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INVESTIGATION OF ROAD ASSET MANAGEMENT PRACTICES IN SOUTH ROAD AUTHORITY (THE CASE OF SODO DISTRICT)

Feseha Sahile Asrat[1*], Haymanot Demise Tiku[1]

[1]*Civil Engineering, Arba Minch University, Institute of Technology, Ethiopia*

**Corresponding Author's Email: feseha.sahile@amu.edu.et*

Abstract

Road asset management (RAM) is a critical function for ensuring the sustainability, safety, and efficiency of transportation infrastructure. In developing countries like Ethiopia, RAM practices face significant challenges due to the lack of appropriate tools, limited technical capacity, inadequate data systems, and insufficient coordination among stakeholders. This study investigates the current status of road asset management practices in the Sodo District under the South Road Authority (SRA) of Ethiopia. A descriptive survey design incorporating both qualitative and quantitative approaches was employed. Primary data were collected through questionnaires administered to 15 professionals, including team leaders, data collectors, and supervisors, as well as interviews and field observations. The study revealed multiple deficiencies, including a lack of digitalized systems, poor data organization, inadequate maintenance planning, limited awareness, and poor integration of management components. Statistical analysis showed weak correlations between performance monitoring and overall asset system issues, indicating gaps in implementation. Based on the findings, the study recommends adopting a modern, digital road asset management system; enhancing technical capacity through training; improving inter-agency coordination; and implementing evidence-based, proactive maintenance strategies to optimize resource use and extend asset lifespan.

Keywords: ***Road Asset Management, Sodo District, Infrastructure Maintenance, Rural Roads, Ethiopia, Data Integration***

I. INTRODUCTION

Road infrastructure plays a fundamental role in fostering socio-economic development, especially in developing countries where rural connectivity directly influences access to markets, healthcare, education, and other essential services. In Ethiopia, the expansion of rural road networks has contributed significantly to improving household income, reducing poverty, and enhancing

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resilience against environmental shocks [1]. For example, studies show that rural roads can reduce the risk of falling into poverty by up to 14.4% and increase household consumption by 16.1%, highlighting their strategic importance to national development [1].

Despite these benefits, the management of road infrastructure remains a major challenge. The Ethiopian Road sector is overseen by multiple institutions, including the Ethiopian Roads Authority (ERA), the Ethiopian Road Fund (ERF), Regional Roads Authorities (RRAs), and Woreda Roads Offices (WROs). However, these bodies often operate with limited coordination, inadequate technical capacity, and scarce financial resources[2]. Road maintenance in particular has been persistently underfunded and poorly managed, leading to the rapid deterioration of assets and significant financial losses. A World Bank report estimated that developing countries have lost over $45 billion worth of road infrastructure over the past two decades due to poor maintenance losses that could have been prevented with just $12 billion in preventive interventions [3].

The South Roads Authority (SRA), responsible for road infrastructure in the Southern Nations, Nationalities, and Peoples' Region (SNNPR), exemplifies these challenges. In districts like Sodo, road asset management is hindered by outdated practices, manual data handling, limited use of digital systems, and a lack of strategic planning. Effective Road Asset Management Systems (RAMS)—which integrate engineering, economic, and technological principles—are either poorly implemented or absent. Moreover, there is minimal alignment between data collection, project selection, and long-term planning.

This study aims to investigate the current road asset management practices in Sodo District under the SRA, identify key gaps and challenges, and propose a practical framework for improvement. Through field observations, surveys, and interviews, the research explores how RAM components such as asset inventory, condition assessment, performance monitoring, and program optimization are currently applied and what measures are necessary for effective and sustainable infrastructure management in the region.

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II. RESEARCH METHODOLOGY

A. Description of the Study Area

The study was conducted in the Wolayta zone of Ethiopia, as shown in Fig.1 and the Sodo district was one of the twelve (12) districts under the South Roads Authority. Although, Sodo District was administered 33 road construction sites. The study areas of both Road Construction Sites were namely, Areka-Bombe, 19.6km, and Boditi-.Badessa, 17 km. The zone is located 300 km south of Addis Ababa and about 155 km southwest of the Southern Nations, nationalities, and Peoples Region (SNNPR) state capital of Hawassa and geographically located at 6°54' N latitude and 37°45' E longitude with an elevation between 1600 and 2100 meters above sea level. The climate of the location is Weina Dega with annual rainfall of 800 to 1200mm. The annual mean temperatures also vary between 24°c and 30°c during the day and 16°c to 20°c at night all year round. Based on the 2007 census conducted by the Central Statistical Agency of Ethiopia (CSA), this zone has a total population of 5,473,190; with an area of 4,208.64 square kilometers. Wolayta has a total population of 356,670. Of these, 172,514 (11.49%) are urban inhabitants, and an additional 1,196 (0.08%) are pastoralists [4]. Wolayta has 562 kilometers of roads managed by the South Roads Authority and 669 kilometers of URRAP roads managed by the Wereda Roads Authority. It has an average road density of 292 per 1000 square kilometers.

