ROAD ASSET MANAGEMENT SYSTEM FOR MADURAI CBD

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Abstract: The road sector is highly complex sector and can be termed as a "Strategic Infrastructure sector" for the development of country/economy/society. The deterioration of a country's transport facilities is a clear indication of decline of economic growth. In developing countries like India, major investment on infrastructure is for building roads including maintenance and rehabilitation. Development of an asset management system for road administrations is a logical evolutionary step from managing individual assets from a broader perspective. As such, asset management system is generally integrated systems in which existing management systems for individual assets can be combined to produce new and often more conceptual information. There is earnest need to introduce Road Asset Management System (RAMS) for transportation infrastructure which assists in planning and prioritization of assets with its storage, transformation, analysis, modeling and reporting capabilities. In this report scope, project study area, methodology, tools and techniques, benefits were discussed.

Keywords: Asset Management; GIS; Road assets; Strategies.

1. INTRODUCTION

The road network constitutes one of the largest community assets. It is a universal truth that if assets once created are not adequately maintained and managed, then the possibility of erosion in asset values are not only high but the danger of losing the entire asset is also high. The agencies responsible for the transport infrastructure must maintain, operate, improve, replace and preserve this asset. At the same time, the financial and human resources needed to achieve the performance objectives of the road network are scarce and must be managed carefully. The concern of this report is to discuss as detailed as possible on the road asset management. Its intention is to describe, explain and comment asset management with respect to road infrastructure.

Government are placing greater pressures on road administrations to improve the efficiency and accountability for the management of the road assets. The asset management system allows enough scope for adoption of the simple methodologies and addresses the issues of timely removal of deficiencies even from project preparation/designing stage to make the road assets so created more sustainable.

Often debate is made in the road sector as to whether the "connectivity" or "mobility" or "sustainability" is to be given more weightage over the other. Road Asset Management System (RAMS) would be able to facilitate the road sector professionals as well as decision makers to allocate the financial resources in a realistic manner while addressing the critical issues of connectivity, mobility and sustainability in an optimized manner. This research work dealt with only physical assets of road infrastructure. Asset is defined as anything tangible or intangible that is capable of being owned or controlled to produce value and that is held to having positive economic value.

A definition of "asset management" that is appropriate for the road sector is: "A systematic process of maintaining, upgrading and operating assets, combining engineering principles with sound business practice and economic rationale, and providing tools to facilitate a more organized and flexible approach in making the decisions necessary to achieve the public's expectations" [10]. The term Asset Management System (AMS) embraces all the processes, tools, data and policies necessary to achieve the goal of effectively managing assets.

The state-of-the-art of Asset Management has been extensively researched and the Indian roads requires an Asset Management System which should be devised and designed for Indian conditions based on real field data. Asset management planning enables asset owners to demonstrate to their customers and other stakeholders that services are being delivered in the most effective manner. It also provides a basis for evaluating complex service price/quality relationships in consultation with customers. The approach combines

management, financial, economic, and engineering and other practices when applied to physical assets. It requires the use of a multi-disciplinary approach to management to develop and implement programmes for asset creation, operation, maintenance, renewal and disposal, over the life cycle of the asset.

Based on this review of Asset Management Systems for the roads sector, benefits of the RAMS are immense and many. It is inevitable that AMS, as defined in this report, will be implemented in some countries as a legislative requirement and in other countries to reflect the incremental benefits of an integrated system over the systems for managing individual assets.

2. STUDY AREA DESCRIPTION:

The area selected for this project work is Madurai CBD. Madurai is located in the South West part of Tamil Nadu Being an important tourist destination; it attracts large number of tourist vehicle into the heart of the city. As indicated by the Tourism Department, the average daily floating population in the city is 2.10 lakh persons.

