



Using and Maintaining a Flexible, User-Friendly LRS for Locally Developed, Spatially Accurate Roadway Alignments

Kenneth Bennett

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www.bdsys.com

bd Systems, Inc.
P.O. Box 2707
385 Van Ness Avenue, Suite 200
Torrance, California 90509-2707
(310) 618-8798, FAX (310) 782-5741

Total Commitment to Superior Services and Customer Satisfaction

Project Background

- ❑ Caltrans reliance on FUNC coverage
 - Based on 1:100,000 USGS DLG layer
 - Low accuracy and resolution
 - Acceptable for high-level, statewide planning
 - Impractical for design-level use by local districts

- ❑ District 11's CAiCE CADD database
 - Spatial accurate alignment layer
 - Control points registered to Caltrans' county-route-postmile LRM

- ❑ Caltrans' Postmile Process
 - Existing application for mapping event data to FUNC coverage
 - Difficult to use and to identify and fix data errors

The CTLRS Project

- ❑ Funded jointly by District 11 and Caltrans HQ
- ❑ Project Goals
 - Convert CAiCE data to ArcGIS layers in personal geodatabase
 - Develop CTLRS application to replace Postmile Process
 - Transfer knowledge to District 11 staff
- ❑ CTLRS Application Functionality
 - Maintains highway route layer based on District 11 alignments
 - Maintains postmile points and route measure lookup table
 - Prepares, validates, and displays highway event data

CTLRS Platform

- ESRI's ArcGIS 8.3 software

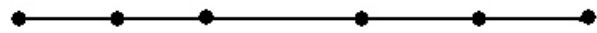
- Personal geodatabase based on Microsoft Access 2000

- Customized user interface
 - ArcMap document with customized menu
 - Implemented using Visual Basic and ArcObjects
 - Compiled as a DLL file


CTLRs Data Model

- Highway Route Layer
- Postmile Point Layer
- Route Measure Lookup Table
- Event Tables

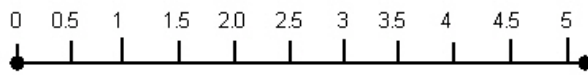
Highway Route Layer

A horizontal line with five evenly spaced black dots representing individual features.

5 features with the same county, route and direction.

A single horizontal line with two black dots at each end, representing the aggregation of the five features above.

5 features aggregated into one route, i.e, SD805.

A horizontal line with a scale from 0 to 5. Major tick marks are at 0, 0.5, 1, 1.5, 2.0, 2.5, 3, 3.5, 4, 4.5, and 5. A black dot is at the 0 mark and another is at the 5 mark.

Measurement system associated with route SD805.

- ❑ Hwy alignment layer features attributed with route IDs
- ❑ Features with like route IDs aggregated into routes
- ❑ Establish route measures: zero to length of route

Highway Route Layer Data Issues

- ❑ Non-uniform direction of digitization

- ❑ Self-overlapping alignment feature

- ❑ Alignment feature geometry affects route starting point
 - U-shaped alignments
 - Circular alignments
 - Spurs

