

# Table of Contents

<b>1</b>	<b>Introduction .....</b>	<b>1</b>
1.1	Background .....	1
1.2	OVERVIEW .....	1
<b>2</b>	<b>HIMS Functional Details .....</b>	<b>3</b>
2.1	General Features .....	3
2.2	Support for Different Data Types .....	3
2.3	Data Management .....	3
2.4	Administration .....	3
2.5	Web Interface .....	3
2.6	Parameters Input Module (PIM) .....	4
2.7	Business Policies and Standards Module (PSM) .....	5
2.8	Digital Imaging Module .....	6
2.9	Geographic Information System .....	6
2.10	Road Referencing SYSTEM (RRS) .....	7
2.11	Network Management .....	8
2.12	Mobile Interfacing .....	8
<b>3</b>	<b>Sub-Systems (Modules) .....</b>	<b>10</b>

## List of Tables

Table 2-1: List of Supported Browsers .....	4
---	---

## List of Figures

Figure 2-1: Sample Login Screen for User based access .....	4
Figure 2-2: Images being accessed in context of a location .....	6
Figure 2-3: Referencing System in HIMS .....	7
Figure 2-4: Network Management in HIMS .....	8

# 1 INTRODUCTION

## 1.1 BACKGROUND

The development of the HIMS Asset Management System (HIMS) was started in year 1999 and was initially designed by Dr. Chris Bennett, who now works with the World Bank. The first HIMS implementation was completed in 2001 in Samoa on a World Bank funded project. Since then there has been a continuous development and improvement carried out by our team.

Some of the notable (financed by the international funding agencies, such as the World Bank and Asian Development Bank etc.) projects where HIMS was implemented:

- Road Asset Management System, Samoa, 2000-2001 (appx. 800 km);
- Road Management and Decision Support System, Kingdom of Cambodia, 2003-05 (appx. 12,000 km);
- Gujarat Road Management System, India, 2004-06 (appx. 70,000 km);
- Bridge Management System, Papua New Guinea, 2004-05 (appx. 2,000 bridges);
- Road Management System, Sri Lanka, 2006 (appx. 10,000 km);
- Urumqi Road Management System, China, 2007 (appx. 1,200 km);
- Wuhan Road Management System, China, 2009 (appx. 3,000 km);
- Road Asset Management System, Zambia, 2009 (appx. 40,000 km);
- Central Road Database, Serbia, 2010 (appx. 20,000 km);
- Mozambique Road Management System, Mozambique 2011-16 (appx. 30,000 km);
- Sri Lanka Road Asset Management System, Sri Lanka 2014-15 (appx. 11,000 km); and,
- Karnataka Road Asset Management System, India 2015-16 (appx. 50,000 km);

## 1.2 OVERVIEW

HIMS Asset Management System is a powerful and flexible database management and analytical system designed to meet the needs of asset owners, asset managers and their consultants. HIMS is capable of storing and analyzing data on any type of asset with a particular emphasis on linearly referenced assets such as pavements, bridges, culverts and fords etc.

HIMS was developed based on the "zero coding by the end user" principle. HIMS offers most of its functionality to be configured by the end users without actually writing additional or modifying the existing software code, more than any other similar Commercially Off the Shelf (COTS) systems available in the market.

HIMS is built around the concept of varying "user levels", each level having different functional accessibility and privileges. This routine can also be used to define the "access network" for each user.

HIMS has the capability to store and manage data related to project, programme and strategy level analysis. It also has the capability of transferring data from one level to another level (such as programme level to strategic level etc.).

A very flexible and advanced data validation routine is available for validating data while importing (even after importing if required) data into HIMS system. The end user can change validation rules

at a later date if required.

HIMS has embedded engine to design reports, charts and other graphs. With this engine, existing reports can be modified or new reports can be developed by the end user (having enough user privileges) at any time.

The main features of HIMS are:

- Secured role and area based access;
- Flexible Referencing System;
- Network Editing and Auditing;
- Multi Language Support;
- User Definable Objects;
- Embedded GIS;
- Homogeneous Sectioning;
- Analysis Engine;
- HDM 4 Interface;
- Data view & Reporting; and,
- Mobile Interfacing.

