DRISI

CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

Research Results

Improving the Accuracy of Intersection Counts and Densities for Measuring Urban Street Network Compactness and Resilience

This project performed research on methods for improving the calculation of street intersection counts and densities.

Advanced Research

AUGUST 2023

Project Title:
Improving the Accuracy of Intersection Counts and Densities for Measuring Urban Street Network Compactness and Resilience

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Task Manager:
Hamid Ikram
Transportation Engineer (Electrical)
hamid.ikram@dot.ca.gov

WHAT WAS THE NEED?

Street intersections (junctions where two or more roads meet) are an important part of the street network characteristics that contribute to urban resilience, such as compactness, centrality, connectivity, walkability, and safety. The intersection counts and density (counts normalized by area) data is used as foundational input data by researchers and practitioners to represent the real world accurately and to plan a resilient and sustainable transportation infrastructure, that supports active transportation. Despite the street intersections' apparent simplicity, counting the street intersections can be challenging. Using existing methods (rough approximation methods), the transportation practitioners often count intersections incorrectly, which results in overcount of intersections. This overcount of intersections can introduce bias and prevent a true accounting of the transportation system's ability to support sustainable and environmentally responsible travel behavior. To improve the measurement of urban street network compactness and sustainability, there was a need to improve the accuracy of methods used for calculating street intersection counts and densities data.

WHAT WAS OUR GOAL?

The goal of this project was to develop accurate method of counting the street intersections, to help improve the measurement of urban street network compactness and support sustainable transportation practice.

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WHAT DID WE DO?

This project has developed an algorithm (a reusable toolkit) to calculate the intersection counts automatically and correctly, by using a topological consolidation method. The algorithm improves accuracy of the street network by 1) consolidating multiple nodes comprising complex intersections (due to divided roadways, roundabouts, and slip lanes etc.) that should belong to the same intersection in the real world, and 2) unlike geometric consolidation, it prevents the false consolidation of topologically remote but spatially proximate nodes, such as unconnected intersections on overpasses and underpasses. This network consolidation algorithm was then tested on graph models of every urban area in the world for an empirical analysis of the phenomenon's effects, and then a sample of the resulting models were manually validated.

WHAT WAS THE OUTCOME?

This project developed and validated an algorithm that automatically and correctly calculates intersection counts.

WHAT IS THE BENEFIT?

This project addresses the longstanding problem of bias in intersection counts data. The results demonstrate that the algorithm effectively corrected the street network and could be a useful tool for future research and practice.

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Link to the final report is to be decided.