

The Growing Evidence Base for Complete Streets: A Literature Review of Complete Streets Policy and Projects



A five-year Complete Streets partnership in Sacramento, California resulted in improved pedestrian and bicycle infrastructure. (Photo Credit: Melanie Curry/Streetsblog)



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About this Report:

In fall 2020, Elysia DeSandoli, an intern at The Centre for Active Transportation (TCAT) conducted a review of scholarly articles and books on Complete Streets to better understand how this transportation planning concept is viewed within the academic context.

Clean Air Partnership (CAP) is charitable environmental organization that enables communities to improve air quality, advance active transportation, and take bold climate action. The Centre for Active Transportation (TCAT), a project of CAP, advances knowledge and evidence to build support for safe and inclusive streets for walking and cycling. Complete Streets for Canada is an online portal developed by TCAT featuring national best practice on streets redesigned to benefit pedestrians and cyclists and providing research, policy and design guidance for Canadian municipalities.

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Complete Streets, streets that are designed to be safer for everyone, have become more widely adopted in the last decade in municipalities across the continent. Based on our ongoing research at The Centre for Active Transportation (TCAT), there has been a [steady uptake](#) in Canadian cities since 2009, with 2014 being the year to date with the most Complete Streets policies created. 87 Canadian municipalities currently have at least one form of Complete Streets policy, typically adopted within transportation master plans or official plans.

But how is this transportation planning concept viewed within the academic world? We dug into the scholarly literature to find out. The 14 academic articles and one book included in our review span from 2009—the year the first municipal Complete Streets policy was created—to 2020. We searched for articles published in peer-reviewed journals and scholarly books covering the topic of Complete Streets, with specific mention of Complete Streets within the title or body of the article. Searching for “complete streets” in Google Scholar and Worldcat returned few results, but the articles we did find pointed us to more through their references.

The majority of the academic articles reviewed here examine the effectiveness of Complete Streets policy in the U.S., with some providing case studies of successful implementation of these street types. Some authors offer ways in which to measure the completeness of Complete Streets, which could be particularly helpful for municipalities looking to move from policy to implementation. Only two of the articles and one book look at Complete Streets with an intersectional lens; the effects of Complete Streets across gender and race have yet to be studied extensively. One study reviewed provides an international glimpse at Complete Street potential in Saudi Arabia, highlighting the need for context-dependent approaches when taking this policy abroad. Finally, only a couple of the articles provide a critique of Complete Streets, a unique standpoint given the generally positive opinions around this concept.

Some key takeaways from this literature review include:

1. The necessity of adopting a context-specific approach to Complete Streets design and implementation.
2. The need for a concrete form of assessing the “completeness” of streets—both on its own and within a larger network—so as to gauge the effectiveness of the Complete Streets redesign or development.
3. A good process for handling trade-offs in Complete Streets implementation is important yet still largely lacking in practice. Based on current research, cost and reduction in automobile level of service (LOS)—arguably two of the main deterrents to implementing Complete Streets— are only marginally affected by Complete Streets projects.



Al-Mosaind (2018). *Applying complete streets concept in Riyadh, Saudi Arabia: Opportunities and challenges.*

The city of Riyadh, the capital of Saudi Arabia, is a modern mega-city with a population of 7.6 million as of 2018. It is characterized by fast population growth, uncontrolled urban sprawl, and total dependence on car travel for local and city-wide trips. It has one of the world's highest rates in death and casualties resulting from car collisions (p.130). This study explored the applicability of Complete Streets concepts at various city levels within Riyadh, highlighting the need for implementing these concepts so as to reduce automobile dependence.

The success of implementing Complete Streets concepts lies in the ability to adapt policy to local contexts. Riyadh requires a unique strategy given the hot and humid climate in this geographical region. As such, the author proposes six measures to increase the comfort of pedestrians and cyclists on Riyadh's streets:

- 1) Provide shade by trees, buildings, and artificial covers
- 2) Construct cool air towers in select street locations
- 3) Use water coolers (sprays) in some walkways
- 4) Enhance neighbourhood and street designs to reduce walking distances to residents' activities and public facilities
- 5) Reduce waiting times for traffic lights at pedestrian street crossings, and
- 6) Use weather-friendly (heat reduction) street pavements and pedestrian furniture

The author also recommends strategies to tackle the strong automobile culture in Saudi cities as well as increasing public awareness regarding health and well-being. Overall, there is a need to integrate Complete Street initiatives with development Master Plans to ensure successful implementation of Complete Street principles in order to ensure the continuity of such policies in space and time (p.145).

