

**ESRI International**  
**User Conference 2005**

## **Development of a Slope Failure Management System Using ArcGIS Server**

**Ji FANG, Akiyuki KAWASAKI and Satoru SADOHARA**

### **Abstract:**

There are many incidents of slope failure across Japan every year. In order to improve landslide management activities, we developed a Web application for the Prefectural Land Development Department of Kanagawa County. We used ArcGIS Server to build a centrally managed system because there are ten dispersed Public Works Offices. The ArcGIS Server web application is utilized in order to effectively collect, restore, manage, and analyze the slope data to support the routine work of personnel in those Public Works Offices. With this system, we can predict potential slope failure by using the results of analytical and real-time rainfall data. This system would allow the user to retrieve the closest rainfall data at the time and detailed slope inventory data from the web page, and a GPS cellular phone can capture the place and describe data about a collapse and send it to web server via the internet in times of emergency.

### **Keywords:**

Slope Failure Management; Geographic Information System;

## Introduction

One of the important problems in Kanagawa is there are many steep slopes all around the building. To make matters worse, heavy rains strike Kanagawa every year. Many people, buildings, and city infrastructures are on the hilltop, hillside, and bottom of hills. Recently soft-measures are expected since hard-measures such as constructing soil fall protections are difficult in execution because of economical and environmental consideration.

The goal of our research is to develop ways to identify and predict dangerous landslides by city officials using data from various sources and information technology.



We used ArcGIS Server to build a centrally managed system because there are ten dispersed Public Works Offices. The ArcGIS Server web application is utilized in order to effectively collect, restore, manage, and analyze the slope data to support the routine work of personnel in those Public Works Offices.

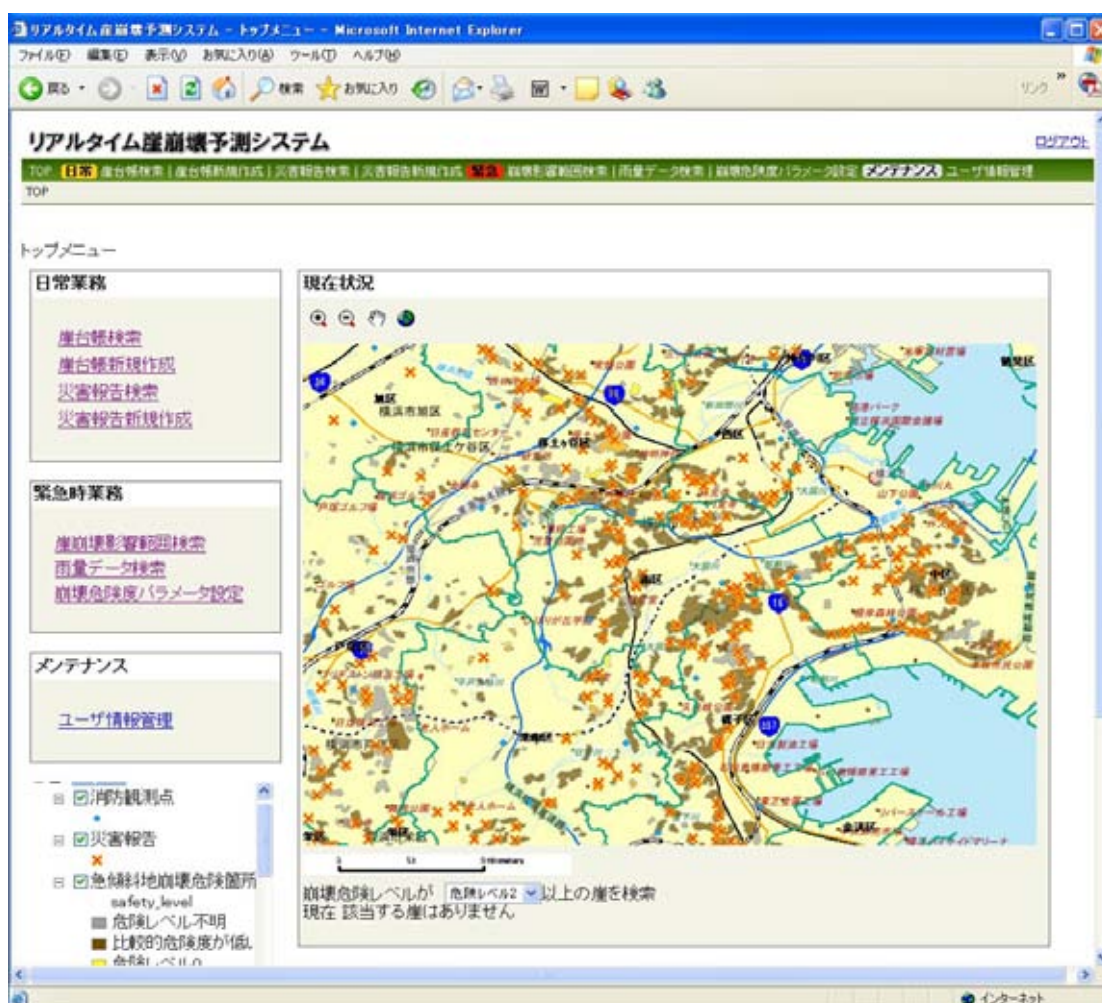
There are two general goals to our work: 1. Create a user-interface (website) for daily landslide observation by city officials, 2. Having that interface is useful for emergency response by predicting landslide location and extent of damage based on existing buildings.

