Cress A. Bates
Local Government Services
Lane Council of Governments
Eugene, Oregon 97401

MILEPOINTS: A GIS INDEX FOR PUBLIC WORKS AND PUBLIC SAFETY APPLICATIONS

Abstract: In Lane County, Oregon four government agencies and the Lane Council of Governments have installed a second generation mapping and information system known as the Common Mapping Project. The geographical indexes to the graphic data base have included site address, property owner name, map and tax lot number, intersections, x,y coordinate and other linkage mechanisms. Milepoints are used by Public Works departments within Lane County to record features along roadway. These features include roadside vegetation patterns, guard rails, pavement condition, signs, traffic accidents and more. The public safety providers use milepost sign locations to record calls for police, fire and emergency medic services. This paper will examine the importance of milepoints as a geographic index, explain the obstacles overcome in creating milepoints, detail several completed milepoint applications and overview future applications that rely on milepoint indexes.

INTRODUCTION

Most motorists are familiar with the small, unobtrusive signs planted along the side of many State and County roads showing milepoint locations. Within Lane County most of these small green signs are placed atop a four foot high slender metal post and have white reflective numbering for the mile number. For the observant motorist, these signs can serve as a guide for distance travelled along a road or used to compute distance to go to the next small town. Public works officials do not recommend, however, that these markers should be used to calibrate the car odometer. Unseen between each of these mile markers are the one hundred "invisible" milepoints used by the Public Works Department to inventory features along side, and about the road upon which the motorist is travelling. Just as addresses are used to create a unique location for delivering mail, these milepoints, when combined with a unique road number, are used to create an "addressing" system for the road rights-of-way.

The motorist may happen to have an accident while travelling along the road (perhaps from trying to see the milepost, and not watching the road) that requires the assistance of police, fire or ambulance. Within Lane County these calls for service are recorded by several geographic identifiers, one of which is milepost number. (It is important to note here the distinction between the milepost, or mile marker, located every whole mile and the milepoint located every 1/100 mile.) The call for service is matched to an x,y coordinate to both help with dispatching the proper agency and later perform incident and accident analysis.

In Lane County, the creation of data layers that use milepoint number as an index are becoming more prevalent. Dynamically creating the milepoint system presented several obstacles, but once overcome, offered additional opportunities for new applications for Public Works and Public Safety departments.

BACKGROUND

Lane County is located at the southern end of the Willamette Valley in western Oregon. Covering over 4,600 square miles the County stretches from the crest of the Cascade mountains in the east to the Pacific Ocean in the west. The 1990 population was 283,000. Lane County has over 1,400 County-maintained roads covering about 1,500 miles. The complexity of maintaining the Lane County road network was brought home by a County Commissioner when the County was contemplating building a roadside vegetation data base. He commented that performing such an inventory on both sides of the road was equivalent to driving from Eugene, Oregon across the United States to the East Coast; without leaving Lane County.

GIS INDEXES

Data processing in Lane County is provided through a consortium of government agencies known as the Regional Information System (RIS). During the same time that the RIS partners were building the geographic data layers, additional non-graphic administrative files were beginning to emerge. These files include the countywide site address file, the Eugene zoning and building permit file, the voter registration system, the real property file and the Lane County zoning file. The countywide address system, or ADLIB has emerged has the hub of an integrated system of non-graphic files. By knowing either an address or map and lot number (taxlot) a user can enter other administrative files by issuing a simple single-digit command.

