Geographic Information Systems (GIS) a tool for Transportation Infrastructure Planning in Ghana

A case study to the Dept. of Feeder Roads

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1.0 Introduction

Many development projects have serious dependence on transport network. Authentic information on the transport infrastructure is fundamental requirement for many decision making process; therefore information is required to be reliable, updated, relevant, easily accessible and affordable.

This demand for information requires new approaches in which data related to transportation network should be identified, collected, stored, retrieved, managed, analyzed, communicated and presented. The road transport related data in particular involves activities like traffic counting, sign inventories, accident investigation, recording of construction and maintenance projects and funding, right of way surveys, bridge inventories, pavement condition surveys, geometry design inventories, and other data collection and maintenance activities.

1.1 Initial problems faced without GIS

The database that existed before did not allow the user

- 1/ to manipulate, access and query the database other than in a very limited way
- 2/ is limited to textual queries only
- 3/ cannot select and view attribute data with respect to spatial and topological relationship
- 4/ cannot access related data such as land use, population, and the road network characteristics of the area in the crossing vicinity.

2.0 A case study to DFR

- Road network in Ghana is more than 50,000km of road length
- The planning and management of such a huge network in the country has been primarily done at three levels
- About 13,367km of Trunk Roads
- About 4,029km of Urban Roads
- And about 32,600km of Feeder Roads

ROAD SYSTEM OF GHANA

TRUNK ROADS	Length (Km)
Rigid Pavement	38
Asphalt Surfaced	1,566
Bituminous Surfaced	4,733
Gravel	6,357
Missing Links	673
Total	13,367

URBAN ROADS	Length (Km)
Asphalt Surfaced	427
Bituminous Surfaced	1,496
Gravel	2,106
Total	4,029

FEEDER ROADS	Length (Km)
Gravel	32,600
Total	32,600

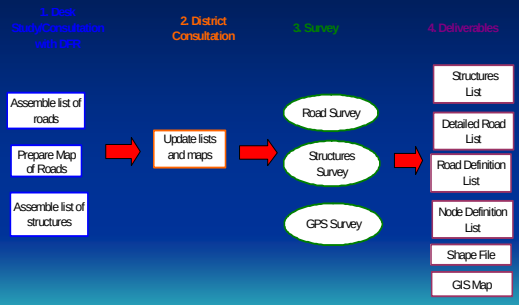
TOTAL LENGTH OF NETWORK	49,996

3.0 Purpose

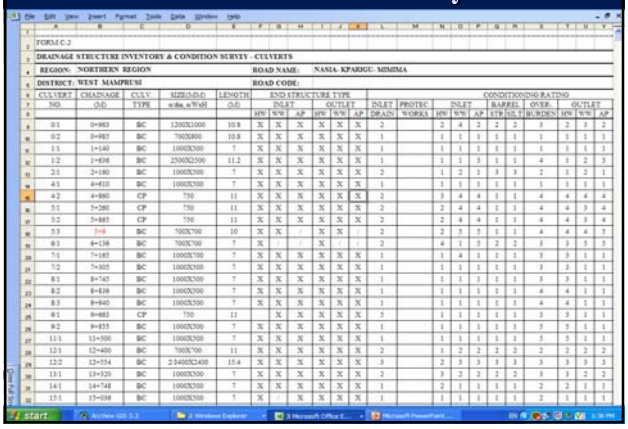
The purpose of this Pilot phase project in the northern region of Ghana was in three parts:

- – Planning
- – Management
- – Engineering

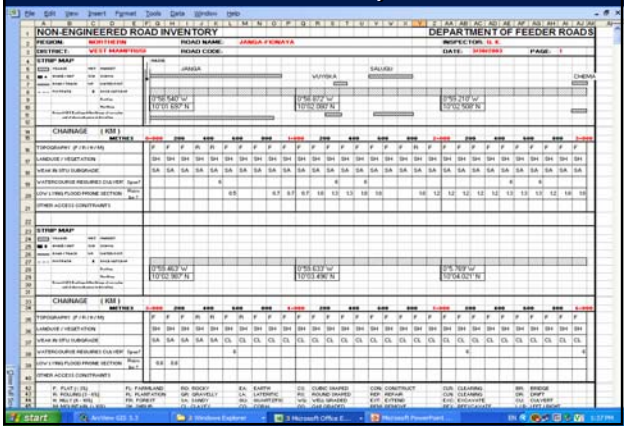
4.0 Methodology



Old DFR Structure Inventory format



Old DFR Road Inventory form format



4.1 Field Survey

Prior to the survey on the field, we had thorough field reconnaissance on the collection attributes data. These were the forms we came out with:

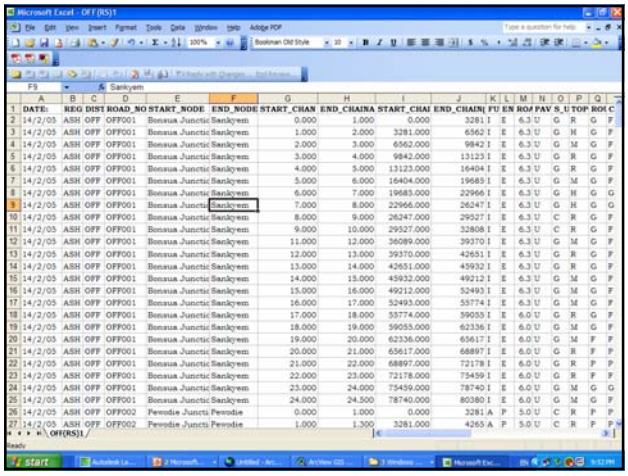
- Structures Survey Form SS1
- Road Survey Form RS1
- GPS Survey (to generate node and road table)

4.1.1 Road Survey (Attributes) Form RS1

- Columns (Fields)

1. Date
2. District code.
3. Road id.
4. Start Node Name
5. End Node Name
6. Start Chainage (km+m)
7. End Chainage (km+m)
8. Functional Class I/C/A

9. Engineering Class E/P/N
10. Road Width (m)
11. Pavement P/U
12. Surface unpaved R/G/S/C
13. Side Drains L/U
14. Topography (F/R/H/M)
15. Roughness G/F/P
16. Camber G/F/P
17. Drainage G/F/P
18. Traffic H/M/L
19. Notes

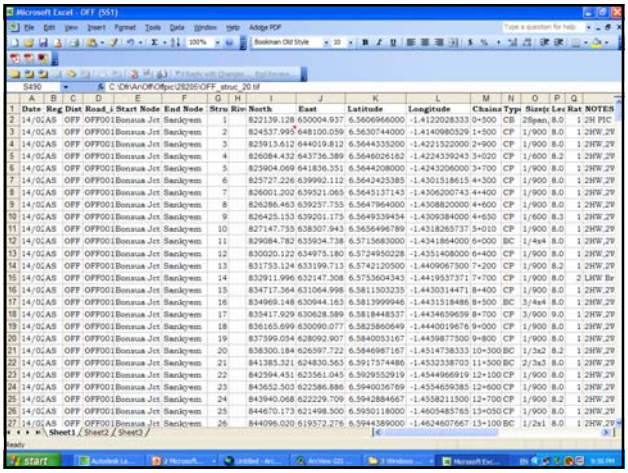


4.1.2 Structures Survey (Attributes) Form

- Columns (Fields)

1. Date
2. District Code
3. Road id
4. Start Node Name
5. End Node Name
6. Structure No
7. River Name
8. GPS Northings

9. GPS Eastings
10. Chainage (km+m)
11. Structure Type (eg. BC,SB,CP,CB,TB,LB)
12. Size (mm) n / dia, n / W x H
13. Length (M)
14. Headwalls (0/1/2)(R/L)
15. Structure Condition Rating (1-5)
16. Notes



4.1.3 Road definition (Attributes)

Columns (Fields)

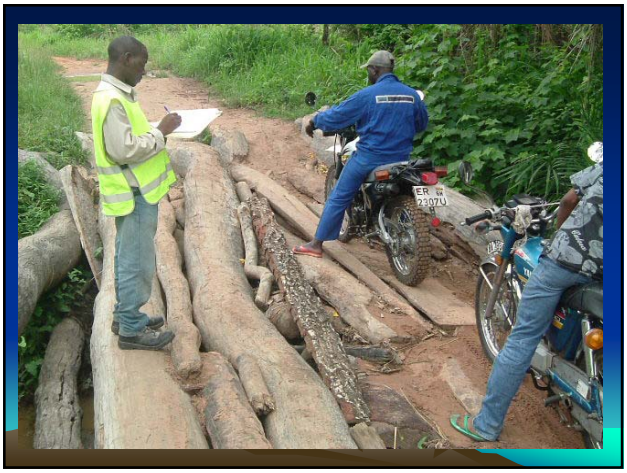
- Region
- District
- Functional class (I/C/A)
- Road id
- Start node name
- End node name
- Length (km)
- Overall Road condition rating (G/F/P)

4.1.4 Node definition (Attributes)

Columns (Fields)

- Region
- District
- Node id
- Node name
- Node Type (J=Jct, V=Village, R=Ref)
- Northing
- Easting

