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TECHNOLOGIES 2012
Curvature Extension for ArcMap (CEA)

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

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The Challenge

Consistency is an important principle in roadway safety. It ensures that roadways conform to recommended guidelines and promote safety to drivers. A large percentage of crashes occur on horizontal curves on two-lane highways, making consistency in design and signage of upmost importance for departments of transportation (DOTs).

The Federal Highway Administration (FHWA) has guidelines incorporated into the national *Manual on Uniform Traffic Control Devices*. Some of the techniques described in the guidelines require knowing the radius of the horizontal curve. Traditionally, this has required aerial photography analysis and a survey crew, and the time and money to field them. The Curvature Extension for ArcMap (CEA) does away with the need for aerial photography analysis or a survey crew — improving safety by not exposing crews to traffic, and improving consistency with roadway design.

Time and cost savings from the use of the Curvature Extension for ArcMap are now realized by eliminating the labor-intensive methodologies of calculating curve classification either in the field or by using aerial photography.

The Solution

Several years ago, the Florida Department of Transportation (FDOT) Statistics Office's, geographic information system (GIS) section was asked to research the possibility of using GIS technology to help derive curve class information along highway performance monitoring system (HPMS) samples. Curve classification is a requirement of HPMS that is reported to FHWA annually, and is required for HPMS samples that are assigned to various roadway segments.

A simple prototype was developed for ArcView 3.x (GIS software); however, it was not powerful enough to eliminate all guesswork regarding curve class. The introduction of ArcGIS, along with the ArcObjects development environment, allowed for the development of a more powerful and robust solution that makes precise calculations and has the ability to export directly to Microsoft® Excel.

The result of the research was CEA, a software tool compatible with Windows® 7 and ArcGIS 10, which quickly provides accurate roadway curvature data for HPMS reports. It enables a user to quickly and easily derive the radius and classification of a curve along a given segment of road.

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Implementation Facts

This technology can be implemented by any organization that uses ArcMap software. It is intended for use by state DOTs throughout the United States, but can be used anywhere and by any type of organization.

To adopt this technology, an organization needs to take the following steps:

1. Acquire ArcGIS (which includes ArcMap) software with an ArcView license (at a minimum).

2. Acquire and install the Curvature Extension for ArcMap from the Florida DOT.

3. Acquire a GIS dataset comprised of road features for the area of interest, such as a state, if the organization does not possess such a dataset already.

Components of the Curvature Extension for ArcMap.

The Benefits of CEA Technology

The accuracy of curve classifications is improved greatly by using CEA. Historically, curves were estimated from construction plans. When construction plans were not available, curves were estimated by performing crude calculations in the field, or by using aerial photos or other hardcopy sources. These sources were not always readily available, and their accuracy was often in question.

> CEA, a software tool compatible with Windows® 7 and ArcGIS 10, quickly provides accurate roadway curvature data for HPMS reports.

CEA improves this by using a GIS dataset and automating calculations. Further, for complex HPMS samples where only a fraction of the curve is included, CEA easily adjusts its calculations and reports.

Time and cost savings are now realized by eliminating the labor-intensive methodologies of calculating curve classification either in the field or by using aerial photography. It is estimated that using CEA reduces the time required to classify a curve from 30 minutes or more to less than one minute, saving Florida DOT an estimated $12,000 annually. Additional benefits include reducing vehicle usage costs and employee exposure to traffic as a result of reducing fieldwork and deriving the curve data in an office setting.

Also, since curve classification is a requirement of the aforementioned HPMS that is reported annually to FHWA, the CEA technology provides a methodology for deriving curve classification that is accurate and easy to use using the latest GIS technology.

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