Spatial Identifiers

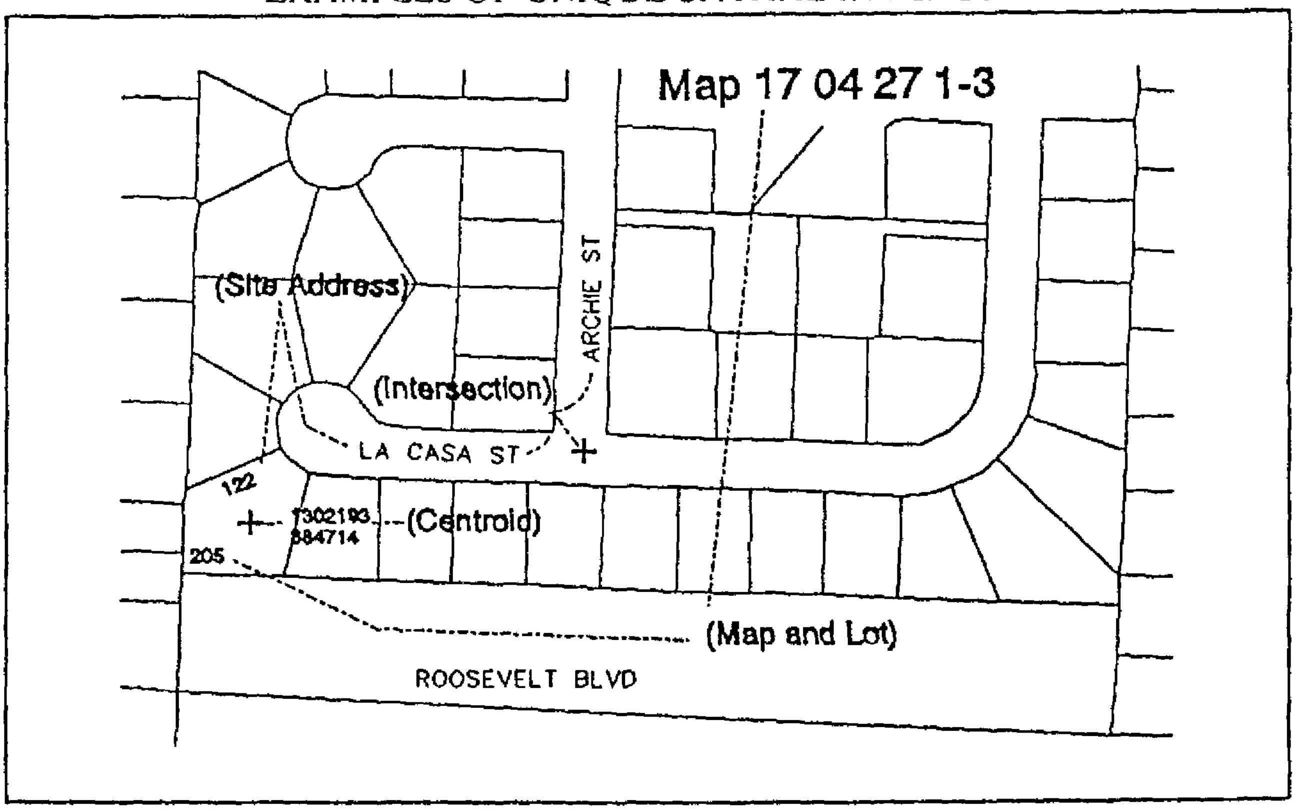
Both the site address and taxlot indexes point to a unique location on the ground making them unique spatial identifiers. These identifiers are important within a GIS since using them to point into the graphic data base will always provide a means to locate a specific geographic area. The collection of administrative files within Lane County contain a variety of such indexes that are worth noting. They include:

- Map and Tax lot number.
- Site Address.
- Subdivision name, lot and block number. This index is more valuable in the State of Oregon with the passage of the short plat legislation. This legislation requires that even minor partitions of land creating three or fewer new lots still be treated with the same requirements as major subdivisions. This means that even a tax lot created through the minor

partition process will have a unique identifier even before the tax lot number assignment.

- Real Property Account Number. This is the unique number assigned to each property account for Lane County Assessment and Taxation purposes.
- X,Y State Plane Coordinate. Through the initial digitizing process a tax lot centroid coordinate was calculated for each parcel in Lane County. This coordinate pair is also attached to a variety of other data layers such as site address, intersection and other point data.
- Road intersections

TABLE 1
EXAMPLES OF UNIQUE SPATIAL INDEXES



There are other indexes used as well; several used exclusively within the public works and utility arena. These include electrical transformer number, fire hydrant number, sewer manhole number, customer information service number and of course, county road number/mile point number.

