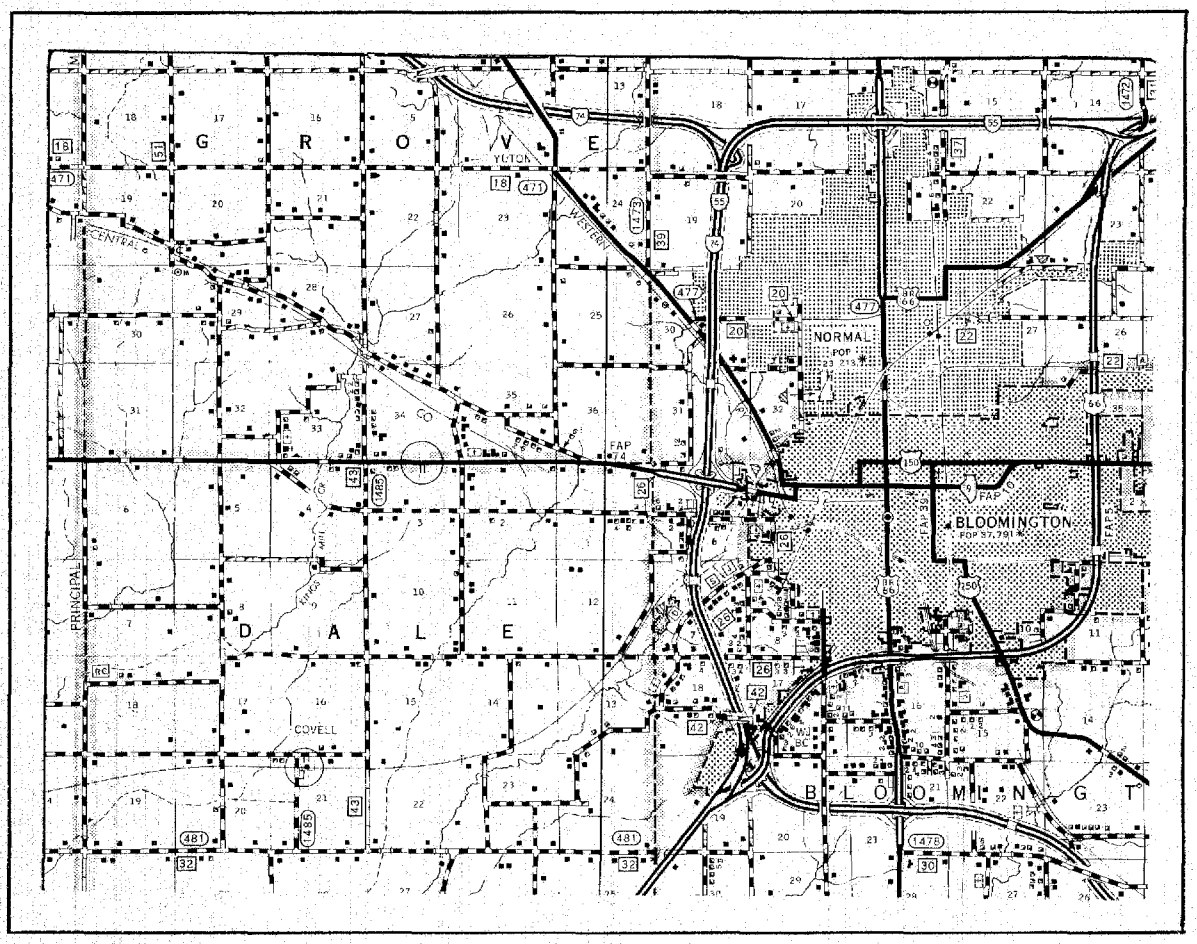
Mueller

TRANSMITTAL 125

VOLUME 20
APPENDIX 56

HIGHWAY LOCATION REFERENCE METHODS



U.S. DEPARTMENT OF TRANSPORTATION
Federal Highway Administration

FEBRUARY 1972

HIGHWAY LOCATION REFERENCE METHODS

FEDERAL HIGHWAY ADMINISTRATION

Office of Highway Planning
Program Management Division

Office of Highway Safety
Technical Development and Standards Division

Office of Traffic Operations
Traffic Performance and Analysis Division

February 1972

INTRODUCTION

Background

The need for better information systems in highway administration has become increasingly evident over the past few years. With sophisticated computer equipment being used more and more by highway engineers, opportunities exist for the development of better information systems in several highway department functions, including highway planning, safety, and maintenance. Any information system requires the input of data on many phases of the highway network, but a common denominator is the location of specific points along the roadway. A system to facilitate the identification of these points -- a highway location reference system -- is thus an essential part of the overall information needs of a highway department.

Purpose of Report

A number of different location reference methods have been developed and used in the various States. Each method has certain advantages and disadvantages with respect to particular highway networks, and no one method can be considered the best for all circumstances. This report has been prepared to provide information on several workable methods that are in use, and includes descriptions of each method, ways each is used, advantages and disadvantages, and other factors.

Explanation of Terms

This report uses terms that may be unfamiliar or that may be confusing because the terms have more than one meaning in common usage. This section defines the terms used in this report.

Highway Location Reference Method - The technique used to locate a specific point or segment of highway, either in the field or in the office.

Highway Location Reference System - The total set of procedures for determining and retaining a record of the locations of points along a highway. The system includes the highway location reference method together with the procedures for storing, maintaining, and retrieving location information about points and segments on the highways.

Milepost - A physical entity, ordinarily a sign, which is placed along a highway and which contains a number indicating the mileage to that point from some zero point on the highway.

Milepoint - The name given to the numerical value of the mileage displacement from a zero or base point to any point together with route identification to identify the location of the data included in a data record.

Reference Post - A physical entity, either a sign or a fixed identifiable roadside feature, along a highway and containing a number that does not indicate the mileage to that point.

