Construction of GIS in Iwata City, as the Basic Information For the Prediction of Earthquake Disaster

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Abstract

The purpose of this report is to show the process of the development of the database of physical and social environments of Iwata City as the basic information for estimation of earthquake disasters and to show the contents of a computer application for handling the database. As the development of GIS in Iwata City, several facts were revealed as the very useful information for the prediction of disasters.

Key words: GIS, Database of IWATA City, Tokai Earthquake, GIS application

1. Introduction

Earthquake disasters frequently happen in Shizuoka Prefecture and it is commonly recognized that a giant earthquake(Tokai Earthquake) could occur in the near future.

Iwata City is located in the west of Shizuoka Prefecture as shown in Fig.1, population of approximately 86000, area of approximately 64 km^2, could have extensive damages, if Tokai Earthquake happened. To estimate the earthquake disaster or to make a action plan to restore the damages, basic regional information is necessary. A lot of kinds of information of physical and social environments in Iwata city is offered or published by the government, prefecture government, city government or private company in various types. These data have been separately used and have never been collected as the database in one system. In this study, various types of information are collected and the database is constructed and GIS application using Map objects by ESRI is developed.

2. Database

Digital vector maps(DVM), digital raster maps(DRM), paper maps(PM), digital mesh data(DMD), digital table data(DTD), text table(TT), text description(TD) for the basic information of Iwata City are collected and the database of Iwata City is constructed. The contents and the source types are showed below.

2-1 City information

City geographical information based on basic census area unit and based on 1km by 1km mesh

(500m by 500m mesh in densely inhabited districts(DID))

Total and male/female population(DTD, DMD)

Total and male/female population over 64 years old(DTD, DMD)

Total and male/female population percentage over 64 years old(DTD, DMD)

Numbers of families(DTD, DMD)

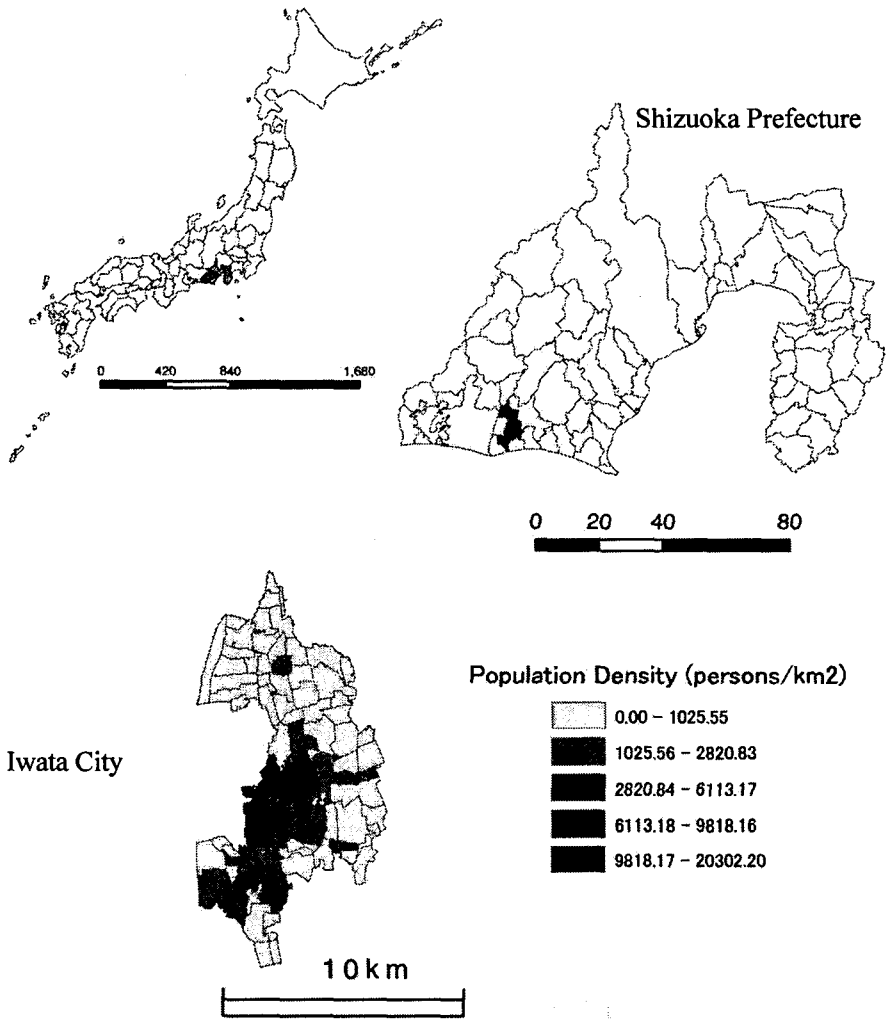

Fig.1 Location of Iwata City and population density in Iwata City in basic census area units