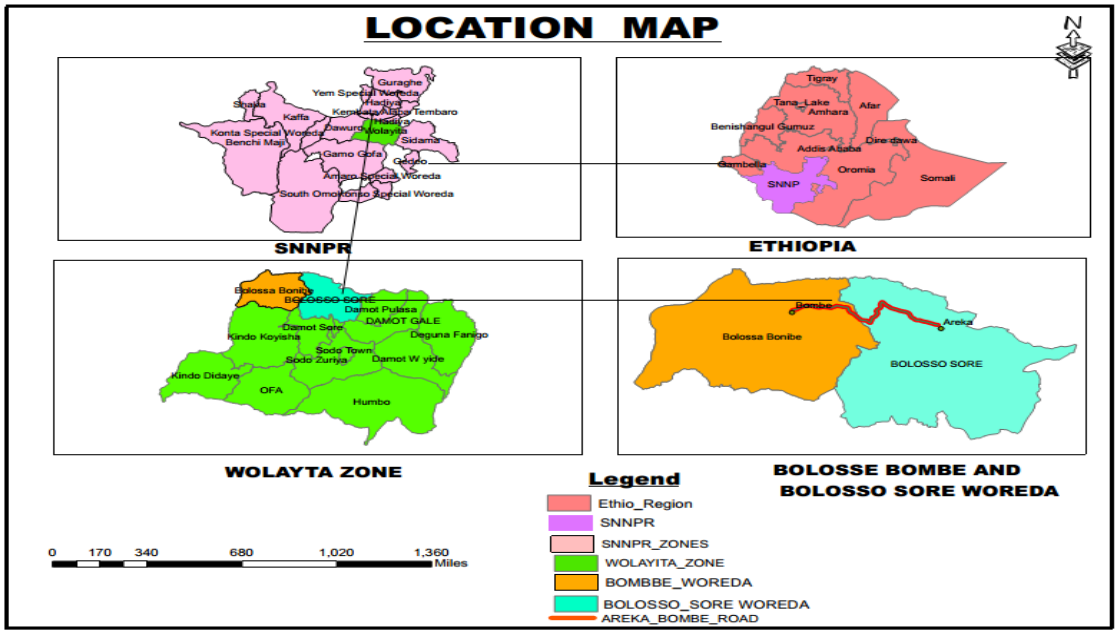

Fig.1: Study area location map

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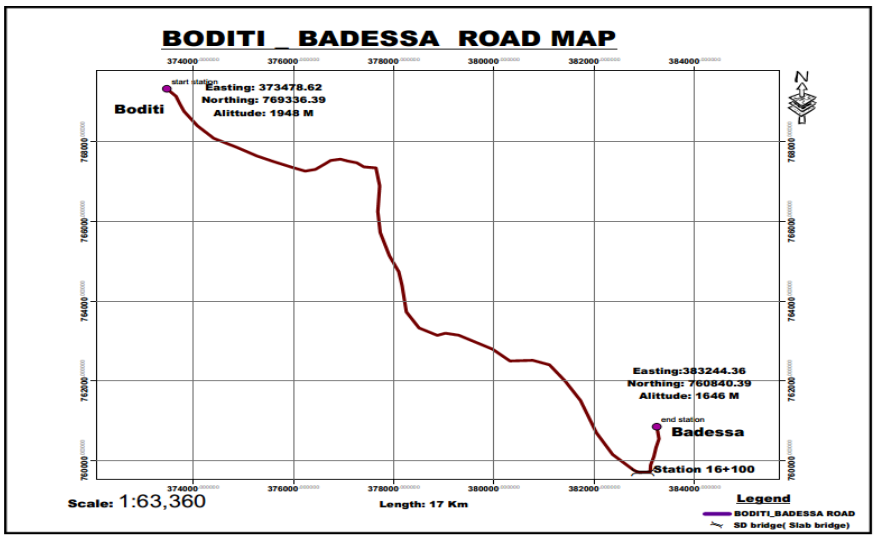


