Maximizing Improvements for Multiple Agency Goals

tech transfer summary

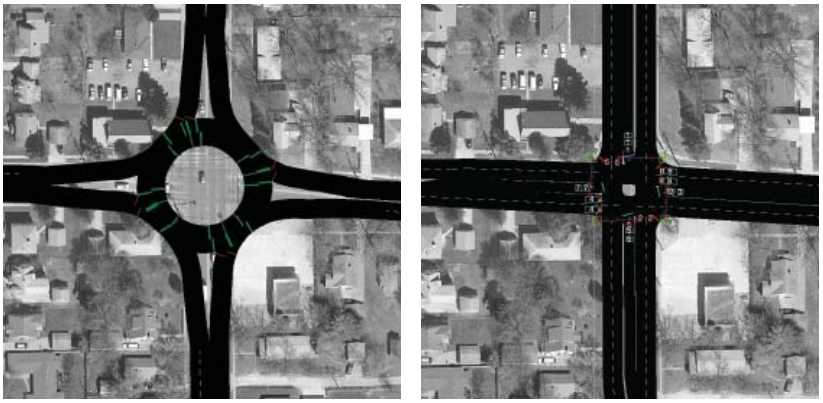
Understanding the tradeoffs between operations, safety, and air quality goals for different capital improvement projects can help agencies leverage funds and use resources cost-effectively.

Objectives

Develop a decision support toolbox for measuring the efficiency of common improvement projects against multiple agency goals in several areas (operations, safety, and air quality).

Problem Statement

Transportation agencies allocate significant resources to meet goals in areas such as traffic operations, safety, and air quality. However, agencies that plan improvements to meet goals in one area often do not consider how the improvements will affect goals in other areas. As a result, agencies may miss opportunities to make better informed decisions about cost-effective improvements. For instance, installing either left-turn lanes or a roundabout at a particular intersection may improve safety, but the roundabout may also reduce fuel consumption and improve air quality. Agencies can maximize the impacts of their improvements by using toolbox of standard measures to evaluate the efficiency of different projects against multiple agency goals.



Models of two alternative improvement projects proposed for an intersection in Ames, Iowa: roundabout (left) and turning lanes (right)

Research Design

The effects of seven improvement types on traffic flow, safety, and fuel consumption/air quality were examined. The improvements included roundabouts, left-turn lanes, median treatments (raised medians and two-way left-turn lanes [TWLTLs]), driveway consolidation, U-turns, signalization and traffic signal spacing, and alternative access (frontage and backage) roads. Additionally, three case studies were conducted using a microscopic traffic simulation program, VISSIM. These were based on actual corridors that would benefit from improvements.

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RESEARCH PROJECT TITLE
Toolbox to Assess Tradeoffs between Safety, Operations, and Air Quality for Intersection and Access Management Strategies

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The Midwest Transportation Consortium (MTC) is part of the Center for Transportation Research and Education (CTRE) at Iowa State University. The MTC is the University Transportation Centers Program regional center for Iowa, Kansas, Missouri, and Nebraska.

Key Findings

The table below, based on previously published research and VISSIM case studies, summarizes the effects of seven improvement types on traffic flow, safety, and fuel consumption.

Effects of seven improvement types on traffic flow, safety, and fuel consumption

Traffic Flow Impacts	Safety Impacts	Fuel Consumption Impacts
Roundabouts		
• Higher capacity and lower delays; most benefits during off-peak periods • Best for two-lane approaches with heavy thru or left-turning traffic • Better access to businesses than raised medians or TWLTLs	• Typically reduce overall crash rates, injury crash rates, and incapacitating injury crash rates	• Impacts vary with traffic density • Emissions reduced during peak periods, but acceleration/deceleration may increase • Better than light-controlled crossing; worse than signalization
Left-turn Lanes		
• Removing left-turning vehicles from traffic increases capacity • Reduce average delay, stopped delay, and travel time	• Reduce rear-end, sideswipe, left-turn crashes; increase right-angle crashes • In some studies, few safety benefits	• Decreasing delay should reduce fuel consumption
Median Treatments		
• TWLTLs generally reduce delay, improve operations; may lead to excessive driveway development • Raised medians improve average speeds and have delays similar to TWLTLs	• Raised medians may increase neighborhood cut-throughs; safety hazard if struck; difficult to see in the dark • Vehicles turning left at TWLTLs have difficulty finding a gap when opposing volumes are high	• For raised medians and TWLTLs, improving operations and traffic speeds should decrease fuel consumption
Driveway Consolidation		
• On multilane roads, speeds drop 0.25 mph per access point, up to 10 mph lower for 40 access points per mile • Should reduce slowing and improve operations	• Accident rates increase with greater number of driveways and streets	• Improved traffic flow usually results in higher travel speeds and reduced slowing/acceleration, reducing fuel consumption
U-turns		
• No information available	• Lower accident rates than TWLTLs and prohibited-left-turn corridors	• No information available
Signalization/Traffic Signal Spacing		
• Benefits depend on traffic volume, turning movement, intersections intervals, signal phasing • Good for high traffic volumes and heavy left turns	• Low crash rates when less than two signals per mile • Accident rates increase significantly as signal density increases	• Travel time increases with increased signal density, and fuel consumption rises
Alternative Access Roads		
• Travel times increase when stopped delays decrease • Short trips may be delayed	• Should reduce conflict points, reducing accident rates	• No information available

Implementation Benefits

A decision support tool can help agencies maximize the benefits of each improvement project and allocate resources effectively.

Implementation Readiness

Additional research will help to quanitfy the effects of these improvement types on various agency goals.

Left-turn lanes installed on a corridor in Ankeny, Iowa