

# USAGE OF SPATIAL TECHNOLOGY IN EMERGENCY MAPPING

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**ABSTRACT:** This paper reports on the findings of a study to use of GIS, Remote Sensing and mobile GPS on humanitarian assistance. The aim of this work was to develop a geographic information system (GIS) based road network map of War affected areas in Northern Province, Sri Lanka that can be used to analyze road conditions and suggest possible solutions. The handheld global positioning system (GPS) was used to acquire geographic coordinates of major locations such as hospitals, key government offices and schools. The transformed GPS coordinates were added to the ArcGIS environment to define the spatial locations. Prior to that, the road map was digitized and geo-rectified. Google Earth environment was used to acquire data of new roads, for map updating and revision. Geographic information systems (GIS) operations using ArcGIS 10 were used to create road map. The study recommends that, these technologies have been proved most efficient and accurate compare to traditional methods. Use of advanced technology with grass root or local knowledge is always advantageous to get better results and generate trustworthy information. Generating, managing and updating such a kind of database can be utilized for development of Decision Support Systems which will further support Spatial Decision Support System (SDSS) on Humanitarian Assistance.

**Keywords:** GIS, GPS, Humanitarian Assistance

## 1. INTRODUCTION

The rapid development of spatial technologies in recent years has made available new tools and capabilities to Extension services and clientele for management of spatial data. In particular, the evolution of geographic information systems (GIS), the global positioning system (GPS), and remote sensing (RS) technologies has enabled the collection and analysis of field data in ways that were not possible before the advent of the computer.

The objective of this study was to develop a geographic information system (GIS) based road network map of War affected areas in Northern Province, Sri Lanka that can be used to analyze road conditions and suggest possible solutions. In year 2009, when resettlement started UN agencies have started operating from Vavuniya to reach locations where humanitarian assistance is needed. Area was too much wider and agencies required report and maps for immediate access. Mines / UXO (Unexploded ordnance) threat was high in certain areas, therefore proper access maps required for access in those war affected areas.

Key challenges were inadequate data on topographic maps (scale 1:50,000), survey department maps were not adequately updated for many years in war affected areas, And in

certain areas, Google map was not clear due to cloudy conditions and other reasons. To overcome this challenge a combined method adopted, with field collection data for more reliable and accurate information. This article describes some uses of GIS-GPS-RS in resource management applications, provides a roadmap for becoming familiar with the technologies, and makes recommendations for implementation.

## **2. METHODOLOGY**

This method involves pre-field work database generation. For this survey, Topographic sheet (mainly 1~18 topographic sheets on scale 1:50,000) and Google earth images were used. To identify plot data on ground, Map source software was used with Garmin gpsmap 60csx mobile GPS. For database generation, processing and analysis purpose ArcGIS 10 software was used.

### **Step 1: Preparation of Topographic map**

Topographic sheet of selected area is georeferenced. Using this georeferenced Topographic sheet, all roads were digitized. Google earth is used for georeferenced to maintain better accuracy.

### **Step 2: Preparation before field mission**

GPS receiver configured for local coordinate system, which is Sri Lanka Kandawala projected coordinate system. Applying parameters to the GPS is crucial because GPS's are giving their positions according to the WGS84 Geographic coordinate system. Surveyors in Sri Lanka cannot use WGS84 ellipsoid because it is nearly 100m away from the actual geoid. All members on data collection were briefed and understood to perform procedures for mapping points, lines and areas. Also they understood GPS theory and troubleshoot problems that may occur in the field.

### **Step 3: Data collection**

Field data collection performed carefully. GPS coordinates received by vehicle borne receivers for routes and point layers received on certain locations and saved them separately. For routes every 5 seconds data received and stored automatically, therefore vehicle speed was limited to below 40 km/h. During normal operation, data received from the GPS is stored in memory.

### **Step 4: Transfer field data**

GPS files (\*.dxf, \*.gdb, \*.gpx, \*.mps, \*.txt) were transferred to computer using the USB interface. First it was transferred to Mapsource software to check the readings. After that it was exported to ArcGIS 10 software.

### **Step 5: Analysis and preparation of map**

In ArcGIS software, overlay analysis carried out on field data and Topographic sheet of area map and quality of the reading assessed (Figure 1 and 2). Again Google earth is used for reference to maintain better accuracy. After the corrections final map was prepared (Figure 3). This method used to produce many maps and Figure 4 and Figure 5 are examples, which released for public. From field observations, it was noted that certain roads were reconstructed slightly in different areas and some new roads which were not presented in 50 k topographic maps.



