Digital Mapping and GIS-Driven Feeder Road Network Database Management System for Road Project Planning and Implementation Monitoring in the Feeder Road Sector

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Key words: Feeder Roads Condition Survey, Database Development

SUMMARY

The Feeder Road Sector of the Economy is one of the key correspondents of Ghana's Growth and Poverty Reduction Strategy. The Department for International Development (DFID) is supporting a comprehensive GIS-mapping in which every kilometer of both "engineered" and "non-engineered" feeder roads are to be chained and the conditions described. The attributes to be described include bridges, culverts, road surface drainage, and social economic infrastructure along the roads, e.g. markets, schools, clinics, etc. The project is being implemented in three zones:

Zone 1 covers Central, Eastern, Greater Accra and Volta Regions; Zone 2 covers Western, Ashanti and Brong Ahafo, while Zone 3 covers the three northern regions.

In each administrative region the feeder road network is being organized into administrative district level network. The district network will however be joined together into the regional network and the region be joined to have the national feeder roads network in GIS-format. The database is being structured such that each road segment has its district and regional codes to which is linked the various attributes. Georeferenced to the Survey Topographic map (1/50,000 series) the database will harmonize with the other databases being structured and harmonized in GIS environment. The presentation focuses on work done in the Zone 1 of the Project.

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1. BACKGROUND

Under the Ghana's Growth and Poverty Reduction (GPRS), the Feeder Roads System is one major growth/poverty level indicator to be used to assess the community's development. For this reason the Department for International Development (DFID) of the British Government is one of the major donors supporting the Government of Ghana's Feeder Roads sector improvement.

As part of the DFID support a British consortium, IT Transport/Scott-Wilson is assisting the Department of Feeder Roads to have a GIS-based comprehensive inventory of the feeder roads in each District (Local Government) in Ghana. It is a geo-inventory which entails a method for which every kilometre of the feeder road is geo-located with GPS and the conditions including occurrence of bridges/culverts are systematically recorded with a data collecting table and later transferred on electronic mode in ACCESS format.

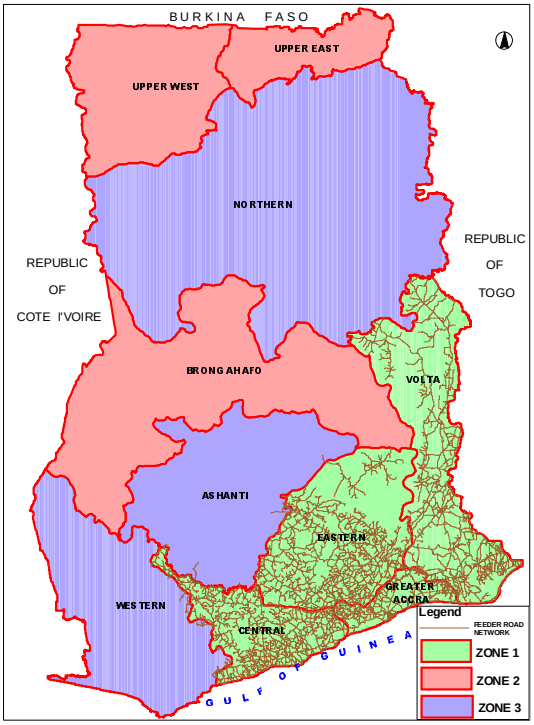

Fig.1: Zone 1 display of the GIS-based Feeder road network

CERSGIS and two other consulting firms have been engaged in this field data collection and GIS-processing for cartographic visualization at the district/regional levels. CERSGIS was assigned to work in four out of the ten regions in Ghana, namely Greater Accra, Central, Eastern and Volta regions, which constituted Zone 1 of the project area.

2. OBJECTIVES

The objectives of the assignment were to:

- Define and confirm the extent of the Feeder road network in the Districts of the four regions and provide a more comprehensive and accurate network model for District planning purposes.