## System

### The system development environment

Windows2000 server (IIS ) & .Net Framework 1.1
SQL Server2000
Arc GIS Server 9.0
Arc SDE 9.0
VisualBasic.net

The objective of this study is to develop a slope failure disaster management system to support disaster management works in municipality.



In this moment, two parts were developed.

1. "Slope Information Management", which is used for daily disaster management use.

**基本項目**

箇所番号	105-1-003
箇所名	大岡1丁目1B
崩壊危険度	危険度不明
崩壊危険度 評価点数	-0.955
がけ崩れ災害の有無	有
がけ崩れ災害調査の箇所番号	57360
位置	横浜市南区大岡1丁目
延長	
雨量観測所	黒河5宮

**地形要因**

傾斜度	40度	斜面高さ	14m
斜面方位	西向き斜面	上位地形の方向	その他
斜面形状	 凸形変形型斜面	断面形状	 平坦な斜面である
浸食線	 浸食線が不明	浸食線の位置	該当なし

2. "Real-time Landslide Prediction", which is for preparedness and emergency response work after disasters.

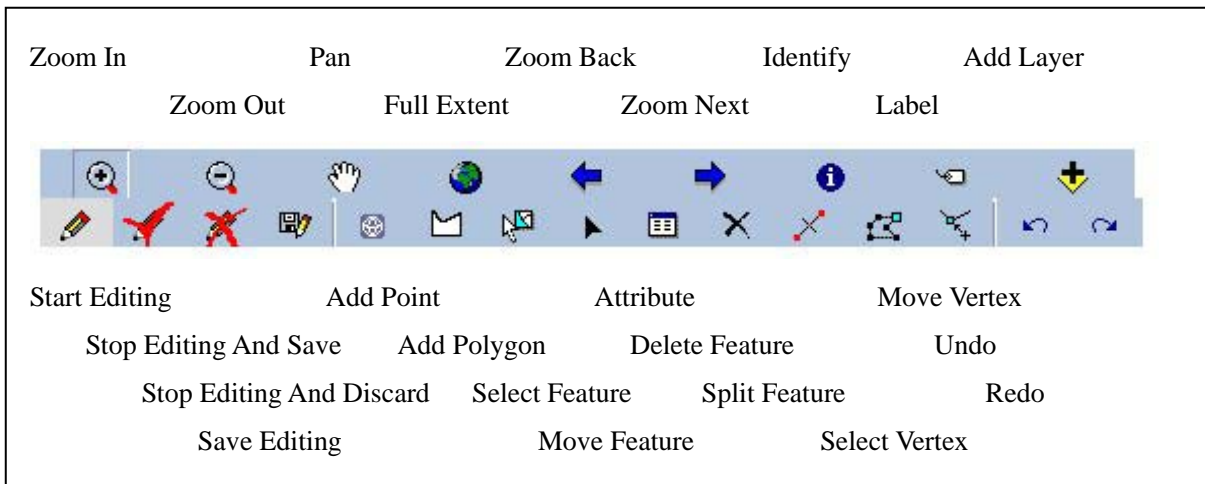
**リアルタイム崖崩壊予測システム**

検索結果

影響が及ぶ可能性のある施設  
1 2 3 4 5 6 7 8 9 10

- 1 位置 大岡1丁目1B
- 2 位置 大岡1丁目1B
- 3 位置 大岡1丁目1B
- 4 位置 大岡1丁目1B
- 5 位置 大岡1丁目1B
- 6 位置 大岡1丁目1B
- 7 位置 大岡1丁目1B
- 8 位置 大岡1丁目1B
- 9 位置 大岡1丁目1B
- 10 位置 大岡1丁目1B

