



CHAPTER I

INTRODUCTION

1.1 Background

Among Asian countries, Lao PDR has one of the most undeveloped road networks. With a few exceptions, recent road improvement works have mainly been focusing on establishing a primary road network. Given that Laos is a poor country and investment funds are limited, a proper selection of projects is essential to maximize the impact of the scarce investment funds.

Road inventory data in Laos are collected and maintained by different groups within the transportation community. Currently, Ministry of Communication Transport Post and Construction (MCTPC) in Lao PDR has constructed the Road Management System (RMS). RMS is a tool that analyzes physical attributes of roadway as well as the current road inventory, condition of roadway, pavement and ride quality. The information derived from the RMS is used to make recommendation regarding to the best way to maintain and preserve county roads. The application has developed the equipment specifically to be utilized in the field data collection process and design for seamless integration into the existing MCTPC database.

The information technology application is very useful in data collection in remote field locations, especially in developing countries such as Lao PDR. Road inventory and maintenance are performed on the basis of GIS (Geographic Information Systems) relying on geo-referencing and content information about the road conditions. There is an urgent need to develop a simple method for inspection data collection of the road inventory, which will assist in planning and providing a variety of facilities.

In this research study, we propose a mobile inspection system based on a handheld device, GPS receiver, a camera and standard mobile GIS software. A handheld inspection is the result of recording continuous attributes of the roadway. This research study presents the role of Personal Digital Assistance (PDA) in remote field data collection and in management of roadway inventories data by utilizing ArcPad 6 and ArcPad Studio6.0.1 with GM-270-ULTRA's GPS receiver.

With the ArcPad and ArcPad Application Builder with GPS receiver, roadway inventories data such as location referencing point, classification, node, link, number of lane, and geometric road characteristics can be collected. These data include road condition such as pavement conditions, shoulder conditions, right of way conditions and GPS coordinates. The study focuses on the advantage of technology including increasing the quality of data, the customized application, and the integration process of data collection and establishing and developing the roadway inventories system by using handheld mobile inspection with ArcPad and GPS receiver to improving field inspection process and road inventory database in Lao PDR.

1.2 Problem Statement

For many years up to now the Ministry of Communication Transportation Post and Construction (MCTPC) in Laos use traditional data collection method, which typically records data by paper form with pencil and transfer them into the database on a PC computer. This method is time consuming, labor intensive, vulnerably erroneous and inaccurate. Plus, it is not efficient, out of date, incorrect, poorly managed and difficult to update data.

Nowadays the advanced handheld inspection like Personal Digital Assistance has become more sophisticated in to remote field location. Therefore, this research study will develop handheld PDA equipment with touch screen for input data combined with GPS receiver to record road attribute data and to improve the quality of data. This is a new version of application mobile inspection to record roadway

inventory data in the remote field for improvement and development and will be applied in Lao PDR to support the Road Management System (RMS).

1.3 Research Objectives and Scope of the Study

This research limits its focus to information management in the roadway inventory and condition inspection process. The objective of this research study is to develop mobile inspection for the field data collection and application and to update standard roadway inventory for MCTPC in Lao PDR. Taking advantage of handheld mobile computing and satellite technologies, the system will allow both attribute and image data to be entered or captured in the field and saved directly into a GIS database, thereby, eliminating the labor-intensive task of processing redundant data whereas developing and updating a prototypical of roadway inventories and roadway condition system.

The key research objectives and current research's scope involve:

- (1) Developing a method and handheld PDA equipment combined with GPS receiver to improve the quality of roadway inventories and the roadway condition data at remote field locations
- (2) Improving the efficiency, timeliness and accuracy of the inspection process at the remote field location
- (3) Facilitating easy acquisition, transference, archive, query, and distribution of roadway inventory data from mobile inspection process to the database

1.4 Research Procedures

This study can be divided into seven tasks as follow:

- (1) Study the role of Personal Digital Assistance (PDA) combined with Arcpad and Arcpad Application Builder software and GPS receiver
- (2) Study the fundamental of collecting roadway inventory and condition data at the remote field
- (3) Develop roadway inventory data model and Geo-database for use with PDA
- (4) Conduct a case study on national road (Rd No 13) in Laos
- (5) Discuss the advantages and disadvantages of field data collecting using PDA
- (6) Suggest and recommend road inventory data collection techniques
- (7) Summarize and prepare the thesis

1.5 Research Outcome and Contribution

The expected outcomes and contribution from the current research study can be described as follows:

- (1) To improve the research on using Personal Digital Assistance (PDA) to collect the roadway inventory at the remote field
- (2) Information acquisition, the means, methods and picture for roadway inventory data collection in the remote field location

- (3) The ability to improve inspections of roadway inventory data by using mobile inspection computers
- (4) Expectedly, the proposed system can be implemented and used in the real-time application at remote field location
- (5) Conclude the advantage and disadvantage of handheld mobile inspection compared to the traditional methods
- (6) Provide recommendation for implementation and continuation of the research

1.6 Chapter Organization

This research study contains the evaluation criteria of using Personal Digital Assistance (PDA) for roadway inspection and using information technology to build road inventory system in Laos PDR, and is dividing into the following chapters:

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| Chapter I | <i>Introduction:</i> provides and gives an overview of road inventory system in Lao PDR, and the context in which mobile inspection can be applied |
| Chapter II | <i>Literature Review:</i> contains a summary of the available literature on mobile inspection using ArcPad application |
| Chapter III | <i>Fundamental Techniques for Mobile Inspection Devices:</i> provides an overview introduction to the theory and application of fundamental technique for mobile inspection devices. Data requirements and procedures of mobile inspection are described in this chapter |

- Chapter IV *Research Methodology:* contains research methodology and procedure of fundamental techniques for PDA mobile inspection. Road inventory attributes from developed ArcPad application are discussed
- Chapter V *Field Data collection:* provides methodology and procedural guideline for field data collection based on inspection field data collection. This chapter also provides a practical experiment on national route 13N from Vientiane to Luangprabang province
- Chapter VI *Discussion and Conclusion:* provides discusses the summary finding and recommendations from the study