Burden & Litman (2011). *America Needs Complete Streets.*

To meet the needs of future travel demands, it is integral that a multimodal transportation system is integrated into future city plans. This article acts as an advocacy piece for Complete Streets policy in the United States. The authors state that choice in one's transportation mode is fundamental to improving safety, service, comfort, and performance for all (p.36). Furthermore Complete Streets adoption can help mitigate the current issues of automobile-related accidents and fatalities, the low rates of community health and fitness



related to the country's rising obesity problem, rising air pollution rates, inaccessibility to adequate transportation, and high traffic congestion rates.

Elias (2011). *Automobile-Oriented or Complete Street?: Pedestrian and Bicycle Level of Service in the New Multimodal Paradigm.*

In this article, the author looks to identify the most important criteria for designing a Complete Street. He explores various cross-section layouts and how they affect level of service (LOS) scores of two of the four modes (bicycle and pedestrian) using a new methodology from the *Highway Capacity Manual (HCM)* that assesses multimodal LOS of an urban street. All in all, eight different designs were tested within four right of way (ROW) widths.

Results showed that with proper design and considerations, a Complete Street design can improve bicycle and pedestrian LOS significantly while minimally affecting automobile LOS (p.86). Bicycle LOS proved easiest to improve with the simple addition of a bike lane; this saw an average 44.8% improvement to the bicycle segment score across all four ROW widths. Pedestrian LOS, however, only showed a slight improvement with 7.9%. Nevertheless, something as simple as adding two feet to a pedestrian buffer zone can result in a street with better pedestrian LOS than an auto-oriented street. The author ends with a reminder that understanding trade-offs involved in Complete Street designs is ultimately the best way to improve the travel experience for all modes.

Geraghty, et al (2009). *Partnership Moves Community Toward Complete Streets.*

This article looks at a specific example of Complete Streets policy implementation in Sacramento, California. The Partnership for Active Communities, a local organization, created a five-year project to support increased walking and bicycling. This partnership linked multidisciplinary organizations with diverse interests to produce a powerful advocacy network for the adoption of Complete Streets. They focused on programs and promotions to expand walk and bike to school programs and conducted systematic reviews of development projects influencing land use, Complete Streets policy change, and improving transit infrastructure.

As a result, walk and bike to school programs grew, and community-design workshops helped leverage more than \$12 million in additional support, ultimately delivering more than 150 project reviews to city planners, architects, and developers with recommendations for improved pedestrian and bicycle infrastructure. Complete Streets is now included as a policy in the region's transportation plan, the city's updated general plan, the county's draft circulation plan, and the regional transit master plan. The authors attribute their success to the organization of the partnership, stating that "the coming together of many diverse



organizations magnified changes beyond what could be expected from independent action” (p.5426). Furthermore, integrating work on programs and policy change helped “energize the partnership and increased the depth of its learning of how to gain positive change to support active living” (ibid.). Finally, persistent communication with local government staff and elected officials and early land-use development review contributed to the partnership achieving important policy changes.

Gregg & Hess (2018). *Complete streets at the municipal level: A review of American municipal Complete Street Policy.*

This paper questions the extent that Complete Streets policy and its proliferation is in fact challenging the primary accommodation of automobiles. Given the legacy of planning, engineering, and infrastructure in facilitating automobile movement, successfully shifting toward accommodation of other modes is unlikely to be a simple change (p.1).

This study questions how Complete Streets is defined in policy, what physical characteristics are associated with Complete Streets, and how the policies guide the process of negotiating trade-offs (p.2). It is important, they argue, for municipalities to recognize the reality of trade-offs between user types and to respond with context sensitive network level thinking applied across the street network, including the development of a more complex lexicon of street designs that addresses a broad range of contexts (p.1-2).