Table 1: Streets of Madurai CBD

Madurai CBD	Veli Street
	Masi Street
	Avanimoola Street
	Chithirai Street

The city has the distinction of being served by National Highways, State Highways and District roads in addition to being a Railway junction. Within the CBD area Veli streets forms a ring type road. Historically, development of the City was noticed around the temple, which is the focal point in the southern part of river Vaigai. The major roads serving the town are:

- Dindigul Road (NH-7)
- Alanganalur Road
- Natham Road
- Alagarkoil Road (SH)
- Trichy Road (NH-45B)
- Sivagangai road
- Rameswarm Road (NH-49)

- Arupukottai Road
- Tirunelveli road (NH-7)
- Theni Road (NH-49B ext)
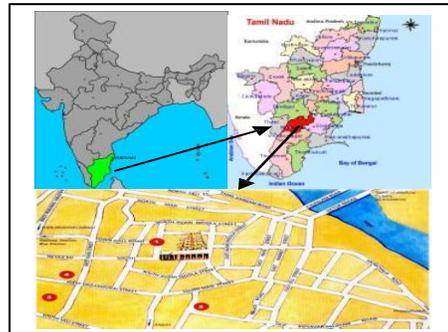
Figure 1: Project study area

2.1 IDENTIFIED PROBLEMS

- Presence of temple and wholesale market within the CBD area attracts large volume of pedestrian on the streets. This is clear that locations within CBD area witnessed higher pedestrian volume throughout the day.

- Madurai is located in the south west part of Tamil Nadu, being an important tourist destination; it attracts large number of people into the heart of the city and trip attraction also high in Madurai CBD.

- Presence of whole sale market, grocery market and private transport offices in the Central Business District (CBD) attracts large number of heavy goods vehicle into the central part of the city. Movement of such goods vehicles in the central part of city increases the congestion level in the main arterial roads and other main roads in the CBD area.

- Presence of number of commercial establishment along the main road in the CBD and On-street

parking in the CBD severely affects the free flow of traffic along the major corridors.

- Excessive delays, lack of facilities for pedestrians are the key problems identified in the study area especially at intersections.
- Unavailability of on hand data about road sector causes ineffective asset management system.

Table 2: Shortfall in funds for road maintenance in the Tenth FYP (Rs in crore)

Year	Requirement as per norms	Amount Provided	Shortfall	Shortfall as % of requirement
2002-03	2200	800	1400	63.64
2003-04	2200	731.74	1468.26	66.74
2004-05	2480	745.56	1734.44	69.94
2005-06	2480	868.10	1611.90	65.00
2006-07	2480	814.38	1665.62	67.16

2.2 AIM & OBJECTIVE OF THE PROJECT WORK:

To create Road Asset Management System for Madurai CBD and arrive best possible solutions for Traffic & Road management projects in future.

The objective of the study is to develop a road asset management system for an identified study area. Following objectives are set for this research work.

- To identify problems related to road assets in Madurai
- To arrive at suitable methodology through extensive literature survey.
- To identify appropriate tools and techniques
- To collect the data as per standards and requirements
- To create database system that integrates all assets
- To suggest appropriate solutions to the identified problems of road assets in Madurai

3. RESEARCH METHODOLOGY

This chapter discusses the methodology adopted for addressing various tasks involved in a RAMS. The process begins with defining a problem statement and accordingly set of asset management system goals and objectives. This will frame the type of assets that would be included in the investigation. There is a need for selection of critical asset from list of physical asset. The details of asset should be collected in such a way that ensures quality which plays a vital role in RAMS success. The data attributes would be collected as per the issue defined and output needed. Further, collected data will be updated to the Geographic Information System (GIS) is said to be one of the useful tools that can be utilized to manage database in road maintenance engineering. It is capable of storing, managing, analyzing, computing and displaying all forms of geographical data for road asset management. The next stage leads to create queries based on output. This helps to achieve a clear output and sometimes it creates new policy framework also. An effective utilization of result will be based on query builder. Finally implementation process takes place. Once the feedback get from monitoring of existing implemented system would be incorporated into the problem definition again the process will continue. An overview of study methodology is shown in Figure 2.
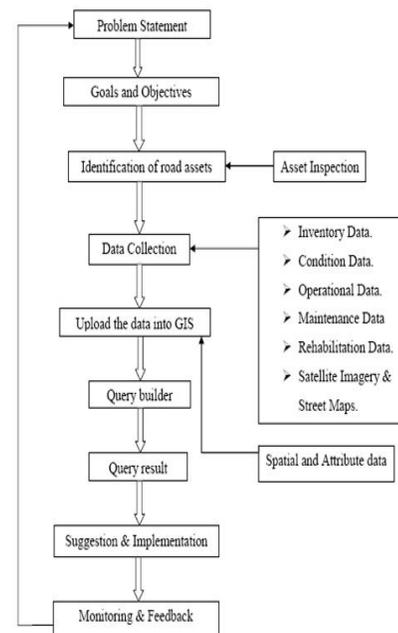
Figure 2: Research Methodology

