

Consultancy Services for Providing
Technical Assistance to Establish an Asset Management System on the State Road Network

Schedule of Workshop

1. Conceptual Design and Data Collection

Session 1 (10.30AM – 11.45 AM)

1. Introduction to the Project
2. Data Requirements
3. Data Collection (Formats + Methodology)
 - a. GPS Referencing
 - b. Road, Culvert and Bridge Inventory
 - c. ROW Features

Session 2 (12.00 Noon – 1.30PM)

1. Data Collection (Formats + Methodology)
 - a. Road and Bridge Condition
 - b. Road Roughness
 - c. Pavement Strength
 - d. Traffic Survey
 - i. Classified Volume Count
 - ii. Axle load Survey

LUNCH (1.30 PM – 2.30 PM)

Session 3 (2.30 PM – 3.30 PM)

1. Overview of the Project
2. Data Requirements, Collection and Methodology (Overview)
3. AMS System Components

2. Needs Analysis and System Architecture

Session 4 (3.45 PM – 5.30 PM)

1. Results of Needs Analysis
2. AMS/ Information Systems Implemented else-where
3. System Architecture
 - a. Possible Relationship and Dependencies
 - b. Implementation – State-wide
 - c. AMS Software
 - i. Indigenous Development
 - ii. Commercial-off-the-Shelf (COTS) Software
 - d. Evaluation of Software
4. Recommendations

3. BACKGROUND TO THE STUDY AND BROAD NEEDS OF THE OWD

3.1 Orissa has a road network of over 2,62,703 Km comprising of National Highways, State Highways, Major District Roads, Other District Roads, Rural Roads, Panchayet Samiti Roads and Village roads. The Orissa Works Department (OWD) looks after the construction and maintenance of National Highways, State Highways, Major District Roads and Other District Roads totalling to a length of 18,069 Km which is about 7 % of the total road length. The remaining roads are under the control of Rural Development Department, Panchayati Raj Department, Water Resources Department, Forest Department, Urban Development Department and so on. Table-1 below gives categorywise road length under the control of OWD.

Table 1 Orissa Road Network under OWD

Road type	Length (km)
National Highways	3,592
State Highways	3,682
Major District Roads	4,481
Other District Roads	6,314
Total	18,069

3.2 The responsibility for development and maintenance of National Highways in the state vests with the Ministry of Shipping, Road Transport and Highways (MoSRTTH) of the Government of India. The OWD acts on an agency basis to undertake construction and maintenance works on this national network as required by the MoSRTTH. However, the construction and maintenance of the State Highways, Major District Roads and Other District Roads are being looked after by the OWD. These 17831 Km of roads which are under the control of OWD carry the bulk of the traffic and are the principal carrier of economic activities.

3.3 The Government of Orissa (GOO) has completed preparation for the proposed World Bank assisted road project to upgrade part of the core road network under Orissa State Roads Project (OSRP). The high priority state roads identified for upgradation and improvement under the above project in Phase-I cover a length of approximately 461 Km of State Highways. The OWD, with help of a DPR consultant, has prioritized works for these roads for upgradation and periodic maintenance for implementation during the project using HDM-4. The DPR consultant has also completed a network analysis for the remaining State Highways (SH only) for prioritization of SH Road Network based on Traffic & Socio-Economic parameters. Besides, the Project Implementation Unit (PIU) has also identified about 3000 km of roads as "Primary Core Network" which are the important and high traffic density corridors of the state. It is envisaged that the AMS Consultant shall evaluate all the current network, such as all SHs, all MDRs and re-assess the extent of primary core network on which majority of state traffic plies.

3.4 The core of the AMS will be development of a web based **Road Information System (RIS) & Bridge Information System (BIS)**. These will be a series of databases linking different road and bridge data items. It will be accessed either from a centrally linked server or as a distributed database, which is independent of any network. The system will be designed for multi-level user requirements (i.e. headquarters, Circle, Division, Sub-Division as well as the general public through the internet) with appropriate security, interfaces and reporting facilities appropriate to the level of the user. There will be a number of applications developed to address the various requirements of road & bridge asset management that will interface with the RIS-BIS. These applications will be designed based on the specific requirements of the different management processes. This GIS based information system for road &

bridges shall be developed by the consultant from the base data of latest Survey of India map and/or satellite imageries of road network. These data shall be procured by the OWD from Survey of India offices and/or Remote Sensing Agencies of Govt. of India, such as Orissa Remote Sensing Application Centre (ORSAC) with procurement assistance by the AMS consultant without any service charge. The number of layers and attributed database of the RIS-BIS shall be finalized in consultation with the client. The BIS database shall contain sufficient attributes to maintain the bridge diary besides some 3 to 4 critical attributes to determine investment and rehabilitation needs in bridges.