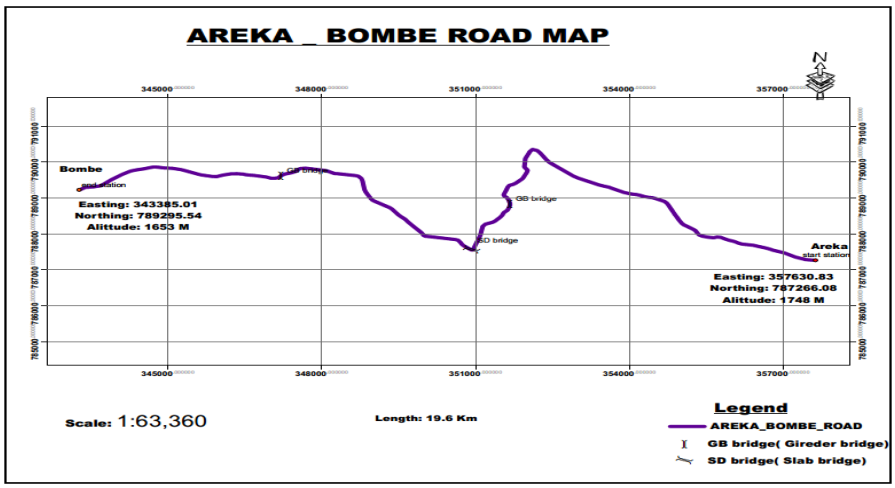
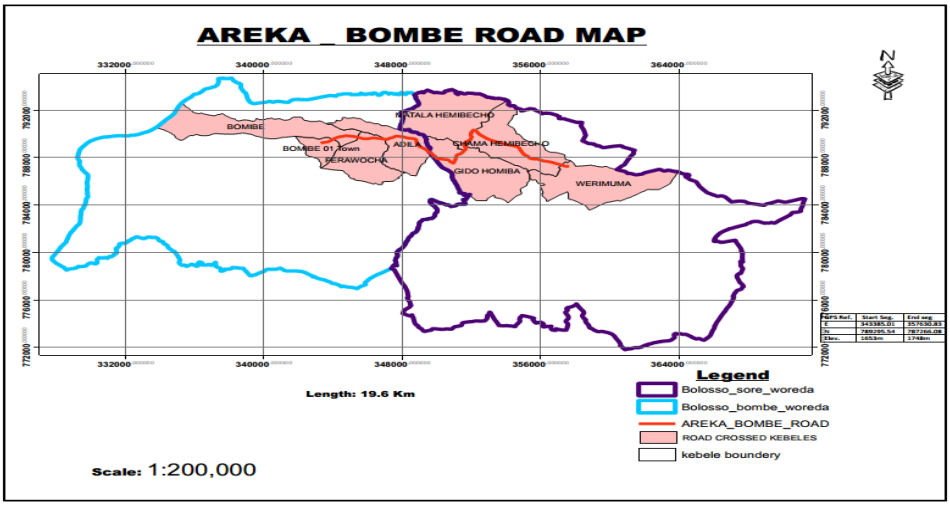


Fig. 2: Study area road alignment map



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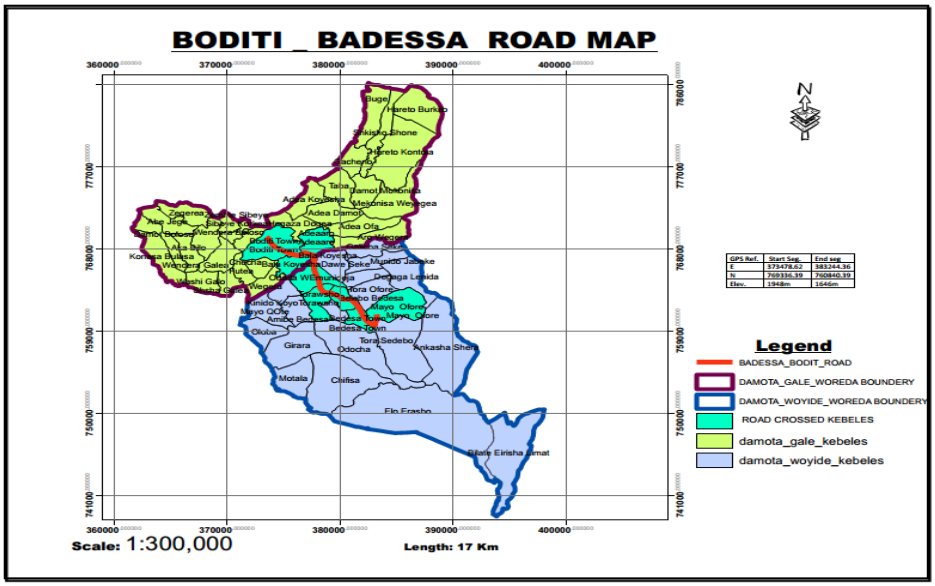

Fig. 3: Study Area's Crossing Kebles Network Map

B. Research Design

According to Creswell (2008), there are three types of research design. These are descriptive, exploratory, and explanatory research designs. The research design used for this research is descriptive since it provides an accurate and valid representation of variables that are relevant to achieving the main goal of this research and answering the research questions.

C. Target Population

The targeted populations were pertinent government organizations in the road sector in Ethiopia, such as the South Roads Authority (SRA), Sodo District.