Postmile Point Layer

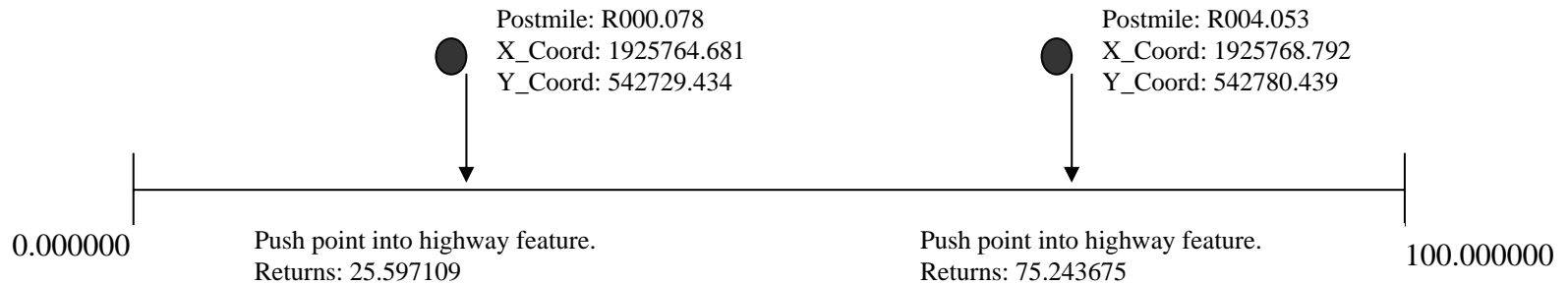


- ❑ Built originally from control points in CAiCE database
- ❑ Points mark known Caltrans postmiles
- ❑ New points digitized using CTRLRS interface
- ❑ Points used to build route measure lookup table

Route Measure Lookup Table

- ❑ Needed because postmiles are alphanumeric
- ❑ Built by spatially relating each postmile point to a measure along the corresponding route
- ❑ Can be rebuilt using the CTLRS interface as new points are added to the postmile layer
- ❑ CTLRS uses the route measure LUT to convert event measures from postmile values to internal route measure values
- ❑ Interpolation used to convert event measures falling between records in the route measure LUT

Route Measure Lookup Table – cont'd



County	Route	Direction	Postmile	Measure
SD	5		R000.078	25.597109
SD	5		R004.053	75.243675

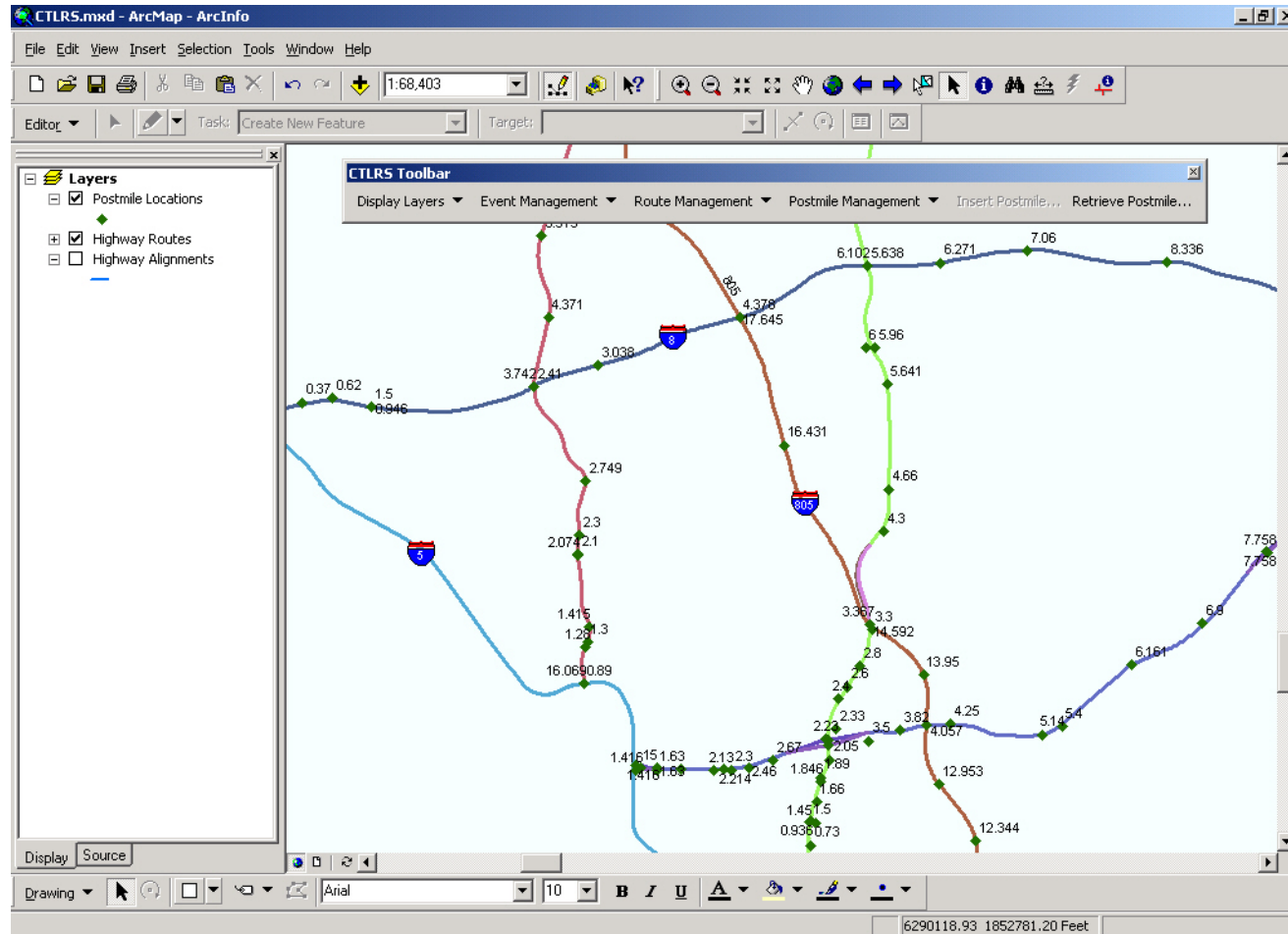
Postmile Data Issues Affecting Route Measure LUT

