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Paper II
Current Status Of GIS Implementation in JKR
Ir.Muhamad Rahimi bin Abdullah
Penolong Pengarah Kanan (GIS/IT),Jabatan Kerja Raya Malaysia

CURRENT STATUS OF GIS IMPLEMENTATION IN JKR

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Abstract

The ability of road infrastructure to sustain rising demand is pivoted to socio-economic progress. Substantial investment has been made in building road infrastructure. Now there is immerse pressure from road users and public for better management of the existing road network and associated information. Public Works Department (PWD) of Malaysia (often referred to as Jabatan Kerja Raya or JKR) as the major road custodian in the country, is responsible for managing the operation and maintenance most of the road infrastructure.

With the increasing use of GIS technology, JKR has taken advantage of GIS as a more effective planning tool for making better-informed decisions. The technology is used to enhance existing spatial and attribute data maintenance, query and spatial analysis and display processes. SUTRA (System for Planning and Mapping Utilities and Infrastructure) was developed on GIS technology. Through SUTRA, a department-wide data sharing culture has been introduced to users. Since its introduction in December 1995, the awareness towards data-sharing has increased.

INTRODUCTION

Computerized geographic information systems (GIS) have become an increasingly integral part of organizations' functioning. A GIS provides the ability to automate, develop, analyze, and output geographic and spatial inquiries of assets and interests, making it a powerful technology with broad applicability.

With the increasing use of GIS technology, JKR has taken advantage of GIS as a more effective planning tool for making better-informed decisions. The technology is used to enhance existing spatial and attribute data maintenance, query and spatial analysis and display processes. SUTRA (System for Planning and Mapping Utilities and Infrastructure) was developed on GIS technology. Through SUTRA, a department-wide data sharing culture has been introduced to users. Since its introduction in December 1995, the awareness towards data-sharing has increased.

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The road spatial data were initial digitize from the existing map. Because of the road layout on the map are not accurate, the output from the map when digitize also not accurate. To get accurate data, GPS technology was used to capture the road features and was implemented in two phases, first phase in year 2001 and second phase in year 2002.

GIS IN JKR

Jabatan Kerja Raya (JKR) has been recognized as the technological arm of the Government. JKR provides important data on transportation for GIS usage in Malaysia . The department has two important assets namely infrastructures and utilities, which can be used to produce valuable and useful information. By using GIS in managing the information, the department can provide data that is current and accurate, which can be retrieved at anytime and anywhere. Effective management is very important to eliminate data duplication. The adoption of GIS will lead to a more organized management of the digital data for example road data on kilometer posts, signage, road edges, etc.

JKR started the GIS project in 1993 as a research and assessment to study its capabilities and usefulness. It was started in Pusat Teknologi Maklumat, JKR under "Unit Pemetaan Dan Utiliti" or Mapping and Utility Units. The main function of this Unit was to initiate, implementing and monitoring the usage of GIS technology in the department. This is because JKR comprises of multi discipline branches such as road, building, electrical, mechanical, architecture and quantity survey which have their own priorities, business plan and objectives. At the same time, JKR are also situated in all states and district.

In year 2001, this unit was moved to Road Branch under Road Design Unit. The rationale in moving GIS unit from IT Department to Road Branch was to speed up the process of capturing road features because road features are the main or based for all location based data. In 2004, under the reorganization of Road Branches, GIS section was put under Support Services Unit.

IMPLEMENTING GIS

Information system plays vital role in planning and development of the infrastructures such as road and bridges. The most advanced computer based information technology tool for spatial planning is the Geographic Information System or GIS, which would become indispensable in planning and management of database. GIS can be used as an effective tool for road information system, which will help the planners and administrators to identify the problems associated with road development activities, location and provision of appropriate facilities, monitoring and maintenance management of the assets.

