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SPECIAL ATTACHMENT: *MTC Asset*

CTRE

Center for Transportation Research and Education

IOWA STATE UNIVERSITY

Integrating spatial and linear referencing data for DOTs

Before the widespread use of geographic information systems (GIS), state departments of transportation (DOTs) relied on linear referencing methods (LRM) to collect and store location information associated with the characteristics and condition of transportation systems. Linear referencing locates objects in terms of their distance and direction along a segment from a known set of points.

An LRM works well for describing things like an accident location because the system uses terms such as "1/2 mile west of milepost 149 on I-80" rather than spatial coordinates. But LRM data are one-dimensional and can only be described in terms of their relationship to another object.

As GIS became more common, most DOTs implemented some type of GIS to maintain spatial data (which is two- and three-dimensional) such as roadway networks or inventories of roadway features. However, spatial point features, such as data collected using global positioning systems (GPS), are fundamentally incompatible with LRM data in the way they are collected, integrated, and manipulated.

Both types of data are necessary and useful, but their usefulness would multiply if they could be related to each other, i.e., integrated.

Shauna Hallmark, transportation engineer at CTRE, analyzed several integration issues and offers recommendations in a project sponsored by the Iowa Department of Transportation and the Midwest Transportation Consortium.

Integration issues

Several issues arise when attempting to link LRM data with spatial point features collected by a GPS or other methods such as satellite or aerial imagery.

- The accuracy of the GPS or other data collection methods affects whether the point will be mapped to the correct location and whether it will map to the correct segment.

- Spatial information is lost when converting two- or three-dimensional GPS data to one-dimensional LRM data.

- The spatial accuracy of the cartography on which the LRM is based affects other factors such as linear offset calculations, horizontal offset, and placement of features.

Recommendations:

- Store spatial data points, when feasible, as independent spatial features, and convert to a linear referencing system as necessary.

- If features cannot be stored as coordinates, retain additional information in a data field, such as coordinates, elevation, and horizontal offset.

- Use route identifiers to ensure that point features map to the correct roadway segment.

- Locate point features in an LRM as a percentage rather than distance, or use calibration to adjust for differences between different calculated lengths among LRMs for the same segment. •