HIMS is available in four versions:

- **Desktop Version:** This version is based on the MS SQL Express database and is ideal for small Councils (road networks) or low on IT infrastructure; - **Tentative cost varies from USD 80,000 to USD 250,000 (depending on modules and number of licenses opted)**
- **Enterprise Version:** This version is more suitable for agencies having huge data management; client server environment and well developed computer network. This version is based on SQL Server backend; - **Tentative cost varies from USD 200,000 to USD 750,000 (depending on modules and number of licenses opted)**
- **Web Version:** This version is based on Enterprise with data uploading and retrieval using web interface. System can be hosted on an internal or external server. - **Tentative cost varies from USD 500,000 to USD 1,250,000 (depending on modules opted)**
- **Cloud Version:** This version is SAAS model based on monthly subscription (billed based on the usage), we will be hosting application and data at our data centers. - **Tentative monthly subscription cost varies from USD 2,500 to USD 7,500 (depending on modules and bandwidth opted)**

**Please note:** *The above mentioned costs are tentative costs. These costs varies based on the client requirements, amount of configuration required, size of road network, modules opted and number of licenses opted etc. hence actual cost can be derived after looking at exact scope of work.*

## 2 HIMS FUNCTIONAL DETAILS

### 2.1 GENERAL FEATURES

HIMS includes managing location referencing and other attribute data required for different sub-systems, particularly PMS. Our location referencing is based on the "Road, Link and Node" concept which also allows multiple referencing methods. The advantage of the multiple referencing methods is that the staff working with HIMS can use link based chainage while field engineers and maintenance crew can be supplied with road based chainage. Descriptions of data import / export / view / sorting / reporting and querying of data are detailed in Technical Requirements and General Features.

### 2.2 SUPPORT FOR DIFFERENT DATA TYPES

HIMS stores data using different spatial attributes. Point data exist at a single point in space, for example a kilometer stone. Continuous data are over a section, for example the roughness. Each data item can have its own unique referencing and these are then reconciled as a series of 'overlapping sections' to create a homogeneous section. Spatial attributes can be associated with data items or sections and these are displayed in the GIS.

### 2.3 DATA MANAGEMENT

Ability to Manage Old Data: The historical attribute data (like inventory, condition, traffic, roughness etc.) can be loaded in the system while the past historical changes of the road network are not possible and they have very little value in this context.

Ability to Archive Data and Restore: There is also the ability to store independent data. These are items not associated with a road, for example the location of a quarry.

Support to Field Data Collection Devices: HIMS supports for commonly used text and data like XLSX, XLS, MDB etc. which are compatible standards for data interchange among survey equipment/field devices. The export import facility is configurable by the user to enable ease of data transfer with standard sources.

Ability to generate strip maps, linear charts of homogeneous sections showing attributes: In HIMS there are multiple options for creating homogeneous analysis sections. The software analyse data using various criteria to create analysis sections which are homogeneous with their attributes. These analysis sections are maintained for several years unless there are significant changes between years in their attributes.

Ability to Edit Network Data: Data management module of HIMS provides full network editing functionality. It has the capability for Auditing, splitting, joining and modifying of road sections, and modification of road section lengths.

Ability to display Multimedia Data: Data management module of HIMS provides full multimedia functionality. It has the capability for viewing photos, video files based on frames / road chainage / link etc.