*Figure 1. A sample area highlights the field data overlaid on Google Earth map for analysis*

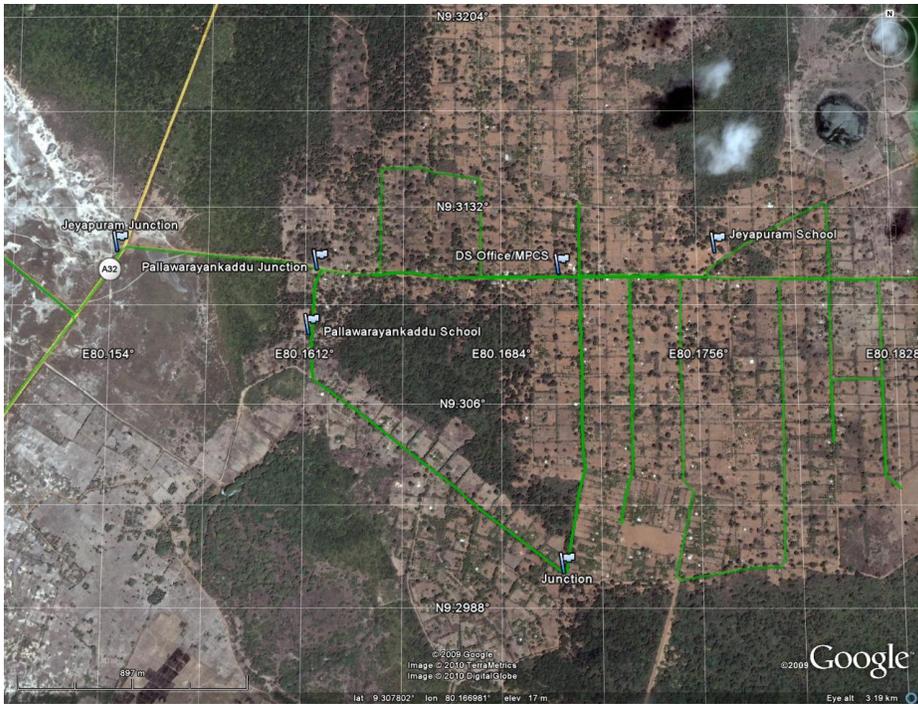


Figure 2. Overlay method used to check readings between field data and data from topo sheets

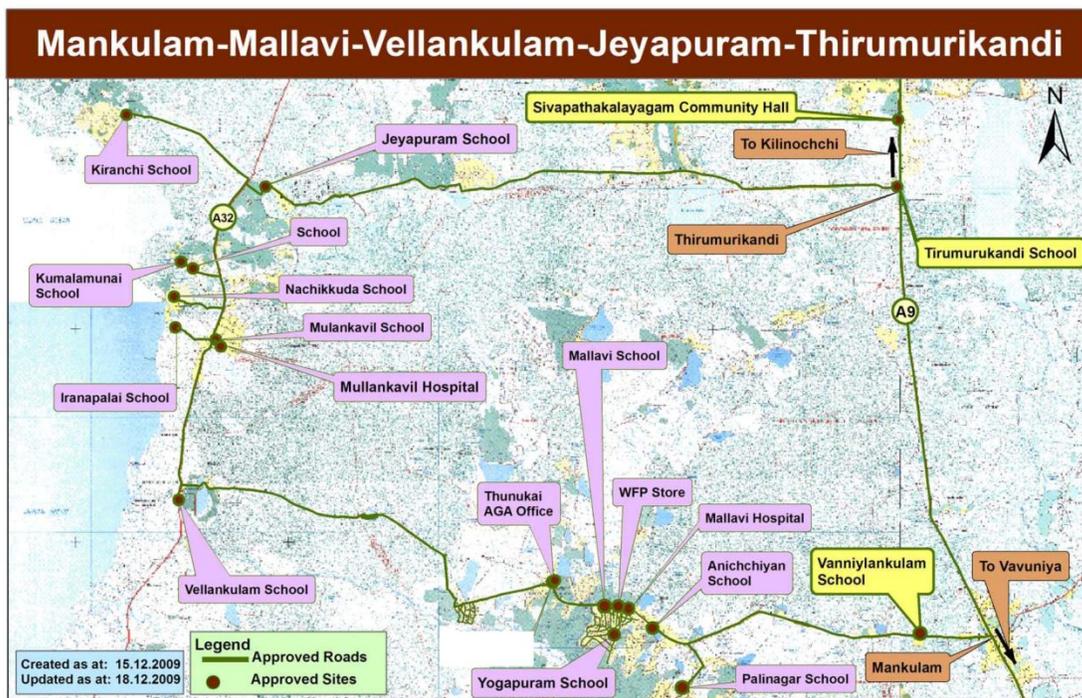


Figure 3. After error correction map prepared to share with agencies and authorities

### 3. RESULTS AND DISCUSSION

Urgent humanitarian assistance required to the affected population within very short time and therefore humanitarian workers had requirements beyond their capacity. This method used to produce many maps within short time and less human resource with acceptable quality. Figure 3, Illustrate a sample map which was shared to agencies and authorities for their usage later. Also these maps were used to brief all humanitarian workers prior to their mission in these hazardous areas. At later stage these info shared to other organizations and released for public. Figure 4 and Figure 5 illustrates such samples shared to public.

