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Caltrans Division of Research, Innovation and System Information

Research Results

SB-743: From LOS to VMT, VHT, and Beyond through Data Fusion: Application to Integrated Corridor Management

Provide analysis tools to infer essential metrics in support of SB-743 from infrastructure data, fused with GPS and cell tower data.

Transportation Safety and Mobility

WHAT IS THE NEED?

California's State Senate Bill 743 (SB-743) suggests a process to change the analysis of transportation impacts under the California Environmental Quality Act (CEQA). This goal is further supported by the memo entitled Preliminary Evaluation of Alternative Methods of Transportation Analysis issued by Governor Brown's Office of Planning and Research on December 30, 2013, which outlines the necessity for California to provide alternatives to the use of Levels of Service (LOS) as defined by the Highway Capacity Manual (HCM) and other technical documents for the evaluation of transportation impacts. While LOS is currently widely used to assess the operational efficiency of transportation system elements, it is indicated that this metric is relatively difficult to compute accurately. The memo outlines the multi-step process required to compute LOS values and describes the use of this metric as "difficult and expensive." It further suggests the use of possible alternative measures such as Vehicle Miles Traveled (VMT), VMT per capita, Vehicle Hours Traveled (VHT), automobile trip generation rates, or automobile trips generated.

Among the various topics of interest to SB-743, two are of particular interest for the present work: VMT and VHT. Note that these also relate to other metrics of interest to SB-743, in particular Multi-Modal Level of Service (MMLOS) and Fuel Use (FU).

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WHAT WAS OUR GOAL?

The goal of this project is to provide analysis tools to infer essential metrics in support of SB743 from infrastructure data, fused with GPS and cell tower data.

WHAT DID WE DO?

Task I SB 743 "modeling"
*   Mathematical formulation of all metrics to be investigated beyond the VMT I VHT from data (how to compute from which data).
*   Validation of importance of metrics for operations, planning, and assessment of relevance for SB 743
*   The deliverable for this task is a research brief summarizing the different metrics which could be used for performance assessment. These will be documented in light of the data available for typical corridors of California.

Task 2 Algorithm development
*   Development of algorithms for VHT inference, validation on existing data (Mobile Millennium data for Northern California)
*   Development of algorithms for VMT inference, validation on existing data (synthetic data from Matsim)
*   The deliverable for this task is a set of algorithms implemented in prototypical form for some experimental data available for the team. The deliverable will consist in a summary of the numerical work performed on this experimental data.

Task 3 Algorithm testing
*   Testing on GPS data for VHT inference, Pasadena
*   Testing on CDR data for VMT inference, entire 1210 corridor
*   The deliverable for this task is a document summarizing the algorithms result on the

1210 data (in particular Pasadena if the data available is of sufficient quality). Deliverable due: Jan. 2016.

Task 4 Comparison of results with existing state of the art (LOS in particular)
*   LOS inference from currently available data (for example for Pasadena racetrack data, 2006 data, etc.
*   Comparison of LOS computed from the proposed methodology with the ones available today and assessment of improvements
*   Assessment of improvements of new computed metrics (VMT, VHT) from additional data used by the project.
*   The deliverable for this task is a short brief on the comparison on how the new metrics compare to the traditional ones (i.e. LOS) in assessing the performance of the corresponding links in the network.

Task 5 Recommendations
*   Reporting effort for the project
*   Recommendations for investment in infrastructure (rep01t)
*   Recommendation for data procurement (GPS and CDR)
*   Final report finalization.

WHAT WAS THE OUTCOME?

This study created a data-fusion based method for computing performance metrics for corridor intersections. Under the assumption that travel time data can be obtained from a sub-population of vehicles. The new method combined the sample mean of travel times with the vehicle count obtained from mid-block loop detectors to obtain an estimate of VHT. This estimator has several advantages as compared to the current state-of-practice. First, it is data-driven rather than model-driven and therefore, it does not rely on any modeling assumptions. For this reason it

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can be applied in a variety of scenarios, including congestion and spillback. It is also very simple to compute as compared to the delay formulas of the HCM. The method also does not require signal timing parameters to be known.

WHAT IS THE BENEFIT?

The outcome of this phase will yield an assessment representative not only of what can be done for the 1-210 corridor in light of available data, but also for any other corridor management projects in California, and possibly elsewhere in the country. Caltrans is planning to implement 50 Connected Corridors in the next 10 years.