Creating a Milepoint Data Base

The Lane County Public Works Department is responsible for performing maintenance and road reconstruction on all County roads. These roads are subject to a variety of traffic and weather throughout the year. Cold freezing weather in the winter and later spring and summer warming cause expansion cracking of the asphalt and concrete. Moreover, the climate in Lane County is very conducive to vegetation growth; both for marketable crops and for harmful roadside vegetation. The roadside vegetation, if not controlled will eventually erode the pavement edge and also find a way to start growing in the pavement cracks. Traditionally this vegetation is controlled by either mowing or trimming techniques or by chemical spray.

Private citizens and societies, such as the Rare Plant Society, have expressed concern over the County's spray program. Lane County Commissioners, responding to this citizen concern, decided to hire a Vegetation Management Coordinator and charge him with the job of finding an effective balance between preserving both the environment and the County's road system.

In the summer of 1989, the County hired the Lane Council of Governments to create two data bases. One would contain the vegetation inventory for each road in Lane County. The other would use the Common Mapping system to create a single line representation for each County road as well as the milepoint locations at 1/100 mile intervals. The collection of the vegetation data was done during the summer when many plant species were mature and easy to identify. Roadside vegetation information was collected using the combination of County road number and milepoint number as the unique identifier. Meanwhile, the digital representation of the County road system and milepoint information was entered into the Common Mapping system.

