Complete Streets as a Redevelopment Strategy

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Our main streets and thoroughfares need a radical redesign. Complete Streets aren't just about bike lanes and sidewalks; [they're] also about traffic signals, medians, and transit. It's about helping people move around freely and safely, stopping the traffic carnage on our streets, building affordable housing, and supporting economic development. If we do this correctly, it will create redevelopment opportunities while improving affordability, safety, and community livability.

Earl Blumenauer, Member of Congress[1]

Abstract

This article asserts that converting America's main streets and thoroughfares into Complete Streets is an important redevelopment strategy. Although this article will show that they improve safety, their principal purpose—the extent to which they are associated with redevelopment—has not been researched. This article presents the first comprehensive assessment of the role of Complete Streets as a redevelopment strategy. Using statistical analysis applied to 26 Complete Streets in 16 central counties, research reported in this article establishes associations between Complete Streets and increased jobs, people, and households; improved jobs-housing balance; increased commuting via transit, walking, and biking; working from home; and increased multifamily residential rents with respect to proximity, meaning that people are more willing to pay to be close to Complete Streets. Moreover, constituting less than six-tenths of one percent of their central county urbanized land areas between 2013 and 2019 (after the Great Recession but before the COVID-19 pandemic), Complete Streets accounted for disproportionately large shares of central county growth and change. Although the Complete Streets in the research sample cost about $600 million to build (in 2023 dollars), much of which would have been spent anyway in the normal cycle of street rehabilitation and upgrades, it is estimated that they are associated with $6 billion in redevelopment investments. Few economic development programs match this return on investment. Although some evidence indicates gentrification, policy interventions are outlined to help mitigate adverse outcomes. It may be difficult to imagine more cost-effective redevelopment strategies than Complete Streets.

[1] Adapted and expanded from https://blumenauer.house.gov/media-center/press-releases/blumenauer-introduces-bipartisan-bill-to-maintain-nation-s-orphan-highways pursuant to correspondence of November 20, 2023.

Overview

According to the U.S. Department of Transportation, Complete Streets provide safe options for all users of streets, including pedestrians, bicyclists, motorists, and transit riders. This article will show that, in addition to their primary purpose of improving safety, Complete Streets attract jobs, people, and households; improve the local jobs-housing balance ratio; reduce automobile dependency; and increase real estate values. Complete Streets are thus an important redevelopment strategy. It will also contend that Complete Streets help meet the market demand for walkable and transit-accessible communities. Given that the market demand for them vastly exceeds supply, an approach is outlined to capture the value added from Complete Street investments in a way to leverage more of them. Strategies to mitigate potentially adverse gentrification outcomes are also presented.

The article begins with a review of what Complete Streets are, including their history and their principal planning and design features, with special reference to improving pedestrian, cyclist, and traffic safety. It continues by asserting that Complete Streets are a form of redevelopment because they involve the redevelopment of the physical streets on which they are formed. This assertion leads to the proposition that Complete Streets leverage redevelopment along and near their corridors in the ways described in this article. After reviewing redevelopment concepts and applications relevant to Complete Streets, this discussion closes by showing that the market demand for Complete Streets and associated landscapes far exceeds supply.

The article continues by presenting various theories associated with redevelopment outcomes with respect to Complete Streets along the dimensions of safety, jobs, people (including households), housing, gentrification, jobs-housing balance, change in commuting mode to work, and real estate values focusing on multifamily rents. This discussion is followed by a review of the literature reporting Complete Streets outcomes along those dimensions. The section continues by identifying gaps in the literature on the association between Complete Streets and redevelopment outcomes. Gaps are framed in terms of research questions, which are followed by hypotheses that guide the research for which findings are reported in subsequent sections.

The following sections present research designs, data, methods, and results with interpretations with respect to the association between Complete Streets and attracting jobs; attracting people and households, with special reference to gentrification; change in the jobs-housing balance ratio; change in commuting patterns; and influence on multifamily rents.

This article concludes with a summary assessment of research findings showing how Complete Streets are an important redevelopment strategy. The conclusion outlines an approach to capturing the value added from Complete Street investments to create new ones and to help mitigate such impacts as gentrification. The authors also call for an expansion of Complete Streets to meet market needs and to increase opportunities for jobs and people. Finally, the conclusion discusses how Complete Streets could affect housing, improve jobs-housing balance, reduce automobile dependency, and improve real estate values.

The article proceeds with an introduction to the Complete Streets movement, what they are, how they advance safety, the market demand for them, and their role in facilitating redevelopment.

The Complete Streets Movement

This section provides a brief history of Complete Streets, their policy purpose, their planning and design, their role in improving safety, the apparent market demand for them, and their potential role as a redevelopment strategy.

Brief History and Purpose

Arguably, Oregon launched the nation's first Complete Streets effort in 1971. Over the objections of highway interests, the Oregon Department of Transportation (ODOT), and the state's then pro-land use planning governor, Tom McCall, Oregon enacted the "Bike Bill." The current version of this state law requires that new or rebuilt roads accommodate bicycles and pedestrians safely and conveniently. ODOT now works with local governments to plan, design, and fund bicycle and pedestrian facilities in the state's rights-of-way. One percent of the state's highway budget is earmarked for this purpose.

Since Oregon's initiative, 32 more states, the District of Columbia, and Puerto Rico have adopted Complete Street statutes. California may best capture the purpose of Complete Streets, as follows:

> [A] balanced, multimodal transportation network that meets the needs of all users of streets, roads, and highways (including bicyclists, children, persons with disabilities, motorists, movers of commercial goods, pedestrians, public transportation, and seniors) for safe and convenient travel in a manner that is suitable to the rural, suburban, or urban context.[2]

The U.S. Department of Transportation offers this definition of Complete Streets (McCann, Boutros, and Biton, 2023):

> Complete Streets is a transformative strategy in which the transportation network is planned, designed, built, operated, and maintained to enable safe mobility and access for all road users, including, but not limited to, pedestrians, bicyclists, motorists, and transit riders across a broad spectrum of ages and abilities.

By 2024, more than 1,700 cities, towns, and counties had adopted Complete Streets policies.[3]

Complete Street Planning and Design

Every Complete Street is different because no single template exists for them. Each one is designed respecting its community context, whether downtown, urban, suburban, or rural. Unfortunately, no inventory of Complete Streets exists; hence a call is made to assemble one for information, technology transfer, and research.

Complete Streets vary considerably in their purposes, planning, and design on the basis of individual community objectives. Broadly, four areas of Complete Street design are relevant (Litman, 2015):

[2] State of California, Assembly Bill No. 1358, 2008.

[3] For periodic updates, see https://smartgrowthamerica.org/program/national-complete-streets-coalition/policy-atlas/.

Pedestrian Infrastructure. This infrastructure includes sidewalks, traditional and raised crosswalks, and median crossing islands. Other design considerations address ADA (Americans with Disabilities Act of 1990) features such as audible signals for people with low vision, crosswalk push buttons that are reachable by people in wheelchairs, curb cuts, and curb extensions.

Traffic Calming. Traffic calming features are designed to reduce the speed of automobiles and define the edges of vehicular travel lanes. Design elements can include road diet schemes, shorter curb corner turning radii, elimination of free-flow right-turn lanes, angled and face-out parking, street trees, planter strips, and ground cover, among other features.

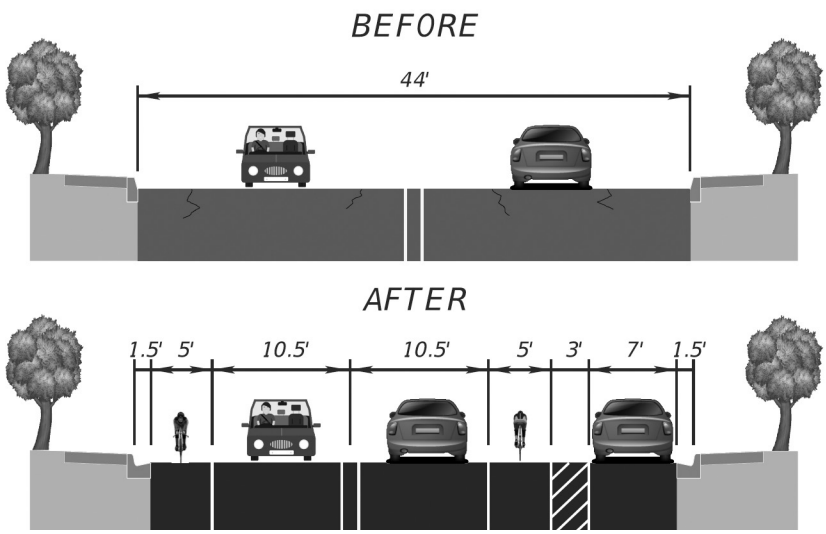
Bicycle Accommodations. Complete Streets usually include a range of bicycle accommodations, such as protected or dedicated bicycle lanes, neighborhood green-painted (greenway) lanes, wide paved shoulders, and bicycle parking.

Public Transit. Local public transit design features are often included for bus rapid transit, bus pullouts, transit signal priority, bus shelters, and dedicated bus lanes. Heavy rail (often called third rail) and commuter rail transit is usually not built into Complete Streets.

A Complete Street may thus include such elements as sidewalks, bike lanes (including wide paved shoulders), dedicated bus lanes, comfortable and accessible transit stops and stations, safe crosswalks, median strips and islands, accessible pedestrian signals, curb extensions, narrower travel lanes, roundabouts, and other features (NCSC, 2018; Smart Growth America and NCSC, n.d.). Illustrations of Complete Street design for suburban and rural settings without transit and urban settings with transit are illustrated in exhibits 1 and 2, respectively.