Practical GPS Exercise

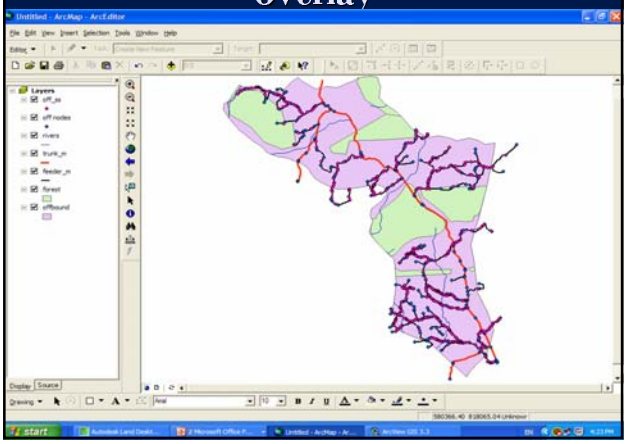


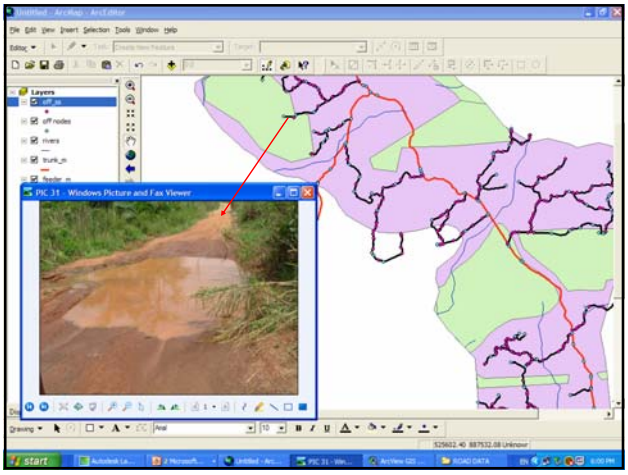
4.1.5 GIS Map

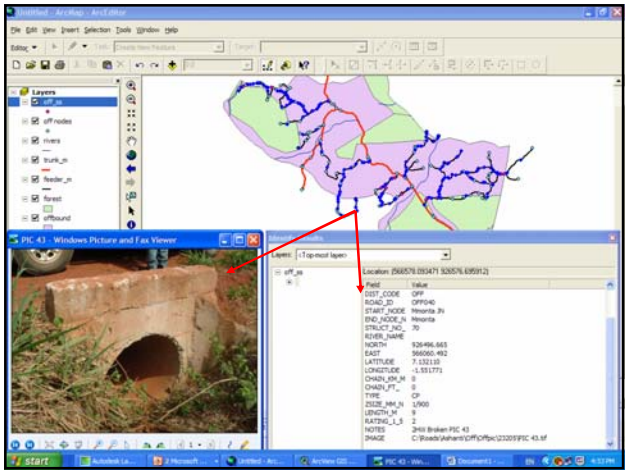
For the purpose of identifying and classifying, the following functions were used to create GIS Map

- Basic functions (editing, display, measurements,)
- Convert Polyline to PolylineM (adding M-values)
- Overlay
- Dynamic segmentation
- Raster display and analysis
- Surface modeling.
- Links to other software.

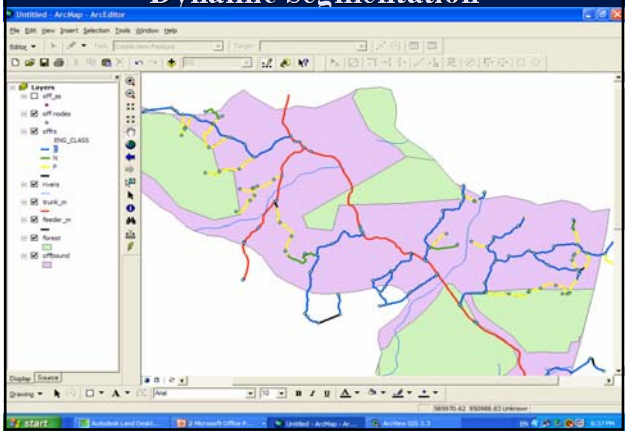
Overlay







Dynamic Segmentation



5.0 The Way Forward

5.1 Two areas were identified

- 1/ **Training and Updating**
- 2/ **Engineering** (Which is a relationship between Planning and Management review cycles)
- - 4 areas are identified

➢ **Pavement Management System**

➢ **Bridge & culvert Maintenance**

➢ **Traffic Engineering**

➢ **Safety Management**

6.0 Conclusion

- There is an urgent need to organize the existing database compatible to GIS environment and suggest various other new data items, which are considered useful for better planning and management.

- If GIS technology is exploited to it's fullest extent in Ghana it will completely take over the decision making process in transportation engineering. The huge amount of information related to transport infrastructure in Ghana could be put together for its most efficient utilization in planning, design, construction, maintenance and management of the transport system.

Thank You