User - Anyone who employs a location reference method to identify a point or to find a point on a highway. Users may fall in any of the following categories: State or local highway agencies, law enforcement agencies, other government or private agencies with concerns related to highways, emergency services, and the motoring public.

Direct Location Reference - A milepoint is computed and recorded in the field at the time of data collection, or a milepoint is given for finding a point at any other time.

Indirect Location Reference - A milepoint is not computed and recorded in the field at the time of data collection, nor is one given for finding a point at any other time. Instead, a point of interest is identified in terms of its displacement from a known intermediate point, e.g., distance and direction from an identified and locatable highway feature.

HIGHWAY LOCATION REFERENCE SYSTEMS

Objective

A highway location reference system is designed to provide a means for, first, locating and identifying a specific point on a highway and, second, for finding that point at any time. The identification of a point can be made in the field at the time of data collection or in the office at a later time.

The system is intended to provide uniformity in the way in which various highway-related data observations are located. This means that the procedures for determining the location of a point, for identifying the location, and for recording that identity should not depend on the individual procedures of the organizational unit making the observations. Rather, a uniform method should be used by all units to produce compatible data. Thus, different kinds of data about the highway can easily be correlated and points of interest along a highway can be identified with some confidence in accuracy of the location.

Linear Relationship of Points

Just as a traveler commonly measures his progress and orients himself in terms of distance from or to a known point, so do highway authorities use this technique of distance from a known point to identify highway points or sections in their data files. The known point may be a State line, county line, a control section terminus, or some other fixed location.

This form of location identification has come to be known as route number/milepoint identification. It is the most familiar and perhaps the simplest way of relating any point on a highway with all other points. Most of the location reference systems now in use are based on route number/milepoint location identification in the data records, either directly or through some variation of this principle.

There are three elements common to the use of almost all location reference methods: Identification of a known point, a distance measured from the known point, and a direction of measurement. These characteristics make it possible to derive a milepoint identification for a point on a highway, using any of several methods. Thus, it is possible to make any location reference system compatible with any other. This is important from a record keeping standpoint because different functional levels of highway networks may, to be practical, require different location reference methods.