Exhibit 1

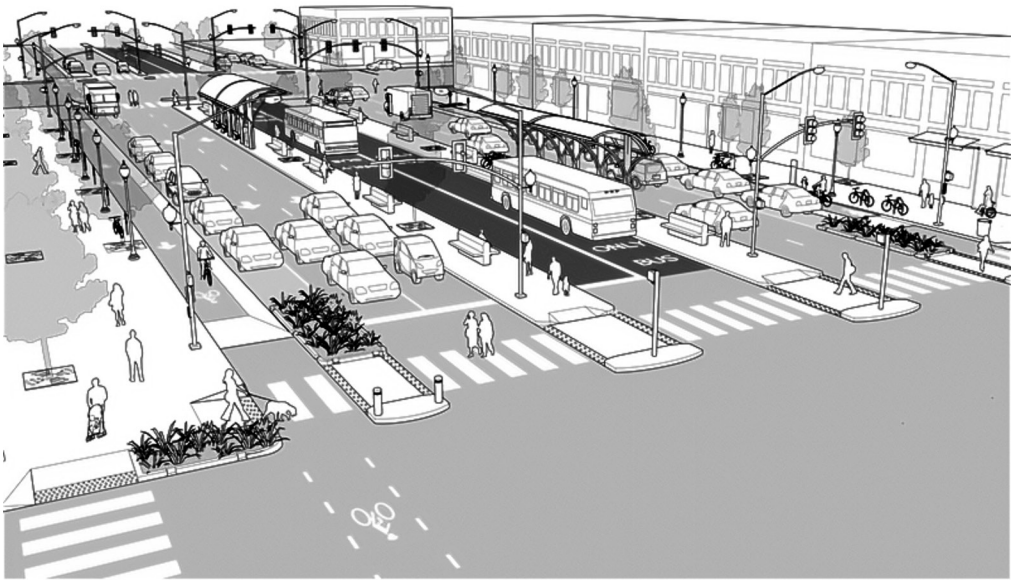
"Before" and "After" Conceptualizations of Suburban and Rural Complete Streets



Source: Adapted from City of Tampa, FL https://www.tampa.gov/sites/default/files/content/files/migrated/presentation_publicmtg1_columbusdr_cot_18d00007_2019_final.pdf#view=Fit&toolbar=1

Exhibit 2

Complete Street with Transit in Urban Setting



Source: NACTO guidance on median transitway
https://nacto.org/wp-content/themes/sink_nacto/views/design-guides/retrofit/urban-street-design-guide/images/dedicated-median-bus-lanes/dedicated-median-bus-lanes.png

Safety as the Driver of the Complete Streets Movement

Streets are dangerous, often being characterized as dangerous by design (Smart Growth America and NCSC, 2022). In 2020, for instance, more than 6,500 people were killed while walking along streets or crossing them, which was 4.5 percent more than in 2019 (Smart Growth America [hereafter, SGA] and National Complete Streets Coalition [hereafter, NCSC] (Smart Growth America and NCSC, n.d.). Concerns about pedestrian and bicyclist safety led to a national movement to make streets safer, culminating in the founding of the National Complete Streets Coalition in 2005 (McCann, 2010).[4] The literature review section of this article will provide evidence of the association between Complete Streets and safety.

Market Demand for Complete Streets

The Complete Streets movement is consistent with the emerging market demand for walkable communities, transit-accessible communities, and "missing middle housing" communities (Nelson, 2012, 2013, 2020; Parolek and Nelson, 2020). For instance, the National Association of REALTORS® (NAR) periodically produces a "Community Preference Survey" (CPS). The NAR's

[4] David Goldberg, then the communications director for Smart Growth America, coined the term *Complete Streets* in 2003 (McCann, 2010).

CPS is applied to the nation's 50 largest metropolitan statistical areas, which account for most of the nation's population and growth. The survey includes 2,000 adults aged 18 years or older. The method used is called "stated preference," meaning that, given a narrow set of plausible though opposite choices, which one would the respondent prefer? (AAA FTS, 2011). Exhibit 3 summarizes key findings from its 2023 CPS.

Exhibit 3

Key Findings from National Association of REALTORS® 2023 Community Preference Survey, Revealing Implicit Residential Market Demand for Complete Streets

Community Preference Survey Question	Prepandemic 2017 (%)	Pandemic 2020 (%)	Postpandemic 2023 (%)
Given a choice: Would you prefer to own or rent an apartment or townhouse, and you have an easy walk to shops and restaurants and have a shorter commute to work? YES reported.	50	48	53
If you were moving to a new home, would you be willing to spend more to live in a community where you could easily walk to parks, shops, and restaurants? YES reported.	60	57	78

Source: National Association of REALTORS® 2023

More than one-half (53 percent) of respondents from the 50 largest metro areas would choose to own or rent an apartment or townhouse if they had an easy walk to shops and restaurants and a shorter commute to work. This percentage is the highest share since before or during the pandemic.

More than three-quarters (78 percent) of respondents would be willing to spend more to live in a community where one could easily walk to parks, shops, and restaurants. This share is a substantial increase over the sentiment during the pandemic (57 percent) or before (60 percent).

Taken together, it appears that as more workers work from home, they want to do so in a neighborhood where it is easy for them to walk to places, and they are willing to pay for it. Because the NAR survey findings are richly detailed in terms of demographics, income, region, and so forth, an opportunity exists for the survey to inform policymakers and planners about changing community preference trends.

Unfortunately, these opportunities may be available to only about 13 percent of America's urban households (Koschinsky and Talen, 2015). Roughly 40 million households in the nation's 50 largest metropolitan areas want to live in walkable communities and are willing to pay for them; only about 10 million households in those metropolitan areas have that opportunity. The gap is thus about 30 million households in the 50 largest metropolitan areas, which account for about 55 percent of the nation's population. The inference is that the national demand for living in walkable communities that are accessible to shops, restaurants, and services, with a short commute to work for those not working at home, is about 70 million households. About 20 million households live in those kinds of communities now, leaving a gap of 50 million. Even if all new residential units were built in these kinds of communities through the year 2050, the current demand would not be met.

How can the pent-up market demand for walkable, transit-accessible, and middle-housing communities be met? Redevelopment efforts are needed to transform the existing built environment into such communities through Complete Streets. This link is made in the next section.

Complete Streets as a Redevelopment Strategy

Complete Streets entail the redevelopment of existing streets. Some of them are very expensive redevelopments of downtown corridors, such as in Cleveland for the HealthLine bus and rapid transit (BRT) system connecting downtown to the Case Western Reserve University medical facilities. Most of these redevelopments are much less expensive, involving adjusting travel lanes and parking, adding bicycle lanes, widening sidewalks, and so forth. The construction of Complete Streets is thus an exercise in redevelopment per se.

Moreover, although the explicit purpose of Complete Streets is to improve safety, other purposes include increasing the number of jobs and people near them. In effect, Complete Streets are seen as a way to leverage new development along them. Given that Complete Streets are built mostly along existing, developed corridors, the development that occurs along them is mostly a form of redevelopment, including the redevelopment of parking lots. Whether and to what extent this happens will be discussed in subsequent sections of this article.

The redevelopment objectives of Complete Streets are consistent with redevelopment purposes overall (Blaesser and Cody, 2008). An important difference is that whereas Complete Streets address the redevelopment of the street, redevelopment generally involves changes to the built environment on parcels of land in targeted areas, such as redevelopment districts.

The need for the public sector to facilitate the redevelopment of the built environment indicates that the physical stock of urban development—such as buildings, infrastructure, and even parking lots—depreciates over time and eventually becomes obsolete. This aging of infrastructure can lead to structural blight, in which buildings become unfit to occupy, and economic blight, in which new investment is dissuaded from renewing an area's vitality. Indeed, urban areas go through cycles of development and redevelopment (Bourne, 1967). However, sometimes, the private sector cannot redevelop an area for such reasons as insufficient infrastructure capacity; parcels of insufficient size, shape, or location to be rejuvenated efficiently; and fragmented or unknown ownership that prevents assembly of property for efficient development, among other impediments. The public sector is thus needed to overcome barriers to private-sector investment in an area. Public-private partnerships are often created where private-sector investment is leveraged from public-sector resources pursuant to a planning and policy process (Nelson, 2014).

Through various initiatives such as redevelopment authorities, the public sector often takes the lead in redeveloping underinvested or blighted areas. As the Urban Design Lab notes, several different approaches to redevelopment are possible, such as the following or combinations of them:[5]

[5] Adapted from Urban Design Lab, "What is Urban Development, Redevelopment and Conservation." https://urbandesignlab.in/development-urban-redevelopment-conservation/.

Urban regeneration involves creating new buildings and infrastructure in poor-quality neighborhoods through comprehensive interventions, leading to economic, social, and environmental improvements.

Urban revitalization refers to reviving older parts of cities by creating new functions for older structures while often protecting the existing social and economic structure.

Urban reconstruction results in demolishing structures in blighted areas and replacing them through reconstruction and redevelopment.

Urban clearance means demolishing the existing urban structure, often through the removal of slum neighborhoods, and replacing it with new physical structures, which frequently leads to displacement.

Urban renewal is a formal program of land redevelopment that involves recreating a new urban fabric patterned after the morphology and functions of existing buildings that were demolished, often in areas of moderate- to high-intensity urban land use.

Adaptive reuse is the process of reusing old sites or buildings for purposes other than for what they were built or intended, such as converting warehouses into residential lofts, and it is often viewed as the middle ground between preservation and demolition.

Urban retrofitting provides urban areas with new or modified features that were not possible at the time of initial development, often including infill of vacant or abandoned sites and the development of parking lots.

Thousands of American cities, towns, and counties are engaged in redevelopment. Many rely on independent redevelopment authorities that have planning, eminent domain, financing, development, and management powers. Notable examples of redevelopment are Baltimore's Inner Harbor; New York City's Battery Park; Portland, Oregon's Pearl District; New Orleans' French Quarter; and thousands of others, ranging from less than a city block to large swaths of jurisdictions. One thing that is common to nearly all these efforts is the taking advantage of existing transportation infrastructure investments or, often, investing in new transportation systems. Indeed, Portland incorporated its streetcar into the Pearl District's redevelopment of an old railyard and warehouses north of downtown (exhibit 4).

Exhibit 4

Before (1988) and After (2022) Images of Portland's Pearl District (Foreground) Redevelopment Area

Source: Top image, Bob Heims, U.S. Army Corps of Engineers, 1988. Bottom image, Google Earth, 2022, accessed November 15, 2023, from https://earth.google.com/web/@45.53283317,-122.67922885,11.32390806a,1584.70049221d,35y,166.82917209h,77.37204764t,0.00000001r/data=OgMKATA

What are the specific ways in which Complete Streets can facilitate redevelopment? In addition to making streets safer, the next section of this article will review literature suggesting that Complete Streets should attract jobs, people, and households (Anderson and Searfoss, 2015; Federal

Highway Administration, 2022; National Association of City Transportation Officials, 2012). By making streets safer and more attractive, these outcomes would arise even in the absence of formal public redevelopment efforts. Thus, at the intersection of the economic benefits of streets and the push to make streets safer and more attractive, investing in Complete Streets can be viewed as a redevelopment strategy. This article may be the first to make this explicit claim, at least in the context of research supporting that claim.[6]

However, the literature on Complete Streets misses another important benefit: improving the jobs-housing balance (Stoker and Ewing, 2014). To the extent that Complete Streets are job-rich, which usually means they are in an urban context and are therefore relatively housing-poor, attracting more households to them would improve their jobs-housing balance. The result would create such benefits as reducing dependency on automobiles in the journey to work and increasing the use of transit, walking, and biking (Bas et al., 2023).

