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Evaluation of Incorporating Hybrid Vehicle Use of HOV Lanes

Project

Evaluation of Incorporating Hybrid Vehicles Use of HOV lanes, 2006

Organization

University of California Irvine

Caltrans

Sector

Transportation Planning, traffic Operation

Objective

Evaluate the impacts of allowing use of HOV lanes by single-occupant gasoline-electric hybrid vehicles

Highlights

- Study site includes freeways I-5, I-405, SR-55, SR-22, SR-57, and SR-91 in Orange County, California. The total freeway lane miles are 1000 miles.
- HOV, SOV and Hybrid demands are estimated
- Model is calibrated against observed data based on the FHWA guideline
- Both operational and emission effects of the policy are investigated

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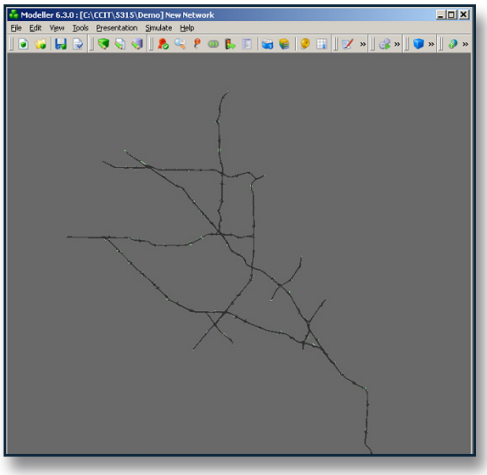
High-Occupancy Vehicle (HOV) lanes have been regarded as a cost-effective and environmental friendly option to help move people along congested routes. Many states in the US have deployed the policy to allow hybrid vehicles to use HOV lanes, with the expectation to reduce vehicular emissions by encouraging drivers to use fuel efficient vehicles as well as ease traffic congestion through the more efficient use of the reserved capacity on the HOV lanes.

Orange County (OC) is a densely populated portion of the Greater Los Angeles metropolitan area, with 3 million inhabitants in 800 square miles with 1.8 million cars registered. The baseline traffic condition shows that some HOV lanes in OC are already congested during peak periods and thus the impacts of the policy to OC is investigated using a method that combines the traditional planning model for demand estimation and analysis with microscopic simulation modelling for accurate measures of system performance.

The simulation network includes all the major busy freeways in Orange County: I-5, I-405, SR-55, SR-22, SR-57, and SR-91, which are well covered by loop detectors and also contains a variety of HOV lane configurations, including freeway-to-freeway HOV lane connectors, exclusive HOV lane ramps, and limited ingress/egress points. Ramp meters were added to all applicable on-ramps and set to the field metering rate, and loop detectors were placed to collect data across the network. As one of the biggest Paramics simulation models in the world, the network has a total of 800 mainline lane miles and 200 HOV lane miles, and 265 zones. The baseline Single Occupancy Vehicle (SOV) and HOV demand data are originally extracted from the regional planning model and then further fine-tuned using the Paramics OD estimator tool. The model is calibrated by matching observed and simulated loop detector data and bottlenecks based on Federal Highway Administration (FHWA)'s calibration guideline.



Based on California's Hybrid vehicle policy and the existing HOV guidelines from California and FHWA, four different study scenarios, each of which corresponds to a different hybrid vehicle market penetration, are designed and developed based on the calibrated baseline model. The hybrid demand for each scenario is derived from the hybrid demand distribution pattern estimated using multinomial logit and binomial logit model based on socio-economic data such as population, number of workers, average household size and median income.

The impacts of the hybrid-HOV policy are analyzed in term of overall system performance, corridor level performance and air quality. The overall system performance measures include Vehicle Hours Traveled (VHT), Vehicle Miles Traveled (VMT) and average travel speed. The corridor level performance measures include Level of Service (LOS) and average travel speed. The Comprehensive Modal Emission Model (CMEM), developed by University of California, Riverside along with University of Michigan and Lawrence Berkeley National Laboratory, was used to evaluate the performance of different scenarios with respect to air quality.