In implementing GIS in JKR, initially it was divided into 5 phases,

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- Phase 1 (1993-1995)
- Phase 2 (1996-1998)
- Phase 3 (1999-2000)
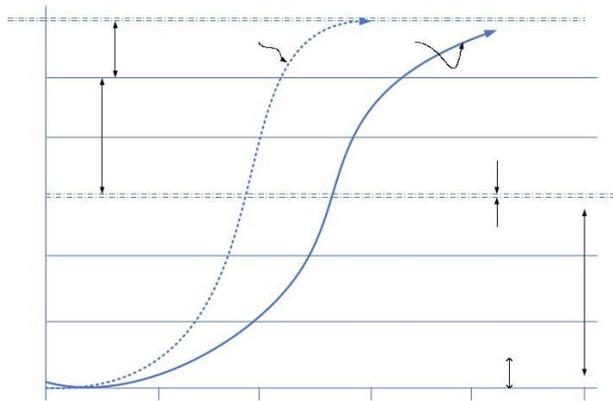- Phase 4 (2001-2004)
- Phase 5 (2005 onwards)

Figure 1: SUTRA progress implementation chart

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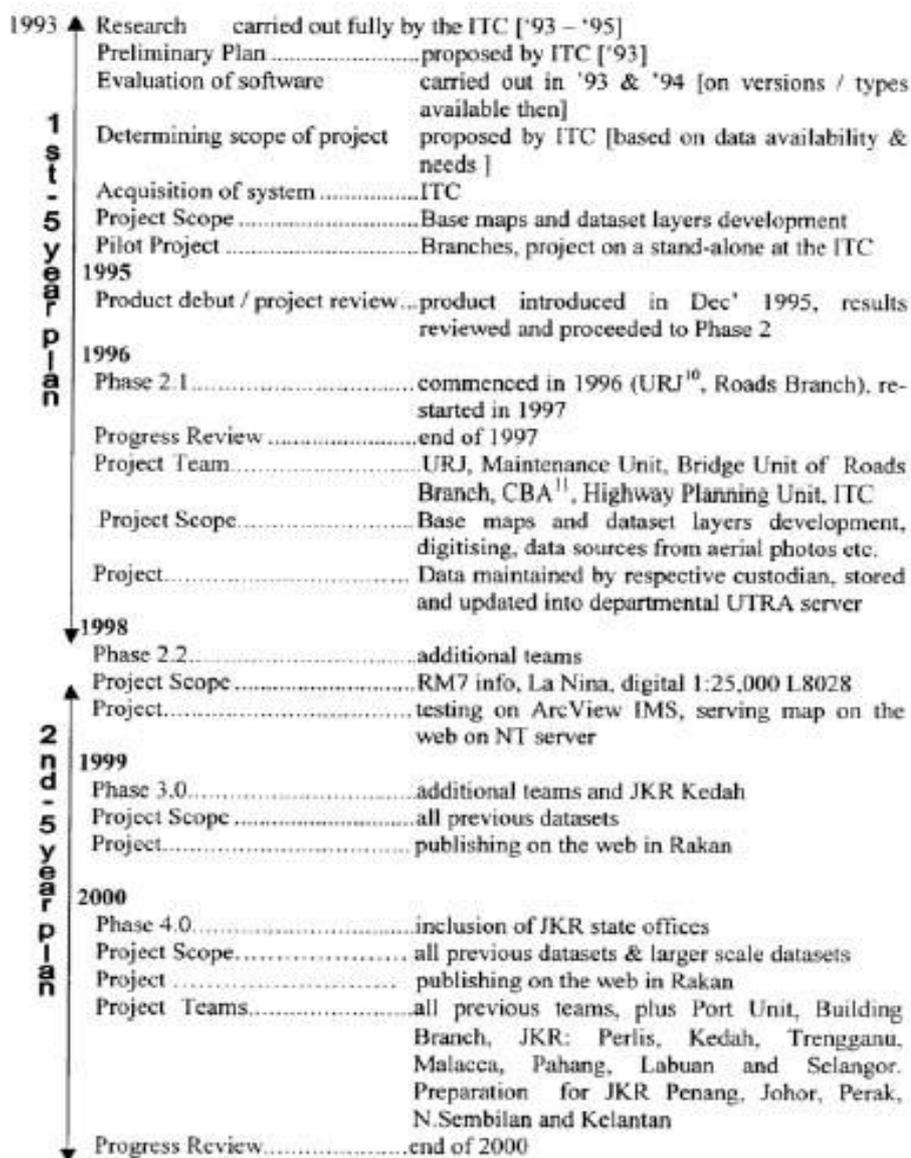### Penolong Pengarah Kanan (GIS/IT),Jabatan Kerja Raya Malaysia

