Application of a Regional Multi-Modal Transportation System Performance Monitoring Framework

PI: Genevieve Giuliano, Co-PI: Sandip Chakrabarti
RGL 216, 650 Childs Way, Los Angeles, CA 90089-0626
giuliano@usc.edu

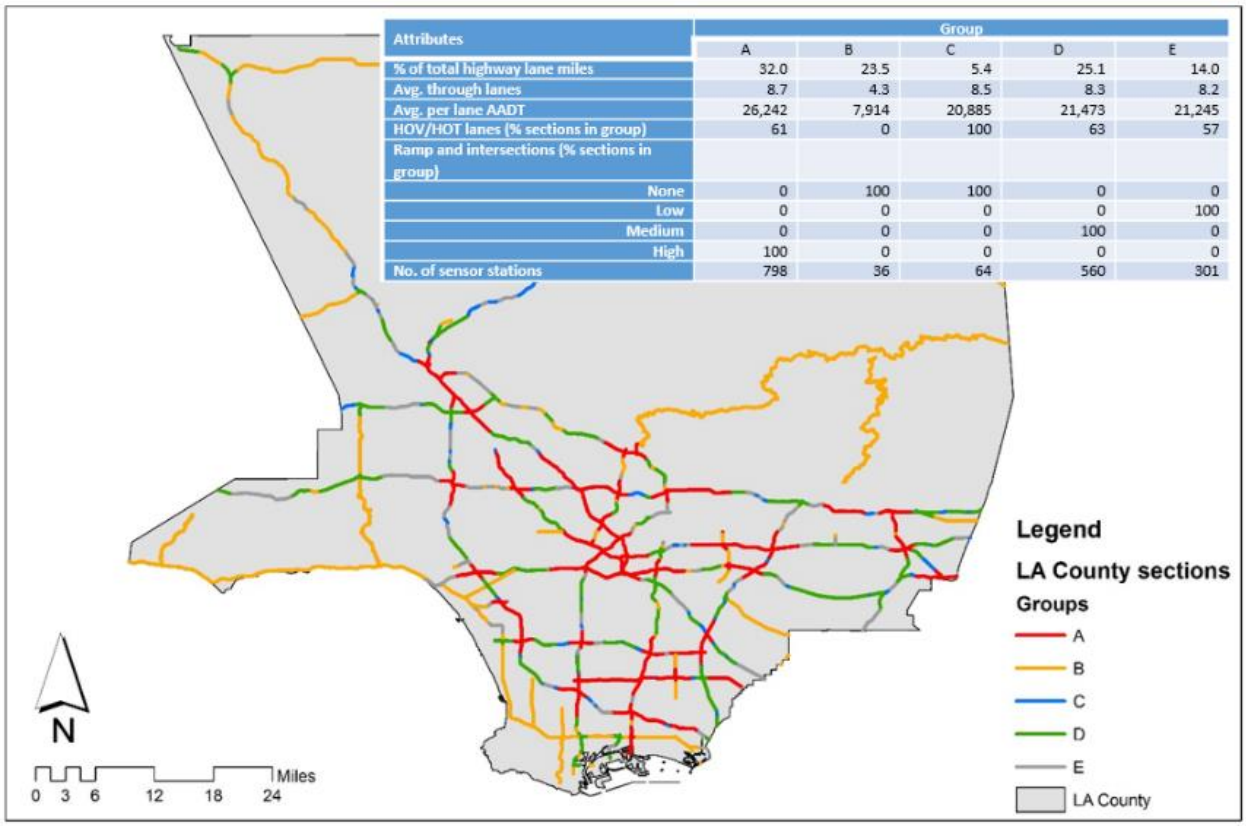
1. Project Objective and Problem Statement

The increasing availability of archived real-time transportation system data provides new opportunities for transportation system performance analysis across highly disaggregate units of space and time. In this study, we demonstrate an application of the Archived Data Management System (ADMS), a comprehensive archive of real-time multi-modal transportation system data in the Los Angeles region, to examine the characteristics and determinants of intra-metropolitan variation in highway system performance in Los Angeles County. We use traffic speed, flow and buffer index as test performance measures. We conduct our analysis using one year (January 1 to December 31, 2014) of highway traffic data for Los Angeles County over five different weekday time periods (AM peak, PM peak, and three off-peaks). We identify highway segment groups via cluster analysis, and compare performance across and within groups. We estimate regression models to test factors associated with performance variation.