3.5 For managing periodic and capital road works activities a **Pavement Management System (PMS)** application will be created, which will cover preservation of the existing road network as well as expansion which may cover new links, multi-laning, or capacity increases. The PMS shall in general be user-friendly, for simple and direct application. The engineering and economic analytical tool of PMS should include deterioration prediction model for both bituminous and concrete pavement. The processes to be covered include, but are not limited to:

- network-level planning
- project-level planning
- multi-project programming and budgeting
- optimization of projects under budget constraints
- overall network performance monitoring and evaluation against projected targets

3.6 A **Routine Maintenance Management System (RMMS)** application will be created that: a) determines routine maintenance investments for sections not receiving periodic maintenance or improvements in that year and b) prepares reports and charts for a business plan.

3.7 A **Right of Way Features Information Management System (RWFIMS)** application will be created that: a) maintains all features such as structures, utility services both below and above ground, trees etc, within the Right of Way (ROW) b) generate strip maps showing these features. These database shall be integrated with Road Information System (RIS).

3.8 The AMS is envisaged as a system which will eventually serve all levels in the OWD, i.e. headquarters, Circle and Division offices, in planning and managing the state road network under OWD control.

3.9 To establish the AMS, the OWD now intends to commission a team of international and local consultants, hereafter referred to as 'the consultant', to undertake the following terms of reference. Concurrent with these services, the OWD / GOO is undertaking a comprehensive program of investment in Information Technology and its management information systems more broadly as well as commissioning Institutional Development and Strengthening (IDS) consultants to help implement portions of its institutional strengthening action plan.

A. FUNCTIONAL AND TECHNICAL REQUIREMENTS OF THE SOFTWARE

After the need analysis is completed, the proposal of the Consultant for the software to be developed or to be purchased will be evaluated against the criteria mentioned below. The following information shall not be used for evaluating the technical proposal of bidders. The option shall be open to the consultant to choose whether he/she wishes to develop his/her own system or buy and customize an off-the-self system provided it satisfies all the basis parameters of need analysis and the system requirement of the country, state and the client. This applies to GIS, the database and the economic modules.

The following clarifications on the functional and technical requirements of the software are to be provided by the AMS Consultant:

1. General Information

The Consultant shall supply the following general information on the proposed system.

- **Commercial Off-the-Shelf Software:** The project is expected to use commercial off-the-shelf (COTS) software. Proposals based around proprietary systems or requiring that software will be custom developed will be rejected as non-conforming.
- **Configurable Software:** The software supplied must be configurable. This means that it is possible for the application administrator (initially the Consultant, but later the Client) to modify parameters or settings, or to otherwise to set up or initialize the system so that it meets the requirements. Applications requiring significant customization (i.e. requiring significant additional coding and/or changes to existing source code) will not be considered for the assignment. The Consultant shall clearly indicate the level of customization required for the assignment in their proposal. If this is considered to be excessive, then the proposed system shall rejected by the client.
- **Regional experience with the application:** The Consultant shall indicate in his proposal the regional and country presence of the application, listing within the last five (5) years: (i) all agencies to which the application was supplied; (ii) the year that the system was implemented; (iii) the current status of the implementation; and (iv) the current contract details of the users.
- **Country presence:** The Consultant shall clearly indicate whether or not there are any support offices in the region or country that will provide on-going support after implementation.
- **Support and maintenance services:** The Consultant shall clearly describe future potential support and maintenance services for the application. This should include a sample Service Level Agreement.
- **Reference sites:** The Consultant shall provide a minimum of three (3) reference sites, including contact details, for agencies that have implemented the application within the last five (5) years, and which would be suitable for the Client to contact during any post-process exercise. The Consultant shall confirm with the reference sites prior to submitting the proposal that they are willing to provide comments on the implementation to the Client.