Function Toolbar in the system

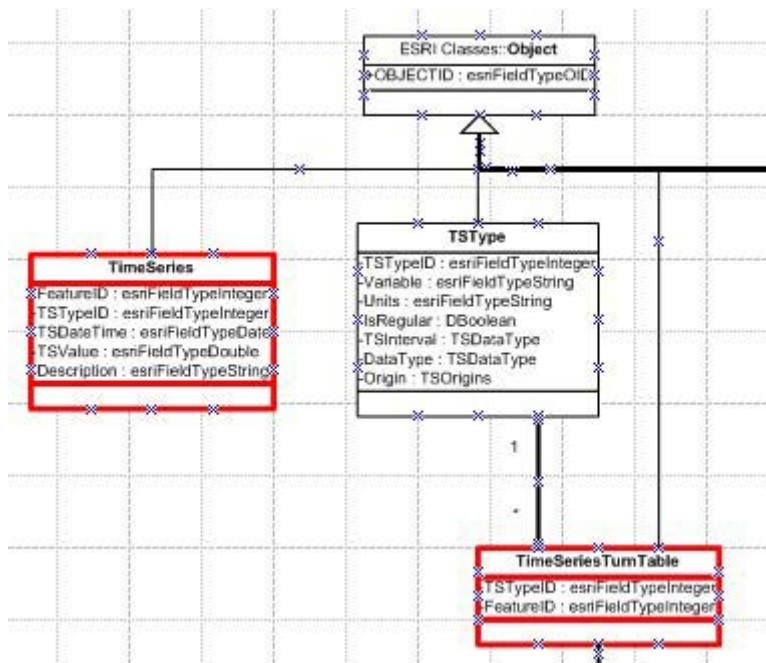


## Historical Data & Dynamic Data

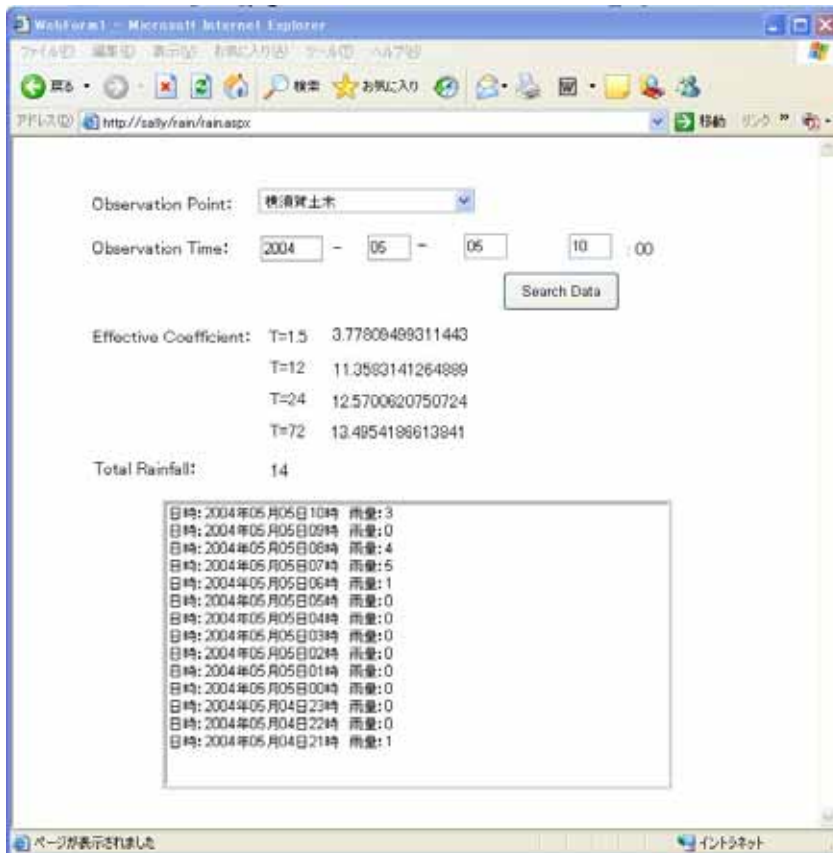
Municipality of Kanagawa has much kind of paper data related to steep slope and dangerous cliff in the city. In order to mitigate the risk of the calamity by slope failure, those paper data was digitized by us. Municipality's data related to slope failure (inventory, collapse record, and precipitation) were stored and managed using GeoDatabase (SQLServer2000 and Arc SDE 9.0 )

## Data Collection Methods

The following UML diagram shows the core model for time-series in system.



**We can search the time-series rainfall data by observation point name and time.**



## CONCLUSIONS

Slope failure disaster management system in Kanagawa, Japan, is under development using existing municipal government data and GIS. By combining some methodologies, a prototype system of “Real-time evaluation system against slope failure disaster” was developed. This system consists of two components:

- Slope Information Management System for effective daily support of steep slope management activities by integrating municipal data related to steep slope management
- Real-time Slope Failure Prediction System for response activities after a collapse by accumulation and analysis of slope failure records and precipitation data.

In next step, thorough a questionnaire and interview to users, system development needs further improvements as to be a decision-making support tool in practical disaster management work in municipality.