Finally, if they are successful in attracting jobs and people, Complete Streets should influence the real estate market such that properties closer to them gain a premium in value or rent (Yu et al., 2018).

The next section reviews the Complete Streets literature to derive theories and hypotheses that guide the research that is presented in this article.

Literature, Theory, Hypotheses, and Research Strategy

This section reviews the literature addressing how Complete Streets improve pedestrian, cyclist, and traffic safety. It continues with a review of the scant literature on the outcomes of Complete Streets with respect to attracting jobs and people, with special reference to gentrification, jobs-housing balance, commuting mode, and real estate value (based on multifamily rents) with respect to Complete Streets proximity. The literature review leads to theories and hypotheses that, in addition to safety, frame the research strategy.

Progress in Safety—A Complete Streets Priority

This discussion starts with the mismatch between vehicles and pedestrians or cyclists. Using Newton's physics of mass times speed with respect to human physiology, Hutchinson (2018) developed a theory that equates vehicular impact with pedestrian (and, by extension, cyclist) injury and death. The lighter the car and the slower its speed at impact, the less likely injury or death occurs. Empirical studies show that the average risk of severe pedestrian injury when struck by a car of average weight is about 10 percent at 16 miles per hour (mph), 25 percent at 23 mph, 50 percent at 31 mph, 75 percent at 39 mph, and 90 percent at 46 mph (AAA FTS, 2011). Simply slowing vehicular speeds can improve pedestrian and cyclist safety significantly. Based on this cause-and-effect relationship, reducing speed is the chief objective of "road diets" as an element of Complete Streets (FHWA, n.d.).

An implicit theory embodied in the genre of research into "dangerous by design" shows how the physical design of roads, sidewalks, crosswalks, signage, traffic lights, lighting, and so forth affects

[6] The authors are indebted to an anonymous reviewer who pointed out this fact.

the safety of pedestrians, cyclists, and occupants of vehicles. The word *implicit* is used because the dangerous-by-design literature does not establish cause-and-effect relationships or associations between improvements in specific design elements—other than vehicular speed—and safety (Smart Growth America and NCSC, 2022). Readers are referred to the design recommendations of the National Association of City Transportation Officials (2012).

Evaluations of safety outcomes associated with Complete Streets are thin (Mofolasayo, 2020). As a general proposition, interventions to improve pedestrian and cyclist safety within and along roadways can be accomplished, although the extent of improvements is mixed in the literature (Jordan and Ivey, 2021; Namatovu et al., 2022). With respect to Complete Streets, research by Hanson, Noland, and Brown (2013) shows that different road features influence the number of pedestrian casualties. These features include sidewalks, traffic lighting, travel speeds, the number and width of travel lanes, and evening visibility, among others. In their case studies of nine Complete Streets, Hanson and Botchwey (2018) found that vehicular crashes declined after Complete Street safety-related intervention.

To date, the most comprehensive assessment of Complete Street safety outcomes is the study conducted by Porter et al. (2018) in Florida from 1975 to 2013. Using data from that study, Schneider (2018) focused on the period during which Florida implemented a statewide Complete Street policy, 1984–2013. Analysis shows that over those 29 years, Florida's pedestrian fatality rate decreased by about 0.5 percent more per quarter than would have been expected on the basis of national trends. This calculation translates into preventing about 3,500 pedestrian fatalities over the 29-year study period.

Numerous case studies show the improved safety outcomes of Complete Streets. For instance, Great Neck Village officials redesigned Great Neck Road to reduce vehicle speeds, enhance the downtown environment, improve walkability, and better serve bicyclists and transit vehicles. The number of automobile travel lanes was reduced, bikeways were installed, and other changes were made. The result was a 64-percent reduction in injury-related accidents, not to mention a more vibrant and visually pleasing main street (NYSDOT, n.d.). Before and after images are shown in exhibit 5.

Exhibit 5

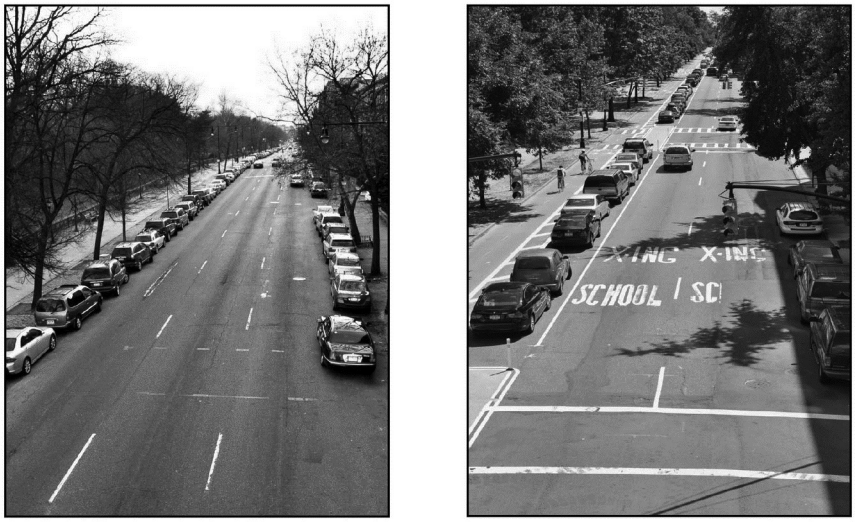
Before and After Images of Great Neck Road in Great Neck, NY

Source: New York State Department of Transportation

A second case study comes from New York City, where the redesign of Prospect Park West reduced crashes by 16 percent, tripled weekday use of cycling, and reduced crossing times for pedestrians (Project for Public Spaces, n.d.). Before and after images are shown in exhibit 6.

Exhibit 6

Before (Left) and After (Right) Images of Prospect Park West in New York City



Source: New York City Department of Transportation

The emerging evidence shows that Complete Streets result in safer streets (Anderson and Searfoss, 2015). They do so by redeveloping existing "incomplete streets" into those that separate traffic from people and cyclists, reduce traffic speeds, and increase mobility options, among other improvements (Shapard and Cole, 2013). What is not clear is whether and the extent to which Complete Streets help achieve other outcomes of redevelopment, such as increasing the number of jobs and people, improving the jobs-housing balance, reducing automobile dependence, and improving real estate values. Literature related to these dimensions is reviewed next. Data and

methods, results, and interpretations along each of these dimensions are reported in subsequent sections of this article.

Job Change

Conventional theory posits that streets are associated with economic development (Berg et al., 2015). Moreover, a local street network that is safe, vibrant, and efficient is a key ingredient of local economic development (Global Designing Cities Initiative, 2016). By contrast, congested or dangerous streets can undermine economic exchange. By extension to Complete Streets, improvements to flow, safety, and mobility, among other features, are expected to improve economic exchange along them. In their effort to improve flow and traffic safety, expand multimodal options, and create physically attractive locations, Complete Streets should attract economic development even if that is not a principal policy objective (Liu and Shi, 2020). Unfortunately, very little research has been done on the association between Complete Streets and economic development, such as job growth generally or by economic sector.

The theory is offered that Complete Streets will influence the kinds of jobs attracted to them or even repelled by them over time (NCSC, 2016b; see also New York City Department of Transportation, 2013). The kinds of jobs matter. For instance, the authors anticipate that Complete Streets will not attract industrial or institutional jobs because of the land-extensive nature of those employers, but Complete Streets are expected to attract jobs in retail, food service, lodging, information, office, education, health, arts, and culture.[7] But do they?

One of the only studies on the association between Complete Streets and change in retail sales was conducted by the New York City Department of Transportation (2013). Using descriptive analysis, the study showed that retail sales along seven "sustainable streets" increased more over time than in the city as a whole.

Another case study found that an investment of $11.5 million to create a Complete Street in Lancaster, California, leveraged $130 million in new private investment that also nearly doubled sales tax revenues. Through multiplier analysis, the study showed that this Complete Street generated $273 million in additional economic output (Congress for the New Urbanism, 2013). This study showed the potential for multiplier effects of Complete Street investments (Nelson et al., 2009).

Based on 11 responses to a survey, the NCSC found that Complete Streets can facilitate redevelopment, leading to increases in jobs (Anderson and Searfoss, 2015). In comparing employment within one or two blocks of Complete Streets between 2 years before and 1 year after their completion, their study found that jobs increased in the areas represented by 7 of the 11 responses. In 6 of those 11 projects, job growth outpaced citywide job growth during the same period. The NCSC cautioned, however, that their study was based on a small number of cases with limited, project-level data. More systematic research is needed (Anderson and Searfoss, 2015: 19).

Although one metric that can be used in the analysis is simply the change in jobs overall and jobs by sector, that comparison would not necessarily show that Complete Streets attract jobs,

[7] For an application of economic sector analysis along a transit corridor similar to a Complete Street, see Nelson et al., 2013.

especially if the region grows faster than the corridor. Regions are defined as the counties within which Complete Streets are located, all of which are central counties as defined by the census. The authors created a metric that measures the extent to which Complete Streets gained or lost their proportionate share of jobs in the region. This question guides the authors' research:

> Is there an association between proximity to Complete Streets and an increase in the share of jobs overall relative to the region over time and with respect to economic sectors?

Another consideration exists for which literature offers no theory or empirical analysis. One could imagine an aspiration in which Complete Streets attract lower-wage jobs, benefiting lower-skilled workers living nearby or within an easy commute. An alternative perspective is that Complete Streets would attract higher-wage workers who are attracted to firms that are also attracted to Complete Streets for their improved safety, multimodal accessibility, and street design amenities. Lacking theoretical guidance, the following open-ended research question is offered:

> Is there an association between proximity to Complete Streets and an increase over time in the share of lower-, middle-, or upper-wage jobs relative to the region?

The null hypothesis posits no change in the share of regional jobs per se or jobs based on wages locating along and near Complete Streets during the study period compared with central counties. Its rejection would indicate that Complete Streets are associated with the change over time in the share of regional jobs and jobs based on wages.

People, Households, Housing Tenure, and Household Income, with Special Reference to Gentrification

As a form of redevelopment, one can look to theories to draw inferences regarding the effect of Complete Streets on people, population, households, housing tenure, income, and gentrification.