Categories of Highway Location Reference Methods

Highway location reference methods are either (1) field oriented, with signs or posts along the roadway, or (2) office oriented, using maps, logs, straight-line diagrams or other documents in lieu of physical markers on the roadway. Variations of these two basic approaches create four location reference methods, two field oriented and two office oriented. These are described in the outline below.

Field Oriented I - Signs or posts with numbers that indicate the number of miles from a base point (includes the "milepost" method).

A. Characteristics

1. Signs or posts may be placed at any spacing, but usually at miles or tenths of a mile.

2. Signs or posts contain the milepoint of that location.

3. The message on signs or posts may or may not be readable from a moving vehicle.

B. Use

Because this method incorporates signs or posts containing milepoints, the actual milepoint for a point of interest on a highway can be immediately determined. The distance from the point to a sign is added to or subtracted from the number on the sign, depending on the direction of travel. This milepoint, as well as the route number, is recorded.

An alternate procedure is to record the distance, direction of measurement, sign number and route number, leaving the computation of the actual milepoint to office personnel.

To find a point on a highway when given the milepoint, the reverse of either procedure is followed.

C. Advantages

1. Because the signs or posts reflect mileage, which is familiar to and understood by many people, this method can be easily learned and understood by most users.

2. The motoring public is provided information for charting progress along the roadway.

3. There is fairly uniform spacing so the user does not have to proceed more than some fixed distance to find a marker.

4. There is a built-in sequence to the numbers provided on the signs and posts, which, in turn, provides easy orientation.

D. Disadvantages

1. Changes in the length of a route after initial placement of signs or posts may result in the numbers on them not relfecting a true milepoint.

Comments:

- Depending upon how records are kept, all records in all files may have to have milepoint identification changed every time a route length change occurs. (Information to the motoring public may still be provided even if changes occur, however.)

- Central office records containing the true milepoints of signs and posts must be kept. Adjustments to identification on input data must be made before the data are included in the data files.

2. When there are concurrent routes, the numbers on the signs or posts reflect mileages for only one of them.

3. The placement of signs or posts along the highways can create problems for maintenance forces.

Field Oriented II - Signs or posts with unique numbers that do not necessarily reflect number of miles from a base point (includes the "reference posts" and "link-node" methods).

A. Characteristics

1. Signs or posts may be placed at any spacing increment.

Comments:

- In some cases, placement is at major intersections and jurisdictional boundaries.

- In other cases, placement is a fixed, uniform interval.

- A combination of the above two also may be used, plus placement at special roadside features.

2. Signs or posts usually contain numbers that are not related to a milepoint and which may or may not be in sequence along a route. The signs also may include route number and jurisdictional codes.

Comments:

- Signs usually carry a number that is unique, i.e., the number is not repeated on any other sign in a State or local jurisdiction.

B. Use

The milepoint cannot be computed in the field when this method is used. The distance, direction of measurement, sign number and route number are recorded, leaving the computation of the actual milepoint to office personnel. This procedure is reversed when the location of a point on a highway is desired and the milepoint is known. It also is possible for the location of the point to be given in terms of the number of miles from a zero point.

C. Advantages

1. Changes in route lengths caused by construction do not affect the placement of signs or posts or the validity of the numbers on them.

2. When unique numbers are used on the signs or posts, it is not necessary to record route number or any jurisdictional data, since these will be in the central file.

3. Posts and signs apply to all concurrent routes passing them.

D. Disadvantages

1. Depending on numbers used on signs, the motoring public may not be provided information for charting progress.

2. A computation must be made every time a milepoint or mileage is needed.

3. The placement of signs or posts along the highways can create problems for maintenance forces.

Office Oriented I - Strip maps, straight line diagrams, or printed logs that show or name features that can be identified along the roadways -- intersections, waterways, monuments, etc. -- are used in lieu of physical signs or posts. (This includes the "straight line diagram" method and the "route log" method.)