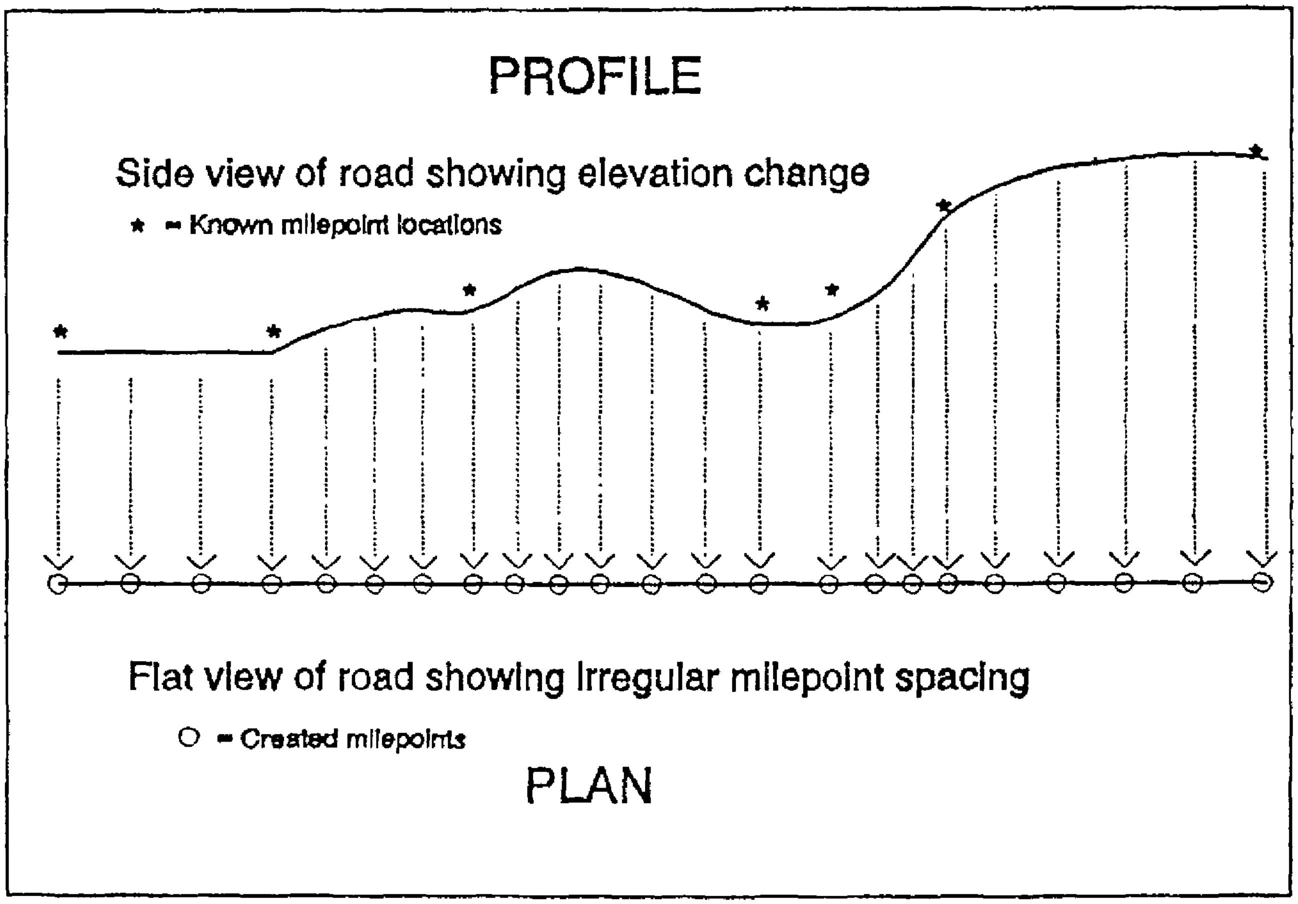
Milepoint Problems

The milepoint files were created using data residing on the mapping system, that is not controlled to high survey accuracy standards and in some places does not match accurately with what is on the ground. This meant even for flat roads, the milepointing process would need to compensate for inaccuracies in the parcel base. Most roads in Lane County have elevation changes. This third dimension to the road adds length not accounted for in the two-dimensional parcel base. Again, it was realized that some method of controlling the milepointing process was needed.

There were approximately 150,000 milepoints created as part of the vegetation management project. This number was known before any operator sat in front of the digitizing station and began entering data. Even if it only took 30 seconds per point to enter each milepoint, it would still have taken an operator over 156 working days to enter all the milepoint data. In addition, the single line representation of the road system had to be digitized. It was soon realized that an automated method of calculating milepoints was needed.

The solution was to create an online, interactive milepointing routine. The program allows the operator to digitize the road system; entering the road name, the road number and the beginning and ending milepoint number. By identifying known milepoint locations along a road (such as bridges or road intersections) the operator can control the milepoint creation between those known locations. Air photos, existing straight line maps and the vegetation inventory data were used to identify known milepoints along roads. The program prompts the operator to identify the road segment and enter the known beginning and ending milepoint values. The correct number of milepoints are then added to the data base and displayed to the screen. Ideally the milepoints should be spaced 52.8 feet apart. Due to the inherent inaccuracies in the data base and controlling for terrain and known features, spacing of 46 to 58 feet was accepted. Initial problems with milepoints not falling exactly on the road line and problems in milepointing around curves had to be worked out of the program. Still, another important feature of the online program is that it automatically added all the non-graphic data from the road line (road name, road number) and filled in the milepoint number. This practically eliminated any hand entry of non-graphic data for the milepoint data layer.