- Postmiles not spatially sequential order
- Postmiles with zero values
- Postmiles beyond snap tolerance from route
- Postmiles required at
 - Beginning and end of routes
 - Beginning and ending of divided highways
 - Points where a route enters or leave a county

Event Tables

- Can come from any data source
- Must have columns required by system
- Preprocessed by CTRLRS application
 - Validates table structure
 - Adds additional columns to store internal route measures
 - Calculates internal route measure using Route Measure LUT
 - Validates preprocessing results and reports errors to user
- Calculate Offset functionality calculates variable offset values for overlapping events
- Adjust Offset allows for fine-tuning of maps

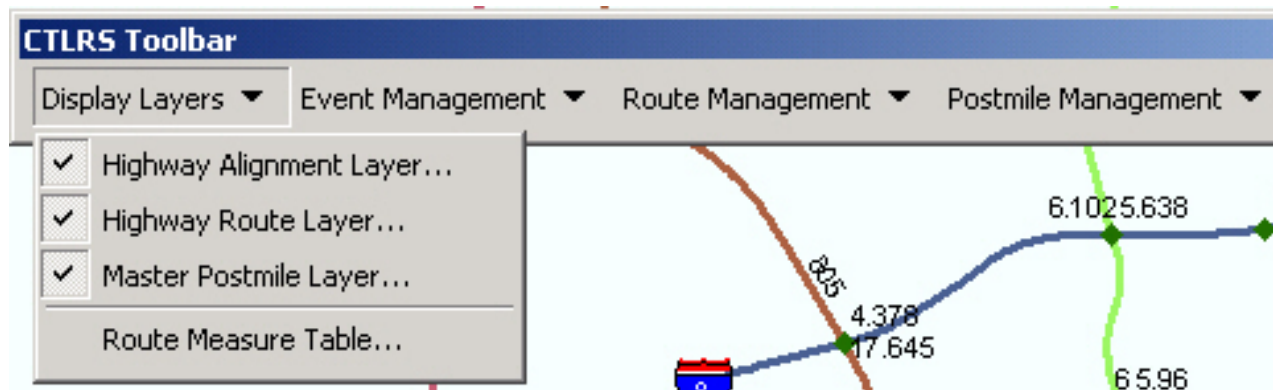
CTLRS Interface



CTLRs Menu

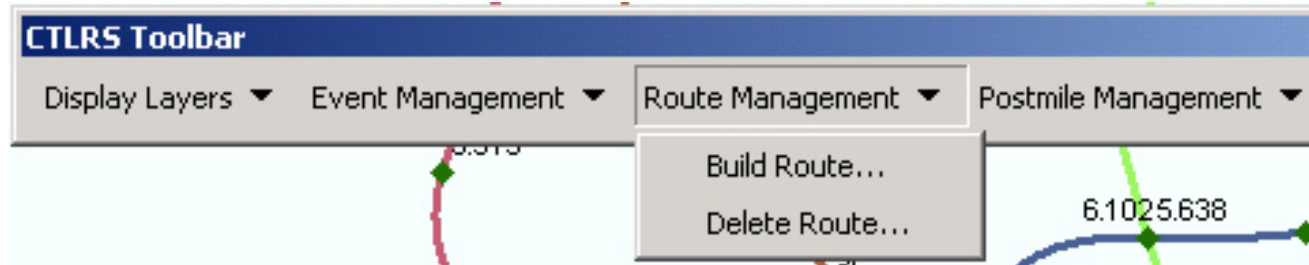
- Display Layers
- Route Management
- Postmile Management
- Event Management

Display Layers



- Easy toggling of required layers
- Access to system's Route Measure Lookup Table

Route Management



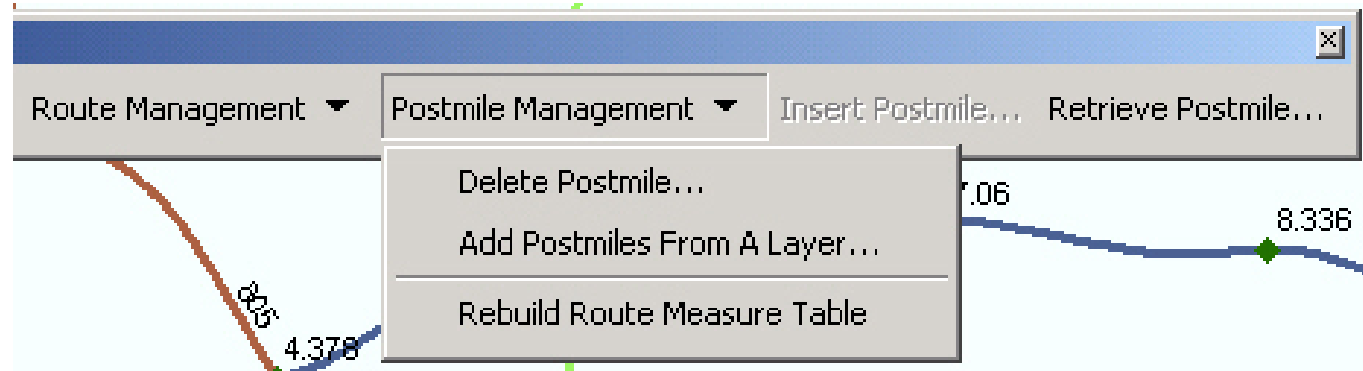
□ Build route

- Select a highway alignment feature
- Finds all other features with same Route ID
- Merges geometry and calculates internal measure
- Use interface to rebuild Route Measure LUT after edits

□ Delete route

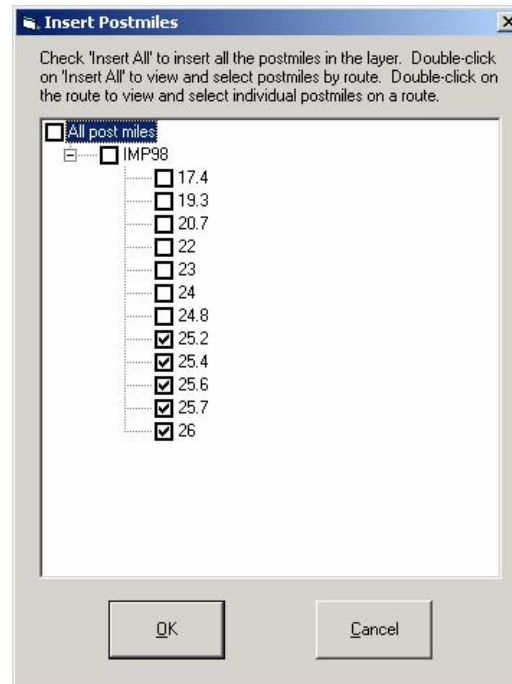
- Writes route to Deleted Route layer for archive/recovery