A. Characteristics

1. A milepoint is assigned to each of the identifiable features shown on a strip map or straight line diagram, either by specific identification or by scale.

2. Printed logs list identifiable features, using the name by which the feature is signed or is known in the field. The current milepoint of each is printed following the name. The log generally is in order by route number.

3. A variation of the above two is the use of a reference number in place of the milepoint.

4. The method can be employed either in the field or the office.

B. Use

Because no signs are placed along the highway in this method the actual milepoint for a point of interest on a highway is determined by: (1) identifying a topographic feature on a map or log that is nearest the point of interest on the highway; and (2) determining the distance and direction from the point to the feature. The actual computation is made by adding to or subtracting from the milepoint of the feature the distance to the point of interest, and is usually done in the office.

To find a point on a highway when given the milepoint, the reverse of the above procedure is followed.

C. Advantages

Physical signs or posts are not needed.

D. Disadvantages

1. Users of the method must be given revised sheets when changes require making revisions to map or log milepoints.

Comment:

- When reference numbers are used in lieu of milepoints, revised sheets are usually distributed only when significant features are added to or deleted from a map or log.

2. The motoring public is not provided a means of charting progress along a route or a means of locating a point on a highway.

Office Oriented II - Maps with names or roads or streets and addresses. (Includes intersection reference and geocoding methods.)

A. Characteristics

1. The method actually can be a variation of any of the first three categories of methods given above.

a. Names of intersecting streets are used as a reference point and a distance is measured from the intersection.

b. Names of streets or roads and address numbers are used to identify points on the roads and streets.

2. The method is more applicable in urban areas than in rural areas.

B. Use

The name of the street on which the point of interest lies and the name of the intersecting street that is nearest to the point of interest are recorded, as well as the distance from the point of interest to the intersecting street. The milepoint number is determined by office personnel, utilizing maps or logs containing the actual milepoint designation of all intersections. Where the milepoint of the point of interest is not desired, the recorded information is retained in the submitted form.

An alternate procedure utilizes street names and addresses. The name of the street on which the point of interest lies and the street address number closest to the point of interest are recorded. Office personnel locate the point of interest with respect to the beginning of the street or to a particular block.

To find a point on a street when given the address of the point, the reverse of either procedure is followed.

C. Advantages

1. The existing street and road network is used without the necessity for placement of posts or signs or for preparation of maps or logs.

2. The reference points or features used will tie in with other data collection activities that are peculiar to urban areas.

D. Disadvantages

1. There may be instances of misspelled names, so there must be provisions for correcting errors in spelling.

2. Many street or road names are very similar or identical.

3. Many streets have more than one name.

Other Methods

There are other location reference methods being planned or developed by some States that do not fall into any of the above categories, for example, coordinated grid systems and electronic procedures for locating specific points. They have not been included in this report because it is believed that they have not demonstrated their practicability for use in the field. Coordinates, for example, provide a unique identification for a point, but the determination of coordinates for a point by manual means is, even in an office, a time-consuming procedure with a higher potential for error than any of the other methods given. There are machine oriented procedures for assigning coordinates to points located and identified by other methods.

The omission of other existing methods in this report does not preclude their use in the future, but it is believed that further analysis and development needs to be carried out before they can be implemented successfully.

Additional Considerations

Before selecting a highway location reference method, the following Federal requirements and guidelines need to be taken into account.

1. The 1971 Manual on Uniform Traffic Control Devices adopted by the Federal Highway Administration as a national standard for all classes of highways, contains both guidelines and specific criteria for use of mileposts as a field reference system.

   For conventional roads (Section 2D-47) mileposts may be erected along any section of a numbered highway route "To assist the driver in estimating his progress, to provide a means for identifying the location of emergency incidents and to aid in highway maintenance and servicing." Where used, on conventional roads "Milepost signs shall be vertical panels with 6-inch white numerals, a border and a word MILE in 4-inch letters on a green background and shall be reflectorized. . . . While milepost signs serve as a guide for motorists, they also provide a means of identifying traffic accident locations and sections of highway for maintenance or other purposes."

