Abstract
Measuring arterial performance presents many challenges as compared with measuring freeway performance. Inductive loop detectors are generally not deployed in sufficient numbers to describe the complicated traffic patterns of arterial roadways and are instead ordinarily used only to describe conditions around traffic signals. This study examines the promise of combining existing systems signal data with information gathered by city buses equipped with GPS technology in order to more accurately describe arterial conditions in real time.

Objective
The objective of this research is to examine the potential of using data from two complimentary sources in order to measure arterial performance and provide real-time traffic conditions on arterial streets, as has recently been done in Bellevue, Washington (see figure to the right).

Data
This study made use of archived loop detector data from the Portland Office of Transportation and archived automatic vehicle locator (AVL) data provided by TriMet, Portland’s transit provider, in order to study a 4.5-mile segment of Barbur Boulevard in Portland, Oregon.

Methodology
The shape of the congestion interval around each signal was determined by plotting bus trajectories on top of a contour plot of loop detector occupancy readings. Speed data recorded by buses were used to fill in the gaps where loop detector readings were not relevant. These segments where conditions were unknown were filled in by finding the maximum speed attained by the last bus to pass through the segment.

Conclusions
The result is a time-space speed contour plot derived from a combination of loop detector and archived bus data that conveys traffic conditions more accurately than either data source alone. While this study made use of archived data, the necessary information could be made available in real time. This could be used to create a congestion map like the one featured to the right, which would benefit travelers by enabling more informed route selection and would assist traffic engineers in managing the roadway network.

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Using Signal Systems Data and Buses as Probes to Create Arterial Performance Measures
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Signal systems contour plot

Signal system loop detectors report occupancy levels every 5 minutes.

Unknown conditions persist

There are large intervals where loop detector readings do not accurately convey conditions.

Congestion regime manually redefined

Bus trajectories indicate that congestion only persists around the signal.

Buses provides complimentary information

Each dot represents a bus stop while the colors represent the maximum speed achieved by the bus since the previous stop.

Algorithm confirms manual adjustment

A simple algorithm identifies locations where buses repeatedly experience congestion.

Contour plot based on signal and bus data

Unknown conditions are assigned by looking back to the maximum speed attained by the last bus to pass through the segment.