Figure 8- *Implementation of SUTRA*

[10] URJ – Unit Rekabentuk Jalan / Roads Design Unit
[11] CBA – Cawangan Bekalan Air / Water Supply Branch. The project is based at JKR Labuan

Figure 2: Implementation of SUTRA

GIS is already proven as the technology to use in order to integrate and utilise scattered data to the maximum. Its data-handling capabilities with relatives' ease of use and efficiency have made it the obvious choice. SUTRA (System For Planning and Mapping Utilities & Infra-structures) is developed incrementally as a tool to realize this objectives.

The activities of SUTRA implementation framework and the schematic of SUTRA are as in figure 3.

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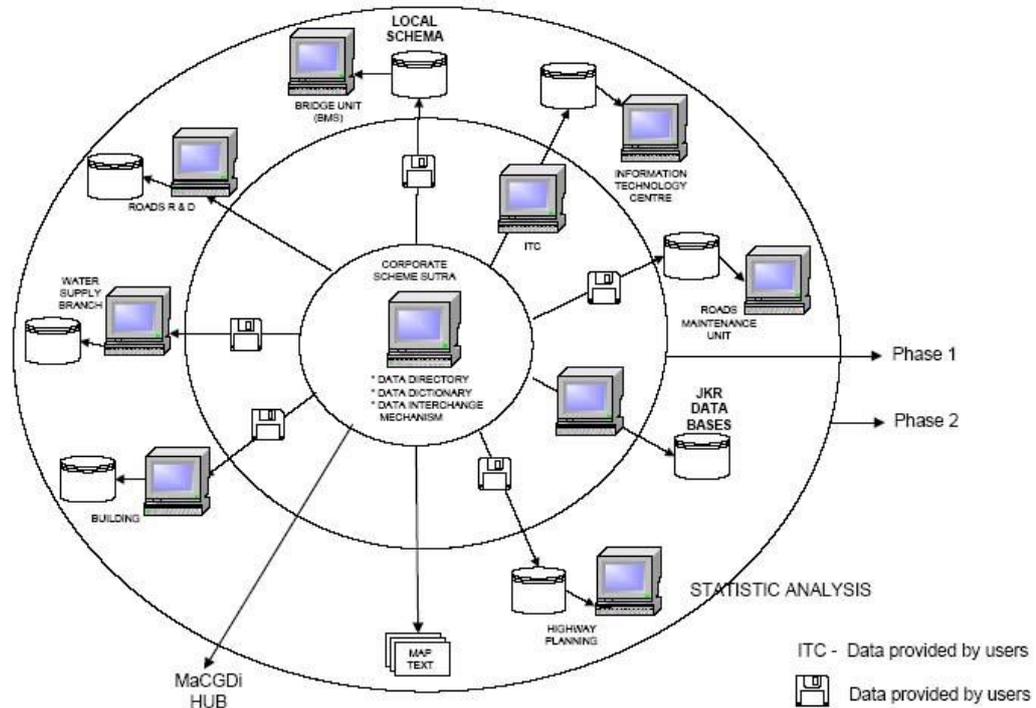
SCHEMATIC VIEW OF SUTRA IMPLEMENTATION