2-2 Physical environments

Annual and monthly temperature in 1km by 1km mesh(DMD)

Annual and monthly precipitation in 1km by 1km mesh(DMD)

Contour lines in 20m interval(DVD)

Contour lines of very soft mud layer depth(PM)

Mud bank slope(PM)

Artificial mud-filled-up land(PM)

Topographical classification image made by Iwata City(PM)

Surface geology made by Shizuoka Prefecture(DVM)

Surface topography made by Shizuoka Prefecture(DVM)

2-3 Earthquake disaster in 1944 in basic census area units(TT)

Completely destroyed house percentage

Partly destroyed house percentage rate

Number of houses completely destroyed

Number of houses partly destroyed

Completely destroyed house percentage rate in the low land

Number of houses in 1944

Estimate seismic intensity

2-4 Emergency support facilities(TD)

The name of these facilities is picked up from books and the addresses are picked up form NTT telephone number guidebook.

Shelter facilities

First-aid stations

Shelter parks

Shelter facilities in case of earthquake alert declaration

Fire stations and fire station branches

Police stations police stands

Emergency support stock houses

2-5 Earthquake damage estimation by Shizuoka prefecture(DVM or DTD)

Seismic estimation(1km by 1km mesh)

Seismic intensity

Maximum surface acceleration intensity

Liquefaction intensity

Houses and buildings(basic census area unit)

Number of houses and buildings(Present status, not estimation)

Total number, wooden type, RC or SRC structure type, S structure type, others

Density of wooden houses

Damage ratio of houses and buildings in each damage level

Slight, moderate or severe damage

Damage ratio of houses and buildings by landslides in each damage level

Slight, moderate or severe damage

Fire

Damage area by fire expansion

Fire outbreak points(easy to be extinguished by the first action program

Fire outbreak points(easy to be extinguished by the first action program

Fire outbreak points which could cause the extensive fire

Floods

Floods of depth 0-0.5m

Floods of depth 1-2m

Floods of depth over 2m

2-6 Facilities which we should pay attention (Dangerous facilities)

Dangerous footbridge(TD)

Dangerous slopes(TD)

Dangerous roads(TD)

Dangerous liquid or solid storing facilities(TD)

2.7 Basic maps for display of the database

For the basis to display the database, the maps as shown below are prepared.

Boundary of Iwata City(DVD)

Buildings and houses(DVD)

Area of city landuse(DVD)

Precise road boundaries(DVD)

Main road center lines(DVD)

Expressway and toll road center lines(DVD)

Railway(DVD)

Station center lines(DVD)

Topographical map(1:25000) (DRM)

3. Development of software to handle the database

The computer software to handle the database was developed using Map Objects by ESRI(USA) and Visual basic of Japanese edition by Microsoft(USA). When the software is executed, the first picture is displayed as sown in Fig. 2. In the first picture, you can choose one button in 6 items. Then choose one item in the menu, you get to the picture of the item. In each map, you can enlarge and reduce, move and it.

4. Examples of the facts revealed using this system

Fig. 3 shows the contour lines of very soft mud layer depth and the railways(Tokaido line and New Tokaido line or Shinkansen). The railways run on the artificial filled-up bank over the deep mud layer. When Tokai Earthquake happened, some damage could occur in this area. Especially, the trains on the New Tokaido line runs very fast, Great damage could occur, if a Shinkansen train was running on this point in case of Tokai Earthquake.

Fig.4 shows the liquefaction estimation and the distribution of shelter facilities. Some shelter facility is located in the area where severe liquefaction could occur. When Tokai Earthquake happened, Some people could not get to the shelter, because of liquefaction. When a disaster restoration program is planned, we should really recognize this result.