D. Sampling Techniques

The sampling techniques used to select representatives of the population were purposive and snowball sampling. Snowball sampling focuses on asking people who have participated in a survey to nominate other people they believe would be willing to take part.

Accordingly, the questionnaires were distributed to all asset management professionals (Team Leaders) and data collectors working in the Road Asset Management Directorate in Sodo District purposively. Whereas, the interview was made using the snowball sampling method to team leaders and construction supervisors only. So, this will make it free from bias since the population is very small.

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E. Data collection tools

Based on the focus of the study, the primary data was collected using instruments such as semi-structured interviews, questionnaires, and different tools such as GPS and Tape meters on the field for manual observation.

1)**Questionnaire Design**: The questionnaire design was based on a combination of an extensive review of literature dealing with Road Asset Management. Questions were developed from the information gathered from the literature and on best practices of Asset Management supplement to achieve the research objectives. The questionnaire form is accompanied by a cover letter. The questionnaire survey mainly contains close-ended questions because close-ended questions were often easier and quicker to record and code the responses obtained from the respondents. They are also easier and quicker for the respondents to fill (Yes/No) the responses. The questionnaire is categorized into two sections. The first section is the Organization and Respondent's position about general agency information on asset management decision levels, and decision processes. The second section is about Self-Assessment Performance Evaluation (District Level) and asks for information regarding data collection, management, and integration and their relation to the project selection decision level of Roadway Assets, and the questionnaire focused on factors affecting the implementation of asset management. Limited numbers of open-ended questions were also included in the questionnaire because open-ended questions allow respondents to include additional information including feelings, attitudes, and understanding of the subject, and enable them to raise new issues. This allows the researcher to better access the Respondents' true feelings on an issue under study and to access extra information from them.

2)**Interview**: Information on research questions and objectives was requested from key informants to deepen understanding of the data gathered through the questionnaire. The purpose of the interview was to assess the practices and perceptions of key informants on Asset Management System practices. More efforts were made to identify additional problems that were not identified through the questionnaires and to increase the accuracy and reliability of the challenges obtained through the questionnaire.

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F. Data Sources

Both primary and secondary sources of data were used to get ample information about the Investigation of Road Asset Management Practices in Sodo District. The primary sources were to get firsthand information. The primary sources were Interviews with the manager of the road district, professionals/ team leaders, and experts at the district and survey questionnaires filled by those that have direct involvement in the work.

The secondary source was used to strengthen the primary sources of data. The secondary sources were second–hand information which included Wolayta Zone's and Woreda's different documents such as annual reports, journals, articles, reference materials, various books, other published and unpublished sources, and relevant documents. They were used to fill the inadequacies and insufficiencies of the data and to make the study more reliable.

G. Data Analysis Techniques

The study employed a combination of both descriptive and inferential statistical techniques to analyze data collected from the sample respondents. The data were coded and entered into SPSS version 20 for statistical analysis. This information was used to substantiate and enrich the findings from the quantitative analysis of the structured questionnaires. Data analysis requires a cumulative skill, especially statistical analyses and correlation analysis. Quantitative data was collected by questionnaire and was categorized, classified, tabulated, coded, and entered into a computer for analysis. In this case frequency and descriptive statistical analysis were carried out through cross-tabulation whereby percentages and frequencies were computed. Correlation analysis is employed to test whether significant effects between the independent variables (variables like Performance Monitoring) and dependent variables (variables like overall asset System problem which are expected to be influenced by the independent variables). In this regard, a correlation analysis model was employed to analyze the overall effects of the variables.

III. RESULTS AND DICUSSIONS

A. Response Return Rate

For this research, a total of 18 questionnaires were distributed to purposively selected respondents, including professionals, team leaders, and employees from the district Road Authority's engineering office. Of the 18 distributed questionnaires, 15 (83.33%) were completed and

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returned, as shown in Table I. This indicates the importance of thoroughly cross-checking the gaps in the current Asset Management Practices within the Sodo Road District Office.

TABLE I: Distribution of questionnaires and response rate

Respondents	Total Distributed Questionnaires	Returned Questionnaires	% of valid/ returned questionnaires
Asset Management professionals/ team leaders	15	12	66.67
Data Collectors	3	3	16.67
Total	18	15	83.33

B. Demographic Characteristics of Respondents

TABLE II: Educational background of respondents

Educational Status	Frequency	Percent	Valid Percent	Cumulative Percent
Diploma	1	6.7	6.7	6.7
Degree	13	86.7	86.7	93.3
Master's	1	6.7	6.7	100.0
Total	15	100.0	100.0	

As shown in Table II, the educational qualifications of the respondents were as follows: 6.7% held a diploma, 86.7% held a bachelor's degree, and 6.7% had a master's degree. Based on the data gathered, it is evident that the current workforce is neither sufficient in number nor adequately qualified to effectively manage the district's road assets systematically. Academic qualification is a key criterion for establishing a proper and standardized digital asset management system, and the existing manpower falls short of meeting this requirement.