The authors’ analysis consisted of sampling 113 policies from varying American municipalities. They found that most municipalities in the US do not yet produce Complete Streets plans or design guidelines, and most are also in the infancy of physically building Complete Streets. Together, ‘plans’ and ‘design manuals’ make up only 11% of municipal level policy in the National Complete Streets Coalition database (p.2).

The policy analysis revealed that many Complete Streets policies are reflective of a general cultural change in street design, however most do not appear to give clear legal authority for implementation or clear concrete directions for this change (p.8). These weak policies do not create a solid foundation for transforming deeply institutionalized auto-oriented street building practices (ibid.). The authors conclude that Complete Streets policies should better acknowledge the need for trade-offs between transportation modes and give guidance on how to make these decisions (p.9).



Hui, et al (2018). *Measuring the completeness of complete streets.*

When assessing Complete Streets and developing subsequent design and policy, there needs to be a context-sensitive approach acknowledging the context of a street and its role within a street network. Thus, context-sensitive standards of “completeness” must be established. The authors address this by combining a street classification system with sets of priorities and target performance levels for different types of streets. Their study consists of a literature review of frameworks that can define the priorities and performance standards for different types of streets, followed by identifying the impacts of Complete Streets and ways in which they can be assessed (p.2). Finally, they finish with a discussion of two potential applications for quantitative definitions of “completeness” (ibid.).

The authors propose that performance standards should address a street’s fulfilment of its movement, environmental, and place functions and be flexible enough to account for the many ways that these functions of a street can be fulfilled. They found, however, that streets are always classified according to transportation contexts and only sometimes classified according to place context, while environmental contexts, such as a street’s vehicle emissions or stormwater management, were never observed (p.19). A measure of completeness, they state, should recognize that a function of a street can be fulfilled in many ways, and many levels in fulfilment beyond compliance or non-compliance (ibid.). They conclude by recognizing the importance of assessing the completeness of all streets within a network in its ability to allow municipalities to prioritize streets for infrastructure investments, and to develop strategies for policy development by identifying and targeting patterns of incompleteness in the network (p.19).

Ingram, et al (2020). *Health Disparities, Transportation Equity and Complete Streets: A Case Study of a Policy Development Process through the Lens of Critical Race Theory.*

Historic disinvestment in transportation infrastructure is directly related to adverse social conditions underlying health disparities in low-income communities of color (p.1). This case study examines the potential for an equity-focused policy process to address systemic barriers and identify potential measures to track progress toward equity outcomes. The methodology consisted of analysis of grant reports and task force notes, community workshop/outreach activities, digital stories, and stakeholder interviews using an analytical framework provided by critical race theory.

The authors’ final analysis showed that transportation inequities are entrenched in historically rooted disparities that are perpetuated in ongoing decision-making processes. Intentional efforts to incorporate equity into discussions with community members and



representatives contributed to explicit equity language being included in the final policy. As such, the authors identify two concrete strategies to engage community members and focus city decision-making practices on marginalized and disenfranchised communities to positively influence future policy decisions. The first is a multi-faceted approach to community engagement that ensures a broad reach to as many people as possible, with more collaborative, intensive, and community-driven processes (p.8). The second employs specific practices that focus discussion and decision-making on the priorities of marginalized and disenfranchised communities (ibid.). All in all, from a public health perspective, the focus on equity recognizes the potential for Complete Streets policies to improve the health of vulnerable and marginalized populations by addressing underlying issues of access and opportunity (p.10).

Jensen, et al (2017). *Walkability, complete streets, and gender: Who benefits most?*

In this study, the authors attempt to fill the gaps in Complete Streets analysis and gender equity by answering the following questions:

- 1) Compared to less walkable streets, do more walkable streets have more people, and more women?
- 2) Does street use increase following Complete Street renovations, and is the increase sustained?
- 3) Are proportionately fewer females than males using streets and does this vary by walkability?

Understanding the connection between walkable Complete Streets and gender differences in street users is important when considering female safety; women are more likely to report instances of public harassment and consequently may avoid public spaces (p.3).