Figure 3: Schematic view of SUTRA implementation

- **SUTRA**

SUTRA (System for Planning and Mapping Utilities & Infra-structures) is developed on the Geographic Information System (GIS) technology. SUTRA is used to display information and result of analysis such as road traffic volumes, location of project and their attribute which are supervised by JKR etc. Information collected, thus far, are roads network and related features covering Peninsular Malaysia and Labuan. For the roads networks we have captured the road edges, centerlines, and lane dividing lines for all the federal and state roads under JKR maintenance. Some of the features captured are bridges, culverts, kilometer posts and signage. The information produced is in the form of dynamic thematic maps that can be shared throughout the department.

The Growth of Gis System (SUTRA)

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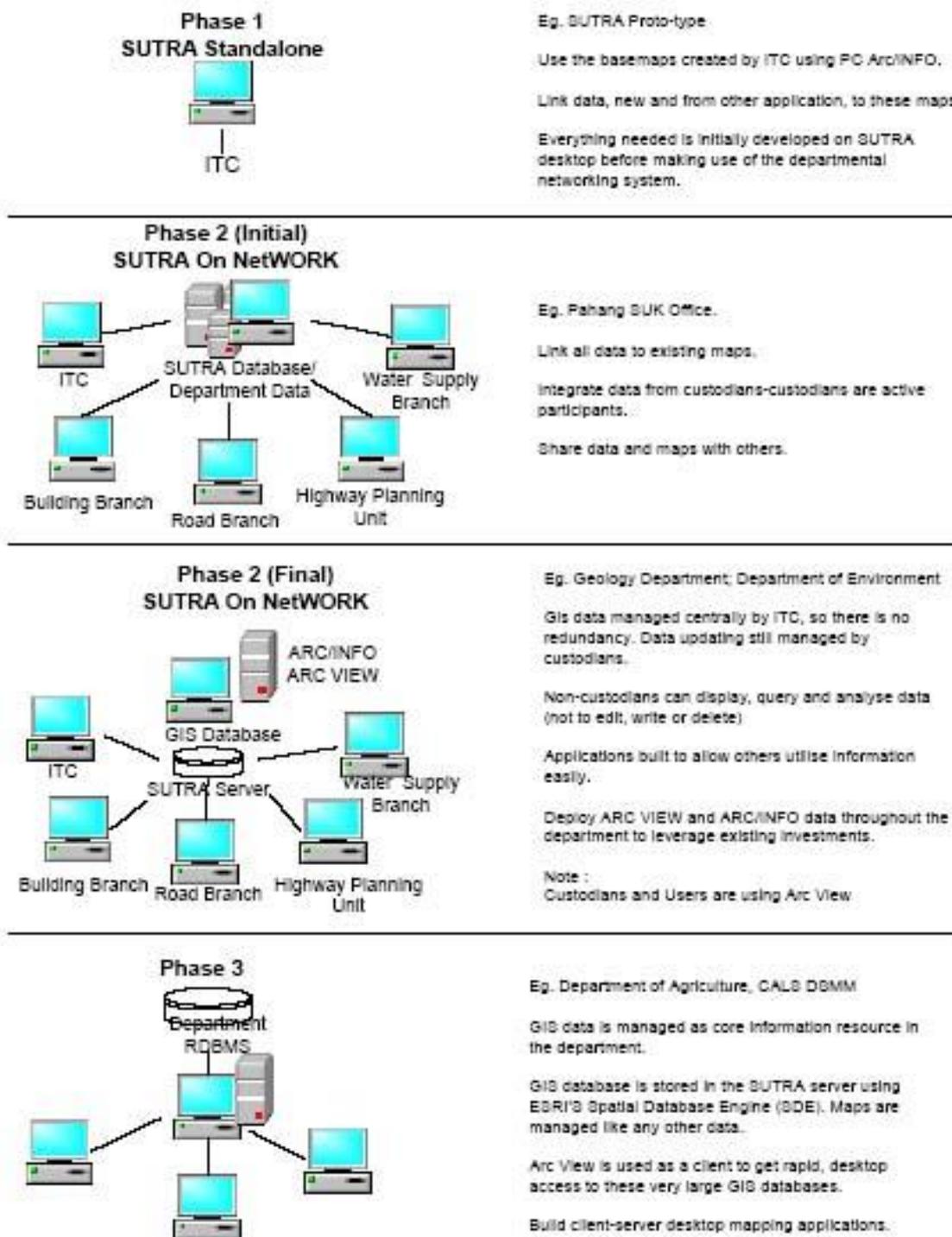**Penolong Pengarah Kanan (GIS/IT),Jabatan Kerja Raya Malaysia**