2. Research Methodology

ADMS was developed at USC in partnership with the Los Angeles County Metropolitan Transportation Authority (Metro). It includes historical real-time data from over 5,000 highway sensors, 10,000 arterial sensors, as well as ramp meters, video cameras, bus and rail vehicles (GPS), and event/incident feeds. These data are supplemented with transit service supply, demand, and performance data, and multi-modal network configuration data.

Figure 1: Groups of highway sections



Data Sources:

- Traffic data from 1776 Caltrans traffic sensor stations, aggregated to 15 minute intervals
- 2012 HPMS (Highway Performance Monitoring System) shapefiles
- SCAG (Southern California Association of Governments) network files
- California SWITRS (Statewide Integrated Traffic Records System)
- American Community Survey (ACS) 2010-14 5-year estimates.

We use cluster analysis to classify highway sections based on attributes, including measures of demand, and roadway configuration or geometry. Figure 1 maps the groups and shows section attributes by group.

3. Results

Differences between groups are significant

Overall, we find day-to-day travel conditions to vary significantly across space and time, even within groups. These values can serve as a baseline for system managers.

Table 1: Mean of speed, volume, and buffer index by group (AM peak example)

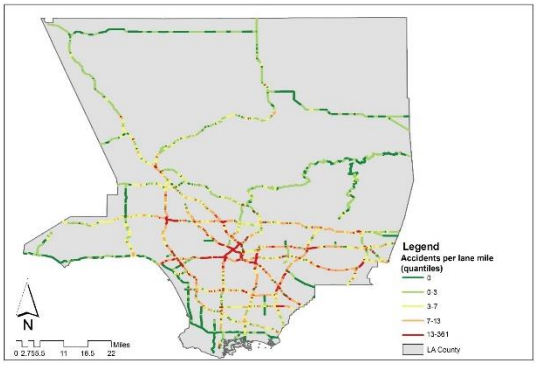
Time period/Measure		Group A	Group B	Group C	Group D	Group E
Averages						
AM Peak	Average speed (mph)	52.2	56.1	54.2	53.6	55.0
	Average volume (veh/lane/hr)	1299.2	742.5	1468.6	1386.7	1307.1
	Average BI (%)	97.4	50.5	86.0	81.9	74.2
	N	1,718,411	79,852	129,820	1,150,727	683,352

Explaining variation within and across groups

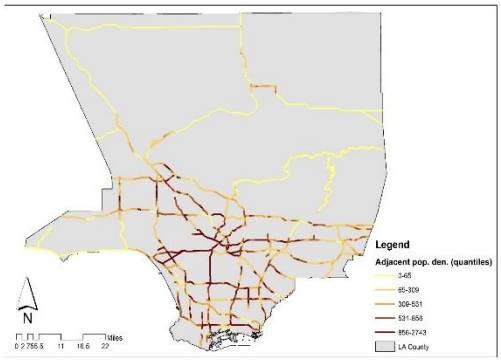
We estimate regression models to examine whether the cluster groups are significant factors in performance, after controlling for time of day, accident rates, and population density (a proxy for general travel demand). We find:

- As expected, time period, accident rate, and population density are significant factors
- Controlling for these factors, cluster groups remain significant factors

Accidents per lane mile



Population density



Implications for Practice

Our analysis suggests that the clusters represent many unmeasured factors that influence performance. Our method provides a flexible tool for identifying and evaluating intra-metropolitan variation in highway system performance. The clusters may be interpreted as peer groups, and sections that perform below the cluster average can be targeted for analysis and improvement. The study demonstrates the benefit of archiving traffic sensor data and making it available for system planning and analysis.