

is Used to Locate Schools in East Timor

Utilities

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Welcome to East Timor, an island in Indonesia, and a place where the political climate has been in a constant state of flux since 1999. The eastern half of the island (East Timor) was a former Portuguese colony until 1975, when its people voted to become an independent nation. The political unrest, while ongoing, reached a zenith in 1999. At that time, the Indonesian currency went into a virtual free-fall. Rising prices, coupled with food shortages and massive unemployment, led to outbreaks of violence throughout the year. As a result, much of the island's infrastructure lay in ruins.

Since then, East Timor has been under the administration of the United Nations (U.N.), which recognized the need to rebuild the country's infrastructure. Even though East Timor is no longer under Portuguese rule, the government of Portugal has always lobbied for East Timor's right to self-government. Currently Portugal is one of the major contributors to the reconstruction efforts. Once reconstruction has been completed, the U.N. will hand over the administration to a democratically elected government, so that East Timor can once again be an independent nation.

One of the reconstruction projects was the development of a strategic plan. Developed by GERTiL, (Study Group for the Reconstruction of East Timor), in cooperation with a number of other groups from the Technical University of Lisbon, Portugal, the plan focused on the island's schools. The government recognized that a critical component in

the recovery process would be providing an education to the nearly quarter of a million students in East Timor.

The overall responsibility of developing the "School Mapping" project fell to the University, which recruited several other groups to assist on the project. ICIST, a research and development company, was chosen for its GIS and engineering expertise; while CESUR, the coordinating agency, was chosen specifically for its expertise in educational infrastructure planning. Because there are over one thousand schools on the island of East Timor, the project team decided to use Global Positioning Systems to inventory and record each school's location.

Professor Joao Matos, ICIST Project Manager, elaborates, "Since 1996, ICIST

has maintained a permanent GPS base station in Lisbon and we established a new one in Dili in October 2000. Because GPS is such a fundamental tool for GIS work, we decided to use it to locate all of the schools because no maps or other geographical data sources were available. We had three objectives for the school mapping project: 1) survey the present conditions of the schools in East-Timor, including record coordinates and area, 2) forecast demand for 2002 through 2012, and, 3) generate a proposal to determine new schools that needed to be built, and those that needed to be closed."

The participating groups on the project chose the Leica GS50 GPS/GIS receiver to locate and record schools in East Timor. According to Joao Matos



A crowd gathers for a demonstration of the Leica GS50 GPS/GIS receiver.

the GS50 was chosen for several reasons. "The project required an accuracy of less than 2 meters, and the Leica GS50 is a submeter unit. The schools needed to be located within 2 meters to make sure they were placed in the correct 'suco,' (minor administrative unit in East Timor). In addition, we needed to determine the terrain where each school was located, in order to evaluate expansion possibilities. Finally we used the GPS to record the roads (lines) so we could update the road network, as access conditions to the schools was a major issue in the project."

Many of the schools were located in heavily forested areas, requiring a hike through thick vegetation. Often, an entire day was required to locate, record the GPS coordinate of a particular school, and then hike back. The Leica GS50 "backpack" receiver is designed specifically for collecting data in rugged conditions, including hiking through thick tree canopy and across difficult terrain. Matos mentions that "The GS50 performed particularly well in forested areas." Fortunately, Leica's GS50 GPS/GIS receiver is equipped with proprietary MaxTrak™ technology, enabling the unit to track all satellites in view under heavy tree canopy.

Once the field data was collected, it was downloaded and post-processed using Leica's GIS DataPRO™ software. One feature of GIS DataPRO software is it automatically creates shapefiles, which makes it very easy to transfer the data into ESRI's ArcView GIS software. For this project, Matos and his team used ArcView GIS with the Spatial Analyst extension.

Matos says that "The modeling of school demand was in large part a spatial problem, so the need for GIS was obvious. The possibility of presenting maps displaying the schools' locations allowed for a more interactive debate on the proposals and a more intuitive assessment on the present situation. In



Locals use Leica's GS50 GPS/GIS receiver to record GPS coordinates of schools in East Timor.

the field, we collected attributes (defined as a codelist in GIS DataPRO) describing the general condition of the buildings. We also recorded the number of enrolled students and teachers. This helped us immensely with the forecasting portion of the project - trying to determine which schools should stay open, and which should be closed."

GIS was used during the project to determine school demand. Maps were created depicting the present situation for each school, and the technical justification for any recommendations that were made. New service areas for each school were calculated by the GIS based on several factors surrounding each school, including slope, roads, vegetation, population, and obstacles such as rivers. Presentation quality maps (layouts) were printed for each school and specific situation.

Matos and his team were able to create a set of thirteen detailed reports per district as well as a national report detailing the status of schools in East Timor. The reports identified any special problems, and included demographic studies, as well as an evaluation of each school's existing facilities and future needs. The GPS data was used

to create a GIS database of existing schools, and the GIS was used to model how proposed schools would affect certain areas. A total of seventy maps were created to show how educational areas, population, and other variables affected school locations.

Overall, Matos has been very happy with the results of the project. He says that the project would not have been possible without the cooperation of all of the participating organizations. Specifically, "The project was made possible due to the precious support of the Ministry of Education of East Timor, the World Bank, the facilities offered by the Portuguese Government and the commitment of all the staff involved in the project. The technology and the data were transferred to the Ministry of Education of East Timor, allowing for future updates and ongoing facilities management."

In closing, Matos sums up the project by saying "Leica's GPS/GIS technology allowed for a fast acquisition of knowledge on the subject and supported the spatial analysis operations required for the school infrastructure proposals. Without GPS/GIS the project would not have been feasible."

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Leica Geosystems Inc. 23868 Hawthorne Blvd., Torrance, CA 90505-5908 USA
US/Int'l Tel: (310) 791-5300 Fax: (310) 791-6108