To address this, the authors audited two mixed-walkability Complete Streets projects in Salt Lake City, Utah, one in an urban area and the other in a less-urban area, at pre-renovation and twice post-renovation (p.1).

Results showed that Complete Street users increased with walkability, especially in the less-urban area. This suggests that street modifications might enhance walkability and attract more users (p.9). However, the authors' systematic observation method could not answer, beyond gender, who might be using and avoiding the less walkable street and why. Secondly, the authors saw that Complete Street renovations resulted in several instances of increased use, especially in sections of the street that were less busy before the renovation, with sustained weekend use in the less urban areas (p.10). Finally, they found that high-walkable



streets had almost double the proportion of females compared to the low-walkable street (p.11). It is currently unclear whether females are more attracted to the walkable designs, the greater number of users, or both. They conclude by stating that, in their study, males used the sampled streets more than females. Consequently, the increases in physical activity associated with Complete Streets may be more likely to benefit men (p.12). Their results suggest that more walkable designs on busier streets might attract proportionately more females and thus extend the benefits of walking more equally to both genders (ibid.).

Kingsbury, Lowry & Dixon (2011). *What Makes a “Complete Street” Complete?: A Robust Definition, Given Context and Public Input.*

This study presents a novel way in assessing the completeness of Complete Streets. The authors’ approach was to assess streets based on a four-dimensional audit for drivers, transit users, bicyclists, and pedestrians. Their most innovative assessment tool was a framework to calculate a completeness score according to a community’s vision for a particular street. These scores are calculated through a comparison of the desired street profile (as determined by the community) with the audit profile. Individual cities may customize this assessment process to best fit their own local context and to involve their community.

To demonstrate the framework, the authors conducted a case study which assessed 67 streets in a small, rural community in Idaho. Results revealed that some streets, as a result of community-defined contexts, received completeness scores that were better than expected.

McCann (2011). *Perspectives from the Field: Complete Streets and Sustainability.*

Using a lens of sustainability, McCann argues that adopting Complete Streets policy would provide strong environmental benefits by shifting automobile trips to more sustainable modes. The 2009 US National Household Transportation Survey found that 41% of daily trips are under three miles in distance, a distance easily traveled by foot or bicycle, yet 67% of them are made by private cars (p.63). Walking and bicycling instead of traveling by car could reduce carbon dioxide emissions by 12-22 million tons per year for shorter trips (less than one mile) or 9-23 million tons for longer trips (1-3 miles) in the United States (p.64).

Moreland-Russell, et al (2013). *Diffusion of Complete Streets Policies Across US Communities.*

This study aimed to identify potential patterns and correlates in the diffusion of Complete Streets policies across the United States using the concepts of the Diffusion of Innovation Theory. To do this, the authors identified—using historical analysis—several factors



with the potential to affect the rate of Complete Streets policy diffusion: rural/urban status, state obesity rate, state funding for transportation, state obesity prevention funding, percentage of people who walk or bike to work in the state, presence of a state Complete Streets policy, and the number of bordering communities with Complete Streets policy. Data from 49 community-level policies were analyzed.

Results showed that there were three significant predictors of Complete Streets policy adoption: state obesity rate, percentage of people who walk or bike to work in the state, and presence of a border community with a Complete Streets policy. The obesity epidemic has been a strong motivator in the implementation of national and state prevention efforts; Complete Streets policies may help by improving health through active modes of transportation (p.S92). Areas with a high percentage of people who report active commuting may reflect areas that already have large numbers of bicycle lanes, sidewalks, and other walkability/bikeability features (p.S93). Finally, the odds of adopting a Complete Streets policy in relation to bordering communities highlights the importance of geographic proximity, successful peer adoption, and the compatibility of policy innovation with a community's needs, social norms, values, and beliefs in increasing the likelihood of adoption and further diffusion of policies across communities (p.S93-S94).

Shapard & Cole (2013). *Do Complete Streets Cost More than Incomplete Streets?*

Looking at the City of Charlotte, North Carolina, the authors seek to answer the question: does building a Complete Street cost more than building a traditional street? If so, how much more? Staff from the Charlotte Department of Transportation (DOT) compiled information from past projects to determine the cost range of typical Complete Streets projects, as well as analyze line-item bid costs for these project elements such as bike lanes and sidewalks. Finally, the Charlotte DOT examined fluctuations in transportation project costs over a five-year period.