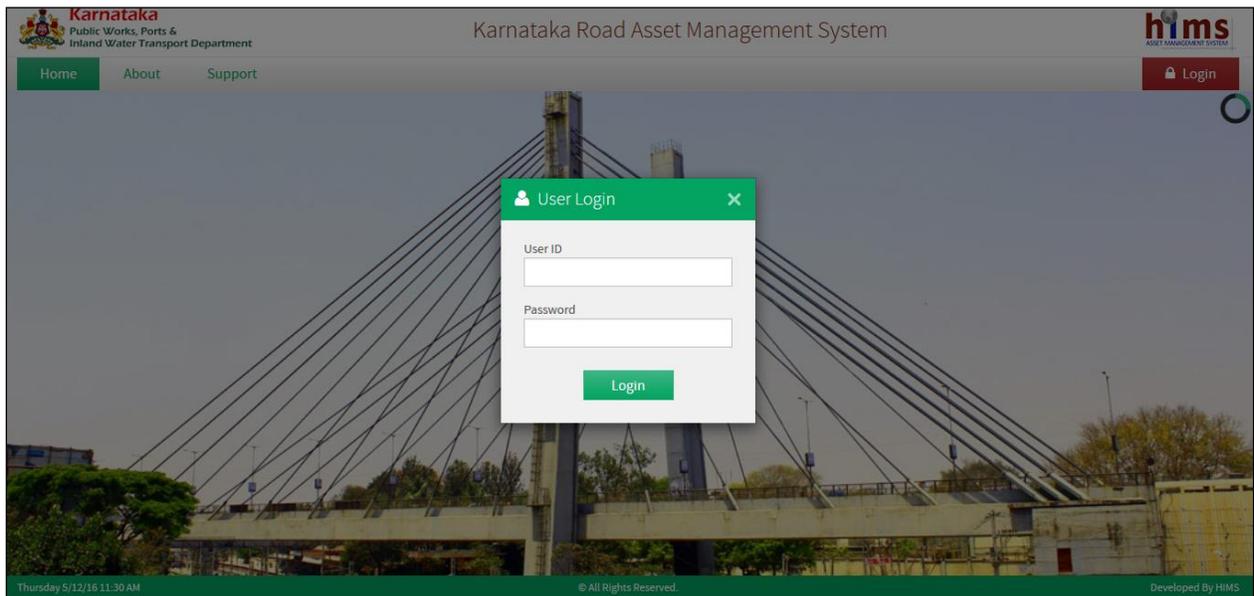
### 2.4 ADMINISTRATION

Ability to set User Access Rights: User Administration module of HIMS can setup various users like Admin, Engineer, and Data Entry and User roles with appropriate user privileges. And it can also define project network level, module level access rights.

### 2.5 WEB INTERFACE

HIMS (COTS) is a web based version provides with an easy and user friendly way to manage (add/view/edit/delete) data, export data, view/query the spatial locations and layout of roads, links,

structures etc and generate various reports. It also has a role, area and module based access.



**Figure 2-1: Sample Login Screen for User based access**

HIMS has been designed to be compliant with W3C web standards and will work with most modern browsers that are standards compliant. Keeping in mind the various operating systems available today, the preferred browser is Mozilla Firefox due to its cross platform availability. A list of browsers and the support levels is detailed below.

**Table 2-1: List of Supported Browsers**

S.No.	Browser	Support
1	 Mozilla Firefox	Versions 5 and above are fully supported
2	 Sea Monkey	Versions 2.2 and above are fully supported
3	 Chrome	Version 16 and above are fully supported
4	 Opera	Versions 10 and above are fully supported
5	 Apple Safari	Versions 6 and above are fully supported
6	 Internet Explorer	Versions 9 and above are supported in standards mode

## 2.6 PARAMETERS INPUT MODULE (PIM)

PMS provides facility to input parameter data used in the various subsystems.

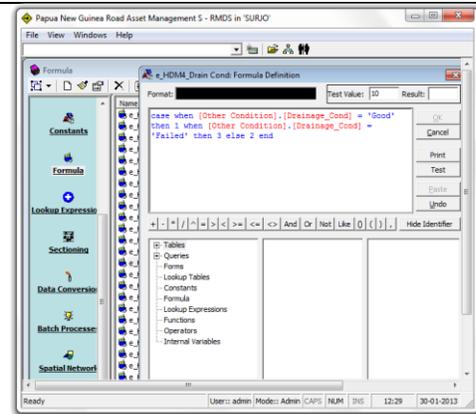
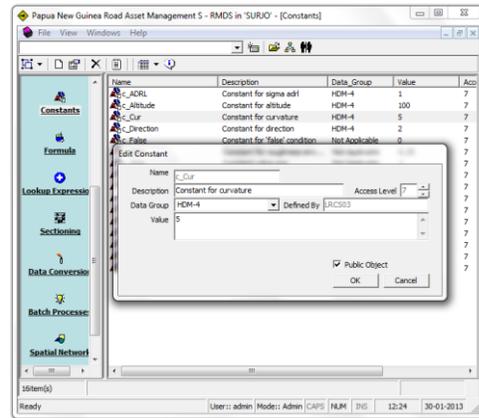
The PIM is exposed as "Setup" option of each module in HIMS so as to make the access more

intuitive for the user. This menu option allows the user to edit the parameters which are going to be used for analysis in the particular module.

