ISSN 2349-6193
Impact Factor: 2.805

IJESMR

International Journal OF Engineering Sciences &Management Research

STUDY ON LOCATION INFORMATION SYSTEM FOR ROAD MANAGEMENT

Sungpil Shin*
*Korea Institute of Civil Engineering and Building Technology, 10223, Korea

Keywords: *Linear Reference System, Road Management, Location Information*

ABSTRACT
The basic purpose of road location information management is to effectively manage and use the location of road and road facilities. From the viewpoint of the road manager, it is the main purpose to easily identify the location of the road facilities to be managed and to facilitate information transmission between the managers. For the driver who uses the road, it is easy to know his / her position on the road or on the road, and to transmit the positional information to each other easily and accurately when informing his / her own position. In addition, the system administrator who operates the road related system can easily and accurately update the data when the linearity of the road is changed or the extension is changed, or when the location of the managed road facility is changed. Especially, the road location information management system in the autonomous road transportation system is indispensable. Although it is easy to collect coordinate information based on the global geodetic system of GPS according to the spread of smart phones, it is difficult to intuitively recognize the position of the user expressed in numbers, and sharing or transmitting position information is not an effective method. Therefore, in this study, we analyze the characteristics of roads and discuss road location information management system that can satisfy road managers, road users, and system administrators at the same time.

INTRODUCTION

Background
As the economic growth of the nation and the exchange of human and material resources have increased, the importance of the road as a national infrastructure has been greatly emphasized. In the Republic of Korea, the total number of the national highways, which are the main roads, is 56, which increased from 12,413.4km in early 2000 to 13,976.6km in 2016. More than 250km per route on average. In addition, maintenance costs incurred in the management of roads are very expensive.

However, in spite of such long routes and enormous road management costs, there is little systematic management of location information that can notify a reference location or road location for road management. Since there are different administrative bodies according to administrative districts in general national roads, different management methods are applied to each management subject, so there is a great difficulty in integrated data management and data exchange of mutual position information.

The Ministry of Land, Infrastructure and Transport(MOLIT) has developed a variety of projects including Pavement Management System(PMS), Bridge Management System (BMS), Traffic Monitoring System (TMS) and Slope Management System We develop and operate road related systems. However, the systems are developed and operated independently of each other, and the location information management methods for the road facilities are different from each other.

Objective
Therefore, in order to efficiently manage roads and systematically maintain roads, it is necessary to precede the construction of Linear Referencing system. In this paper, we propose a method to manage the location information by dividing the route based on the boundary of the administrative area and installing a distance meter (Kilometer Post) and using it as a reference location. Based on this analysis, the kilometer post was applied to the road site, and the analysis result of the operation result was used to establish a section for each management route of each national route. In this paper, we propose a location information management method that sets and operates the same interval as the destination name of the distance table within each interval.

ISSN 2349-6193
Impact Factor: 2.805

IJESMR

International Journal OF Engineering Sciences &Management Research

DEVELOPMENT OF NATIONAL ROAD LOCATION INFORMATION MANAGEMENT MODEL

Characteristic Of National Highway And Management System

As the traffic volume increases and the urbanization area expands, the national roads are actively being improved and newly established. Therefore, in the case of general highways, there is a need for a method that can appropriately cope with the change of the route that occurs frequently. It is desirable for ordinary drivers to be provided with information such as the name of the route, the place name, and the distance necessary for driving. In addition, in terms of road management, national roads should be developed in a way that can cope with the change of administrative districts because the road management subjects are changed according to administrative districts.

In order to reflect these characteristics, the following points are proposed.

1. Set interval

As mentioned above, general national roads are divided into administrative bodies for each administrative district. Therefore, in principle, each route of the national highway should be managed by setting a section based on the jurisdiction of the road management subject.

2. Small section setting

In principle, it is a principle to set and manage the same kilometer post as one small zone based on the short name of the road sign in the zone established based on the jurisdiction of the management subject.