- To update the existing feeder road database to reflect the current situation through a process of "ground-truthing".

3. SURVEY PROCESS

The GIS-mapping involved a participatory approach, which included consultations with the grass-roots road users and the District Assembly involvement in the use of the existing feeder road network map to record missing (old and new) roads.. This output from the consultation provided a sketch map of the district feeder road network to be chained.

The sketch map was presented to the District Assembly for confirmation before the technical survey. The technical survey was undertaken with GPS. Field visits for verification of the additional information also involved the District and local stakeholders.

Prior to the GPS field survey and road inventory, District consultations were held with the District stakeholders.

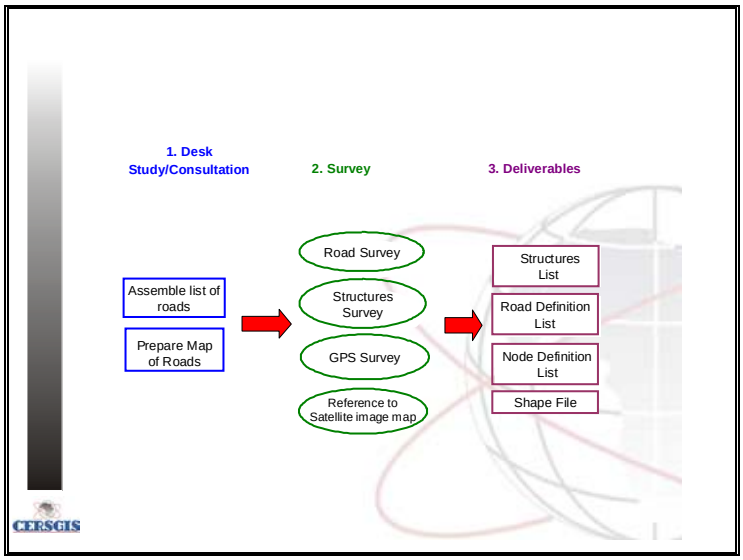

Fig.2: The Survey Process

The Assembly Persons were briefed on the objectives of the survey and introduced to the District road and classified image maps. A standard method for validating the settlement

names was agreed upon – omitted settlements were located on the map with a numbered dot, settlement names which were wrongly spelt were corrected, and settlements with more than one name were indicated with all the various names. Every settlement linked by a road in the Area Council regardless of size was captured.

All motorable roads - unengineered and engineered were identified. Missing roads were indicated on the map.

Persons From Ada Foah And Big Ada Area Councils Validating Settlement Names and Location

Assembly Persons From Sege And Anyama Inserting New Roads For The GIS Capture Assembly

4. GPS SURVEY AND ROAD INVENTORY

After analyzing all the data collected during the District consultation exercise, a draft map was prepared as a working document for the fieldwork. The GPS road mapping and inventory begun in the District on 4th January 2005 and ended on 11th Sept. 2005. All features such as road segments, culvert and bridge locations, infrastructure facilities along each road segment and settlement locations were captured with a Trimble Pro XR GPS receiver with sub-metre accuracy. Data was collected in line mode for the road segments and in point mode for the drainage structures, infrastructure facilities and settlement locations, with the GPS antenna mounted on top of the field vehicle. Satellite images were also used to aid in the identification of tracks unknown to the Area Engineers.