   For freeways (Section 2F-36) the Manual specifies that "Milepost signs shall be placed on all freeway facilities and shall conform to the general provisions for mileposts contained in Section 2D-47. Markers shall contain 10-inch white numerals on 12-inch wide vertical green panels with a white border. . . . The mileage numbering shall be continuous for each route within a State except where overlaps occur."

   Section 2E-37 states, "Milepost markers will be required on expressway facilities which are located on a route where there is milepost continuity. In such case, the provisions of Section 2F-36 will apply."

   The Federal Highway Administrator, acting for the Secretary of Transportation and pursuant to the provisions of Section 109 (b), 109(d), and 402(a), Title 23, U.S.C., has approved the provisions of the Manual on Uniform Traffic Control Devices stated above, as the National Standard for all highways open to public travel. IM 21-2-71, dated February 4, 1971, established December 31, 1974, as a practical target date for achieving compliance with the new sign standards.

2. House Report No. 91-1554 relating to the Federal-Aid Highway Act of 1970 indicated that Congress intended Section 402 highway safety funds for use in part for "the installation of field reference markers designed specifically to meet highway safety standard requirements."

   Highway Safety Program Manual Volume 9 calls for accuracy for locating the site of an accident as follows: The nearest 1/100 of a mile for residential and commercial streets in urban areas, urban expressways and freeways, rural roads within the area of influence of an intersection, and all other locations where there is a convenient reference. In all other cases it is desirable to obtain as much accuracy as practicable under the conditions."

SELECTING A METHOD

Factors

Certain factors, or criteria, should be considered when selecting a field reference system. Although each factor is important, some should be given more consideration or weight than others. It is likely, too, that the consideration or weight given to each factor can vary according to which State agency (police, highway department, etc.) is responsible for selecting the field reference system. Table 1 shows eight factors that should be considered as a minimum and corresponding questions that can be asked about each. The factors and questions are not meant to be exhaustive, but to point up the primary elements of any field reference system.

Users

In addition to the factors to be considered, it should be remembered that there are a number of different users of a field reference system. Like the factors above, some users should be given more consideration than others. For example, it may be more important that law enforcement personnel be able to conveniently locate accidents and respond quickly to the sites of emergency incidents than it is for a motorist to be able to chart his progress along the highway. Following is a list of potential users in most States:

1. Highway department
2. Police
3. Motoring public
4. Emergency services (ambulance drivers, firemen, etc.)
5. Other government agencies
6. Other private agencies.

TABLE 1

1. Ease of use by driving public (including ambulance drivers and firemen)	How difficult is it for the driving public to report the location of emergency incidents (accidents, debris, potholes, etc.)? Can the driver use the reference system to chart his progress along the highway?
2. Ease of use by law enforcement personnel	How difficult is it for law enforcement personnel to reference accidents to the system? How difficult is it for law enforcement personnel to find the location of an emergency incident that has been referenced to the system?
3. Ease of use by maintenance, planning and other State highway department personnel	How difficult is it for maintenance personnel to find the location of a pothole or debris that has been referenced to the system? Can highway planning field crews use the system for inventorying purposes in an easy manner?
4. Cost of installation	What is the cost of installation per sign, including layout?
5. Cost of maintenance	How often will the signs have to be replaced?

6.	Ease of record keeping and processing	Does the location data to be recorded in the field lend itself to a self-coding format? Is the location data recording requirements (sign message, direction, and measurement) simple to reduce possibility of errors to a minimum? Can the location data to be recorded in the field be entered into a data base without extensive manual preparation?
7.	Effect of construction and route number changes	As a result of construction, does the shortening or lengthening of a route seriously affect the true mile-point value of those signs in the construction area?
8.	Ease of implementation	How difficult would it be to educate and familiarize the driving public with the field reference system? How difficult would it be to train police, maintenance personnel, etc., in the use of the system? Is there more than one type of field reference system with which the users must be familiar?

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