An extensive literature review by Mehdipanah et al. (2017) shows that although redevelopment is associated with increases in population and households, the share of minority residents and households falls while income increases. Younger households without children also move into redevelopment areas, leading to minority households, lower-income households, households with children, and older households being displaced, resulting in gentrification. However, no clear direction of change in housing tenure for owners and renters is evident.

No clear theory has been developed on the kinds of people and households that would be attracted to Complete Streets. Although one may assume *a priori* that Complete Streets would become more non-Hispanic White, with higher-income households and fewer households with children—similar to redevelopment expectations—this conjecture has no foundation in the literature on Complete Streets.

What Complete Streets outcomes should one expect? The introductory section of this article shows that more than one-half of Americans want to live in a walkable community (National Association of REALTORS®, 2023). Moreover, an overwhelming number of Americans support

policies that would make their communities more livable by reducing traffic speed, providing more mobility options, and, especially, creating safer pedestrian environments (National Association of REALTORS®, 2017). This perspective is the heart of the Complete Streets philosophy:

> The streets of our cities and towns are an important part of the livability of our communities. They ought to be for everyone, whether young or old, motorist or bicyclist, walker or wheelchair user, bus rider or shopkeeper. But too many streets are designed only for speeding cars, or worse, creeping traffic jams. They are unsafe for people on foot or bike—and unpleasant for everybody. (NCSC, 2016a)

Complete Streets can lead to important social benefits. Lower-income households, including younger households, transportation-disadvantaged persons, and persons of color, are less likely to own cars and more likely to rely on public transportation. Complete Streets—when successful—expand job and housing options without people having to own a car (Brenman and Sanchez, 2012; Sanchez and Brenman, 2008).

Exhibit 7 shows the percentages of households that do not own a car based on minority, income, single-person/single-parent status, tenure, and walk/bike and transit trip mode. These figures are from the Nationwide Household Transportation Survey of 2017. Compared with White households, twice the share of non-White households do not own. Moreover, about a quarter of households earning less than $25,000 (in 2017) do not own cars. While about a fifth of households who walk or bike to destinations do not own cars, two-thirds of those who use transit do not own cars. If Complete Streets improve accessibility to destinations, they may be attractive residential choices among those HHs who do not own cars.

Exhibit 7

Percentages of Households Without Cars Based on Demographic and Commuting Features

Household Feature	No Vehicles (%)
All Households	9
White	6
Non-White	18
Income <$25,000 (2017)	26
Single-Person	20
Single-Parent	13
Renter	21
Walk, Bike Daily	24
Use Transit Daily	67

Source: Compiled by authors from the Nationwide Household Travel Survey (NHTS), Federal Highway Administration (2017)

One concern is that successful Complete Streets can lead to displacement and gentrification (Chapple and Loukaitou-Sideris, 2019; Dawkins and Buehler, 2010; Dawkins and Moeckel, 2016; Hwang and Lin, 2016; Padeiro, Louro, and da Costa, 2019; Rayle, 2015; Zuk et al., 2018). Although no literature associating Complete Streets with gentrification has been published, some literature speculated that it is an outcome with respect to transit-oriented developments (Culver, 2017; Olesen, 2020). On the other hand, little empirical evidence seems to indicate that transit

station-area development leads to large-scale displacement, although some certainly occurs (Delmelle, Nilsson, and Bryant, 2021). If Complete Streets are effective in attracting people, the housing supply along and near them must be increased; otherwise, constrained supply in the face of elevated demand can lead to displacement and gentrification.

The empirical analysis presented in this article will show that although people and households are attracted to Complete Streets, this trend does not lead to higher homeownership rates or households with incomes that are higher than in the central county. The analysis will also show that although Complete Streets in aggregate may lead to some gentrification, this trend may not be the case for individual Complete Streets—this calculation is an area for future research. As suggested elsewhere in this report, the market demand for Complete Streets appears robust. It justifies increasing their supply in case gentrification emerges due to the lack of sufficient supply relative to demand.

On the basis of the literature and theory derived from it, the following research questions are posed that guide research reported previously in this article:

> Over time, does the number of people and households increase in aggregate and as a share of regional change?
>
> If so, does the demographic composition of people—with respect to minority status, households by type, housing tenure for owners and renters, and income—change over time with respect to Complete Street proximity?

If so, does this change signal displacement or gentrification?

As noted previously, *regions* in this context means central counties.

The null hypothesis is that Complete Streets are not associated with significant increases in the number or share of population or households, changes in the number or share of minority persons or households or households by type and income, or gentrification.

If Complete Streets attract jobs and people, to what extent should they alter the jobs-housing balance? This topic is addressed next.

Jobs-Housing Balance

Inasmuch as theory does not directly connect the jobs-housing balance concept to Complete Streets, this is done here.

Achieving a balanced mix of land uses is a key objective of urban redevelopment (Keith et al., 2018).[8] One of the metrics used to measure land use mix is "jobs-housing balance," or JHB (Giuliano, 1991). This metric implies conceptually that communities or areas should be self-

[8] The Urban Land Institute has assembled hundreds of redevelopment projects spanning decades. A common theme is achieving a mix of land uses within redevelopment projects and connecting those projects with the nearby community. For examples, see https://casestudies.uli.org/tag/urban-redevelopment/. See also the mission of the Cambridge (Mass.) Redevelopment Authority at https://www.cambridgeredevelopment.org/history.

contained or self-sufficient, meaning that a sufficient number of workers are available for the jobs in the area. The concept dates back to Ebenezer Howard's *Garden City* concept (Howard, 1902) and C.B. Purdom's *Town Theory and Practice* (Purdom, 1921), a guidebook for planning in the United Kingdom (see also Mumford, 1968). The "area," however, must be considered carefully because very small areas may be mostly job- or housing-rich and difficult to change over time, whereas an entire metropolitan area may be in nearly perfect balance (Wu, Zhang, and Yang, 2015). As Giuliano (1991) frames it, jobs-housing balance "refers to the distribution of employment relative to the distribution of workers within a given geographic area. A community is considered balanced when these distributions are approximately equal and when available housing choices complement the earning potential of available jobs" (Giuliano, 1991: 305). In terms of Complete Streets, achieving JHB would mean bringing the ratio of jobs to housing closer to balance over time, whether that means adding more jobs than housing units or vice versa (see also Stoker and Ewing, 2014). Balance also implies matching jobs with skill levels and incomes in the area (Cervero, 1989). This theory will be operationalized for analysis in a subsequent section of this article.

No literature is available on whether and to what extent Complete Streets improve JHB over time; indeed, such literature with respect to TODs is also thin. Recent research by Blumenberg and King (2021) and Blumenberg and Siddiq (2023) shows that, in the absence of policy interventions, higher-income households are more likely to move toward job-rich TODs, whereas lower-skill and lower-wage workers are pushed out of those TODs, thereby exacerbating housing affordability and increasing aggregate commuting. Those researchers recommend policies that increase the supply of housing in job-rich and high-housing-cost areas, especially near transit stations.

To the extent that Complete Streets aim to improve the mix of land uses, an implicit theory is that once constructed, Complete Streets will improve the JBH ratio over time, meaning that relatively job-rich Complete Streets will become less so as more households are added or that relatively house-rich Complete Streets will become less so as more jobs are added. The research question is framed as follows:

> Is there an association between Complete Streets and change in jobs-housing balance over time such that job-rich or, alternatively, household-rich corridors become less so?

The null hypothesis would assert no change in the Complete Street corridor jobs-housing balance ratio compared with the central county during the study period. Its rejection would imply that Complete Streets are associated with changes in JHB ratios.

The implications of job and household change and JBH on changes in commuting mode are discussed in the following paragraphs.

Commuting Mode

Although no theory directly associates Complete Streets with reductions in the use of automobiles and increases in transit, walking, or biking in the journey to work, such a theory exists with respect to TOD proximity. As workplaces and residences are closer to TODs, commuting by car should decrease, and commuting by other means should increase (Kwoka, Boschmann, and Goetz,

2015). In terms of Complete Streets, this theory is extended by asserting that improvements in street design that make streets safer, make them more attractive, and increase mobility options will reduce commuting by automobile and increase commuting by other modes. A review of relevant literature supports these assertions.

Almost by definition, Complete Streets should change commuting mode patterns. As noted previously, Complete Streets are designed to improve the opportunities and choices for walking, cycling, and, to some extent, choosing transit over driving. Doing so also generates health, environmental, and social benefits that may further enhance the attractiveness of Complete Streets. Complete Streets should thus change commuting mode choices and patterns in two ways: first, by encouraging people to leave their cars, and second, by increasing the use of transit, walking, and biking (NCSC, 2016a).

Complete Streets can achieve these objectives by expanding job opportunities close to where people live. For instance, the NHTS shows that about one-half of all metropolitan trips are 3 miles or less, and more than one-quarter are 1 mile or less, which are distances easily traversed by foot or bicycle. Yet about two-thirds of metropolitan trips under 1 mile are made by automobile. One reason may be incomplete streets that make it dangerous or unpleasant to walk, ride a bicycle, or take public transit (NCSC, 2016b). Another mobility feature of Complete Streets is expanding the supply of safe routes to school (Ewing, Schroeder, and Greene, 2004).

To date, no studies explore the association between Complete Streets and mode choice in the journey to work or any other trip purpose. One simulation prepared for the state of Maryland found that current models of transportation mode choice do not account adequately for the influence of Complete Streets on nonmotorized modes (Bas et al., 2023). Nonetheless, literature on transit station proximity research suggests that people living near Complete Streets should be more likely to walk, bike, or use transit in their journey to work than people living farther away (Ewing, Tian, and Lyons, 2017; Renne, 2009).

A separate issue that has not been addressed in the literature is whether a higher share of people who work at home live near Complete Streets than elsewhere in the region. For these people, accessing transit for trips other than commuting to work improves their transport options. Again, no research on this is available, but the subject will be addressed later in this article.

Given the preceding with respect to TOD research, the authors theorize that Complete Streets will alter commuting behavior in ways that increase the use of transit, walking, and biking; reduce the need to own an automobile; and lead to more people working from home, relative to the region as a whole. This expectation leads to the following research question:

> Are Complete Streets associated with increasing shares of walking, biking, transit use, working at home, and households owning no cars compared with the region over time?

The null hypothesis would assert no change in the commuting mode to work between Complete Streets generally and with respect to central counties in terms of driving, transit, walking, biking, working from home, and not owning cars.