TABLE 2
CONTROLLING THE MILEPOINTING PROCESS

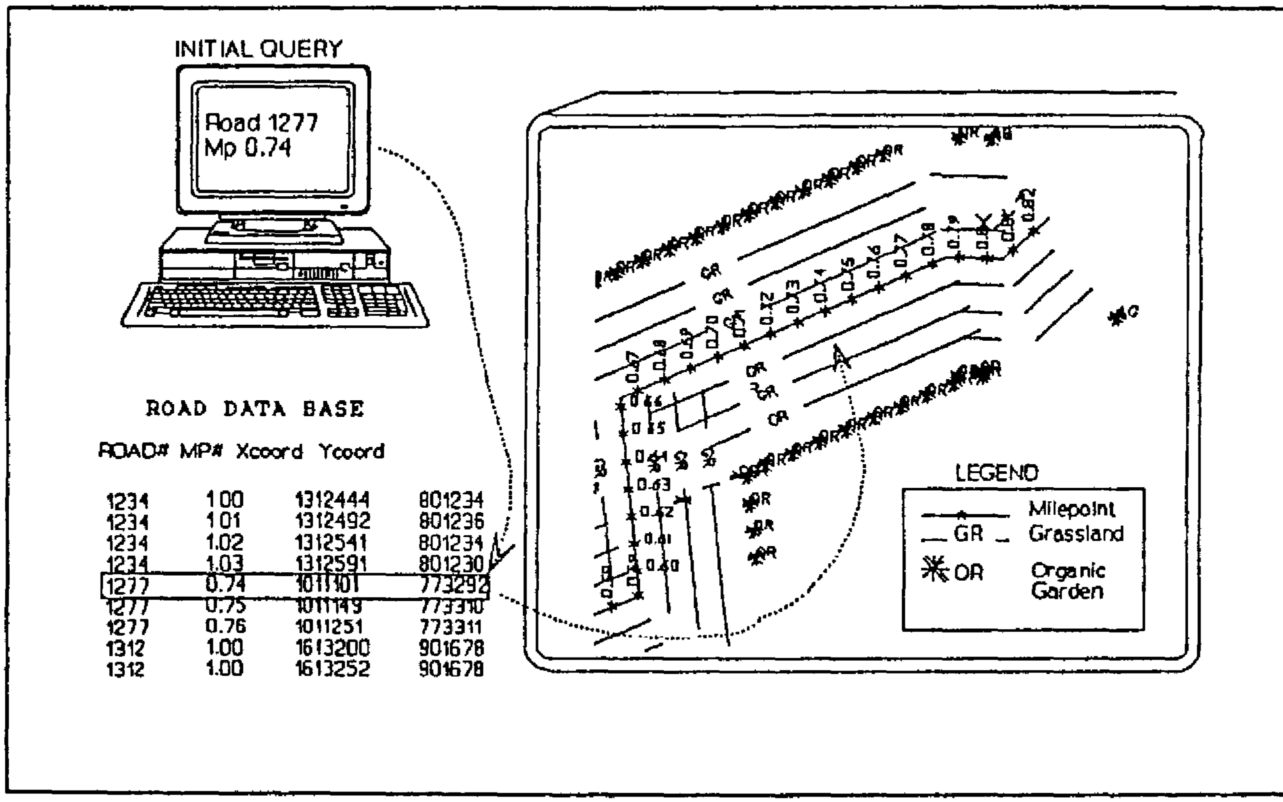


The road line and milepoint data layers were subsequently used to create data layers for the roadside vegetation data. A user-friendly interface to the data base was created so that the vegetation coordinator can see where constraints to spraying or trimming along side the road exist.

User Friendly Query

L-COG has already created several user-friendly queries into the graphic data using taxlot number or site address as the index. A similar query using County road number and milepoint also will be created. The application is shown in Table 3.

TABLE 3
MILEPOINT INDEX QUERY INTO GRAPHIC DATA



Each road number/milepoint record contains an x,y state plane coordinate. When the query finds a match on the road number and milepoint, this coordinate is returned to the graphic session and used to automatically build a user-defined display window. The window is then used to display the appropriate area of the data base along with the requested data layers.

Once the milepoint file was created on the graphic system, the first use was for management of the vegetation data by the Public Works Department. However, other Public Works divisions began to see the value of adding graphic display capabilities to many of their data bases that are also indexed by milepoint. Also, since the data can be easily transferred to other systems, the public safety departments found that a much needed gap could be filled in tracking calls for service and aiding dispatching.

ADDITIONAL PUBLIC WORKS APPLICATIONS

The single line representation used as a base from which to create milepoints is already being used to recreate a set of County maintenance maps. An additional bonus will be the ability to display milepoint locations for certain features on the new maps. The County is also considering additional mapping and data base creation for several administrative files. These include:

- Creating a new set of straight line maps. These maps are a single, straight line representation of the County road. The maps show milepoint locations for features along the road; such as intersections, culverts, bridges, tunnels, streams and more.

- Developing a pavement management system within the graphic environment. The County keeps an inventory of pavement condition that is again indexed by milepoint.

