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TRAFFIC MONITORING USING SATELLITE AND GROUND DATA: PREPARATION FOR FEASIBILITY TESTS AND AN OPERATIONAL SYSTEM	April, 2000
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16. Abstract We address three issues in this report: demonstrate that vehicles can be identified and classified accurately from satellite imagery, develop efficient image processing methods, and determine methods to integrate the imagery with ground-based data and assess the value of this integration. Field tests were replicated, where aerial photographs were used to simulate satellite imagery. We developed software to automate many of the calculations involved, and the empirical results show that our approach and software work well. We notice discrepancies between image- and ground-based data that lead us to propose that there are inevitable differences between image- and ground-based data sets that cannot be attributed to misidentification of vehicles in the images. Automated image processing must be used to perform the detection and classification of vehicles. A more robust methodology that first identifies dynamic (moving) pixels by subtracting an image of a highway segment under *current* conditions from a steady-state *background* image intended to represent the same segment with no vehicles present is described. The effects of different lighting conditions in the current and background images are reduced by first transforming grey tones of one of the images. We develop an iterative, maximum likelihood-based procedure that requires an *a prior* estimate of the probability that a random pixel in the current image is dynamic. Tests on images generated from computer simulations and on images obtained from scanned aerial photographs show promise. The limited temporal coverage of polar-orbiting satellites has led us to focus on using satellite imagery to improve estimates of Average Annual Daily Traffic (AADT) on highway segments and Vehicle Miles Traveled (VMT) over the network of these segments. We develop methods to simulate the improvements in AADT and VMT estimates produced by combining data obtained on time scales consistent with satellite orbits with data collected on the ground. Numerical results indicate the potential of satellite-based data to complement ground-based data and markedly reduce the errors in AADT or VMT estimation and the personnel required to obtain sufficient ground data to produce a given level of accuracy.

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