## 2.7 BUSINESS POLICIES AND STANDARDS MODULE (PSM)

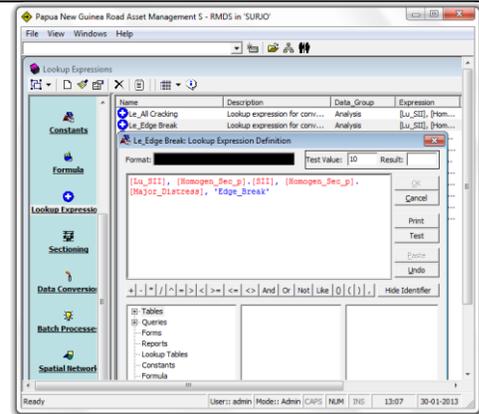
The PSM provides the facility to input rules and parameters that determine the operation of systems. In HIMS this part is exposed via a set of components as below:

**Constants:** Constants are used as a means to get an easy reference to a particular value



**Formula:** Formulae are used to link measured values during analysis, in the case of linearly referenced systems, we require the formula to act in context of the reference, the Formula module is specialised for this task.

**Lookup Expressions:** Similar to formula, we might have tabular lookups from which we need to extract values for our analysis, Lookup Expressions provide a simple interface to set these values.



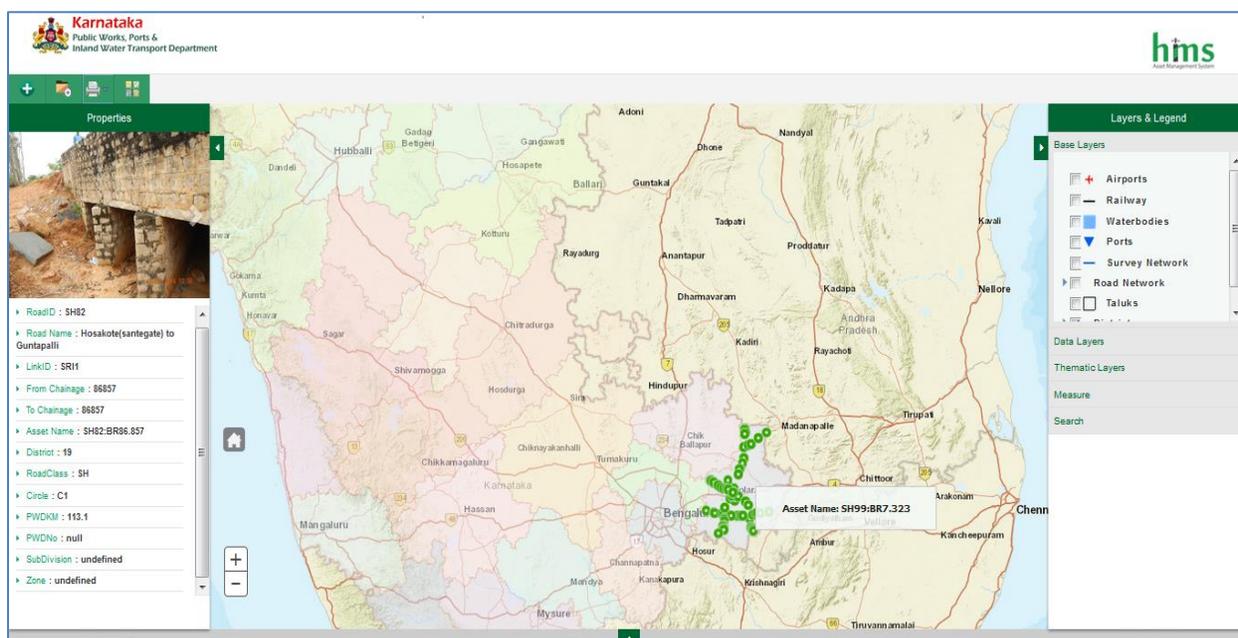
**Sectioning:** Sectioning is a core requirement of analysis on linearly referenced system. Sectioning provides a means to reduce the complexity of analysis by combining/classifying the segments based on various criteria like length, similar value, value range etc.

