and information gathering by ad hoc networking, titled "study of the restoration support of earthquake disasters using image processing and ad-hoc network"(ReSIA Project)[1]. This study is a part of the project supported by Telecommunications of Advancement Organization, Japan(TAO) during 2000-2004.



Fig.1 Location of Hamamatsu City.

## 2. Making of Land surface condition map

### 1) Data

Hamamatsu City Office already published the paper-base land condition and public facility map of 1/30,000 scale of UTM projection. The land surface condition is classified as shown in table 1. This map is digitized on the digital city planning base map of 1/2,500 scale of Japan original modified-UTM projection, prepared by Hamamatsu City Office, using ArcGIS/ArcInfo Ver. 8.3 by ESRI, U.S.A.

As shown in table 1, the land condition is classified based on the surface geology in the mountainous area and the land condition is classified based on the micro-topography in the upland and lowland of the plains. The reclaimed surface(recently reclaimed) means the land

Table 1. Classification of land conditions of Hamamatsu city.

Locaion	Surface condition
Mountain	Paleozoic
Mountain	Metamorphic rocks
Upland	Terrace surface
Upland	Terrace cliff or slope
Lowland	Alluvial fan
Lowland	Natural levee
Lowland	Back marsh
Lowland	Old river bed
Lowland	Present river bed
Lowland	Valley floor sediments
Lowland	Bay-mouth bar or sand dune
Lowland	Marsh between bay-mouth bars
Lowland	Reclaimed surface
Lowland	Reclaimed surface (recently reclaimed)

which reclaimed in the years since 1890.

### 2) Method

The method is as shown in fig.2. and the completed digital land condition map is shown in fig.

## 3. Making of the map of water supply pipe lines

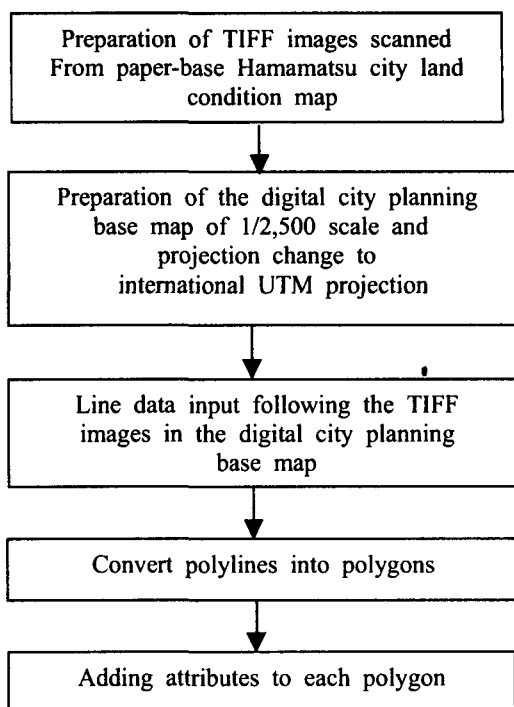


Fig. 2 Making of digital land condition map.

Hamamatsu City Water Supply Department manages the water supply pipelines of 2747 km and the main lines whose diameters are more than 350mm is distributed at the length of 270 km. In this study, the main lines of 270km is digitized. The base map of pipe lines is water supply pipe line map of 1/2500 scale. 293 sheets covers all city area as shown in fig. 3. and the example of the contents of water supply pipe line map of 1/2500 scale is shown in fig. 4.