Postmile Management



- Delete postmile
 - Writes postmile(s) to Delete Postmile layer for archive/recovery
- Add postmiles from a layer
 - Batch process for multiple postmile updates
 - Layer structure must conform to system requirements
- Rebuild Route Measure LUT
 - Used whenever routes or postmiles are added or deleted

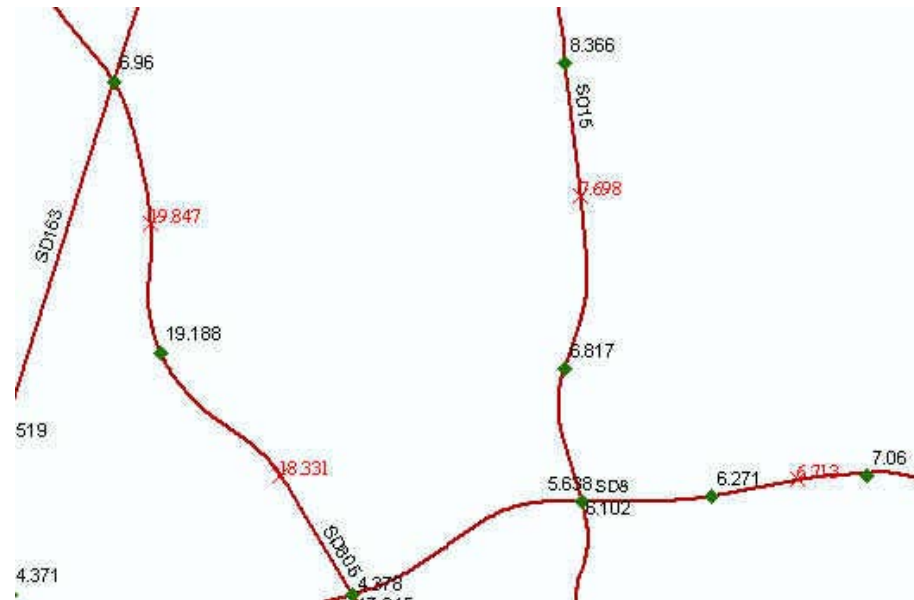
Postmile Management – Cont'd



Insert postmiles interface

- Tree view provides intuitive interface for including/excluding postmiles

Postmile Management – Cont'd



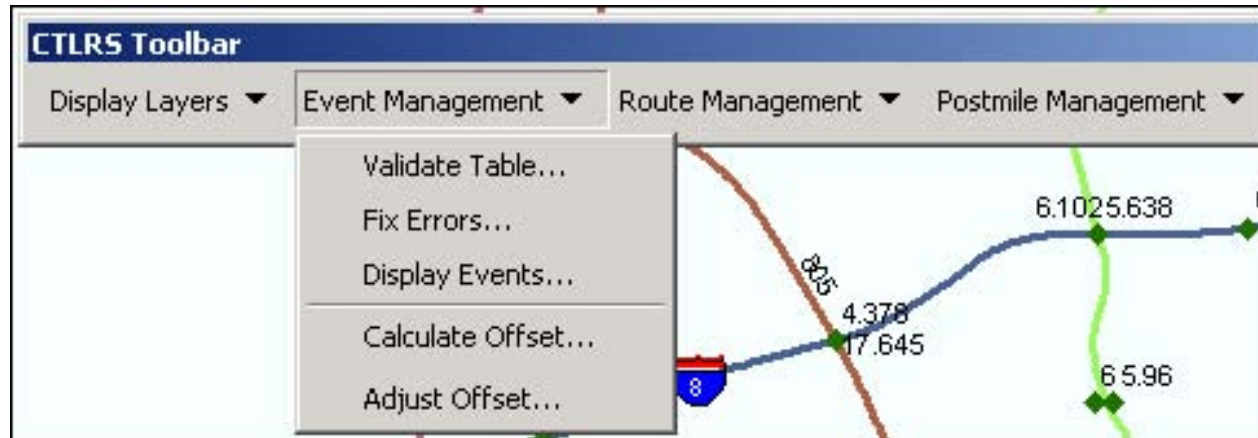
Retrieve postmile

- Interpolates between known points in Route Measure LUT

Insert postmile