3.1 IDENTIFICATION OF ROAD ASSETS:

Generally, the types of assets to be included in an AMS are dependent upon the administration. Typically, the system will start with the administration's major assets and over time be expanded to include other assets as data, or system capabilities, become available for them. Each road administration is responsible for the management of its own unique set of assets. Survey results showed that, in general, agencies collected data on the asset type, location, installation details, and condition.

Table 3: Type of assets and data details

Asset type	Data attribute
Roadway	➢ Road name ➢ Location ➢ ROW width ➢ Lane width ➢ Speed limit ➢ Traffic volumes ➢ Ownership ➢ Pavement condition ➢ Maintenance activities ➢ Pavement type
Drainage	➢ Dimension ➢ Type ➢ Location
	➢ Condition
Sidewalks	➢ Location ➢ Condition ➢ Surface ➢ Description
Street Lighting	➢ Material type ➢ Maintenance details ➢ Lamp location ➢ Condition
Medians	➢ Dimension ➢ Location ➢ Maintenance

Parking	➢ Location ➢ Type ➢ Capacity
Signals	➢ Type ➢ Location ➢ Maintenance details
Sign boards	➢ Location ➢ Type

3.2 DATA COLLECTION

In agreement with the findings from the literature, data collection practices varied from agency to agency. Most agencies employed some form of GPS technology in referencing assets by location. Data collection tools represented in Table 4. The inventory data collected included this location information and other general details such as asset type, geometric information and digital photographs.

Table 4: Data collection tools

Data collection tool	Number of agencies
Visual inspection	9
Contractor records	5
Capture at installation	4
Field Laptops	3
Photo/video log	3

3.3 DATABASE

Data analysis tools are important for an asset management program because their capabilities determine the extent to which the data collected can be used effectively. As shown in Table 5 the most common analysis tools reported. Effective use of data in decision making depends on the data collected and the capabilities of the analysis tools used. Geographic Information System (GIS) is said to be one of the useful tools that can be utilized to manage database in road maintenance engineering.

Table 5: Types of Database

Database/analysis tool	Number of agencies
Microsoft Excel	7
Microsoft Access	6
Oracle database system	5
ESRI ArcGIS	3
GIS Geodatabase	3
Pontis	3
SQL server/database system	3

3.4 QUERY BUILDER & RESULT

This helps to achieve a clear output and sometimes it creates new policy framework also. An effective utilization of result will be based on query builder. An example for query builder showed in Fig. 3. Finally implementation process takes place. Once the feedback get from monitoring of existing implemented system would be incorporated into the problem definition again the process will continue.
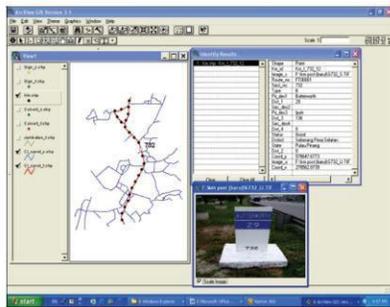
Figure 3: Example of query builder & result