3. Install Kilometer Post

The national highway is divided on the basis of the jurisdiction of the road management subject of each route, and a kilometer post is installed every 1km by applying the distance to the origin road table in the running direction for the ascending and descending of each section.

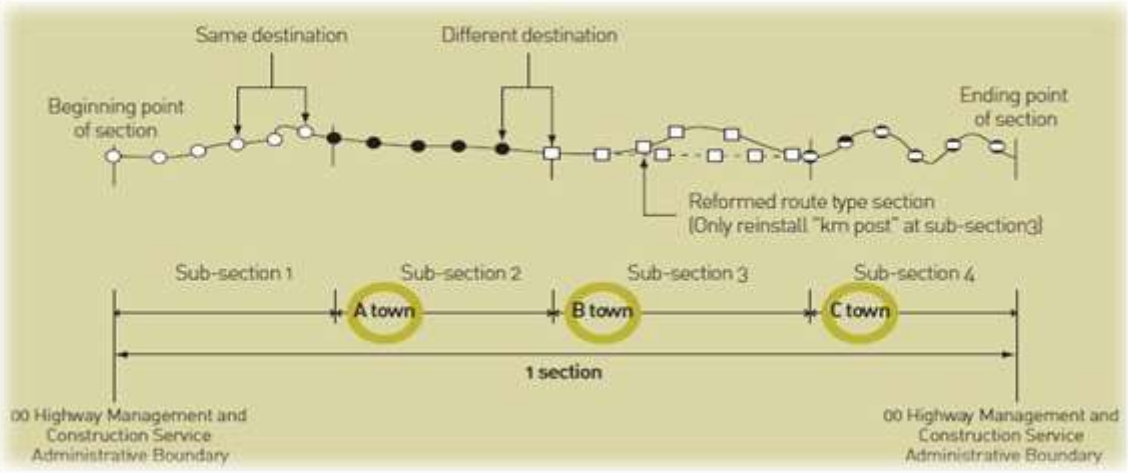


Fig 1 : Section and small section setting

Kilometer Post

1) Kilometer Post contents

As shown in <Figure 2>, the Kilometer Post shows the route number of the road in operation, the destination (administrative designation) in the direction of travel, and the distance to the destination.

2) The purpose of the Kilometer Post

The destination name of the Kilometer Post is to use the shortest place name prescribed by the Ministry of Land, Infrastructure, and Transport(MOLIT), and excluding the place where the route does not pass directly.

ISSN 2349-6193
Impact Factor: 2.805

IJESMR
International Journal OF Engineering Sciences &Management Research

Fig 2 : System Synchronization

3) Remaining distance to destination

The remaining distance to the destination designation indicated on the kilometer post shall be the shortest distance from the distance point installation point to the destination road reference mark, and the shortest distance shall be indicated by summing the closest distances in order of the higher roads.

In case of eup and myeon (name of administrative area in Korea) without road reference, select road reference point of eup and myeon and measure the shortest distance from the selected point to distance table to display distance value of distance table.

4) Location of Street Table

For convenience of road users, the street table is installed on the shoulder of both directions of Shanghai and Shanghai, and the facility manager can use the adjacent street table as a reference point in each facility.

CHARACTERISTIC OF NATIONAL ROAD LOCATION INFORMATION MANAGEMENT MODEL

1) Properly coping with route changes

Since a destination name of 10 to 40 km for one route is managed by dividing it into the same distance table, that is, a small section, even if the route is changed, only the information about the corresponding section can be updated, thereby minimizing the cost and time required for updating the information.

2) Providing continuous information to the driver

By installing Kilometer Post every km within each section, each street table can serve as an information board for drivers who are on the road to know their position. In other words, each Kilometer Post provides information such as the route number of the road being driven, the name of the nearest place in the traveling direction of the running route, and the remaining distance to that point. It can be easily judged. Therefore, it is possible to provide continuous information necessary for driving to the general-purpose driver who lacks information on the route.