Figure 4:The growth of SUTRA

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- **Implementation of SUTRA**

SUTRA is divided into 5 phases,

- ❖ Phase 1 (1993-1995)
- ❖ Phase 2 (1996-1998)
- ❖ Phase 3 (1999-2000)
- ❖ Phase 4 (2001-2004)
- ❖ Phase 5 (2005 onwards)

❖ **SUTRA Phase 1**
Phase I was started at Pusat Teknologi Maklumat, JKR. It was developed as a stand alone `proto-type' with users from various units and branches contribute the existing attribute data. The product was introduced in December 1995.

❖ **SUTRA Phase 2**
Data collected in Phase 1 was updated and expanded. This was collaboration with mainly Roads Branch, the Water Supply Branch, Highway Planning Unit and Building Department. Personnel form the various branches were trained to develop their knowledge on concept and tools of GIS so that they would be able to handle data and develop applications. Phase 2 produced more information and thematic maps.

❖ **SUTRA Phase 3**
The department-wide implementation commenced when the various branches achieved Phase 2 goals. JKR has chosen ArcView and PC Arc/INFO as the best software that meet the requirement of GIS. More branches were included.

❖ **SUTRA Phase 4**
This stage consists of two phases - Phase 4.1 and 4.2. In Phase 4.1, the main activity was capturing data for 7 states - Perlis, Kedah, Pulau Pinang, Perak, Negeri Sembilan, Melaka, and Labuan. In Phase 4.2, where the major activity is capturing data for the remaining states that were not covered in the Phase 4.1. i.e Kelantan, Terengganu, Pahang, Johor and Selangor.

Phase 4.2 of SUTRA is now handled by IT/GIS Section, Services Support Unit of Roads Branch. The work of data capturing was outsourced to several vendors. Our roles are more on coordinating and ensure that the collected data meets our requirements. We are now

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verifying the integrity of the captured data and will be completed end of Disember, 2004.

At the same time, coordinators from each JKR state are appointed to coordinate and to disseminate the GIS technology in respective state. Training and awareness program are conducted for these coordinator.

The future data collection and updating of the data for the applications will be handled by IT/GIS section with the assistance from the GIS Teams in all the PWD States.

The data that was captured using GPS, as below:-

- Road Edges   (Line)

    o Road edge & Pavement shoulder

- Median   (Line)

- Center Lines   (Line)

    o Main center line & virtual center line

- Lane Dividing Line (Line)

- Kilometer Posts (Point)

- Signages   (Point)

- Transmission Line (Line)

- Bridges   (Line & Point)

❖   **SUTRA Phase 5**

At this stage, concentration will be on updating and maintenance of the existing data and to capture new features. Development of "Road Information and Management System or RIMS" will be done at this stage. It will be used by Road Branch professional to plan, monitor, update and maintained the road features and related data.

For the data to be up to-date, the coordinator at respective state must create their own GIS teams which consist of the representative from each JKR district. This team will update the

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data periodically at the district level.

