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Demonstrating the Life Cycle Assessment Framework for Complete Streets

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Issue

“Complete streets” are those designed not only to accommodate private vehicles, but also to enable safe access for all users, including pedestrians, bicyclists, and transit riders of all ages and abilities. Complete streets can contribute to increased transportation choices, economic revitalization, improved return on infrastructure investments, livable communities, improved safety, improved public health through promotion of active transportation, greenhouse gas reductions, and improved air quality.

As funding to create complete streets increases in many parts of the U.S., the processes by which complete streets are located and funded have become more important. Issues that have come to the forefront include the distribution of benefits and impacts of investments in transportation infrastructure on neighborhoods with different existing socio-economic, health, and quality of life conditions. It should be clear what goals complete streets projects are designed to achieve, and whether the projects achieve those goals.

In 2018, researchers at the University of California, Davis and JCH Research developed a life cycle assessment (LCA) framework for complete streets to enable planners and

policy makers to quantify environmental and social impacts over the life cycle of a complete streets project. The researchers developed models to calculate social indicators and identified data sources.¹

In this follow-on project, the researchers applied the framework to three case studies covering urban (San Fernando Street, San Jose, CA), suburban (Franklin Boulevard, Sacramento, CA, Figure 1) and rural/suburban (Kentucky Avenue, Woodland, CA) regions/conditions. The researchers assessed whether the LCA framework was useful in identifying whether a complete street delivered or, in the case of a proposed project, was likely to deliver, the intended performance and benefits, and the social and health conditions of the neighborhoods receiving the benefits.

Key Research Findings

Most of the social and economic performance indicators included in the LCA framework provide useful insight into the benefits of a given complete streets project. Examining the likely changes in these indicators from the complete street projects provided a comprehensive view of each project and its likely benefits and drawbacks. Even if all complete streets projects provide benefits, the relative size of the changes in beneficial outcomes can be quantified.



Figure 1. Sacramento's Franklin Boulevard currently (left, Google Maps, 2020), and as proposed after implementing a complete streets project (right, Franklin Boulevard Complete Street Plan, MIG, Inc., 2019)

The performance indicators provided quantitative data that can inform design changes or consideration of project alternatives that might provide more benefits. The performance indicators revealed that one case study project would result in a reduction in transit accessibility, and that two other projects probably wouldn't provide much benefit for safe access to schools by themselves. They also highlighted the improved pedestrian level of service for one project and improvement of the bicycle level of traffic stress and connectivity to transit for the other two.

Qualitative methods can also help support well-informed decisions. Access to schools is a very important indicator for most neighborhoods. However, a survey of local school principals indicated that the Access to Schools indicator may not capture the impacts (or lack of impacts) of the case study projects on travel to school because of particular travel-to-school patterns and challenges. The use of qualitative methods such as a survey as part of evaluation of access to school should be included in project analyses.

Social vulnerability indices such as the California Communities Environmental Health Screening (CalEnviroScreen) tool can be used with the social LCA performance indicators to identify which complete streets provide the most benefit to the most disadvantaged communities. The use of CalEnviroScreen with the LCA framework provided a practical method for quantifying whether complete street benefits reach disadvantaged neighborhoods. Other tools such as the federal Social Vulnerability Index can be used in other regions.

Environmental benefits of complete streets are highly dependent on how they affect vehicle miles traveled (VMT) and vehicle speed. Researchers found that environmental impacts from building complete streets projects are minimal, which confirms prior study results.

Changes in VMT as a result of the project have much larger environmental impacts, although a reduction in vehicle speeds caused by a complete street may also increase fuel use.

Policy Implications

The Complete Streets LCA Framework shows promise for being used in practice. This will require further simplification of the calculation procedures and better data availability, use of the Access to Schools questionnaire, and potentially a few additional qualitative inputs. The use of CalEnviroScreen with the Complete Streets LCA Framework will aid prioritization of complete streets spending to provide more equitable transportation and conceptualization of projects to better serve disadvantaged neighborhoods. Finally, vehicle drive cycle data are needed to better evaluate the effects of reduced vehicle speeds from complete streets on fuel use. Strategies focused on decreasing fuel use are needed to go with complete streets, considering that complete streets have not been proven yet to significantly reduce VMT.

More Information

This research brief is drawn from "Case Studies of Socio-Economic and Environmental Life Cycle Assessment of Complete Streets," a research report from the National Center for Sustainable Transportation, authored by Maryam Ostovar, Ali A. Butt, John T. Harvey, Zachary T. Ramalingam, Alissa Kendall of the University of California, Davis and Jesus Hernandez of the JCH Research, Sacramento. The full report can be found on the NCST website at <https://ncst.ucdavis.edu/project/life-cycle-assessment-complete-streets-case-studies/>.

For more information about the findings presented in this brief, contact John T. Harvey at jtharvey@ucdavis.edu and Ali A. Butt at aabutt@ucdavis.edu.

¹Framework for Life Cycle Assessment of Complete Streets Projects <https://ncst.ucdavis.edu/project/life-cycle-assessment-complete-streets-framework-and-pilot-studies>

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