customer stories

Mapping Sea Cliff Erosion in California

Customer
Santa Ynez
High School

Project
Sea Cliff Erosion
Mapping Project

Project Date
2004-2005

PROJECT HIGHLIGHTS

- Each year, people are injured falling from jagged, eroding cliffs in Isla Vista, Calif.
- High school students with GPS, GIS expertise tapped to map cliff erosion
- Spatially accurate maps and projections of eroding cliffs assist city in planning, health and safety
- Trimble GeoXT ideal for use in damp, rugged terrain

Located along the scenic Pacific Ocean coastline of California, Isla Vista is the bedroom community for the University of California at Santa Barbara (UCSB) and holds a seasonal student population of 22,000 people in an area slightly larger than one square mile. Having a sufficient amount of housing is always an issue and there is a tremendous demand to be among the select few to live in the apartment buildings along the cliff edge that overlooks the Pacific Ocean. Originally built with a 30-foot offset, erosion has caused the condemnation of three large apartment buildings and has created hardships, lawsuits, and ill feelings between Santa Barbara County government officials, landowners, landlords, and tenants.

In addition to residential concerns, the cliff edges are becoming a serious health and safety concern for the residents of Isla Vista. While the cliff edges are fenced off in most areas, every year, an average of five people are severely injured after falling from the 40- to 60-foot cliff in the dark—often after late-night college parties.

Because of their past success with Geographic Information System (GIS) and Global Positioning System (GPS) mapping, Santa Barbara County environmental geologists asked the 18 students in the Environmental and Spatial Technologies (EAST) class at nearby Santa Ynez High School to develop a complete map of the cliff edge and cliff base using GPS and GIS technology that could be incorporating into the county's existing databases.

The EAST program facilitates strong relationships among business, government, and education in communities. A non-profit organization now operating in more than 200 high schools in seven states, EAST is helping educators create a learning environment that encourages initiative and produces tangible results, as in the case of the sea-cliff erosion-mapping project. For this project, the students were asked to establish an initial baseline so that better analysis, notification, projections, and decisions could be made regarding the state of the eroding cliffs.

EAST students have a wealth of technologies available to them, including computer-aided design (CAD), GIS, GPS, animation, video, and graphics. To develop the sea-cliff erosion map,

students amassed different types of data, such as satellite imagery and aerial photography of the area, and researched the problem. Existing data layers were incorporated into the GIS, and then student teams went to Isla Vista for two days to collect data on-site.

The first team walked the cliff base and documented the state of the shoreline with digital cameras and video. Then, using a Trimble® GeoXT™ rugged GPS handheld receiver running Microsoft® Windows Mobile™, the students located and documented all access points, any severe erosion, storm drains, and cliff vegetation.

To gain a different perspective, a second student team equipped with GPS receivers mapped the cliff edge in nearby backyards, beach access areas, and a public park. The students also filmed the area and interviewed residents, landowners, and tenants as well as construction crews working on the eroding cliffs to get a better sense of the questions that were of utmost concern to the people directly involved with the eroding cliff.

Trimble®

Back in the classroom, the students used ESRI's ArcMap GIS software to map the edges and differentially correct the field data for the most accurate representation of the cliff edge. A third team began working on an informational DVD using the collected field data, interviews, and video footage. The students used aerial photos and satellite imagery obtained from various sources, public data layers, parcel data layers, soil layers, GPS layers, and photographs, to assemble a complete map of the area.

Once finished, the detailed maps and the video were distributed to the Santa Barbara County Public Works Department for review and for discussion with Isla Vista residents at public meetings. The maps were also distributed to UCSB for review and are available on the Santa Ynez High School website, where they can be accessed by residents, government agencies, contractors, and any other interested parties, including the general public.

In addition to providing a spatially accurate map of the area, the students also studied the rate of erosion along the cliff. Using research from UCSB, Santa Barbara County building permit offsets, and aerial photos from 1972 to the present, the class determined that the average rate of erosion was just less than 1 foot per year (.98 ft/year).

They also found that the erosion rate is not constant and seems to be dependent on weather, but it is unclear whether ocean waves or rainfall do the most damage (since both are common during El Niño conditions). The class then projected the cliff line back 30 years to 1975 and forward to 2055 to provide a better understanding of the history of the erosion and to more accurately predict the future effects of erosion.

All of the students' findings have been presented to Santa Barbara County environmental geologists and to county supervisors for further evaluation. County officials plan to utilize the data to assist in conducting further studies of the cliff and erosion rates and to determine what kind of residential and recreational decisions need to be made to help prevent future accidents along the eroding shoreline.

The equipment used on this project includes:

- GeoXT handheld
- ArcMap software

YOUR LOCAL TRIMBLE OFFICE OR REPRESENTATIVE

www.trimble.com

NORTH & SOUTH AMERICA
Trimble Navigation Limited
7401 Church Ranch Blvd
Westminster, CO 80021
USA
+1-720-887-4374 Phone
+1-720-887-8019 Fax

EUROPE, AFRICA & MIDDLE EAST
Trimble GmbH
Am Prime Parc 11
65479 Raunheim
GERMANY
+49-6142-2100-0 Phone
+49-6142-2100-550 Fax

ASIA-PACIFIC
Trimble Navigation Australia PTY Limited
Level 1/123 Gotha Street
Fortitude Valley, QLD 4006
AUSTRALIA
+61-7-3216-0044 Phone
+61-7-3216-0088 Fax

Trimble®