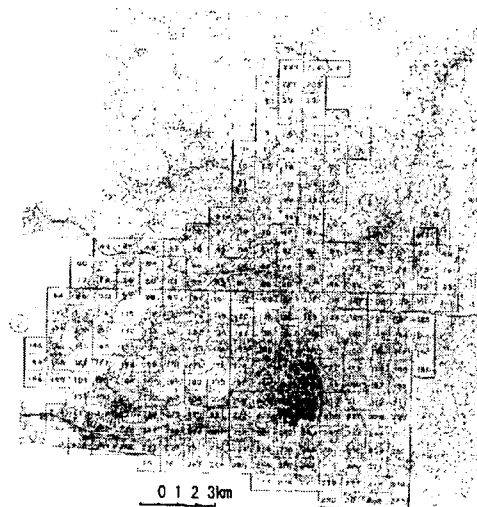


Fig. 3 Index map of water pipe line maps of 1/2500 scale

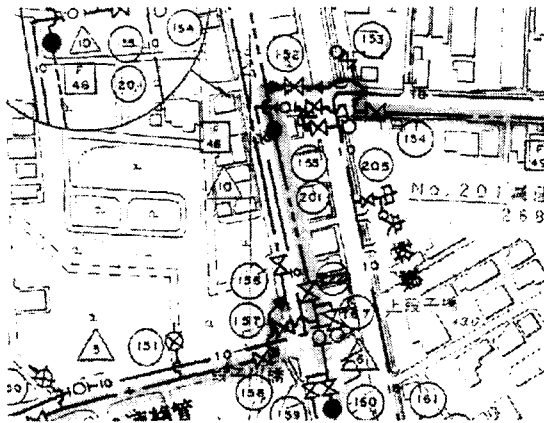


Fig. 4 Example of water supply pipe line map of 1/2500 scale

The water supply line map is digitized in the digital city planning base map just like the land condition map making. The completed map is shown in fig.5.

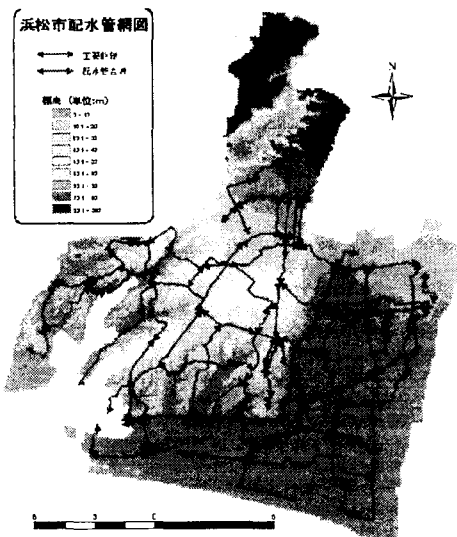


Fig.5 Main water supply pipe lines in Hamamatsu.

#### 4. Discussion

Now the digital land condition map is available, the population of each land condition can be computed, overlapping the land condition map and mesh population density map. The population data used here is the 1km X 1km population density obtained from the Census 2000 results. Population percentage of each land condition is shown in Fig.6.

The results show that 37% of the whole population lives in the safe land(mountain, terrace surface and lowland alluvial fan) but but 63 % lives in the rather unsafe

surface condition(the other area of lowland than alluvial fan and terrace cliff or slope).

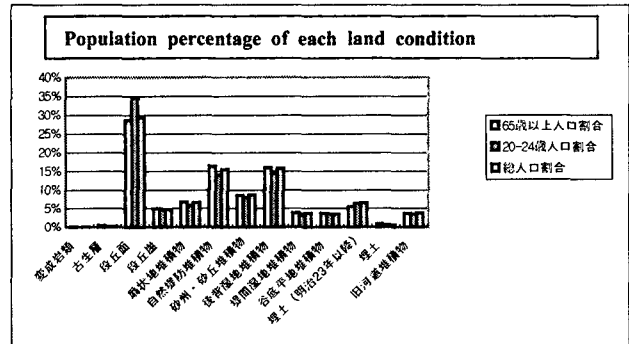


Fig.6 Population percentage of each land condition.

Overlapping the water supply pipe line map and the land condition map, the safe condition and rather unsafe condition of water supply pipe lines can be computed. The result shows that 48% of the main water supply lines runs in the safe land condition(mountain, terrace surface, terrace slope and alluvial fan), and 52% of the main water supply lines runs in the rather unsafe land condition(all area in lowland except alluvial fan).