**Data Conversion:** Similar to Sectioning, Data Conversion too is a core requirement of analysis on linearly referenced system as the various attributes are stored independently and hence will require a means to combine attributes of relevant sections correctly.

**Batch Process:** Batch process is a way to enable the user to combine multiple processes in the correct sequence. This allows the user to define proper workflows for analysis.

## 2.8 DIGITAL IMAGING MODULE

The digital imaging module provides a facility for the storage, management, retrieval and processing of digital images, HIMS exposes this facility via certain function calls that may be accessed via the different GUI elements like Tables, Views, Menus and Map.



**Figure 2-2: Images being accessed in context of a location**

## 2.9 GEOGRAPHIC INFORMATION SYSTEM

HIMS Web/Cloud version was built on open source GIS component (Geo Server) and ESRI-Arc GIS Component. As per the Client requirements, HIMS web can be deployed with ESRI GIS component to have more GIS functionalities. In such case Client has to purchase licenses for Arc GIS software. HIMS can read and import ESRI shape files for use in the embedded GIS. In the similar way HIMS can export data to any external GIS applications very easily.

The external GIS (ArcGIS) can use various sources such as SQL Server, XLS, DBF, MDB, TXT etc. as data source for attribute data. HIMS will be configured with export facility so that attribute data for use in ArcGIS is made available in a predefined location either in SQL Server or in a supported file format accessible from the GIS software, users can then join the exported data with required objects in ArcGIS. The export facility will allow the user to choose required attributes that are to be exported for use in GIS.

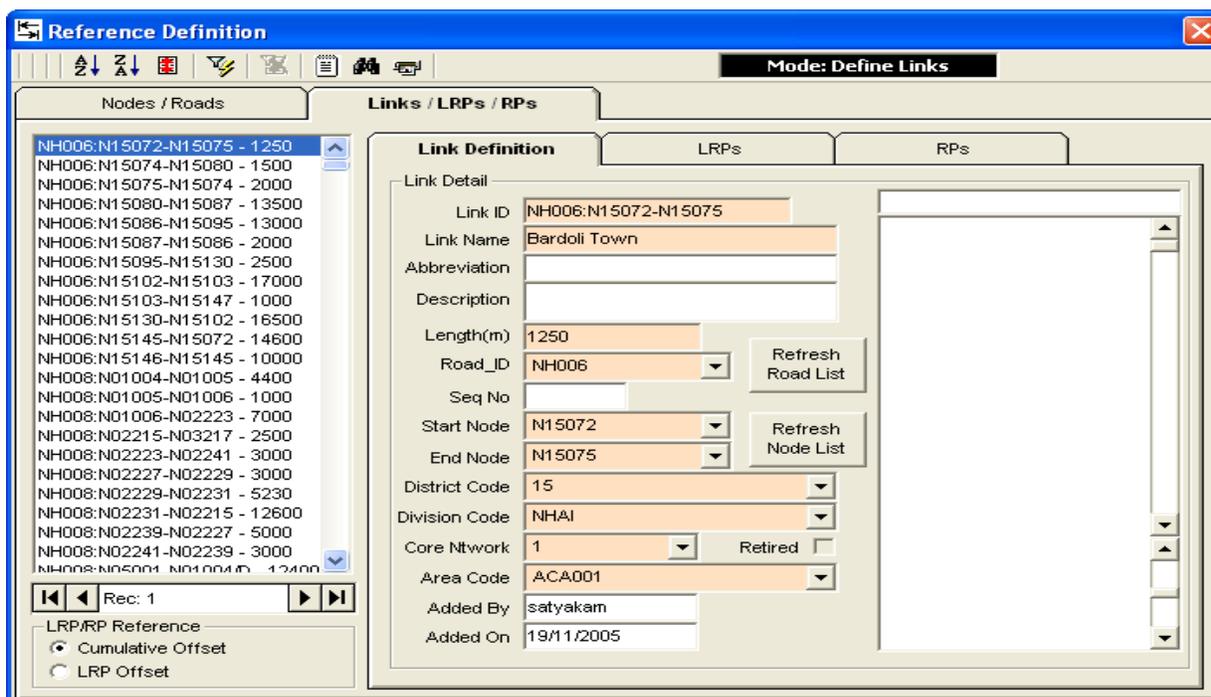
As required for synchronization of data HIMS will provide full support for data import using standard

interchange files (XLS, MDB, DBF, TXT etc.) as well as manual data entry and editing so that data in HIMS and the external GIS can be synchronized.