2. Technical Requirements

Basing on the need analysis findings, the Consultant shall indicate in their report on how the application being proposed conforms to the following Technical Requirements. Note that some of these requirements are Mandatory. If the application being proposed does not conform to a mandatory requirement, then it will be rejected. If the mandatory features are not currently implemented in the system, but will be as part of these services the Consultant shall clearly indicate this in their proposal, and confirm when the features will be available.

The Consultant must clearly indicate whether any customization of source code in his application will be required for the project to meet these technical requirements.

- **Language:** The language of the interface (all menus, screens, reports, and documentation) shall be English.
- **Number of Users:** It is anticipated that up to 50 concurrent users will need access to the application at any one time. **The proposal shall clearly indicate the maximum number of users, both potential and in other agencies using the system. The Consultant should give full details of any licensing options, including per user, per seat, or site licenses, in his report . Note that if the AMS is supplied with optional modules that are licensed with separate costs, then the costs of each module should be listed separately in the report.**
- **GIS:** Currently, the OWD does not have a Geographic Information System (GIS). The client's preference is for an embedded GIS, although a separate application solution shall be considered. The consultant may propose any internationally recognized GIS software as referred at 4.9.
- **Field Data Collection Devices:** **The AMS should support hand-held field data collection devices into which data can be downloaded from the AMS, verified or updated in the field, and synchronized with the AMS later through the Client's LAN. Particular attention should be made to accessing data from the equipment to be procured under this assignment in 4.6 of the Task-2 (eg ROMDAS, axle load pads, etc.)**
- **Web Enabling:** The AMS should provide an interface to allow information from the AMS to be made available to other applications, including presentation on Client websites. This is expected to consist of, as a minimum, a map which is linked to summary data as pavement inventory, pavement condition, and traffic volumes.
- **HDM-4 Interface:** The Client wishes the AMS to interface with HDM-4 (the Highway Development and Management Tool) (latest version).

3. Functional Requirements

The Consultant shall indicate in his findings how the application being proposed meets the following Functional Requirements. Note that some of these requirements are Mandatory. If the application being proposed does not conform to a mandatory requirement, then it will be rejected. If the mandatory features are not currently implemented in the system, but will be as part of these services the Consultant shall clearly indicate this in their proposal, and confirm when the features will be available.

The Consultant must clearly indicate whether any customization of source code in his application will be required for the project to meet these technical requirements.

- **Terminology:** All Screen Labels, Menu Items, and Reports should be configurable to the Client conventions in English.

- **Network Referencing:** The AMS should support different network referencing schemes. These should include linear distance from the start of the road section, linear distance from the start of a road, as well as distance from known location referencing points.
- **Cross-Sectional Positioning:** The AMS should support different cross-sectional positional models, to enable data to be referenced laterally to a location on a road section, in terms of lanes, shoulders, ditches, verges etc.
- **Network Coding Rules:** The AMS should enforce the Client's Network Numbering rules, by performing data validation on entry or through some other form of internal validation procedure.
- **Network Editing:** The AMS should permit splitting and joining of road sections, and modification of road section lengths, while preserving integrity of all current and historical data stored against the affected sections.
- **Network Auditing:** The AMS should audit all changes to the road network definition, and allow review of those changes. The audit should record the date and time of network change, the nature of the change, and the username of the person who made the change.
- **User Defined Data Items, Functionality and Processes:** The AMS should be configurable to enable the user to define additional types of inventory and condition data to be stored, and to define what attributes are to be stored against each type of inventory. There should be no restriction on the number and type of items or their attributes, other than physical limitations of the database management system being used. The RMS must have user-definable data entry forms, including labels in the local language, so that the user does not need to use a table view for entering new types of data.
- **Historical Data:** The AMS should allow the storage of data over different time periods, to enable comparison of data over time. There should be the functionality to view/select the most current data.
- **Multi-Media Data:** The AMS should enable management and display of multi-media objects (eg photographs, video clips etc.) as attributes of inventory items. For video, the RMS should allow viewing of video data by chainage along the road section, based on frame/chainage lookup tables supplied. The GIS should display the multi-media objects in the correct spatial location, and the images should be accessible by selecting them in the GIS.
- **Data Level Security:** The AMS should permit security setup so that user may have different security privileges for sub-networks in different geographical or administrative areas. It should also permit setup so that different users have different levels of access for different types of data.
- **Function Level Security:** The AMS should permit security setup so that different users may have access to different application modules and functions within these modules.
- **Flexible Reporting:** The AMS should provide flexible reporting to enable Client staff to devise their own reports and to make those reports available to other users. Reporting of all items in the RMS database must be permitted, including reporting on user-defined items and attributes, comparisons of current data with historical data, audit records etc. Export to spreadsheet and/or comma-delimited text files should also be provided. The Consultant should also provide details of any interfaces to third-party reporting tools.
- **Dynamic Sub-Sectioning:** The AMS should provide a dynamic sectioning capability that allows sections of homogenous characteristics to be generated and reported upon. This should allow combination of all types of data stored in the RMS. The AMS should allow parameters to be specified for minimum length of section, and also threshold changes in value at which new sections should be created.