Here, we have seen that degree-level employee professionals in the district were not upgrading their educational statuses to master's and above levels. Practically, there was no best framework-based standard and digitalized asset management system practices as compared to regional, national, and international levels on the road network asset management practice in the Sodo district. Therefore, the educational background of professionals affected the road asset management system practices.

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C. Field of Specialization of Respondents

The introduction of Road Asset Management Systems (RAMS) in developing countries presents unique challenges that need to be addressed along with possible approaches to resolve them. RAMS is not included in the undergraduate civil engineering curriculum in the universities and technical institutes of these countries, except for some postgraduate programs. One reason for this is that RAMS involves not only civil engineering, but also other disciplines such as Information Technology (for Programming and Database Management Systems), Geographic Information Systems (GIS), and Mathematical Modeling. This article selected the respondents from this field to discuss the concepts and components of a modern RAMS, as well as its use and application by road agencies. It can help in exploring the challenges and solutions in implementing RAMS in these countries. Several authors have covered various dimensions of the multidisciplinary aspects of RAMS, which is expected to become an essential component of road agencies shortly [4].

TABLE III: Educational background of professional respondents

Educational Background	Frequency	Percent	Valid Percent	Cumulative Percent
Surveyor	2	13.3	13.3	13.3
Civil Engineer	13	86.7	86.7	100.0
Total	15	100.0	100.0	

As shown in the above table, 13.3% of the respondents were surveyors and 86.7% were civil engineers. Therefore, condition surveys of the road assets from the field were not proper and not sufficient. Because there was a lack of surveyors in the district, i.e.13.3% of the total respondents, it negatively influenced the district's current practices of the road asset management system.

D. Experience of the Respondents

TABLE IV: Respondents' experience

Respondents' experience	Frequency	Percent	Valid Percent	Cumulative Percent
3-5 years	6	40.0	40.0	40.0
5-10 years	8	53.3	53.3	93.3
above 10 years	1	6.7	6.7	100.0
Total	15	100.0	100.0	

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The research responses show that 40% of the respondents have worked 3 to 5 years; 53.3% worked 5 to 10 years; and 6.7% have worked over 10 years. So, in the district, the professionals were not well experienced.

E. The Respondents' Position

TABLE V: The respondents' position

Respondent's Position	Frequency	Percent	Valid Percent	Cumulative Percent
Road asset management project manager	1	6.7	6.7	6.7
Asset management professionals/team leaders	11	73.3	73.3	80.0
Data collectors	3	20.0	20.0	100.0
Total	15	100.0	100.0	

Regarding positions of staff professionals on the district level, 6.7% were Road Asset Management Project Managers while 73.3 % were Asset Management Professionals/Team Leaders. The remaining 20.0% were Data Collectors. Although the educational background is good status in the district with one Master's degree holder and the professionals having degree level qualification in civil engineering, there were problems or gaps currently because road asset management practices and asset management systems were not modernized technologically. For practically managing the road assets well, the basic method was collecting the road assets data from the field properly. However, this did not happen sufficiently in the Sodo district.

F. Assessment of Current Road Asset Management Practice

This section discusses the current practice of road asset management practice in the south region's Sodo district as shown in the table below.

TABLE VI: Asset implementation in Sodo district

Yes	2
At planning phase	8
Don't know	5
Total	15

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For the question asked to describe road asset management implementation in the Sodo district, 2 responding professionals, team leaders, and data collectors responded that there is implementation of road asset management in the Sodo district. 8 professionals, team leaders, and data collectors responded that the road asset management implementation is still adopted at the planning phase. About 5 respondents don't know about road asset management implementation in the Sodo district. Based on the responses obtained about road asset management adoption, most of the responses show that road asset management is not well adopted in the Sodo district. It can be noted that road asset management teams in road asset management systems have not been utilized, the most predominant ones among them being: - pavement, bridge, and maintenance management systems. Other systems include safety (SMS), and congestion (CMS) management systems. Furthermore, most of the responding professionals revealed that the level of integration of these individual systems within an overall asset management framework does not yet exist.

In addition to road asset management implementation in the Sodo district, respondents were asked to rate the components of the asset management system. After an extensive literature review, the components of asset management systems like goals and policies, asset inventory, condition assessment, performance monitoring, alternatives analysis/program optimization, short/long-range plans, and program implementation of Asset Management Systems were identified. The respondents were asked about their awareness of these and whether they have adopted them in the Sodo district.