3) Efficient facility management

As the road managers manage the location information of each facility and various events using each Kilometer Post installed every km as a reference point, the location management for road management is simplified and accurate. There is also the benefit of clarity and accuracy of information transfer among all management entities applying this system.

APPLICATION OF COMPUTERIZED SYSTEM COMPUTERIZATION OF LOCATION INFORMATION

1) Input element of position information

When a road administrator wishes to input road facilities or related information into the road management integrated system, road administrator must input three information elements for indicating the location of the road facilities or related information.

ISSN 2349-6193
Impact Factor: 2.805

IJESMR

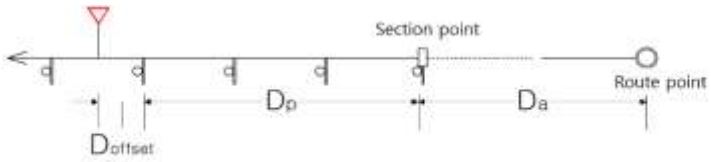
International Journal OF Engineering Sciences &Management Research

The first element is a known reference point on the road. In this system, the distance table becomes a known point. The street table is installed every 1km of the route of each route of the general national highway and has the Kilometer Post management ID which is the information that can be uniquely identified in all the general highways. However, since this code has a problem that it is difficult to visually confirm in the field, it can be an identifier for distinguishing the Kilometer Post by combining the route number, the destination name, and the distance to the destination indicated in the distance table.

The second element is the offset from the Kilometer Post to the facility to be managed, and the third element is the direction information. This direction information indicates the direction of the facility starting from the distance table, and the facility in the direction of progress in the Kilometer Post is positive (+) direction and the facility in the opposite direction is in the negative (-) direction. The road manager or investigator should indicate the location of the road facilities or related information by using the three information elements mentioned above as essential input conditions when inputting the information into the system.

2) The computerization model

In order to apply this model to the computerized system, the equation is shown in Fig 4.



$$D_x = D_a + D_p \pm D_{offset}$$

Here, D_x : Cumulative distance of target point
D_a : Cumulative distance from the route point to the start poin
D_p : Cumulative distance in the section from the section point to the KM Post
D_{offset} : Distance between KM post and target point
(Positive in the progress direction, negative in the reverse direction)

Fig 3: System Synchronization

Application Of Computerized System

We apply this system model developed in this study to National Route 28. Bridge management system(BMS), pavement management system (PMS), traffic volume management system (TMS), and accident location for the second section, which is the jurisdiction of the Longevity National Highway Construction Office. It can be expressed as consistent position information.

Table 1: Bridge Location of Bridge Management System (BMS)

Bridge number	Bridge name	Location
02168	Sandong Bridge.	Yecheon-gun Gaepo-myeon Sang-ri
02170	Kyungin Bridge	Yecheon-gun Homyung-myeon Won-ri
* * *	* * *	* * *

▼

Bridge number	Bridge name	Location
02168	Sandong Bridge.	Yecheon 12km – 0.15
02170	Kyungin Bridge	Yecheon 9km – 0.45
* * *	* * *	* * *