The influence of Complete Streets' proximity on multifamily rents as a proxy for real estate value is considered next.

Multifamily Rent

Standard theory of urban real estate values establishes that the more accessible land is to markets, the more valuable it becomes. In a city with one center, being at the center confers the highest value because it is the closest to all parts of the region. By contrast, being at the fringe confers the lowest value because it is the farthest from all parts of the region (Alonso, 1964; Mills, 1967; Muth, 1969—also known as the AMM model). The AMM model assumes a monocentric city where all the jobs are located while all workers commute to downtown from residences located outside it. However, regions are not monocentric.

As one relaxes the constraints of the AMM monocentric city model, it is possible to imagine the same principles working at smaller scales (Hajrasouliha and Hamidi, 2017). For instance, Complete Streets can serve as a mini-downtown. If so, their effect on real estate markets should be such that the closer real estate is to a Complete Street, the higher its value, all things considered (Nelson, Eskic et al., 2015; Nelson and Ganning, 2015; Nelson, Miller et al., 2015). However, there can be negative proximity effects as well. For instance, suppose a transit station is unattractive—maybe surrounded by parking garages, brownfields, and the like. Real estate values would fall with respect to transit station proximity (Li and Brown, 1980; Nelson, 1992; Nelson and McClesky, 1990).

Nonetheless, finding a positive association between real estate values and Complete Street proximity signals that the market values this relationship and implicitly wants more development near Complete Streets. This preference would be an important policy rationale for local planners to use to increase the supply of development near Complete Streets. That topic is discussed at the end of this article.

The research on the extent to which such interventions as Complete Streets influence real estate values is small. One line of research called *Foot Traffic Ahead* (Leinberger and Lynch, 2015; Rodriguez and Leinberger, 2023) shows that proximity to safe and walkable streets adds value to real estate. Although these reports do not specifically evaluate the effect of Complete Streets' proximity on real estate value, *Foot Traffic Ahead's* findings are clearly applicable to them.

Another strand of relevant research assesses the association between real estate values and transit station proximity. The weight of the statistical evidence shows that the closer real estate is to transit stations, the more valuable it is per square meter; for brevity in citing all the relevant research, the reader is directed to a meta-analysis conducted by Rennert (2022). Nelson et al. (2021), however, shows that proximity to transit stations does not always confer positive associations and instead can confer ambiguous or even negative ones.

Vandegrift and Zanoni (2018) evaluated whether the presence of Complete Street policies in New Jersey cities—but not whether Complete Streets existed—elevated the mean value of all homes in those cities. Controlling for such factors as income and distance to downtown New York City

and Philadelphia, they found no citywide Complete Street policy effect compared with other cities without them. It would seem that the market is more likely to respond to whether Complete Streets exist and, further, with respect to proximity to them.

The only study directly assessing Complete Street proximity on real estate value is that of Yu et al. (2018). They evaluated the value appreciation of single-family detached residential property before and after the implementation of Edgewood Drive, a Complete Street in Orlando, Florida, during the housing market boom from 2000 to 2007. They found that, on average, single-family homes within 800 meters of Edgewood Drive had 8.2-percent-higher home value appreciation than homes outside that range.

For reasons reviewed subsequently in this article, the research reported in this article uses multifamily rents as a proxy for the influence of Complete Streets' proximity on real estate values. Thus, the proximity of multifamily residential units to Complete Streets should confer a positive benefit that is capitalized in the market in the form of higher value or higher rent, assuming that accessibility value exceeds externality value. As an alternative, proximity would confer a negative or ambiguous benefit if the externality value exceeds the accessibility value. The research question posed in this respect is thus the following:

> Do Complete Streets confer a positive or negative premium to real estate value with respect to proximity?

The null hypothesis asserts that there would be no change in real estate value with respect to proximity to Complete Streets.

Analytic Strategy

Unfortunately, little is known about how successful Complete Streets are in achieving redevelopment objectives (Bian and Tolford, 2023). To help close the gap, this article is the first to report research into whether Complete Streets attract jobs and people, improve jobs-housing balance, reduce automobile dependence, and influence real estate values in expected ways.

The analytic strategy is introduced here with details provided below. The research is an empirically based analysis of whether and the extent to which Complete Streets attract jobs and people, change commuting patterns, and influence real estate values. Although the National Center for Complete Streets (NCSC) keeps an inventory of state and local Complete Street policies, no organization maintains an inventory of existing or proposed Complete Streets, their design features, land uses, performance, and so forth, which leads to a call for an entity to do so.

The study areas are those Complete Streets in existence throughout most of the study period based on case studies included in the NCSC's *Safer Streets, Stronger Economies* (Anderson and Searfoss, 2015), Mark Schlossberg et al.'s *Rethinking Streets: An Evidence-Based Guide to 25 Complete Street Transformations* (2013), and others in those metropolitan areas with transit systems that have been studied for the National Institute of Transportation and Communities (Nelson, Miller et al., 2015; Nelson and Ganning, 2015; Nelson and Hibbard, 2019a, 2019b; Nelson et al., 2021). In all, there are 26 Complete Streets in 16 central counties of 16 metropolitan areas for analysis. They are listed in exhibit 8, and their locations are illustrated in exhibit 9.

Exhibit 8

List of Complete Streets Projects Studied

Complete Street Project Name (year opened)	Metropolitan Statistical Area	Central County	Length in Kilometers	Length in Miles
Alder Street—Eugene, OR (2016)	Eugene	Lane	1.2	0.7
Barracks Row—8th Street SE, Washington, DC (2003)	Washington, DC	District of Columbia	0.8	0.5
Bell Street Park—Seattle, WA (2013)	Seattle	King	0.4	0.2
Brighton Blvd.—Denver, CO (2018)	Denver	Denver	3.4	2.1
Broad Street Pedestrian Plaza—Atlanta, GA (2017)	Atlanta	Fulton	0.1	0.1
College Avenue—Tempe, AZ (2011)	Phoenix	Maricopa	3.4	2.1
Decatur Street—New Orleans, LA (2017)	New Orleans	Orleans	1.0	0.6
East Blvd.—Charlotte, NC (2007)	Charlotte	Mecklenburg	2.3	1.4
Edgewater Drive—Orlando, FL (1999)	Orlando	Orange	2.4	1.5
Esplanade Ave.—New Orleans, LA (2010)	New Orleans	Orleans	2.6	1.6
Euclid Avenue—Cleveland, Ohio (2008)	Cleveland	Cuyahoga	7.0	4.4
15th Street NW—Washington, DC (2015)	Washington, DC	District of Columbia	1.9	1.2
Franklin Avenue—Minneapolis, MN (2011)	Minneapolis-St. Paul	Hennepin	0.8	0.5
La Jolla Blvd.—San Diego, CA (2007)	San Diego	San Diego	0.9	0.6
Mill Avenue—Tempe, AZ (2003)	Phoenix	Maricopa	0.7	0.4
Multnomah Street—Portland, OR (2012)	Portland	Multnomah	1.8	1.1
NE 125th Street—Seattle, WA (2011)	Seattle	King	1.4	0.9
Nebraska Avenue—Tampa, FL (2008)	Tampa-St. Petersburg	Hillsborough	1.5	0.9
Nickerson St.—Seattle, WA (2011)	Seattle	King	1.7	1.0
North Williams Ave.—Portland, OR (2012)	Portland	Multnomah	3.1	1.9
South Carrolton Ave.—New Orleans, LA (2009)	New Orleans	Orleans	1.7	1.1
Stone Way N.—Seattle, WA (2007)	Seattle	King	1.8	1.1
SW 5th and 6th Avenues—Portland, OR (2009)	Portland	Multnomah	2.3	1.4
Tennyson Street—Denver, CO (2012)	Denver	Denver	0.8	0.5
Wells Avenue—Reno, NV (2015)	Reno	Washoe	1.3	0.8
West Magnolia Ave.—Fort Worth, TX (2008)	Dallas	Tarrant	1.6	1.0
Total Complete Street Length			47.9	29.6
Mean Complete Street Length			1.8	1.1
Measure			**Land Area in Square Kilometers**	**Land Area in Square Miles**
Central county urbanized land area 2010.			16,663.0	6,433.6
Census block (CB) land area for CBs falling wholly or partially within 100 meters of Complete Street centerlines. This measure is used for the analysis of change in jobs based on the Longitudinal Employment Household Dynamics (LEGD) database, which applied to census blocks.			15.8	6.1
Share of urbanized land area.			0.1%	0.1%
Census block group (CBG) land area for CBGs falling wholly or partially within 100 meters of Complete Street centerlines. This measure is used for the 2013 and 2019 5-year samples of the American Community Survey (ACS), which is applied to census block groups.			97.1	37.5
Share of urbanized land area.			0.6%	0.6%

Sources: Anderson and Searfoss, 2015; Nelson and Ganning, 2015; Nelson and Hibbard, 2019a, 2019b; Nelson, Miller et al., 2015; Nelson et al., 2021; Schlossberg et al., 2013

Exhibit 9

Metropolitan Areas From Which Complete Streets Were Selected for Analysis

Source: Authors

The analysis is limited to measuring change over time with respect to all the Complete Streets in the sample aggregated as a group. Future research will evaluate outcomes with individual Complete Streets. That research can also assess individual Complete Streets before and after opening and over time as they mature. The hope is that future research may use the analytic approach presented in this article as a template. Doing so creates a common framework for evaluating Complete Streets over time and under different analytic scenarios.

As will be seen below, prior research into the change in jobs and investment focused on the first and sometimes second block along Complete Streets. These studies were based on surveys or data collected by local government staff. Because secondary census data are used, which are considered more reliable than surveys or local staff-collected data, the study area based on census geographies is defined as any portion of a census block or block group falling within 100 meters of both sides of the centerline. The actual study area depends on the spatial context in which data are reported. For employment analysis, Longitudinal Employment-Household Dynamics (LEHD) census block (CB) data are used for 2013 and 2019. The total area of the LEHD study area, or all Complete Streets, is 15.8 square kilometers. Compared with the 16,663.0 square kilometers of urbanized land area of the central counties within which the sample of Complete Streets is located, Complete Streets account for about 0.1 percent of that area. For population, household, commuting, and income, American Community Survey (ACS) 5-year sample data are used at the block group (CBG) level for the 2009-through-2013 and 2015-through-2019 periods. Each CBG contains about 4 to

10 CBs. The total land area of CBGs in the Complete Street study area is 97.1 square kilometers, or about 0.6 percent of the central county urbanized land area. These calculations are summarized in exhibit 8.