TABLE VII: Asset management component rating

Components of Asset Management	Percentage of rating			
	Low	medium	High	Very high
Goals and policies	63.5	20.32	9.68	6.5
Asset inventory	60.5	23.32	9.68	7.5
Condition assessment	62.5	21.32	9.68	6.5
Performance monitoring	61.5	19.32	11.68	7.5
Alternatives analysis/program optimization	62.5	20.32	10.68	6.5
Program implementation of asset management systems	61.4	22.32	9.68	6.6

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As can be noted from the above table respondents rate the goals and policies component 63.5% as low, 20.32% as medium, 9.68 as high, and 6.5 as very high. For asset inventory respondents rated it 60.5% as low, 23.32% as medium, 9.68 as high, and 7.5 as very high. The condition assessment component is rated 62.5% as low, 21.32% as medium, 9.68 as high, and 6.5 as very high. Performance monitoring is rated 61.5% as low, 19.32% as medium, 11.68 as high, and 7.5 as very high while program optimization is rated 62.5% as low, 20.32% as medium, 10.68 as high, and 6.5 as very high. The program implementation of the asset management system is rated 61.4% as low, 22.32% as medium, 9.68 as high, and 6.6 as very high.

In addition to rating the components of asset management, respondents are asked to define their decision-making level in road asset management of the Sodo district. It indicates they have not explicitly defined levels in line with the criteria as defined in the literature. The main identified levels were programming and budgeting. This confirms that the organization had primarily focused its attention on the intermediate levels- mainly programming and budgeting- which serve as a bridge between the broad strategic decisions made at the strategic level and their execution at the project implementation level.

G. Correlations between Overall Asset System Problems and Performance Monitoring

Taking care of roads is important to make sure they stay in good shape. Road asset management is all about keeping track of the roads and making decisions about what needs to be fixed or replaced. Right now, most of the data about the condition of the roads is collected and analyzed by people, which can take a long time. Researchers look at three main things when they collect this data: what kind of information they collect, what parts of the road they look at, and how much information they get. Then, they evaluate these categories based on how accurate the information is, how efficient it is to collect, how much it costs, and how much it improves the current way of doing things. But even with all these methods, they found that monitoring the condition of the roads is not very efficient, and none of the methods looked at solving the problem completely i.e., the mentioned problem in this study was overlooked [5].

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TABLE VIII: Correlations b/n overall asset system problem vs. performance monitoring

		Overall asset system problem	performance monitoring
Overall asset system problem	Pearson Correlation	1	-0.055
	Sig. (2-tailed)		.845
	N	15	15
performance monitoring	Pearson Correlation	-0.055	1
	Sig. (2-tailed)	.845	
	N	15	15

As shown in the above Table VIII, correlations between overall asset system problems and performance monitoring of road assets management system responses were gathered from respondents' questionnaires and computed. However, both variables were negatively correlated with a -0.055 value. This result showed there is a great gap in the overall asset management system and performance monitoring of the road assets management system in the Sodo District.

H. Planning to Implement an Asset Management System for the Respondents

In recent years, there has been increasing attention on the investment and performance of highway infrastructure. The current financial challenges and higher public demands have led local highway authorities to reconsider how they manage their infrastructure. Both central and local governments have to find ways to improve the management of highway infrastructure assets through long-term planning. Our society and economy rely on various infrastructure assets, such as water supply, waste disposal, energy, telecommunications, and transportation. These assets are crucial in modern society and require significant investment for development and maintenance. By adopting an asset management approach, resources can be used more efficiently and effectively. This approach also ensures compliance with legal obligations, meets stakeholder needs, and safeguards the engineering integrity of the network.

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TABLE IX: Respondents' plan to implement an asset management system

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	8	53.3	53.3	53.3
No				
Not sure	6	40.0	40.0	93.3
Total	1	6.7	6.7	100.0
	15	100.0	100.0	

53.3% of the respondents were planning to implement an asset management system, 40% were not planning to implement and 6.7% were not sure to implement a road asset management system. This shows that there was not enough asset management system implementation due to the plan in the road district.

I. Causes of Problems Arising in Asset Management Implementation

Road asset management is a systematic process that involves maintaining, upgrading, and operating assets. It combines engineering principles with sound business practices and economic reasoning, as defined by the OECD. This activity is carried out by road authorities and involves balancing costs, risks, and performance. It includes tasks such as data acquisition, data analysis, and resource and budget planning. Pavement managers today face the challenge of meeting transportation needs with limited resources. Additionally, legislative bodies have placed greater demands on highway agencies, requiring more accountability for the use of taxpayers' money. As a result, the importance of management systems has become even more significant. Several studies have highlighted the need to consider the environmental impact of road maintenance and operation in the asset management process. This includes factors such as congestion, noise, and pollution. Furthermore, when choosing between different maintenance strategies, road operators should also consider the impacts on socio-economic life. In recent years, new measurement systems have been developed to provide more accurate information about the condition of road assets at traffic speed. These advancements improve the accuracy of measurements and provide additional data for decision-making [6].