## 2.10 ROAD REFERENCING SYSTEM (RRS)

The RRS module is exposed within HIMS as Location Referencing; HIMS was built on the advanced and best practice location referencing principles for linearly referenced assets. It can store data in multiple referencing systems and then can convert data from one referencing system to another. This routine of HIMS is one of the best available in the industry. User definable linear referencing system is linked to spatial GIS referencing system.

HIMS software avails the advanced and best practice location referencing principles. It can store data in multiple referencing systems and then can convert those from one referencing system to another. An example screen is given below.



**Figure 2-3: Referencing System in HIMS**

HIMS location referencing is based on the “Road, Node and Link” concept which also allows multiple referencing methods. The advantage of the multiple referencing methods is that the staff working with HIMS can use link based chainage while field engineers and maintenance crew can be supplied with road based chainage.

HIMS stores data using different spatial attributes. Point data exist at a single point in space, for example a kilometer stone. Continuous data are over a section, for example the roughness. Each data item can have its own unique referencing and these are then reconciled as a series of ‘overlapping sections’ to create a homogeneous section. Spatial attributes can be associated with data items or sections and these are displayed in the GIS. There is also the ability to store independent data. These are items not associated with a road, for example the location of a quarry

LRM has the ability to handle the following type of references.

- Linear referencing based on the start of a road (Road Start 000 + Chainage)
- Linear referencing based on the start of a link (Link Start XXX + Chainage)

- Linear referencing based on the previous LRP (Kilometer Point + Chainage)

The HIMS uses the reference point method for its referencing. This is a flexible method which also works with the other methods, i.e. a kilometer post can be treated as a reference points as can any reference post.

## 2.11 NETWORK MANAGEMENT

HIMS has an in-built Network Management Module (NMM) which is specifically envisaged for this purpose. This module allows users to track the historical changes in the road network. This module also facilitates to manage (break or merge) attribute data following the changes in location referencing (road network) with couple of mouse clicks. An example screen is given below from Gujarat RMS system.