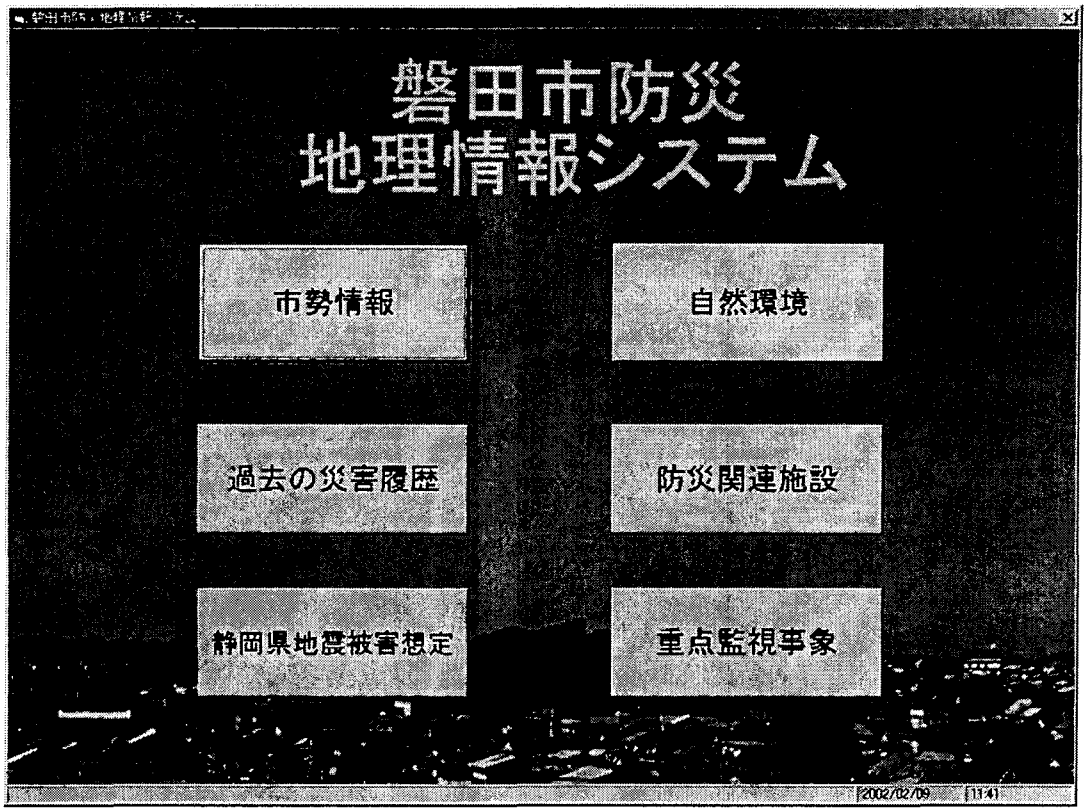

Fig. 2 The main picture of the software for handling the database

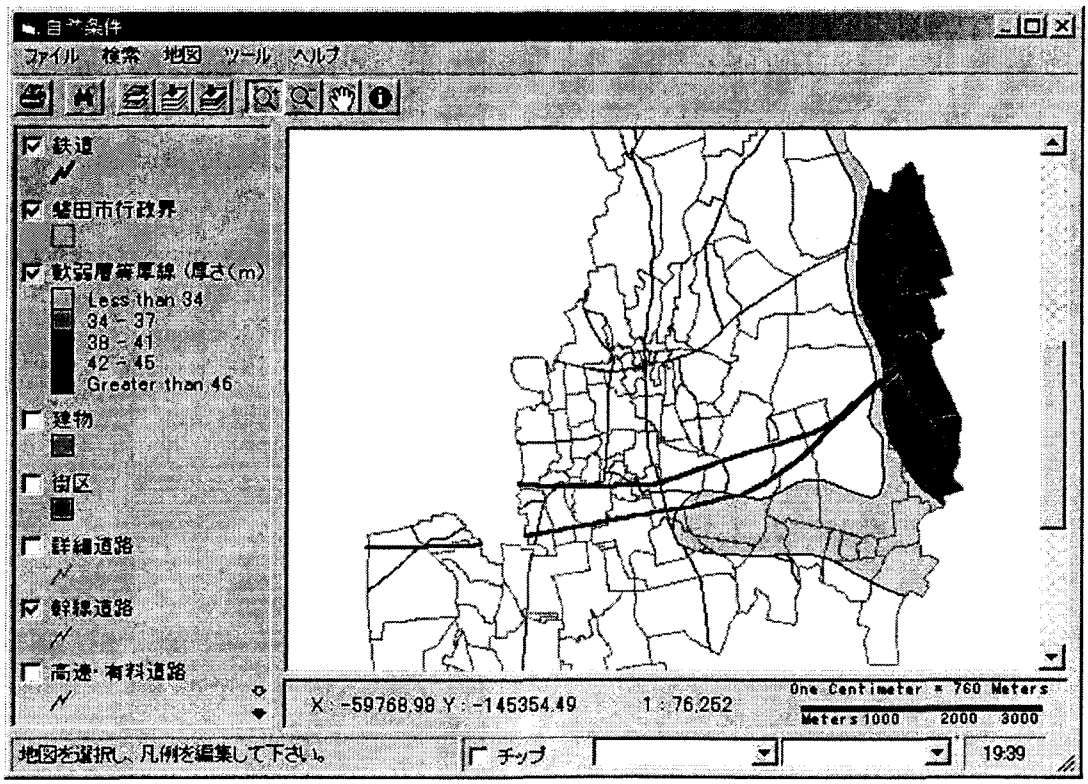

Fig. 3 Contour lines of very soft mud layer depth and the railways

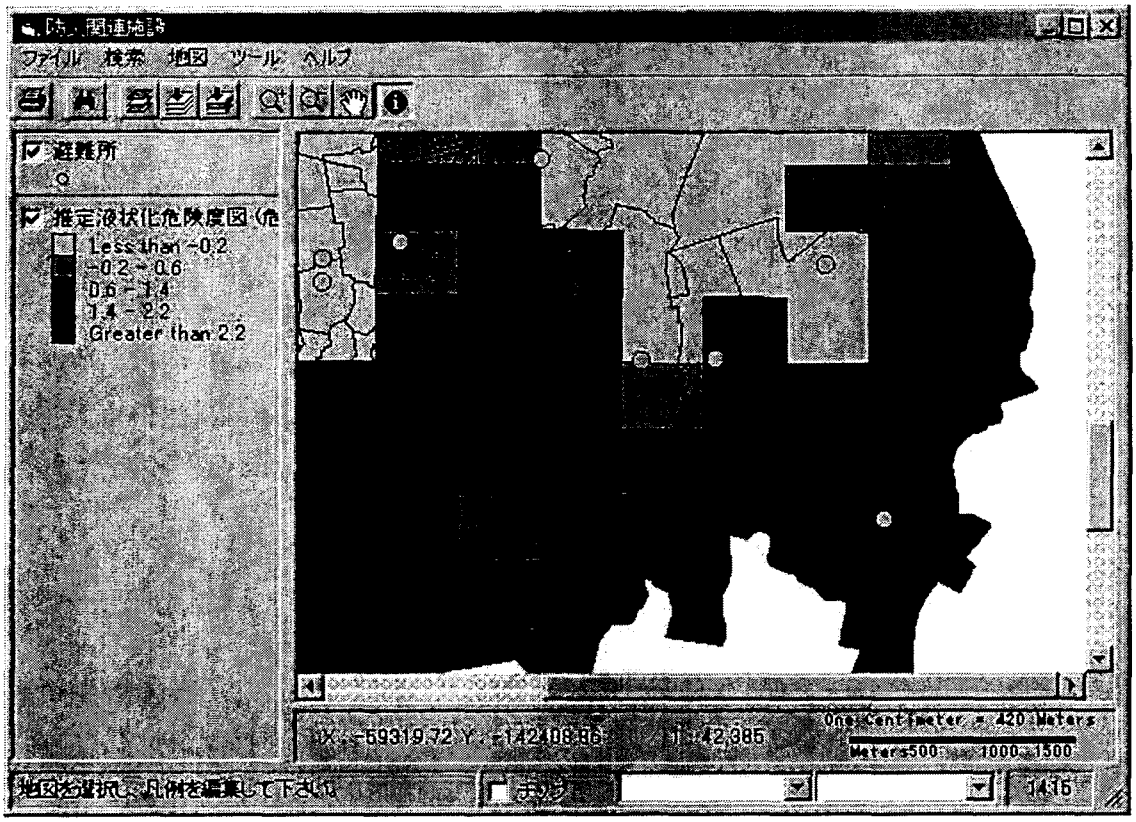

Fig.4 Liquefaction intensity estimation and the distribution of shelter facilitie(yellows points)

5. Concluding remarks

. Various types of information of physical and social environments in Iwata city, which are offered or published by the government, prefecture government, city government or private company are collected the database is constructed. GIS application using Map objects by ESRI is developed for handling the database. As the construction of GIS of Iwata City, new facts are revealed.

We should recognize the importance of the database to make a estimation program or restoration plan of earthquake disasters.

A study on Average CN Estimation in River Basin using Satellite Data

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Abstract

The goal of this study is to apply and evaluate the precipitation outflow in river basin using satellite data and GIS for proposing the efficient watershed management method. Not only precipitation outflow data but also various spatial data such as digital map, soil map, geologic map and multi-temporal TM images were used. Using landcover classification result and soil map were applied to estimate the average CN. The CN value of 63.37 by SCS method was produced in AMC-2 condition otherwise the result of direct estimation with observation method was 63 CN value.

The relative error of two results was 0.59%. It can be possible to apply the satellite data for precipitation outflow analysis. For more accurate and credible analysis of this, the more multi-temporal satellite and real observation data will be needed.