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1) Organizational Challenges:

TABLE X: Organizational challenges

	Frequency	Percent	Valid Percent	Cumulative Percent
Very low	2	13.3	13.3	13.3
Medium	7	46.7	46.7	60.0
High	6	40.0	40.0	100.0
Total	15	100.0	100.0	

Of the causes of problems arising in asset management implementation, 13.3% are very low, 46.7% are medium, and 40% are high challenges in the organization or district. Therefore, this result shows that the asset management implementation in the road district was poor and below the standard qualified level.

2) Financial challenges:

TABLE XI: Financial challenges

S	Frequency	Percent	Valid Percent	Cumulative Percent
Medium	3	20.0	20.0	20.0
High	7	46.7	46.7	66.7
Very high	5	33.3	33.3	100.0
Total	15	100.0	100.0	

Indeed, from the respondents' responses to returned questionnaires, financial challenges were 46.7% high and 33.3% very high respectively. This shows that there was an insufficient budget allocation for the maintenance of the road asset management system. So, the road asset valuation management practice in the Sodo district was not good or very poor**.**

3) Political awareness:

TABLE XII: Political awareness

	Frequency	Percent	Valid Percent	Cumulative Percent
Very low	1	6.7	6.7	6.7
Low	2	13.3	13.3	20.0
Medium	5	33.3	33.3	53.3

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High	6	40.0	40.0	93.3
Very High	1	6.7	6.7	100.0
Total	15	100.0	100.0	

In the Sodo district, the employers in different administration and technical professions departments were not awarded politically. This was why they did not care about politics depending on the interrelation between the road asset management practice performance goal and political awareness.

4) Integration problem:

TABLE XIII: Integration problem

Frequency	Percent	Valid Percent	Cumulative Percent
1	6.7	6.7	6.7
5	33.3	33.3	40.0
3	20.0	20.0	60.0
5	33.3	33.3	93.3
1	6.7	6.7	100.0
15	100.0	100.0	

As shown in the above result, there was a high integration problem in the Sodo district. Different employees in the district did not do their activities together in an integrated manner.

5) Overall asset system problem:

TABLE XIV: Overall asset system problem

	Frequency	Percent	Valid Percent	Cumulative Percent
Low	1	6.7	6.7	6.7
Medium	9	60.0	60.0	66.7
High	4	26.7	26.7	93.3
Very high	1	6.7	6.7	100.0
Total	15	100.0	100.0	

Overall asset system problems in the road district were medium or 60% and high or 26.7%, respectively. This shows the road district had difficulty correcting and reducing managing of overall asset problems for a long period in their current practice without the use of digitalized and modern technology.

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6) The results of the condition assessment and other roads recorded in a computerized RAM system:

TABLE XV: Results of the condition assessment and other recorded in a computerized ram system

	Frequency	Percent	Valid Percent	Cumulative Percent
YES	6	40.0	40.0	40.0
NO	9	60.0	60.0	100.0
Total	15	100.0	100.0	

Based on the result in above Table XV, 60% of the respondents responded saying 'No' to the condition assessment and other roads recorded in a computerized RAM (Road Asset Management) system in the Sodo district. This shows it was not good and is insufficient.

J. South Road Authority in Case of Sodo District Field Observation

Field observation is a variant of field research that attempts to observe a targeted person or a group of targeted persons in their environment to gain insights into behavior, activities, and processes.

1) Boditi to Badessa Road: Fig.4 Boditi to Badessa road field observation shows road asset management practice in the area is below the level expected. Roadside ditches have not been cleaned and maintained at the time. Roadway potholes have not been patched and maintained for mobility. The roadway cumber slope is not constructed well and adjusted to drain water from the road to the side drain. Overall road assessment management in the study area is below the standards.

Fig.4: Road condition survey of Boditi to Badessa

(Source: own Field survey, 2023)

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According to the field observation data, as demonstrated in the above figures, the Boditi to Badessa road and its minor drainage structures were not suitable and stable for the use of transportation systems although motor bicycles were used on the road for transportation most of the time. The road asset management system was not maintained for a prolonged time properly. For three years, there were no maintenance programs with an absence or inadequate funding budget from a higher hierarchy level. So, the road set valuation practice currently was poor or not in good status.

1) Areka to Bomebe Road: Figure 5 illustrates the field observation along the Areka to Bomebe Road, indicating that road asset management practices in the area are below the expected standard. Roadside ditches were cleaned and maintained at the time of inspection. Potholes on the roadway had been patched to ensure mobility. The roadway camber slope was properly constructed and effectively directed water toward the side drains. Overall, the field survey suggests that road asset management in the study area is approaching acceptable standards but still requires improvement.

