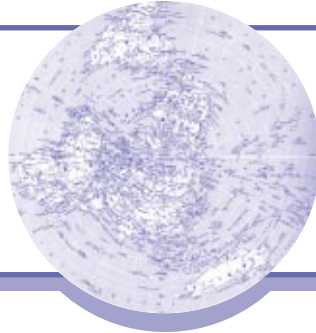


REAL-TIME TRAFFIC PREDICTION FOR ADVANCED TRAFFIC MANAGEMENT SYSTEMS

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Why This Research is Needed

Busy intersections can easily become bottlenecks in a congested traffic system. For example, traffic flow is impeded when large numbers of vehicles slow down to turn instead of going through the intersection at driving speed. As traffic managers search for ways to make intersections function more smoothly and efficiently, they must develop more accurate ways of measuring and predicting this type of traffic flow. Turning movement patterns are required by almost all signal-timing methods, but are difficult to estimate automatically. A full set of detectors in the pavement to measure turning movements at an intersection is expensive to install and maintain.

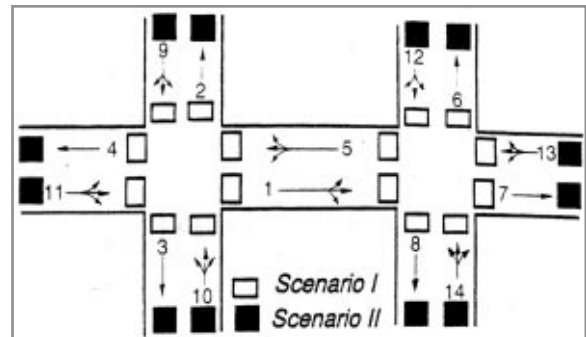
Research Objective

To estimate the “turning ratios” (the relative numbers of vehicles turning left or right, or going straight) for a given intersection without a complete set of detectors embedded in the pavement.

Methodology

Instead of placing a full set of detectors around each intersection, the researchers proposed placing detectors only around the outer perimeter of a set of two intersections—a “cordon-count” system—thereby reducing the number of detectors required from 16 to 12. Without the full set of detectors, it is necessary to develop a procedure for estimating what is going on in the center of the system.

The researchers used two models for estimating the turning proportions: the nonlinear least squares (NLS) system and a quasi-maximum likelihood



Top: Full and cordon-count detector placement scenarios
Above: The test intersection

(QML) approach. After testing these models against data from a full detector array using cordoned-array data, the research team employed recursive estimates of turning movement proportions to produce estimation models that can be updated with incoming data over time. In offline simulations, the recursive QML approach (RQML) showed the best performance.

The RQML algorithm was then tested using data gathered by a video camera trained on a typical Minneapolis intersection from 4:15–5:15 pm. Data were extracted every five seconds, and aggregated every two minutes, giving a total of 45 observations.

Research Results

Comparison of observed data to RQML predictions showed that the recursive algorithm might perform well in a small-scale network under the cordon-count configuration. However, the research results indicate that as the size of the network increases, the sufficiency of detector data to support parameter estimators will likely decline.