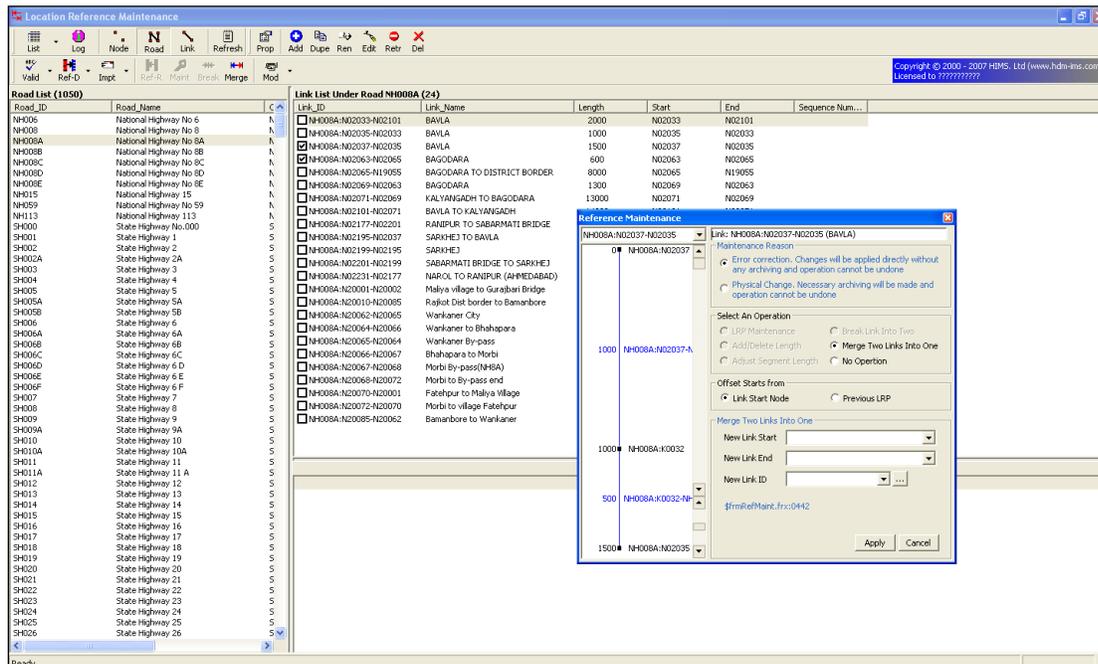


Figure 2-4: Network Management in HIMS

## 2.12 MOBILE INTERFACING

HIMS has an in-built Mobile Interface Module which is specifically envisaged for this purpose. This module allows users to track/view/update the survey data of the road network. This module also facilitates to log the pavement, road furniture defects with couple of mouse clicks. Following are the features available on mobile app are:

- Dashboard
- Modules Menu
- Module wise summary data
- Reports & Charts
- GIS Map

An example screen is given below:

Karnataka  
Public Works, Ports &  
Inland Water Transport Department

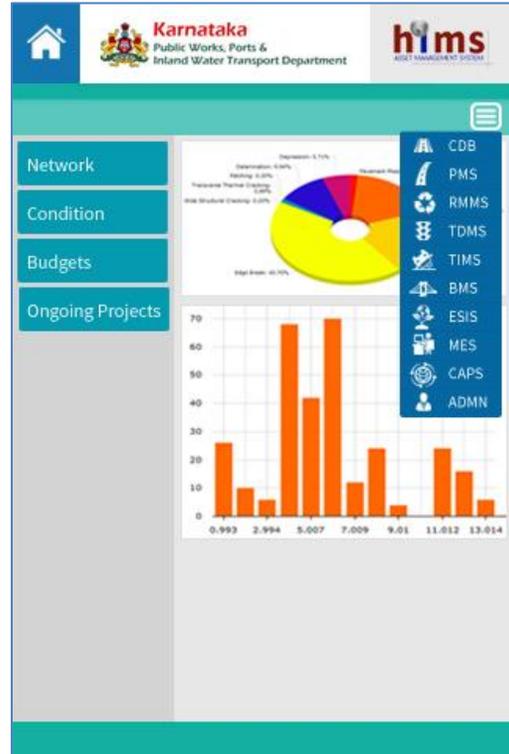
hims  
HMS MANAGEMENT SYSTEM

Username

Password

Login

Powered by HIMS



### 3 SUB-SYSTEMS (MODULES)

As road maintenance specialists, the Consultants thoroughly understand the road agency's requirements in managing and maintaining roads. The role of appropriate, agency's need based and "fit for the purpose" road database cannot be overemphasized when developing / implementing / selecting the road management system. The Consultants recognize and understand that different road agencies have different needs though the overall objective is similar for all road agencies. A road database adopted/developed for one particular agency may not work for another agency. Therefore the Consultants have developed generic tools/functions with which the necessary sub systems can be developed or implemented. These functions require configuration to suit to the agency's requirements.

Using these functions/tools, HIMS in the past has been implemented as Road Information System (RIS), Pavement Management System (PMS), Bridge Management System (BMS), Routine Maintenance Management System (RMMS) etc.

Other systems such as Traffic Information System (TIS), Project Management System (PrjMS), Management Information system (MIS), Budgeting and Prioritization System (BPS), Accident Information System (AIS), Road Furniture Management System (FMS) and Environmental and Social Information System (ESIS) can easily be implemented. Most of the above systems (if not all of them) are implemented in some or other form using HIMS Asset Management System for different clients. Standard templates are available in HIMS software for most of the above mentioned sub-systems however; configuration is required to suit to the agency's specific requirements.

Hence depending on client requirements the following modules can be configured

1. Location Reference Management System
2. Road Information System (Asset Register)
3. Pavement Management System
4. HDM-4 interface
5. Bridge Management System
6. Bridge Information System
7. Traffic Information System
8. Accident Information System
9. Routine Maintenance Management System
10. Road Furniture Management System / Right of Way Information Management System
11. Geographical Information System
12. Slope Management System
13. Disaster Planning System
14. Environmental & Social Information System
15. Monitoring & Evaluation System / Works Management System Component
16. Cross Asset Prioritisation System / Budgeting and Prioritization System (BPS)
17. Document Management System
18. Work Order Management