National Center for Sustainable Transportation

POLICY BRIEF

Can Complete Streets Deliver on Sustainability?

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Complete streets are those designed not only for private vehicles, but also to enable safe access for all users, including pedestrians, bicyclists, motorists, and transit riders of all ages and abilities. Specific street designs vary based on the type of street (Figure 1). Complete streets are intended to improve non-motorized travel safety, reduce costs and environmental burdens, and create more livable, sustainable, and economically vibrant communities. Investment in complete streets projects is growing around the country with these goals in mind. However, there are limited data to verify the effectiveness of complete streets, and the indicators required for quantification of complete street performance are not yet agreed upon. Complete street sustainability indicators are important to assess whether a complete street conversion is achieving its goals and to support decision-making for complete street investment.

Researchers at the University of California, Davis and JCH Research used life cycle assessment, a modeling tool for evaluating a product or activity's environmental impacts through all stages of its life, to quantify the environmental performance of complete streets. The researchers also reviewed the academic literature for social impact indicators, which have generally not been well developed in life cycle assessment applications. The researchers adapted these indicators to better consider equity, guided by interviews with a diverse set of stakeholders. Complete street typologies compiled from several sources were used to test and refine the life cycle assessment framework for complete street conversions.

Key Research Findings

The researchers developed social indicators related to accessibility, jobs, mobility/connectivity, safety/public health, and livability to evaluate complete streets projects (Table 1). Quantitative social indicators incorporating equity considerations should focus on project outcomes in terms of neighborhood improvements, not just the process of neighborhood engagement. These indicators should be quantified based on the amount of change induced by complete street conversion rather than the end state. This helps recognize projects that provide larger improvements to neighborhoods needing the most change.

Social indicators must be tested for equity, as they may have a built-in bias towards advantaged neighborhoods. Evaluating complete streets projects on their potential to increase connectivity to important destinations like jobs, schools, medical services, healthy food, parks, and libraries ignores historical inequities in public infrastructure investment. These inequities have led to fewer of these destinations being present in disadvantaged neighborhoods. Using such an indicator without

Figure 1. An example of a complete street design for a downtown thoroughfare from the National Association of City Transportation Officials' Urban Street Design Guide

considering each neighborhood's density of destinations can bias project selection and exacerbate existing inequities.

Complete streets should be examined and designed within the context of a broader active transportation and transit network. The potential for complete streets projects to improve connectivity is crucial for their success. While indicators must reflect the neighborhood scale, they must also consider the transportation network connecting to and feeding transit both within and between neighborhoods. This is important for achieving equitable outcomes. Given that disadvantaged neighborhoods often have fewer opportunity destinations, improving connections to other neighborhoods can increase access to these key destinations.

Environmental benefits of complete streets have not previously been evaluated on a life cycle basis, and this research shows that benefits are highly dependent on induced changes to vehicle miles traveled. Life cycle assessments of several generic complete street conversions showed that complete streets are not guaranteed to reduce greenhouse gas emissions and air pollution. The materials and construction required for a complete streets project generate their own emissions, so a project's success in encouraging active transportation that reduces vehicle travel is crucial for achieving environmental objectives. Previous work by other researchers has shown mixed results on whether complete streets projects reduce vehicle miles traveled. A sensitivity analysis using data from San Jose, California showed environmental impacts of implementing complete streets are highly dependent on vehicle miles traveled changes.

Vehicle speed changes are another key factor in the environmental performance of a complete street project. Complete street conversions on large thoroughfares that reduce speeds for internal combustion-powered vehicles to closer to optimal operating speeds (45 mph) can reduce emissions and energy use. Reducing speeds on other streets to less than 45 mph can increase emissions if there is not sufficient reduction in vehicle miles traveled to compensate.

Selected Category	Selected Performance Measures
Accessibility	Access to community destinations
	Access to schools
Jobs	Access to jobs
	Job creation
Mobility/Connectivity	Active transportation to local and regional transit connectivity index
	Connectivity index
	Bike/pedestrian delay
	Level of service (auto)
Safety/Public Health	Level of service (bicycle level of service)
	Level of service (pedestrian level of service)
	Level of service (bicycle level of stress)
	Crashes
	Physical activity and health
	Vehicle miles traveled impacts
	Pedestrian miles traveled
	Bicycle miles traveled
Livability	Green space
	Street trees

Table 1. Social performance measures selected for use in the proposed framework

More Information

This policy brief is drawn from "Framework for Life Cycle Assessment of Complete Streets Projects," a research report from the National Center for Sustainable Transportation, authored by John Harvey, Alissa Kendall, Ali A. Butt, Arash Saboori, Maryam Ostovar, and Bruce Haynes of the University of California, Davis, and Jesus Hernandez of JCH Research. The full report can be found on the NCST website at https://ncst.ucdavis.edu/project/framework-for-life-cycle-assessment-of-complete-streets-projects/.

For more information about the findings presented in this brief, contact Alissa Kendall at amkendall@ucdavis.edu.

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