Fig.5: Road condition survey from Areka to Bomebe

(Source, Field survey, 2023)

According to the above field observation Fig. 5, the road asset management practices were good compared to the Boditi to Badessa road. Because, the road took maintenance with available budget funding frequently, Bajaj, Isuzu, and Buses were used on the road comfortably.

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K. Best Framework for Road Asset Management for South Roads Authority, Sodo District

An integrated and holistic approach to road management is needed to align funding, management systems, and procedures. The Road Asset Management System (RAMS) is a powerful tool for achieving optimal road conservation while minimizing costs. RAMS combines engineering principles with business practice and economic rationale and includes digital tools for decision-making. Implementing RAMS benefits decision-makers, road authorities, funds, and road users by improving asset performance, allocating funds efficiently, reducing costs, improving road conditions, increasing safety, and reducing environmental impacts.

Road asset management involves analyzing various road data including inventory, condition, traffic, unit costs, and road deterioration models. This data is entered into a Road Asset Management System (RAMS) for analysis, helping determine optimal budget levels and allocations. The term "framework" encompasses the processes, procedures, support systems, organizational roles, responsibilities, and policies required to facilitate asset management decisions. The five core components of asset management are asset inventory, level of service (LOS) which defines performance expectations, critical assets, revenue structure, and an improvement project plan.

The four-step guideline for RAMS implementation

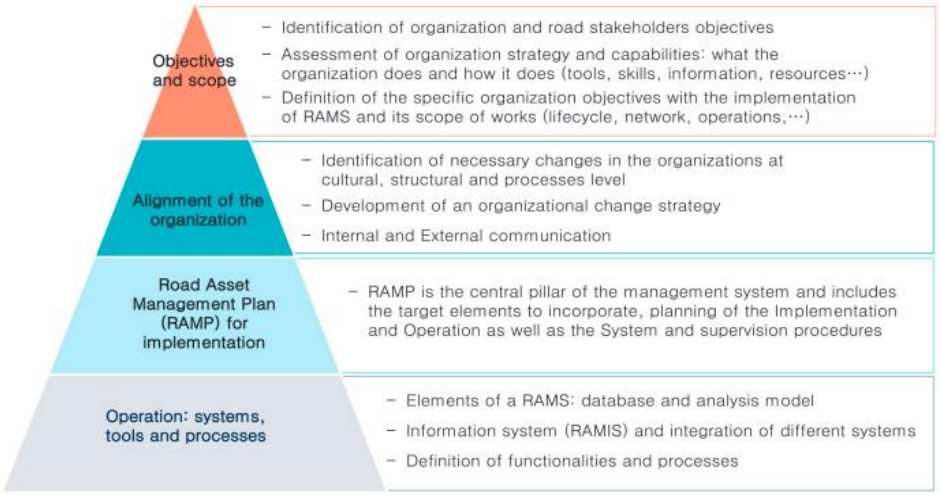

Fig. 6: RAMS implementation guidelines

Source: Framework for the implementation of Road Asset Management System 2023

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IV. CONCLUSIONS

The main objective of this thesis is to study the Road Asset Management (RAM) and the existing practices taking the Sodo district as a case study and making recommendations by preparing frameworks based on the findings. Organizational challenges, financial challenges, political awareness, overall asset management system, performance monitoring, condition assessment, planning of implementation of asset management, and professional competency were the major causes of problems identified for road asset management practice in the Sodo district.

Based on the research assessment the researcher concluded:

- There is a lack of asset management components implementation practice in its adequate form or sense in the Sodo district. The implementation stage of an asset management system is still at the planning stage. Most of the individual management systems have not been utilized, data collection decisions were not based on the standards and input needs of management systems or processes behind the rationalization of data collection. The Sodo district does not still formally identify and document existing links between the data they collect and the project selection decisions they support. The main problems faced in applying asset management practice are a lack of an organized asset management department, lack of professional employers, inadequacies of digitalized asset management system, and absence of short courses to acquire state-of-the-art techniques of road asset management.
- Therefore, this study strictly underlines the necessity of well-defined government road asset management policies, regulations, and strategies as the basis for better road asset management which treats roads as capital assets of both the nation and the study area. Moreover, the study tries to come up with a rational solution for a modern asset management system by investigating the current road asset management system in the study area and then recommending a better way of road asset management for the sustainable social and economic development of the districts as well as the region.
- Furthermore, the study recommends the best framework for decision-makers on how to make quality decisions between alternative maintenance strategies. Also, road operators at different levels should take into consideration the impacts of poor road asset management on the socio-

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economic life of their society. An integrated and holistic approach to road management is needed to align funding, management systems, and procedures.

- Moreover, the study presents relevant topics and future challenges for Road Asset Management. It also summarizes the latest issues related to road infrastructure maintenance and outlines new themes for future research.

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