The research questions, described in more detail below, are based on comparing changes along Complete Street corridors (the treatment) in terms of jobs, people, and households; changes in jobs-housing balance ratios; and changes in commuting mode choice over time with respect to a region defined as the central county (the control) within which a Complete Street is located. Thus, over time, relative to the central county, one could ask the following question:

> Are Complete Streets associated with changes over time in their share of central county jobs, people, and households; increasing households relative to jobs; creating a more favorable jobs-housing balance ratio; and reducing automobile dependency?

Also included is an analysis of the association between Complete Street proximity and multifamily residential rent as an indicator of the market's willingness to pay for Complete Street proximity.

This research is not a counterfactual analysis in that one cannot know what would have happened to the sample of Complete Streets in the absence of intervention. Future research into before-and-after studies of individual Complete Streets is anticipated. Future research could also make comparisons of development and demographic outcomes on extensions to Complete Streets that did not receive interventions. The point of this study is to assess overall outcome associations between the presence of Complete Streets and patterns of change relative to the central counties in which they are located. The metrics used for this analysis can be applied to future studies.

As pointed out elsewhere in this article, all the Complete Streets in the sample are in existing, built-up urban and closer-in suburban areas. Although those areas can have an advantage in attracting jobs and people, doing so comes at higher costs of infill and redevelopment that are not needed elsewhere in central counties or their larger metropolitan areas.

Complete Streets are not randomly selected but are instead an outcome of a decisionmaking process that chooses them for investments and other policy interventions over other opportunities. This is a problem of selection bias. Nonetheless, the aim of this analysis is to assess whether there is an association between Complete Streets and outcomes in terms of attracting jobs and people, improving the jobs-housing balance, reducing dependency on the automobile for commuting, and increasing the value of real estate with respect to distance from Complete Streets. Although one would expect *a priori* that selection for Complete Street investments and other policies aimed at making them more attractive would lead to desired outcomes, the study aims to show whether this is the case. If not, the redevelopment premises of Complete Streets may have to be reconsidered.

There is an additional consideration. Because the sample size is small, at 26 Complete Streets in 16 central counties, and because much of this analysis is exploratory to provide the groundwork for future research, the two-tailed t-test is applied to differences in means between Complete Street and central county outcomes. Rejection of the null hypothesis would occur where $p < 0.05$. Statistically significant differences in mean outcomes between Complete Streets and central counties are found for all comparisons.

Finally, the research needs to be placed in a temporal context. The analysis is based on the period after the Great Recession of 2007–09 and before the COVID-19 pandemic of 2020–23. The study thus avoids analytic complications associated with disruptive economic events. As such, the work may be viewed as the benchmark period that provides context for analysis addressing pandemic and postpandemic outcomes.

The following section assesses Complete Street outcomes with respect to jobs.

The Association Between Complete Street Proximity and Change in Regional Share of Jobs Over Time

This section reports the use of a systematic framework to measure the change in the share of a region's jobs that are attracted to Complete Streets and jobs based on wages. The sample of Complete Streets added jobs at about the same pace as the central county overall, but for individual economic groups (an example of a Complete Street, Cleveland's HealthLine, is illustrated in exhibit 10), Complete Streets added jobs at a faster pace. This fact is remarkable because, for the most part, Complete Streets can add development only through more expensive and time-consuming infill and redevelopment efforts. Findings also indicated that Complete Streets attract jobs paying somewhat higher wages than jobs in the central counties, which makes sense because more costly infill and redevelopment have to generate more revenue to finance ventures, calling for more productive labor that commands higher wages. This section starts with a summary of the theory, research design, and hypotheses, followed by data and method, results, and interpretation.

Exhibit 10

Complete Street Example: HealthLine Route in Cleveland, Ohio

Source: Complete Streets route plotted by Eric Carlson using Google Earth image posted 6-28-2014. https://earth.google.com/web/@41.50661962,-81.63183088,204.21807701a,3830.93973377d,30y,-77.94767459h,80t,0r/data=OgMKATA

Theory, Research Design, Research Questions, and Hypotheses

As theorized previously, Complete Streets should influence the kinds of jobs attracted to them or even repelled by them. Also, as noted earlier, Complete Streets are not anticipated to attract industrial or institutional jobs because of the land-extensive nature of those businesses, but they are expected to attract jobs in retail, food service, lodging, information, office, education, health, arts, and culture. This question guides the research:

> Is there an association between proximity to Complete Streets and an increase over time in the share of jobs relative to the region overall and with respect to economic sectors?

The previous section of this article further addressed the proposition that Complete Streets would attract or repel jobs in lower-, moderate-, and higher-wage categories, which leads to the following research question:

> Is there an association between proximity to Complete Streets and an increase over time in the share of jobs based on lower-, middle-, or upper-wage jobs relative to the region?

These research questions lend themselves to assessment through longitudinal, quasi-experimental design in which Complete Streets are the treatment and central counties are the control.

The null hypothesis posits no change in the share of regional jobs per se or jobs based on wages locating along and near Complete Streets during the study period compared with central counties. Rejection of the null hypothesis would indicate that Complete Streets are associated with a change over time in the share of regional jobs and jobs based on wages.

Data and Method, Results, and Interpretations

The research design can be implemented using the Longitudinal Employment-Household Dynamics (LEHD) data for 2013 and 2019, which allow for evaluating the change in jobs over time.[9] These data are reported at the census block (CB) level. For brevity, most of the jobs in the 20 economic sectors constituting the North American Industrial Classification System (NAICS) are combined into the four economic groups shown in exhibit 11: industrial, office, institutional, and leisure; they comport generally to land use categories used in planning. Excluded are natural resources and construction jobs. Total jobs are also reported, which include those not assigned to the four land use categories. Three categories of jobs for lower-, middle-, and upper-income wages are also created as shown in exhibit 12. This is based on the national sample of the Census Bureau County Business Patterns, which shows roughly equal one-third shares of jobs allocated to each of the wage categories.

[9] For a review of how these data are collected and reported, see https://www.census.gov/programs-surveys/ces/data/restricted-use-data/lehd-data.html.

Exhibit 11

Combinations of NAICS Sectors into Economic Groups for Analysis

NAICS Code	NAICS Sector Title and Economic Group Name
	INDUSTRIAL
22	Utilities
31–33	Manufacturing
42	Wholesale Trade
48–49	Transportation and Warehousing
	OFFICE
51	Information
52	Finance and Insurance
53	Real Estate and Rental and Leasing
54	Professional, Scientific, and Technical Services
55	Management of Companies and Enterprises
56	Administrative and Support, Waste Management, Remediation
81	Other Services (except Public Administration)
92	Public Administration
	INSTITUTIONAL
61	Educational Services
62	Health Care and Social Assistance
	LEISURE
44–45	Retail Trade
71	Arts, Entertainment, and Recreation
72	Accommodation and Food Services

Note: Terms in italics are labels for the respective economic groups.

Source: Adapted from the North American Industrial Classification System by Arthur C. Nelson and Robert Hibberd, University of Arizona

Exhibit 12

Allocation of Workers by Lower-, Middle- and Upper-Wage Groups (1 of 2)

NAICS	Description	Mean Annual Wages, 2013 ($)	Wage Group	Share of Workers (%)
44	Retail Trade	25,779	Lower	NA
56	Administrative, Support, Waste Management, Remediation	35,931	Lower	NA
61	Educational Services	35,427	Lower	NA
71	Arts, Entertainment, and Recreation	32,188	Lower	NA
72	Accommodation and Food Services	17,453	Lower	NA
81	Other Services (except Public Administration)	29,021	Lower	NA
	Weighted National Share of Lower-Wage Workers			***~33***
48	Transportation and Warehousing	45,171	Middle	NA
53	Real Estate and Rental and Leasing	46,813	Middle	NA
62	Health Care and Social Assistance	44,751	Middle	NA
92	Public Administration	51,340	Middle	NA

Exhibit 12

Allocation of Workers by Lower-, Middle- and Upper-Wage Groups (2 of 2)

NAICS	Description	Mean Annual Wages, 2013 ($)	Wage Group	Share of Workers (%)
	Weighted National Share of Middle-Wage Workers			***~33***
22	Utilities	94,239	Upper	NA
31	Manufacturing	54,258	Upper	NA
42	Wholesale Trade	65,385	Upper	NA
51	Information	83,677	Upper	NA
52	Finance and Insurance	88,677	Upper	NA
54	Professional, Scientific, and Technical Services	75,890	Upper	NA
55	Management of Companies and Enterprises	105,138	Upper	NA
	Weighted National Share of Upper-Wage Workers			***~34***

NA = not applicable.

Source: Calculated by the authors using County Business Patterns, U.S. Census Bureau

This analysis is a descriptive one that examines the change over time in jobs by economic group and wage category along Complete Street corridors compared with the central counties within which they are located.

For analytic purposes, a Complete Street corridor is composed of those CBs falling wholly or partially within 100 meters of a Complete Street centerline. This parameter corresponds to the study areas used in other research, in which corridors are one or two blocks along any given Complete Street.

The analysis separates Complete Street data from central counties to avoid double-counting. Analysis of the Complete Streets sample shows that they attracted a higher share of jobs overall and jobs in most economic sectors compared with central counties, but some surprises emerged. Complete Streets also attracted somewhat higher shares of middle- and upper-wage jobs compared with central counties, but the increase in the share of lower-wage jobs is not trivial. In the following section, results are reported for job change by economic group, with interpretations.

Distribution of Share of Job Change by Economic Group with Interpretations

Exhibit 13 presents the distribution of change in jobs within 100 meters of Complete Streets by economic group between 2013 and 2019. To review, 2013 is a reasonable proxy for recovery from the Great Recession. It was the first year when new home sales prices were equivalent to pre-Great Recession prices.[10] The study period goes through 2019, the year before the COVID-19 pandemic. Exhibit 13 shows the change in jobs for the central county as a whole and then the change in jobs near Complete Streets.

[10] See https://fred.stlouisfed.org/series/ASPUS.