The final analysis showed that incorporating Complete Streets elements only slightly increases the cost of a project and makes up a very small percentage of overall costs. For instance, sidewalks add, on average, little more than 3% to a project's overall budget, while bike lanes add little more than 5% (p.136). Indeed, overall market fluctuations in construction costs played a more significant role in project costs than did incorporating Complete Streets elements. As such, the authors make the argument for continuing the inclusion of Complete Street items in project scopes and budgets, stating that "creating a street with elements supporting land use context and incorporating multi-modal transportation choices does not have to be cost prohibitive" (p.137).



Vandegrift & Zanoni (2018). *An economic analysis of complete streets policies.*

This paper tests whether adopting Complete Streets policy has amenity value for local residents by analyzing the link between this policy adoption and house prices. Using a difference-in-differences matching procedure (DIDMP), the results show that adopting Complete Streets policy has no effect on house prices in XYZ location. The authors provided several possible reasons for not finding a positive amenity value from a municipality-level commitment to Complete Streets (p.96):

- 1) low or zero values that residents attach to the design changes from Complete Streets,
- 2) costly design changes associated with Complete Streets,
- 3) town planners or public works departments that simply ignore Complete Streets policy,
or
- 4) low frequency of road construction projects.

The authors speculate that costly Complete Streets design changes may recuperate costs in the form of higher property taxes, which may then reduce house prices, thus higher taxes may cancel out the amenity value of Complete Streets policy adoption (p.96). Complete Streets adoption may also have hidden benefits, such as improvements in air quality, that are not reflected in property values (p.97).

(Wie) Yusuf, et al (2016). *Becoming More Complete: The Diffusion and Evolution of State-Level Complete Streets Policies.*

In this article, the authors propose three research questions:

- 1) In what ways do the states with a Complete Streets policy differ from states without one?
- 2) Have Complete Streets policies become more comprehensive over time?
- 3) Does the type of policy change how comprehensive it is?

The authors' analysis consisted of assessing the spread of policies from state to state and over time to see any changes in the content of the policies. Their methodology first consisted of comparing states with and without Complete Streets policies along dimensions such as commute times, use of public transportation, federal spending on roads, and road conditions. Second, they analyzed only those states with Complete Streets policies. Finally, they compared Complete Streets policies according to their adoption dates.



Their results show that urbanized states—those with longer average commute times, a greater percentage of commuters using public transportation, and more developed land—are more likely to have these types of policies, with more than half of all American states having a state-level policy to encourage adoption of Complete Streets. Currently and historically, states rely on state legislature or an executive-level policy issued by a Department of Transportation or a governor in adopting Complete Streets policies. Both approaches have only become more comprehensive over time, indicating a growing commitment to the concept of Complete Streets. Furthermore, states seem to be paying more attention to the implementation of these policies with emphasis on performance measurement and implementation steps. Finally, the diffusion of the policy appears only weakly associated with adjacency of adopting states.

Zavestoski & Agyeman (2015). *Incomplete streets: Processes, practices and possibilities.*

This book takes the uncommon stance of problematizing the Complete Streets concept. The authors suggest that streets should not be thought of as merely physical spaces, but as symbolic and social spaces. When important social and symbolic narratives are missing from the discourse and practice of Complete Streets, what results are actually *incomplete* streets. Their book questions whether the ways in which Complete Streets narratives, policies, plans, and efforts are envisioned and implemented might be systematically reproducing many of the urban spatial and social inequalities and injustices that have characterized cities for the last century or more. From critiques of a “mobility bias”—wherein the right to the street is rooted in one’s ability to consume and contribute to economic productivity through movement—stemming from the neoliberal foundations of the Complete Streets concept, to concerns about resulting environmental gentrification, the chapters in *Incomplete Streets* variously call for planning processes that give voice to the historically marginalized and, more broadly, approach streets as dynamic, fluid, and public social places (p.i).



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