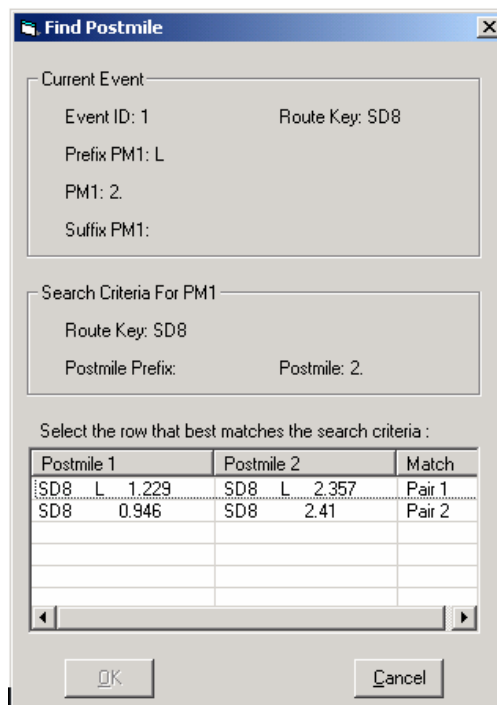
- Heads up digitizing of postmile point (500 ft. snap tolerance)

Event Management



- ❑ Events can be point or line events
- ❑ Validate Table checks table structure and data
- ❑ Fix Errors provides interface for data correction
- ❑ Display Events uses maps events as dyn. seg. layer
- ❑ Calculate/Adjust Offset improves event display

Event Management – Cont'd



Find Postmile

Current Event

Event ID: 1 Route Key: SD8

Prefix PM1: L

PM1: 2.

Suffix PM1:

Search Criteria For PM1

Route Key: SD8

Postmile Prefix: Postmile: 2.

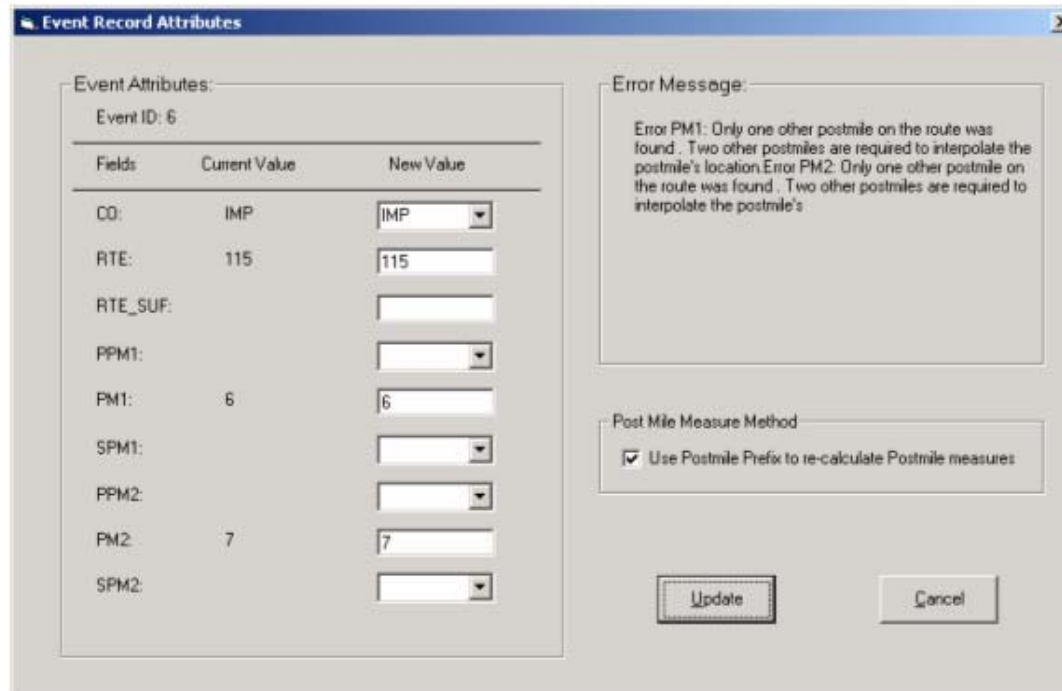
Select the row that best matches the search criteria :