Exhibit 13

Change in Jobs by Economic Group Within 100 Meters of Complete Streets as Share of Central County Change, 2013–2019

Economic Group	Central Counties 2013	Central Counties 2019	Central County Change	Central County Percent Change (%)	100-Meter Complete Street Corridor 2013	100-Meter Complete Street Corridor 2019	100-Meter Complete Street Corridor Change	100-Meter Complete Street Corridor Percent Change (%)	Share of County Change (%)
Industrial	1,807,176	1,955,678	148,502	8.22	24,032	25,820	1,788	7.44	1.20
Office	4,191,155	4,702,309	511,154	12.20	220,724	268,309	47,585	21.56	9.31
Institutional	2,292,585	2,559,866	267,281	11.66	178,956	159,317	(19,639)	– 10.97	– 7.35
Leisure	2,489,881	2,779,326	289,445	11.62	94,086	106,427	12,341	13.12	4.26
Total Jobs[a]	11,294,476	12,694,597	1,400,121	12.40	529,777	573,604	43,827	8.27	3.13

[a] Includes jobs in agriculture, forestry, fishing, mining, or other natural resource economic sectors and construction.

Note: The two-tailed t-test comparing central county and Complete Street corridor means rejects the null hypothesis at $p < 0.05$.

Source: Authors' use of LEHD data that are sorted into the economic groups, as described in the text

Overall, Complete Streets added jobs at a slower pace of 8.27 percent compared with 12.40 percent for central counties. That Complete Streets added jobs (and people, as noted below) can be viewed as positive because Complete Streets are located mostly in areas that are already built out (see Schlossberg et al., 2013). By contrast, many central counties have vast amounts of land available for new development. Growth along Complete Streets occurs mostly through the more expensive and time-consuming process of infill and redevelopment.

An interesting surprise is that the 7.44-percent rate of job growth in industrial jobs along Complete Streets nearly matches the 8.22-percent rate of central counties. This similarity may be explained in part because NAICS defines breweries, bakeries, coffee roasters, and related activities as manufacturing enterprises. Industrial jobs added to Complete Streets accounted for 1.20 percent of all such jobs added to central counties. This statistic is remarkable because Complete Streets account for only 0.1 percent of the urban land area of central counties.

Growth of 21.56 percent in office jobs along Complete Streets outpaced the 12.20-percent growth in central counties by nearly double. Indeed, Complete Streets accounted for 9.31 percent of all the changes in central counties, which is remarkable considering the small land area of Complete Streets Future research can assess whether office jobs were more—or less—resilient along Complete Streets than in central counties in the postpandemic era (see Nelson, Stoker, and Hibberd, 2019).

Jobs in the leisure economic group expanded along Complete Streets at a somewhat higher pace of 13.12 percent, compared with 11.62 percent for central counties. However, Complete Streets as a group lost nearly 20,000 jobs in the institutional economic group, whereas central counties gained nearly 180,000 jobs. A reason is that new educational and healthcare facilities require large areas of land, with parking often in land-extensive, campus-like settings, which cannot be accommodated easily along Complete Streets.

Infill and redevelopment along Complete Streets is often more expensive and time consuming than conventional development elsewhere in the central county. Nonetheless, exhibit 13 shows that nearly 44,000 jobs were added to the sample of Complete Streets. Whereas central counties added vastly more jobs, about 530,000, the LEHD land area of the Complete Streets sample accounts for about 0.1 percent of central county urbanized land area (see exhibit 8). Put differently, although the 44,000 new jobs added to the sample of Complete Streets account for 3.13 percent of all central county job growth, that growth occurred on just 0.1 percent of the central county urban land area, meaning that Complete Streets had 31 times more development proportionate to their land area than central counties. If one removes the institutional economic group from the calculus for reasons noted previously, the Complete Streets accounted for 59 times more growth proportionate to their land area.

Based on this descriptive assessment, the null hypothesis is rejected.

Future research needs to tease out the extent to which Complete Streets would have attracted these jobs anyway, without intervention. Future research can also determine whether there are timing effects, such as growth in jobs soon after the intervention, perhaps absorbing that which was easiest to develop or redevelop first, then growth drifting toward the regional pace because more difficult sites are expensive and time consuming to process. Nonetheless, except for the institutional economic group, this sample of Complete Streets shows a strong association between their presence and growth in jobs during the study period of 2013–19, between the Great Recession and the COVID-19 pandemic.

The change in jobs by wage group is presented next, with interpretations.

Distribution of Job Change by Wage Group, with Interpretations

The literature does not predict whether lower-, middle- or upper-wage jobs will be attracted to Complete Streets. For reasons noted previously, however, the authors expect that Complete Streets jobs will tend to attract middle- and upper-wage groups. Exhibit 14 confirms this point rather starkly with a surprise: lower-wage jobs fell in both central counties and along Complete Street corridors. Although that circumstance requires further research, one may surmise that lower-wage jobs migrated to suburban areas outside central counties, where development costs are lower and demand for those jobs to serve newly suburbanizing areas is higher than in central counties. Notably, Complete Street corridors accounted for 10.44 percent of central county losses in lower-wage jobs.

Exhibit 14

Change in Jobs by Wage Group within 100 Meters of Complete Streets as a Share of Central County Change, 2013–19

Wage Group	Central County Change	100-Meter Complete Street Corridor Change	Complete Street Corridor Share of Central County Change
Numerical Change			
Lower Wage	(395,427)	(41,292)	– 10.44%
Middle Wage	1,334,976	48,915	3.66%
Upper Wage	496,640	34,452	6.94%
Share of Change			
Lower Wage	NA	NA	NA
Middle Wage	72.89%	58.67%	NA
Upper Wage	27.11%	41.33%	NA

NA = not applicable.

Note: The two-tailed t-test comparing central county and Complete Street corridor means rejects the null hypothesis at $p < 0.05$.

Source: Authors' LEHD data sorted into the economic groups, as described in the text

By contrast, Complete Street corridors accounted for 3.66 percent and 6.94 percent of central county gains in middle- and upper-wage jobs, respectively. Moreover, the share of upper-wage jobs added along Complete Streets was higher, at 41.33 percent, than in central counties, at 27.11 percent, although middle-wage jobs dominated the overall share of change at 58.67 percent and 72.89 percent, respectively.

The conclusion is drawn that Complete Streets tend to attract middle- and, especially, upper-wage jobs, with middle-wage jobs dominating the distribution of change. As such, on the basis of descriptive assessment, the null hypothesis is rejected.

An assessment is presented next on the association between Complete Streets and change in people and households, including demographic, housing tenure, and income outcomes over time and with respect to central counties.

The Association Between Complete Street Proximity and Change Over Time in People, Households, Housing Tenure, and Income, With Special Reference to Gentrification

This section will show that people and households appear to be attracted to Complete Streets (an example of the Tennyson Street Complete Street in Denver is illustrated in exhibit 15). This attraction does not lead to higher homeownership rates or households that have incomes that are higher than those in the central county. It will also show that, in aggregate, Complete Streets do not appear to lead to gentrification, although some individual Complete Streets might do so; that topic is an area for future research. Analysis suggests that the market demand for Complete Streets appears robust and justifies increasing their supply in case gentrification emerges due to a lack of sufficient supply relative to demand.

Exhibit 15

Complete Street Example: Tennyson Steet Route in Denver, Colorado

Source: Complete Streets route plotted by Eric Carlson using Google Earth image posted 9-28-2020. https://earth.google.com/web/@39.77196107,-105.04474183,1646.58793007a,845.24421645d,35y,-80.43859268h,39.5t,0r/data=0gMKATA

Theory, Research Design, Research Questions, and Hypotheses

As noted previously, no clear theory exists relating to the kinds of people and households that would be attracted to Complete Streets. Empirical analysis can help close this gap. The analysis is guided by the interest in knowing how the demographic composition of the population and households has changed over time with respect to Complete Street proximity. One may also be

interested in knowing whether the evidence indicates displacement and gentrification associated with Complete Street proximity.

On the basis of the literature and theory summarized earlier in this report, the following research questions that guide research reported in this section should be considered:

> Over time, does the number of people and households increase in aggregate and as a share of regional change?
>
> If so, does the demographic composition of people with respect to minority status, type of housing, housing tenure of owners and renters, and income change over time with respect to Complete Street proximity?
>
> If so, does this change signal displacement or gentrification?

As noted above, "regions" in this context means central counties.

The research questions lend themselves to a descriptive longitudinal, quasi-experimental design that compares change between the treatment— Complete Street corridors—and the control—central counties.

The null hypothesis is that Complete Streets are not associated with significant increases in the number or share of population or households, the number or share of minority persons or households, or households by type and income, or gentrification.

Data and methods are reviewed next.

Data and Methods, Results, and Interpretations

American Community Survey (ACS) data are used for this analysis. The ACS includes reasonably detailed demographic data down to the census block group (CBG) level through its 5-year survey increments. The 2013 5-year survey is the starting point for analysis because it includes mostly data collected after the Great Recession, which ended, technically, in the middle of 2009. The 2019 5-year survey is used as the ending point because it covers a period entirely before the COVID-19 pandemic.

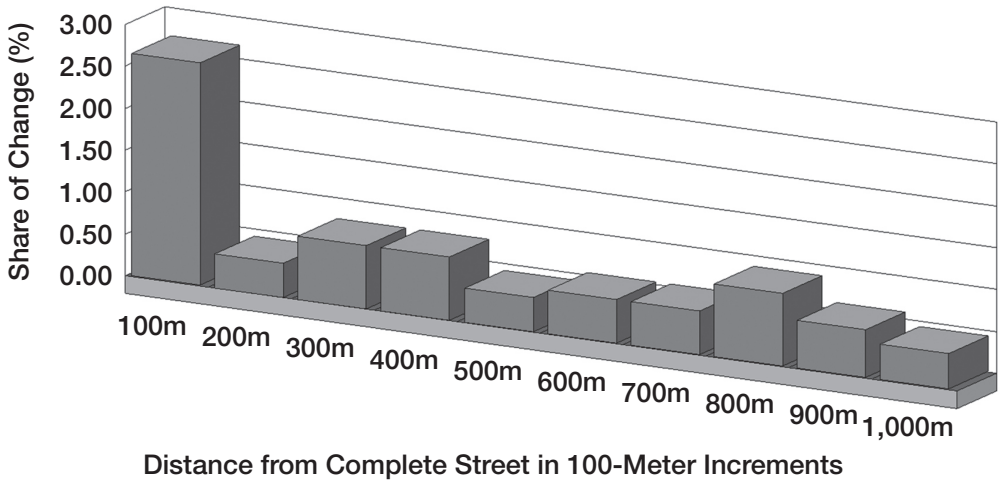
Because this mostly exploratory analysis compares changes for several ACS demographic variables, descriptive analysis is used based on change between 2013 and 2019 along Complete Street corridors as a group and compared with central counties in which they are located, also as a group. Descriptive analysis focuses on the first 100 meters along both sides of Complete Streets' centerlines. The analysis uses a nearest-point assignment, whereby a census block group (CBG) is assigned to the closest 100-meter buffer.