## **ACKNOWLEDGEMENT**

We would like to thank The Ministry of Land, Infrastructure and Transport, JAPAN for the opportunity to develop the Construction Technologies R&D Project. We would also like to thank ESRI JAPAN for their excellent support. And Special thanks to YNU cliff-team members for their dedicated work to this study.

## **References**

Akiyuki KAWASAKI, the Utilization of GIS for the Measure against Slope Failure Disaster in Urban Area”: Joint Workshop on US-Japan Cooperative Research in Urban Earthquake Disaster Mitigation, 2003.1

### **Author Information**

#### **Fang Ji**

\*Graduate student

Graduate School of Environment & Information Sciences,

Yokohama National University

79-7, Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan

E-mail: fangji2000@hotmail.com

Tel: +81-45-339-4246

Fax: +81-45-338-1016

#### **Kawasaki Akiyuki**

Environment and Information Sciences

Sadohara&Yoshida lab.Yokohama National University

Yokohama , kanagawa 240-8501

**Phone:** +81-45-339-4247

**E-mail:** [aki\\_kawasaki@hotmail.com](mailto:aki_kawasaki@hotmail.com)

#### **sadohara satoru**

Y Environment and Information Sciences

Sadohara&Yoshida lab.Yokohama National University

79-7,Tokiwadai,Hodogaya-ku,Yokohama,Japan

yokohama , kanagawa 240-8501

**Phone:** +81-45-339-4247

**E-mail:** [sato610@arc.ynu.ac.jp](mailto:sato610@arc.ynu.ac.jp)