Real Time Kinemetic GPS for Forest Boundary Demarcation

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Back ground

The 20 year National Land Titling Program was initiated in 1984 with the main objective of accelerating the issuance of 13 million title deeds over 65 million rai to all eligible private landholders in the country, over 20 years in four phases, each of 5 years. Also, it was intended to improve and decentralize land administration services and develop and improve valuation services to meet the needs of the public and private sectors. To implement the program, the Government obtained three successive loans from the World Bank to finance the Land Titling Projects. To prevent to issue the title deed in the forest area, the forest boundary demarcation is necessary to be completed in advance of cadastral survey and adjudication team.

There are two departments take responsible for forest boundary demarcation. The Royal Forestry Department is responsible for National Reserved Forest while Land Development Department takes charge of locating Permanent Forest. To support The Land Titling project, Surveying and Cartographic Division of Land Development Department has been assigned for Permanent Forest boundaries demarcation.

Form the past, the theodolite has been used for field survey and demarcation. But it could not fulfil the requirement. So, in the year 2000 Real Time Kinemetic GPS (RTK GPS) has been introduced to the project. After working for several months, we can assumed that we can double the output from the first time. However there still be some problems about the difficulties to receive the signal in close area such as the area that covered with the dense forest or rubber plantations. To solve this problem, the conventional system such as total station is integrated to the RTK to work in the difficult area.

Objective

To develop forest boundary demarcation technique to achieve an accurate ground mark. Moreover, this technique should increase productivity to fulfill the project requirement and reduce the project cost.

Project equipment

In this project GIS system is used to convert the permanent forest boundary from the paper map to be a digital format. This GIS system consists of computer, digitizer, plotter and GIS software such as Arc/Info and ArcView. RTK GPS set is used as the survey equipment to demarcate the forest boundary in the field. This system consists of 3 RTK GPS receivers one is used as Base Station with 25 watts radio modem and the others are used as rover units. More over, the laser guns are introduced to this project for distance measuring in the inaccessible area.

Procedure

1.   Office preparation

As the permanent forest boundary, which is announced by the government cabinet, is in the paper map scale 1:250 000, so it has to be converted to digital form by digitizing through Arc/Info software. Because this map scale is too small, the converted forest boundary digital map is not accurate enough to use for demarcation. To achieve an accurate digital forest boundary map, photomap scale 1 to 4 000 and classification map scale 1 to 50 000 are used to compare and verify the digital forest boundary.

In order to demarcate the forest boundary in every 200-meter, the arc of digital forest boundary is split to be node for every 200-meter and shorter in the irregular boundary. Then GIS application software will generate the name and coordinate of the nodes of forest boundary in ASII format file. The name of these nodes consists of the forest name code, province code and the ID of the node. These nodes will be plotted as 1:4000 map for the survey crew to work in the field.

Since the survey monument of the Department of Lands was established throughout the country, these monuments will be used as the base station of the RTK GPS. The monument description, described the monument location and coordinate, have to be taken form the Lands department.

2.   **Field operation**

The survey monument from department of lands in that project area is set up with GPS receiver to work as the RTK base station. The ASCII file, consisting of the names and coordinates of the nodes, are transfer to the RTK GPS receiver. This coordinate will be used to stakeout or locate the mark of forest boundary in the field. This mark will be measured the coordinate again for later verification. Then the monument is established on that mark as well as the reference of such monument will be measure to create the description.

The data file will be download to PC computer and the description of each demarcation monument is also kept in digital format in PC computer. The survey crew also compares the coordinates of the monument and the forest Boundary node. If they found the different coordinate that indicates some survey mistake. Re-survey is need in this situation.

3.   Back to Office Operation

The field data file is sent to the office, this data will be imported to GIS system. The digitized forest boundary and the coordinate of the demarcation monument theme are compared to recheck again. The inconsistency data such as the name and the coordinate of demarcation monuments from the GIS system and their descriptions will be corrected. Map finishing, such as labeling the monument name and permanent forest name, is also done in this process. If there is no mistake or error, the chain of demarcation coordinate will be plotted as a 1:4000 map. Arcview has been customizes to does this process.
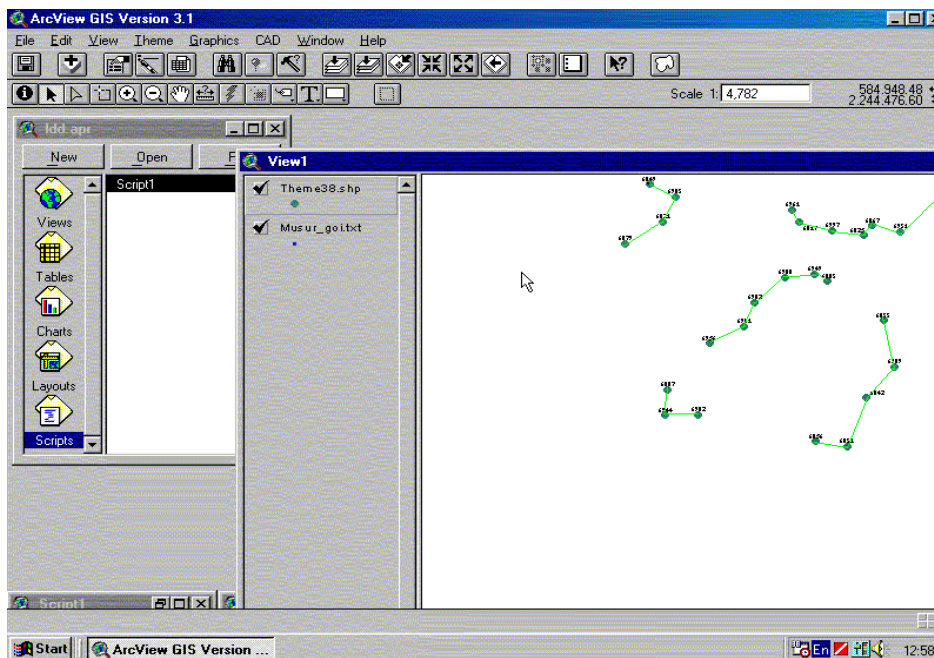
Summary

The RTK GPS is very helpful survey tools to work on the field it give more productivity. In several month after this instrument is implemented, we found that the productivity is increase about double. However, this technique still has some problem to work in the closed area, the total station is used to integrate with RTK GPS to solve this problem. The integrated equipment can work together very well without any interface problem such as data format and equipment interface connection. The GIS system helps us to verify the field survey data to make sure that there is no mistake data in this project. The forest Demarcation Map production is easy to produce as all of data is in digital format.