- **Schematic Line Diagrams/Strip Maps:** The AMS should enable production of schematic line diagrams and/or strip-maps annotated with any data stored in the AMS.
- **Integration With GIS:** The AMS should integrate with the Client's GIS. The following functions should be included:
 - a. The GIS interface should enable editing of the spatial representation of the road network.
 - b. The GIS interface should provide a mechanism to compare the depicted length of the graphical representation with the defined length as stored in the AMS, in order to ensure correspondence of data and to highlight anomalies for user investigation.
 - c. From the AMS, while reviewing a particular road section, the user should be able to view and highlight that road section in the GIS. The interface should highlight if there is any missing GIS representation for a given road section.
 - d. Selected attributes of the road section, as stored in the AMS, should be able to be viewed from the GIS, used as screen labels, and be available for thematic mapping. These attributes should include all section-wide attributes including section identifier, road identifier, defined direction of the section, road classification etc.
 - e. The GIS interface should be able to display dynamically segmented data from the AMS. This means that any data stored in the AMS that varies by length along the road section, can be correctly displayed in the GIS.
 - f. The GIS interface should be able to view all background GIS data held in the Client's GIS database.
 - g. The GIS interface should enable viewing of video data as stored or referenced by the AMS, according to the direction and chainage of the video lookup tables stored in the RMS. The GIS should show a "moving cursor" synchronized with the video to represent location of the individual video frame.
- **HDM-4 Interface:** The AMS should interface with HDM-4 (the Highway Development and Management Tool). The interface should include the following elements:
 - h. An automatic sectioning function to create 'homogeneous' sections for analysis based on inventory and condition data;
 - i. A generic interface which allows the user to define the rules for the above-mentioned automatic sectioning. This can include specification of which data items to use, what transformations to apply to the individual data items (i.e. average, minimum, maximum, dominant, weighted average), minimum and maximum lengths of sections etc.;
 - j. Transformations of inventory and condition data to get it into terms understood by HDM-4 (this may also include manipulation of road construction types to match the set of surface types supported by the tool).
 - k. An ability to bring in default data where one or more data items is missing, and to highlight in the reporting which data items have been defaulted;
 - l. Preparation of HDM-4 Input files for Work Standards, Traffic Classification and Growth Rates;
 - m. Averaging and Preparation of data for Strategy Analysis (as opposed to Program Analysis);
 - n. Import of the results of the works program generated by HDM-4 so that they can be related back to the real road network and displayed in tabular or map-based reports. Depending on how complex the system is and what it is intended for, this may also

require the AMS retaining a copy of the road network definition passed to HDM-4 , so that if any changes occur to that network between the time of passing the data and getting the results, then they do not prevent the results being imported.

B. DATA AND SOFTWARE to be delivered to the Client

1. The floppy diskettes/ CDs/ storage devices etc. containing all basic as well as the processed data from all field studies and investigations, report, appendices, annexure, documents and drawings shall be submitted to the client from time to time as per output delivery schedules. The data relating to *Engineering Investigation and Traffic Studies, Road inventory condition, Roughness, Test pit (Pavement composition), Falling Weight Deflection, Traffic studies (traffic surveys), axle load surveys, Drainage inventory, Inventory data for bridge and culverts indicating rehabilitation, new construction requirement etc. in MS EXCEL or any other format which could be imported to widely used utility packages and linked to AMS alongwith electronic files of Economic and Financial Analysis.*
2. **Software:** The Consultant shall also hand over to the Client floppies /CD's containing any general software / integrated / customised AMS system / tool which has been specifically designed / developed for the project including its user Manual.
3. The floppy diskettes/CD's should be properly indexed and a catalogue giving contents of all floppies/CD's and print-outs of the contents(data from field studies topographic data and drawings) should be handed over to the Client at the time of submission of the final Report.