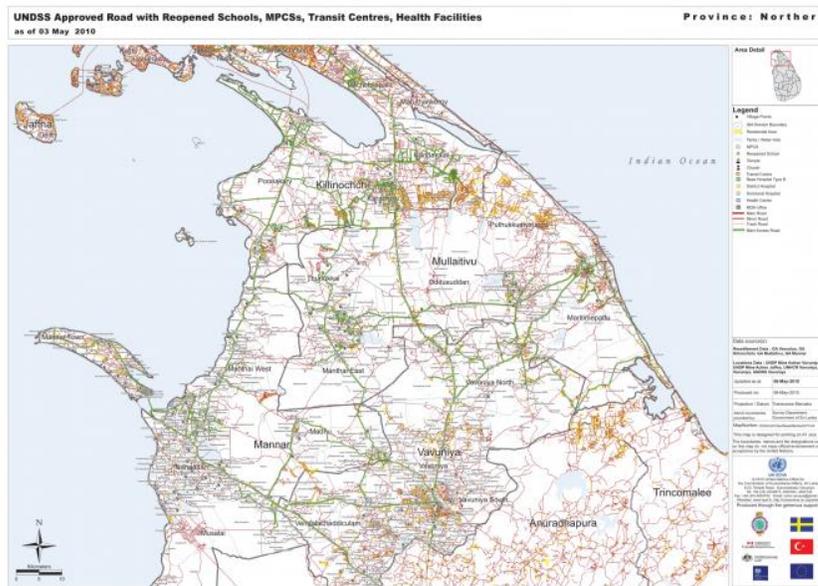


Figure 4. A map published by UNOCHA on 3<sup>rd</sup> May 2010 based on the information provided

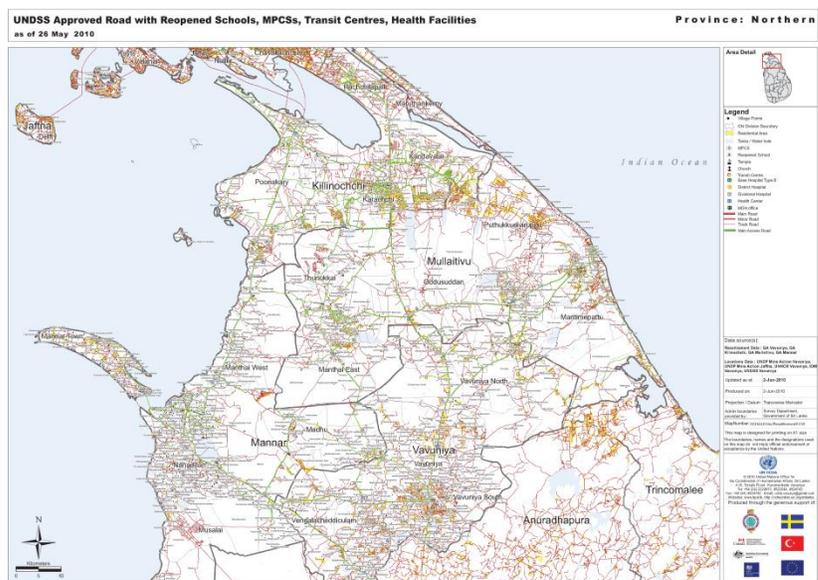


Figure 5. Map published by UNOCHA on 26<sup>th</sup> May 2010 based on the information provided

This method helped to identify the changes on existing roads and new roads with better accuracy. This proven worthy in field operations and can be used for further studies.

#### **4. CONCLUSION**

Looking at the need of reliable data on humanitarian assistance and their applicability in various sectors there is continuous technological update is going on. In this case, use of GIS, Remote Sensing and mobile GPS can be an efficient solution. Use of these tools will become mandatory in coming years as these technologies have been proved most efficient and accurate compare to traditional methods. Use of advanced technology with grass root or local knowledge is always advantageous to get better results and generate trustworthy information. Generating, managing and updating such a kind of database can be utilized for development of Decision Support Systems which will further support Spatial Decision Support System (SDSS) on Humanitarian Assistance.

#### **5. REFERENCES**

JOÃO PORTO DE, A. BENJAMIN, H. & MELANIE, E. (2016) The Tasks of the Crowd: A Typology of Tasks in Geographic Information Crowdsourcing and a Case Study in Humanitarian Mapping. [Online] October 2016. Available from: <http://www.mdpi.com/2072-4292/8/10/859> [Accessed: 03rd November 2016]

UN OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS. (2010) Sri Lanka: Northern Province - UNDSS Approved Road with Reopened Schools, MPCSSs, Transit Centres, Health Facilities (as of 3 and 26 May 2010). Available from: <http://reliefweb.int/map/sri-lanka/sri-lanka-northern-province-undss-approved-road-reopened-schools-mpcss-transit-centres> [Accessed: 03rd November 2016]