GIS SYSTEM DEVELOPMENT

As in the figure 5, there are many individual application in JKR and KKR that can be used with spatial data to do analysis. In this aspect, SUTRA can be used to integrate all this data in terms of data sharing.

Road branch have many data on roads and bridges, but this data are either in hardcopies or in softcopies such as in AutoCAD format. There are also several system which are related to roads that being handled by Maintenance Unit in Road Branch such as HDM4 and BMS. For the spatial data it was being handled by Support Services Unit in the same branch. To merge all this data together, a system is going to be developed called Road Information and Management System (RIMS) that would be used by the planners and administrator of the roads which will be based on GIS technology.
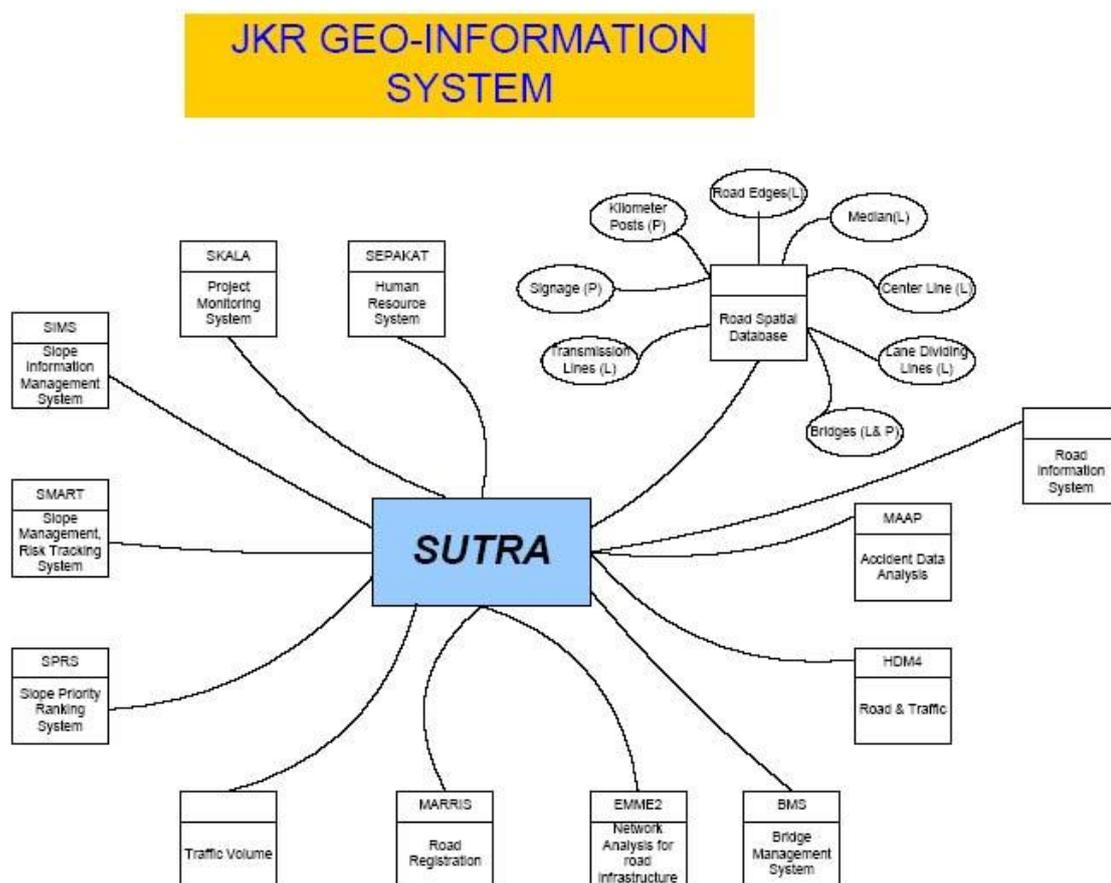

Figure 5: JKR Geo-Information

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- **JKR Road Information Management System (JKR RIMS)**