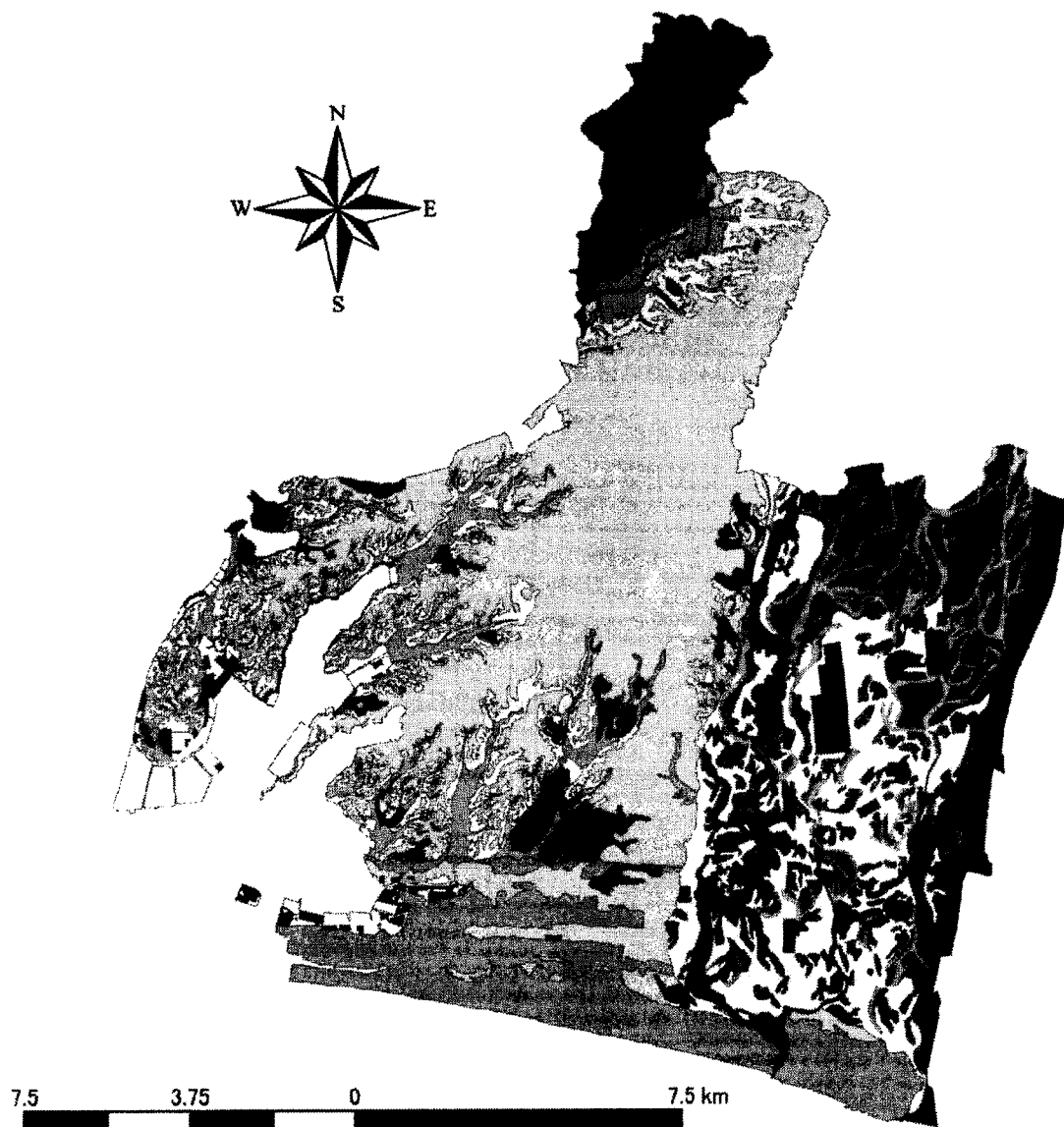
#### 5. Conclusion

The purpose of this study is to arrange the digital maps of Hamamatsu City and to construct the map information system to support the prediction and restoration of Tokai earthquake disasters. The authors arrange the land condition map and compute the populations of each land surface conditions and revealed that 37% of the whole population lives in the safe land, but 63 % live in the rather unsafe surface condition.

















The authors also arrange the digital map of the main lines of water supply pipe lines in corporation with the Hamamatsu City Water Supply Department and revealed that 48% of the main water supply lines runs in the safe land condition(mountain, terrace surface, terrace slope and alluvial fan), and 52% of the main water supply lines runs in the rather unsafe land condition(all area in lowland except alluvial fan). in case of Tokai earthquake.

#### References

- [1] Takashi Watanabe and Kazutaka Iwasaki, 2001. A Restoration Support by Image Processing and Ad hoc Networking in a Disaster, *Proc. URISA 2001 Annual Conference and Exposition*, Long Beach, U.S.A., pp.357-362.



**Instruction**

	 Natural levee
 Inland water	 Old river bed
 Alluvial fan	 Paleozoic
 Back marsh	 Present river bed
 Bay-mouth bar or sand dune	 Reclaimed surface
 Marsh between bay-mouth bars	 Reclaimed surface (recently reclaimed)
 Metamorphic rocks	 Terrace cliff or slope
	 Terrace surface
	 Valley floor sediments

**Fig. 7 Land condition map of Hamamatsu City**