

# Multilevel Linear Referencing System

An LRS Model Supporting Event Location Stability and Temporal Data Management

## Multilevel LRS Background

Hexagon Geospatial is a leading provider of geospatially powered solutions that support the management of complex transportation systems. One of the core solutions for the transportation industry is our Multilevel Linear Referencing System (MLRS). MLRS has been a topic of discussion dating back to the early 1990s and the original National Cooperative Highway Research Program (NCHRP) 20-27 study. The idea is to separate location referencing methods (LRMs) and geometric representations of the road network into separate tables, and link them to a temporally stable datum with an ultimate goal of event location stability (Figure 1). This approach would provide a cohesive LRS that has capabilities far beyond those offered by a traditional single-level LRS. Hexagon Geospatial's MLRS data model, known as the GeoTrans transportation data model, is an improved derivative of the NCHRP 20-27 data model. Hexagon Geospatial's GeoMedia® Transportation Manager provides a rich environment to support the maintenance and analysis of both single and multilevel linear referenced and routing networks. The network management tools of GeoMedia Transportation Manager, coupled with the temporal data management components of GeoMedia, give you a sophisticated LRS model that supports both event location stability and temporal data management. This is critical as transportation agencies have the need to track trends and risk-mitigation efforts. One of the technology advancements within GeoMedia Transportation Manager is the capability to build and support an MLRS data model without the need for IT expertise.

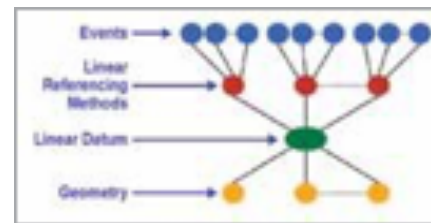


Figure 1: A multilevel LRS reflects changes to the network over time.

## Multiple Location Reference Methods

Most transportation agencies have various departments and external sources that collect data about the road network using a variety of measurement methods and road-naming conventions (Figure 2). To analyze data collected by different methods, transportation agencies require a system that can support various LRMs. With the GeoTrans data model, you can use multiple LRMs for analysis and seamless event transformation without costly data-conversion efforts

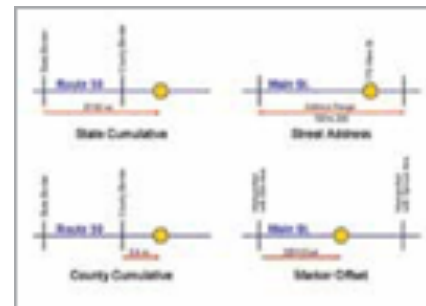


Figure 2: Transportation agencies often must analyze data collected by different methods.

## Temporal Data Maintenance and Analysis

Closely tied to the issue of event data location stability is temporal data maintenance and analysis. Temporal data maintenance preserves old representations of the network as changes are made to reflect the current status of the network. This is an essential factor when measuring the effectiveness over time of changes made to the network. GeoMedia transaction management capabilities enable both temporal analysis and data maintenance. It gives you the ability to perform two different types of time-stamping as needed. One type is for edits that represent real-world changes, such as a road realignment. The other type of stamping is for simple data corrections that do not represent any actual real-world change. This level of detail is important in creating an accurate and

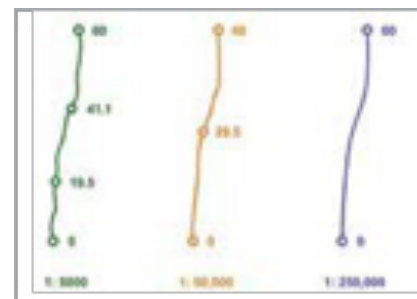


Figure 3: A multilevel LRS allows agencies to use data against different geometric representations.

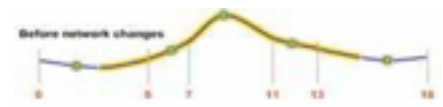
useful temporal record. This works in conjunction with the GeoTrans transportation data model to show only that event data that matches the network as it existed on those dates. These tools enable you to deploy a temporal LRS.

## Multiple Geometric Representations

A transportation agency often manages more than one geometric representation of its network (Figure 3). Your agency may use different levels of generalization for different map products or types of transportation analysis. You may want to use the same event data against different geometric representations, depending on whether you are Event location stability performing large-scale or small-scale analysis. Without an MLRS, it is necessary to replicate all of your data maintenance efforts for each geometric representation. In addition, there is no guarantee the individual referencing systems are synchronized, or if they will generate similar results. Agencies want to easily switch between geometric representations without worrying if this will affect the validity of their analysis. The GeoTrans data model supports these requirements.

## The Complete Package

The combination of GeoMedia Transportation Manager and GeoMedia transaction management capabilities provide everything needed to build, maintain, and analyze a multilevel, temporal LRS. Hexagon Geospatial has extended the editing tools in GeoMedia Transportation Manager to provide a complete data maintenance environment for an MLRS. When used together with GeoMedia transaction management capabilities, the system adds a temporal dimension to both data maintenance and analysis. This provides you with superior linear referencing capabilities right out of the box.



Road networks are dynamic in nature. A key concern of many transportation agencies is the effect of network changes on the stability of operational data that reference the network. When business data are locationally referenced to a roadway, they occupy a known location.



If the changes to the network are not properly synchronized with the business data location, errors will occur. These location errors will result in an erroneous decision-support process.



The GeoTrans model eliminates these shifts by tying the event data to a stable linear datum. This provides event location stability even if the roadway changes at the LRM level.

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## About Hexagon

Hexagon is a global leader in sensor, software and autonomous solutions. We are putting data to work to boost efficiency, productivity, and quality across industrial, manufacturing, infrastructure, safety, and mobility applications.

Our technologies are shaping urban and production ecosystems to become increasingly connected and autonomous — ensuring a scalable, sustainable future.

Hexagon's Geospatial division creates solutions that deliver a 5D smart digital reality with insight into what was, what is, what could be, what should be, and ultimately, what will be.

Hexagon (Nasdaq Stockholm: HEXA B) has approximately 20,000 employees in 50 countries and net sales of approximately 4.3bn USD. Learn more at [hexagon.com](https://www.hexagon.com) and follow us @HexagonAB.

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