JKR RIMS is developed on the Geographic Information System (GIS) technology. It will be used to collect, edit, update, map, analyse, and display road information. Information collected, thus far, are roads network and related features covering Peninsular Malaysia and Labuan.
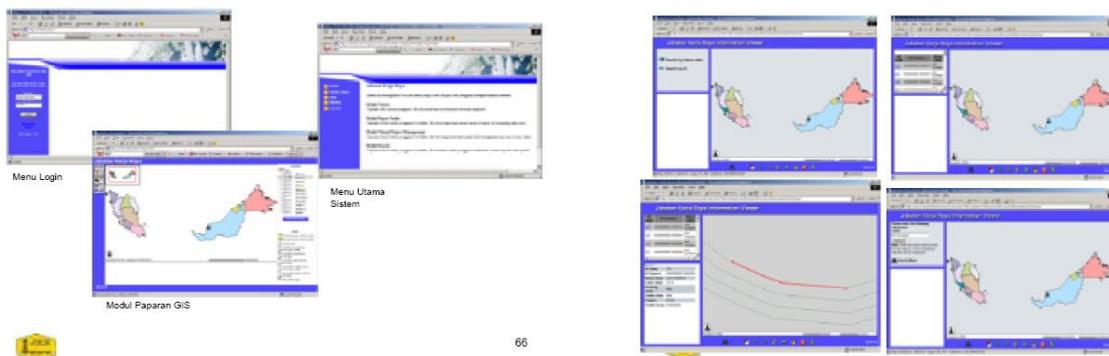Some of the sample pages are as below:

Figure 6: Proposed JKR RIMS Web pages

- **Proposed Implementation of the System**

In implementing the application for the whole of JKR, it will be based on distributed concept whereby JKR district as the data originator, will update and maintain the data. The data will then replicated to JKR state and Headquarters for consolidation. The data that had been consolidated can be viewed through JKR intranet.

Master and Working GIS Databases

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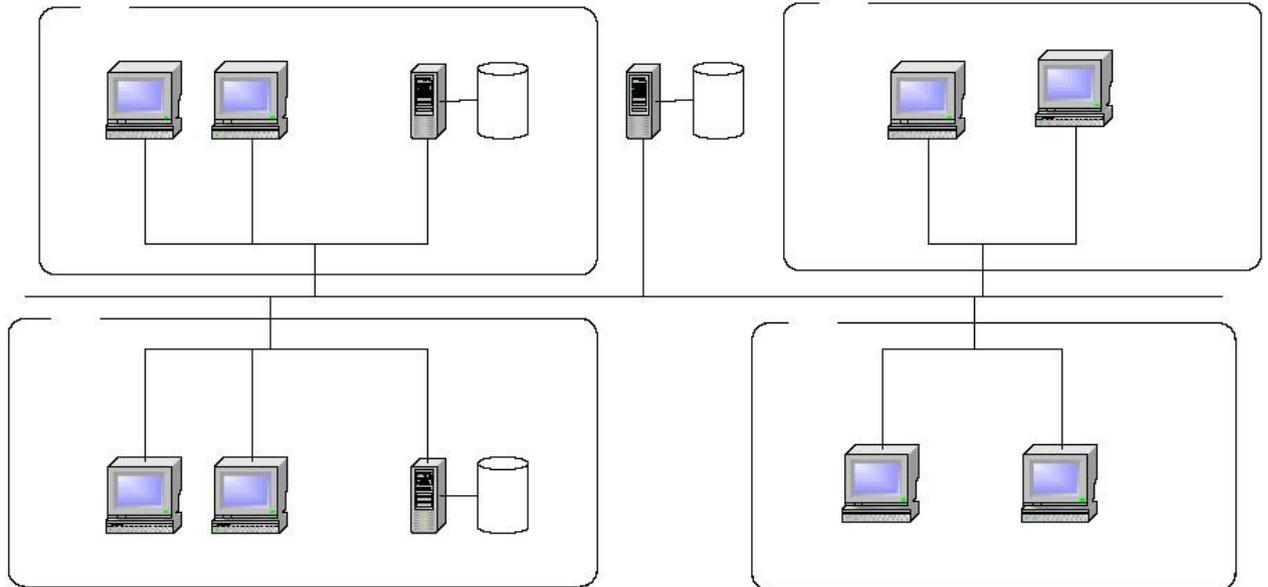**Penolong Pengarah Kanan (GIS/IT),Jabatan Kerja Raya Malaysia**