Postmile 1	Postmile 2	Match
SD8 L 1.229	SD8 L 2.357	Pair 1
SD8 0.946	SD8 2.41	Pair 2

OK Cancel

- ❑ Validate table compares event measure to LUT
 - User picks postmile in case of ambiguity

Event Management – Cont'd



Event Record Attributes

Event ID: 6

Fields	Current Value	New Value
CO:	IMP	IMP
RTE:	115	115
RTE_SUF:		
PPM1:		
PM1:	6	6
SPM1:		
PPM2:		
PM2:	7	7
SPM2:		

Error Message:

Error PM1: Only one other postmile on the route was found. Two other postmiles are required to interpolate the postmile's location. Error PM2: Only one other postmile on the route was found. Two other postmiles are required to interpolate the postmile's.

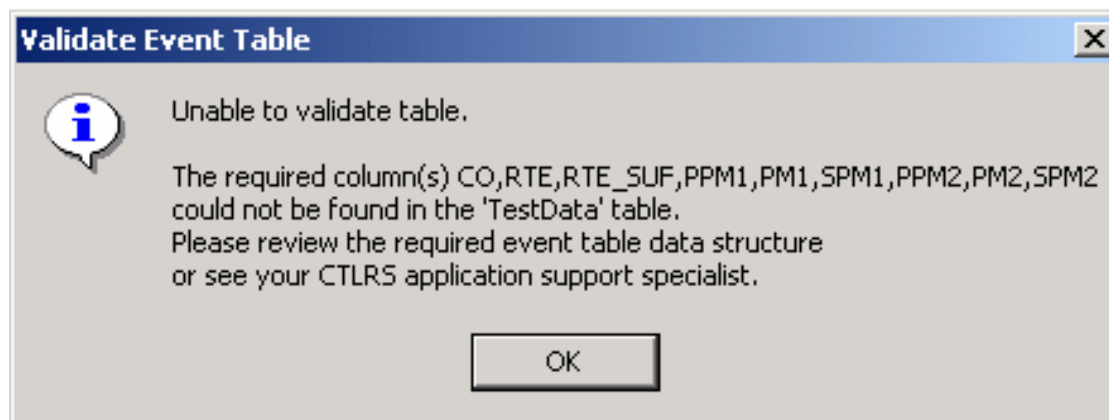
Post Mile Measure Method

Use Postmile Prefix to re-calculate Postmile measures

Update Cancel

- ❑ Validate table checks for data errors
 - User can correct data errors through interface

Event Management – Cont'd



- ❑ Validation process completes when
 - Table structure has errors
 - Table is valid, but data has errors
 - Table is valid and data has no errors

Event Management – Cont'd



Display Events

- Add DBF file or Access table to map through native ArcMap interface
- Adds point and/or line events as a dynamic segmentation layer
- Delete event layer from map through native ArcMap interface

Potential Enhancements

- ❑ Improve the method for storing error information about an event. Currently, the error message has a maximum length of 255 characters.
- ❑ Add functionality to semi-automate and/or customize the editing of the Highway Alignment Layer. Currently, the CTRLRS application relies on native ArcMap functionality.
- ❑ Provide functionality for moving a postmile in the Postmile Layer instead of current delete/add.