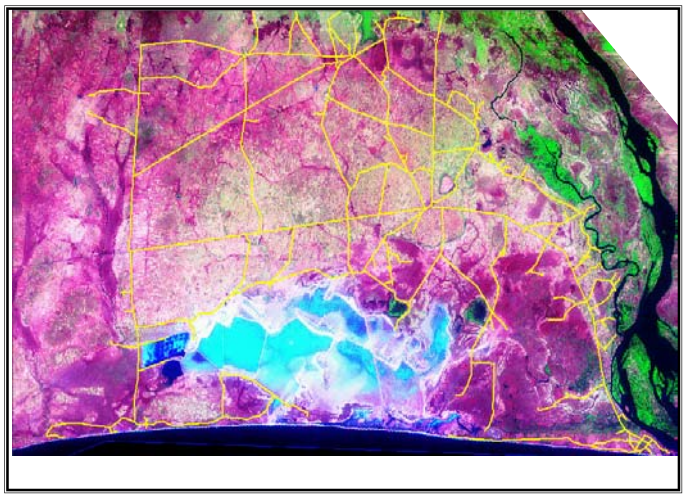

Fig.3: Surveyed roads superimposed on a satellite image

5. DATABASE DEVELOPMENT

The GPS data was pre-processed with the Pathfinder Office software and exported into ArcInfo GIS format for further processing, and for the spatial database development. The features were organized in the following layers:

- Road network
- Culverts and Bridges
- Infrastructure Facilities
- Settlements

The database was also populated with field photos showing the condition of culverts and bridges.

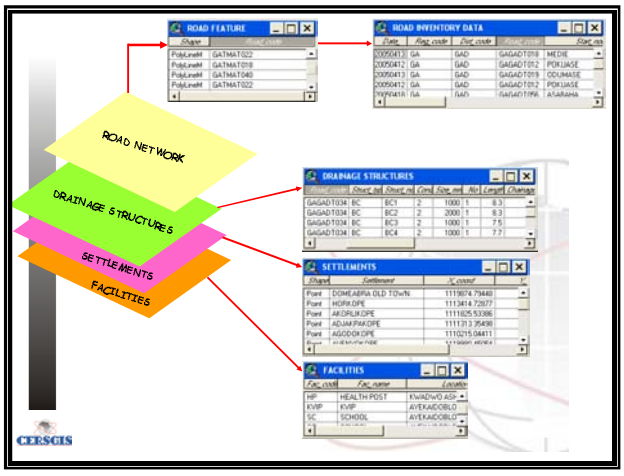

Fig.4: Spatial database of the feeder road network

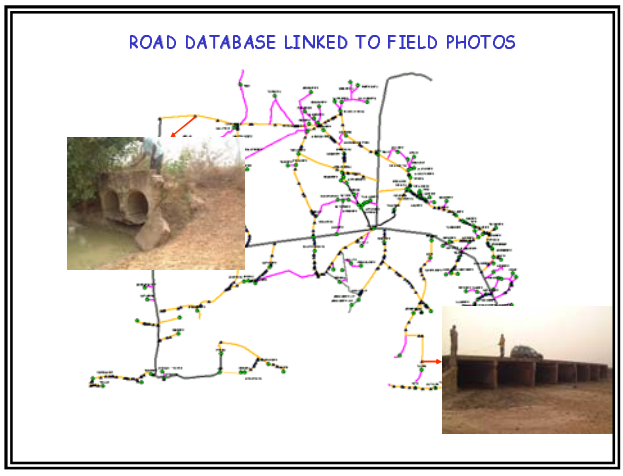

Fig.5: Output map of road classes and linkage with field photos of culverts and bridges

6. INITIAL RESULTS AND CONCLUSION

During the survey period a total of 11,438 kilometres of feeder roads made up of 8,852 km of engineered roads, 984 km of partially engineered roads and 1603 km of Non-Engineered roads were surveyed and inventoried. Drainage structures such as culverts and bridges were also captured. A total of 4 man-months were spent on post field data processing. Draft road maps have been composed for all the districts within the four regions and submitted to the Area Road Engineers for the final field validation.

Though the terms of reference for the assignment was silent on the use of satellite imagery, CERSGIS adopted the use of satellite images to facilitate the identification of roads which were unknown to the area engineers, and surveyed.

Even before the final feedback is received from the Area Engineers, they have found the road database very useful for the prioritization and resource allocation activities of the feeder road maintenance planning process. The Road database, when finalized would therefore provide a valuable decision support tool for managing the feeder road network in Ghana.

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