Figure 7: Proposed GIS Databases

JKR ROUTE MAP

The existing "JKR Route Map" was based on sketches of the road alignment and these data are not as what on ground. Under year 2004, the "JKR Route Map" from four state i.e Perlis, Labuan, Melaka and Negeri Sembilan are updated based on the road features that are captured using GPS technology with the collaboration of JUPEM.
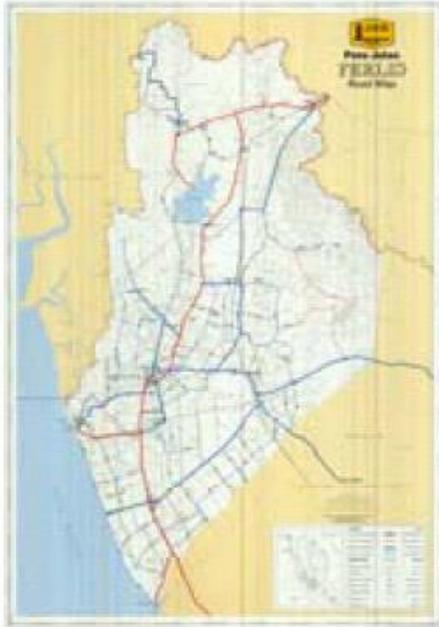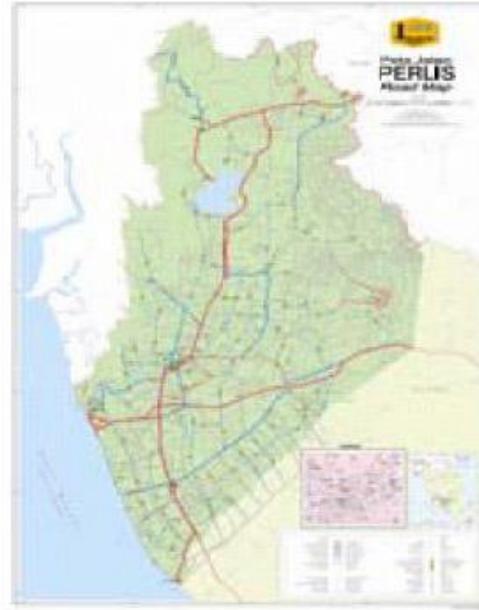
Example of JKR Route map

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Existing JKR Route Map for Perlis   Proposed New JKR Route Map for Perlis

Figure 8: Examples of JKR Route Map

BENEFIT

- A central database storing all data related to the department, available and useable to users when required.
- Increase work productivity particularly in planning and managing of utilities and infrastructures, producing results from numerous combination of datasets.
- Promote data-sharing culture and enhance `team spirit'.
- Improve data currency, accuracy and consistency of data maintained.
- Minimise data duplication.
- Data will be managed more efficiently.
- Provide exposure, experience and and preparation for inter-department data exchanges and a component of MyGDI

CONCLUSION

With the advancement of information and communication technology (ICT) and increasing needs of data in digital format, JKR faced a challenged of providing the data up-to date, accurate and spatially referenced information. Geographic Information System (GIS) is used to convey the spatial information to JKR management that enables them to make query and analysis and using the results in making decision. Because of the location of the

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asset are located throughout Malaysia, it should be managed properly and the only way is using a GIS-based application.