FIELD WORK

Figure 4: Issues in Traffic, Parking & Pedestrian crossing in Madurai CBD

4.   RESULTS AND DISCUSSION:

Roads, though just a part of the complex transport network, are a valuable asset involving huge investment. Any asset, if managed properly, would bring back valuable returns. Hence this thesis treats every road as an asset that has the potential of bringing back monetary returns. This investigation presents overall view of Road Asset Management System. The study area was selected and issues involved were identified. The aim and objective of the project were properly defined to overcome the issues identified. An

extensive literature survey revealed several important aspects in identifying the methodology. In this investigation, research methodology has been framed with the help of literature review. The system created would prove the effectiveness of managing the road infrastructure and allow changes to be implemented at the planning phase. Hence the outcome of a database system is to be treated not as the end but a beginning. With the help of experts, professional from road sector and literature survey, the following assets are included in this investigation.

- Pavement
- Median
- Sidewalk
- Drainage system
- Lighting system
- Signals
- Parking

4.1 MANAGEMENT EFFORTS:

Most of the management efforts seemed to be in the initial or awakening stages of asset management, as defined by the maturity scale presented in the AASHTO TAM report [6]

Table 6: AASHTO TAM Maturity Scale

TAM maturity scale level	Generalized description
Initial	No effective support from strategy, processes, or tools; there can be lack of motivation to improve
Awakening	Recognition of a need, and basic data collection; there is often reliance on heroic effort of individuals
Structured	Shared understanding, motivation, and coordination; development of processes and tools
Proficient	Expectations and accountability drawn

	from asset management strategy, processes, and tools
Best practice	Asset management strategies, processes, and tools are routinely evaluated and improved

Based on this review of Asset Management Systems for the roads sector, benefits of the RAMS are immense and many. The final result will support the following other projects.

- Parking study
- Traffic management
- Congestion reduction study
- Traffic flow pattern
- Pavement types & signals
- Drainage & Lighting

4.2 IMPLEMENTATION CHALLENGE:

One of the keys to advancing asset management practices in state DOTs lies in identifying and addressing the primary barriers that hinder its development and implementation. Common challenges to asset management include institutional and organizational factors, data collection and measurement, data integration and decision making, availability of tools and analytical capabilities, and the need for training and technology transfer for workforce development. Surveys were asked to identify the major barriers faced in the development and implementation of their asset management processes [7]. In that 43 agencies responded, but multiple answers were allowed.

Table 7: Challenges to AM development & implementation

Challenges	Responses	Percent
Lack of resources (e.g. funding, equipment)	35	81%
Lack of staff	29	67%
Resistance to change	26	60%

Inter-departmental interactions	25	58%
Higher and other priorities	22	51%
Lack of expertise and training	22	51%
Staff commitment	18	42%
Executive commitment	14	33%
Staff turnover	11	26%
Availability of adequate tools in the marketplace	9	21%
Outside pressure to have a subjective approach	8	19%
Lack of guidance and support	2	5%

4.3 SUMMARY AND CONCLUSION

From the investigation, road asset management gives excellent benefits as follows.

- Road asset management system which assists in planning and prioritization of assets with its storage, transformation, analysis, modeling and reporting capabilities
- Promotes life cycle cost analysis concept, thereby opening up the avenue for innovative concepts/new methodologies with better risk management including "Maintenance free roads", "Preventive treatment methodologies for pot free roads"
- Improve users satisfaction and help in bridging the trust deficit among different stakeholders; thereby improves viability of the projects including opportunities capitalize the value addition(for PPP projects) thereby helping to bring in fresh capital in road sector
- Provide road administrations with a systematic approach

- Efficient management system
- Strategic planning within budget constraints
- Proper management of road assets
- Increased productivity of the road administration
- Creates Road information system
- Supports traffic and road management projects
- Develop Cost-Effective strategies for long term
- Provides defined level of service
- Managing risks associated with asset failure
- Customer-focused.
- Accessible and user-friendly.

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