- Producing a traffic accident data layer. The County currently receives accident reports from the State Police department. The State Police accident form contains information about the accident as well as the road name and number and milepoint location if known. Often, the milepoint is not included on the report because the State Police do not have a straight line map for a particular road. This is usually because the straight line map does not exist, which is another reason the County wants to automate the straight line map creation. In addition, the ability to display accident data would give the County the means to track hazardous intersections or road segments, map by accident type and perform other accident analysis.

- Creating a sign inventory system. The County is constantly replacing road signs and needs to keep track of the type of sign and location along the road. Once again, sign data is kept by milepoint number.

- Displaying data from the Maintenance Management System worksheets. This file contains such roadside information as fences, drainage considerations, guardrail and landslide problems. Again referenced by road number and milepoint.

The ability to manage this information within a graphic environment is now possible due to the creation of the milepoint data layer. L-COG and the rest of the region are just beginning to see some of the benefits in using milepoint data.

PUBLIC SAFETY APPLICATIONS

The Public Safety departments in Lane County are currently interested in using the Common Mapping system for two applications which will use milepoint data. These are:

1. Crime analysis and incident reporting.
2. Emergency dispatching.

The RIS partners are currently maintaining a criminal justice data base that contains information on both crimes and calls for service, and actual persons who commit crimes. This information is maintained in a system known as AIRS (Areawide Information and Record System). The records are protected and can only be accessed by authorized personnel.

Crime Analysis

Since the late 1970's, as graphic data became available within a shared environment, police agencies have used the GIS to map and report on various types of activity. The incident data is added to the AIRS system on a daily basis and includes such information as agency responding to a call (City, County or State police), type of call, time of call and action taken. Police agencies realized that matching the calls for service with a coordinate provided the ability to perform a number of new functions. These included producing reports for various geographic areas; such as police patrol districts, through geoprocessing techniques. It also provided the ability to display the information within the mapping system. As the patrol officers respond to calls, the information is recorded by several geographic indexes. These are:

- Site address
- Street Intersection
- Landmarks
- Milepost

The site address file created in the mid 1970's was immediately available for assigning coordinates to crime data. In the late 1970's the street intersection file was created and incorporated into the system of administrative files. This file has been refined several times over the last 10 years to provide a better match to the police data. In the mid 1980's the police agencies began building their own landmark file. This file contains coordinates for major landmarks throughout Lane County for which there is no address or that are not always reported by address. This might be a lake, butte, tunnel, shopping center or high school.

Until recently, calls for service reported by milepost number could not be assigned a coordinate. These records could not be geocoded with city limit, fire district, census tract, police patrol boundaries or any other relevant boundary file information. This in turn has meant that any reports or maps being generated would be missing any calls reported by milepost number.

The Public Works milepoint data has been used to create an online system of milepoint information known. This file contains milepoints every 1/100 mile and therefore includes more milepoints than needed by the public safety agencies. Patrol officers in the field are recording information by milepoint to the nearest whole number.

Still, the file does include whole milepoint numbers (1.00, 2.00, 3.00, etc.) and the intervening milepoint numbers are a valuable source of information for the Public Work applications. The AIRS system is now using the file to assign a coordinate to their incident records.

Emergency Dispatching

The emergency dispatching function is part of the 9-1-1 emergency dispatch system within Lane County. The site address, intersection, landmark and milepoint file are used by call-takers to assist in dispatching the correct fire, police or ambulance agency. When a call is received at the 9-1-1 emergency dispatch center, the call taker enters the appropriate information; such as address or milepoint number. The system searches the correct data base to find a matching record and returns information to the call taker's screen that identifies the responsible emergency service agency. Even while the caller is still on the phone, the alarm is ringing at one of the city or rural fire stations.

CONCLUSION

Creating milepoint data layers within the Common Mapping system has offered public works agencies the opportunity to view their data in a new fashion. Road inventory information has become more valuable when it can be displayed by certain geographic areas and matched with other geographic data. These same milepoints have also been beneficial to the public safety agencies. The milepoints have effectively opened up whole new areas of Lane County to the graphic representation of crime data and calls for service. The investment in the milepoint file is proving to be a wise choice. For the Public Works departments it offers a new way of viewing their data, while at the same time helping to save the lives of citizens in Lane County.