ISSN 2349-6193
Impact Factor: 2.805

IJESMR
International Journal OF Engineering Sciences &Management Research

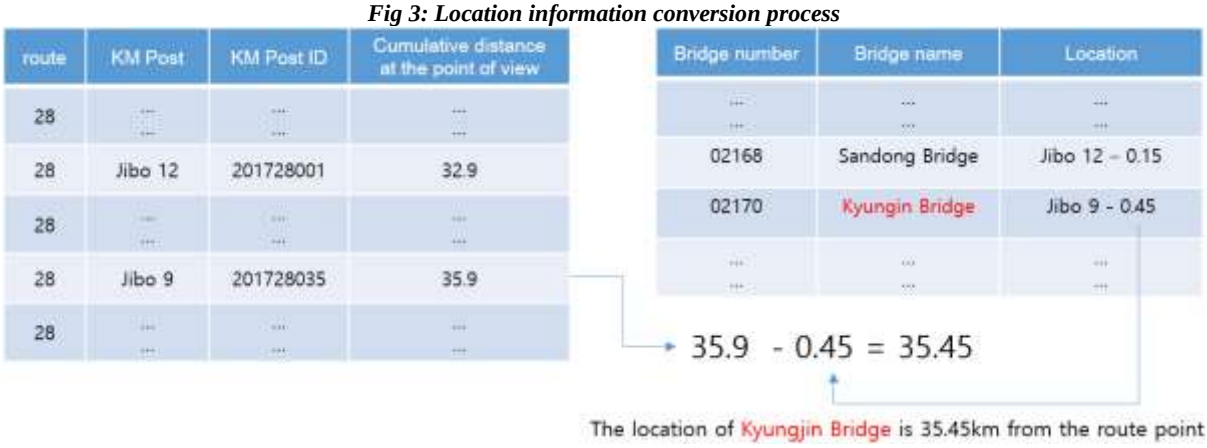
Table 2. Section of Pavement Management System (PMS)

Section number	Section point	Section end point
2	Asin bridge	Kyungin Intersection
2	Usung-Gun Boundary	Jibo bridge
* * *	* * *	* * *

▼

Section number	Section point	Section end point
2	Yecheon 9km + 0.5	Jibo 6km + 0.4
2	Jibo 6km + 0.4	Angye 21km + 0.1
* * *	* * *	* * *

Fig 3: Location information conversion process



In general national roads, the section or point data of existing bridge management system (BMS), traffic volume survey system (TMS), and pavement management system (PMS) are not connected with each other by using address, intersection, It is difficult to integrate the data of the management system, but it is difficult to integrate the data of the management system, but the bridge location, traffic volume survey section and pavement management section of the national highway can be expressed by applying the system developed in this study, It is easy to grasp the correlation of the investigation interval, and it is possible to integrate each data by a simple method in the computer system.

In order to do this, it is necessary to manage the cumulative distance at each route table of each distance table as a database in the computer system. It is possible to accurately express the management section or survey section, bridge position, and accident point of each management system in the digital map by linking this database with the inputted information.

CONCLUSION

In this study, we developed a new system that can be applied to the national highways of Korea, which is characterized by frequent route changes and difficulty in obtaining continuous information on the route by drivers. We have developed a model that can do this.

The developed system is divided into sections according to the boundaries of the jurisdictions of the road management subjects in each route of the national highway, and Kilometer Post are installed every km from the beginning of each section and the same Kilometer Post are set as the small sections. It is a model that manages the location information of the road as a reference point.

ISSN 2349-6193
Impact Factor: 2.805

IJESMR
International Journal OF Engineering Sciences &Management Research

In order to apply this model to the computer system, the total cumulative distance at the time point of each Kilometer Post should be stored in the database. The location information of each point is used in the system by combining the total cumulative distance of the distance table stored in the database and the cumulative distance of the distance and the distance from the Kilometer Post.

The feature of this model is that it can cope with the linear changes of the road and provide continuous information to drivers driving on the road. In addition, the road manager has the advantage of being able to manage the location information of a specific point without special tools and equipment.

In this study, the Linear Reference model is installed for every km of the national highway and the current national highway by applying this model to the actual road, and it can be used as position information correction data for autonomous driving.

REFERENCES

1. *Ministry of Land, Infrastructure and Transport, Highway Management System Maintenance handbook, 2016*
2. *Federal Highway Administration, ARNOLD(All Road Network Linear Rerenced Data) Reference Manual, 2014*
3. *John M. Bigham and Sanhyeok Kang, Buiding Highway Linear Referecing System from Preexisting Reference Marker Measurements for Transportation Data Management, URISA Journal, Vol. 25, No. 1, 2013.*