To confirm the use of the 100-meter distance band for analysis, in exhibit 16, the share of the central county change in households for all central counties was calculated in 100-meter distance bands to 1.0 kilometer for all Complete Streets as a group. The first 100-meter distance band accounts for more than 2.5 percent of the central county share of household change over the

study period (see also exhibit 14), whereas all the other bands accounted for less than 1.0 percent. Consistent with other studies that measured change along the first block or two along Complete Streets, research in this section focuses wholly or partially on any part of CBGs that are within 100 meters of the centerline of Complete Streets.

Exhibit 16

Share of Central County Household Change 2013–19 by 100-Meter Distance Band from Complete Streets



Note: The largest share of change is attributable to the first 100-meter distance band.
Source: Authors

Descriptive analysis uses the ACS 5-year samples for 2013 and 2019 (covering the period 2009 through 2019) to calculate population, household changes, shares of household change of Complete Streets compared with central counties, change in housing tenure, and change in household income for Complete Street corridors compared with central counties. Exhibit 17 summarizes these variables and their sources.

Exhibit 17

Change in Population and Households Along Complete Street Corridors and as a Share of Central County Change, 2013–19

Measure	Central Counties 2013	Central Counties 2019	Central County Change	Central County Percent Change (%)	100-Meter Complete Street Corridor 2013	100-Meter Complete Street Corridor 2019	100-Meter Complete Street Corridor Change	100-Meter Complete Street Corridor Percent Change (%)	Share of County Change (%)	Ratio of Complete Street Change to Central County Change
Population										
Population	20,539,285	22,449,914	1,910,629	9.30	205,504	240,214	34,710	16.89	1.82	1.82
White Non-Hispanic	11,283,190	11,664,985	381,795	3.38	137,032	153,750	16,718	12.20	4.38	3.61
Minority	9,256,095	10,784,929	1,528,834	16.52	68,472	86,464	17,992	26.28	1.18	1.59
Household Type										
Total Households	7,784,674	8,414,875	630,201	8.10	95,785	111,762	15,977	16.68	2.54	2.06
HH w/Child	2,485,393	2,570,210	84,817	3.41	14,593	15,635	1,042	7.14	1.23	2.09
HH no Children*	5,299,281	5,844,665	545,384	10.29	81,192	96,127	14,935	18.39	2.74	1.79
One-Person HH	2,343,006	2,497,799	154,793	6.61	47,167	53,665	6,498	13.78	4.20	2.09
Householder Age										
HH <=25	375,770	322,762	(53,008)	– 14.11	10,554	11,083	529	5.01	All	NA
HH 25–44	3,012,094	3,173,335	161,241	5.35	43,526	52,806	9,280	21.32	5.76	3.98
HH 45–64	2,925,455	3,084,491	159,036	5.44	27,534	30,028	2,494	9.06	1.57	1.67
HH >=65	1,471,355	1,834,287	362,932	24.67	14,171	17,845	3,674	25.93	1.01	1.05

HH = household. NA = Not applicable.

**Excluding single-person households.*

Note: The two-tailed t-test comparing central county and Complete Street corridor means rejects the null hypothesis at $p < 0.05$.

Source: Authors' use of ACS data that are sorted into the demographic groups, as described in the text

The analysis is based on two sets of calculations, both of which separate Complete Street data from data for the rest of the central counties to avoid double counting. The first set of calculations is Complete Street demographic change and demographic change in the share of central county change in terms of total population, non-Hispanic White population, minority population, total households, and households by groups for household type and householder age. The second set of calculations is tenure (owner/renter) and median household income change in Complete Streets compared with central counties.

Exhibit 17 reports descriptive results in terms of the central county and Complete Street corridor figures for 2013 and 2019, along with numerical and percentage changes. The share of central county growth that is attributed to Complete Streets is also reported. The last column is an index of the ratio of Complete Street corridor change to central county change. Ratios above 1.0 indicate that Complete Street corridors are changing at a faster pace than central counties, whereas ratios below 1.0 (of which there are none) would indicate slower change relative to central counties.

Exhibit 17 presents results for the population overall and for White non-Hispanic and minority persons. It also reports results for change in total households, change in households by type from among households with and without children, single-person households by type, and households with householders younger than 25 years of age, between 25 and 44, between 45 and 64, and 65 and older. These results are compared with the results for central counties in terms of growth rates, share of central county growth attributable to Complete Streets, and the ratio of Complete Street to central county growth. Following the results, the authors offer interpretations, including special reference to gentrification.

Population

Adding nearly 35,000 residents between 2013 and 2019, Complete Street corridors grew 16.89 percent, considerably faster than the 9.30-percent growth of central counties. Complete Streets also added minority persons at a much faster pace of 26.28 percent compared with 16.52 percent. On the other hand, the Complete Street corridor White non-Hispanic population grew 12.20 percent compared with 3.38 percent in central counties, or about 3.50 times more. Nonetheless, minorities accounted for most of the population change along Complete Street corridors. In terms of share of growth, Complete Street corridors accounted for 1.82 percent of the total population growth of central counties, 1.18 percent of the minority growth, and 4.38 percent of the White non-Hispanic growth. The null hypothesis that no difference exists in population growth rates between Complete Streets and central counties is rejected.

Households by Type

Complete Streets accounted for a higher share of central county growth among households, 2.54 percent, compared with 1.82 percent for the overall population. Two key reasons account for this difference. First, the number of single-person households grew at about twice the rate along Complete Streets than in central counties, 13.78 percent compared with 6.61 percent—indeed, accounting for 4.20 percent of central county growth. The second reason is that Complete Street corridors accounted for the highest ratio in the change in the share of households with children;

that is, they attracted a ratio of 2.09 times the share of such households in central counties. By comparison, Complete Streets attracted a ratio of 1.79 times more households without children and a ratio of 2.09 times more single-person households. The number is small; 1,042 new households with children were located along Complete Streets compared with 15,977 total new households. The number is not trivial, and it is surprising because one would expect that Complete Streets would not necessarily attract a higher share of households with children than central counties as a whole.

Because households are the key driver of housing demand, demand for new housing along Complete Streets appears to be higher than for central counties. Put differently, by absorbing 2.54 percent of all new households between 2013 and 2019 on urban land area, representing just 0.6 percent of central county urban land area based on CBGs (see exhibit 8), Complete Street urban land area attracted proportionately 42 times more households than their central counties urban land area. This difference is all the more remarkable considering that Complete Street development occurs mostly through expensive and time-consuming infill and redevelopment processes.

The null hypothesis that no difference exists in growth rates among households and households by type between Complete Streets and central counties is supported.

Householders by Age, With Interpretations

Growth among households of all four householder age groups in Complete Street corridors between 2013 and 2019 was more robust compared with growth in central counties. Analysis of the youngest-aged cohort is illustrative. As America ages, its population of younger age cohorts falls. Such is the case among the central counties, where the number of householders younger than 25 years of age fell 14.11 percent between 2013 and 2019. However, the number of these householders living in Complete Street corridors increased 5.01 percent. Mathematically, Complete Streets accounted for all central county growth among householders younger than 25 years of age.

The growth rates among householders between 25 and 44 and between 45 and 64 also eclipsed growth in central counties by 21.32 to 5.35 percent and 9.06 to 5.44 percent, respectively, accounting for 5.76 percent and 1.57 percent of central county growth, respectively. Even the growth rate among householders aged 65 years and older exceeded that of central counties by 25.93 to 24.67 percent, although this group accounted for only 1.01 percent of the share of central county growth.

The null hypothesis that no difference exists in growth rates among households and households by type or householder age between Complete Streets and central counties is rejected.

Changes in housing tenure and household income along Complete Street corridors compared with central counties are considered next.

Housing Tenure and Income, With Interpretations

Exhibit 18 shows changes in housing tenure and median household income for Complete Streets compared with central counties over the study period. The homeownership rate of Complete

Streets fell at a notably faster pace—from 36.5 percent to 33.3 percent—than in central counties, which fell from 57.5 percent to 56.5 percent. Mathematically, 85.59 percent of all new households locating along Complete Street corridors were renters. One can surmise, for reasons noted earlier, that the economics of infill and redevelopment along Complete Streets favors rental over owner-occupied housing. Although the alternative perspective is that existing housing went from owner-occupied to rental, this idea is not supported by the data, which show that the supply of owner-occupied housing increased.

Exhibit 18

Change in Tenure and Household Income Along Complete Street Corridors and as a Share of Central County Change, 2013–19

Measure	Central Counties 2013	Central Counties 2019	Central County Change	Central County Percent Change (%)	100-Meter Complete Street Corridor 2013	100-Meter Complete Street Corridor 2019	100-Meter Complete Street Corridor Change	100-Meter Complete Street Corridor Percent Change (%)	Share of County Change (%)
Tenure									
Owner HH	4,533,603	4,815,140	281,537	6.21	34,936	37,239	2,303	6.59	0.82
Ownership Rate	57.5%	56.5%	NA	– 1.84	36.5%	33.3%	NA	– 8.65	
Renter HH	3,251,071	3,599,735	348,664	10.72	60,849	74,523	13,674	22.47	3.92
Income									
Median HH Income (2019$)	$69,966	$77,833	$7,867	11.24	$61,405	$73,470	$12,065	19.65	NA
Central County Ratio	NA	NA	NA	88%	94%	NA	NA	NA	NA

HH = household. NA = not applicable.

Note: The two-tailed t-test comparing central county and Complete Street corridor means rejects the null hypothesis at $p < 0.05$.

Source: Authors based on authors' use of ACS data that are sorted into the demographic groups, as described in the text

Although the homeownership rate fell nationally during the middle 2010s, the much more rapid decline along Complete Street corridors stands out. One reason noted previously is that development along Complete Street corridors is more expensive and time-consuming than elsewhere in central counties. If so, one of the outcomes could be more expensive housing along Complete Streets, leading to higher rental rates over time.

On the other hand, median household income—adjusted for 2019 dollars—rose along Complete Streets at a moderately faster rate of 19.65 percent compared with the 11.25-percent rate for central counties. Although this finding might suggest an increased ability of households to afford home purchases, the caveat is that household incomes along Complete Streets lagged behind the central county median through the study period, being 88 percent of the median in 2013 and 94 percent in 2019. Indeed, one may be surprised about the moderately steep decline in homeownership rate along Complete Streets compared with central counties. This topic is an area in need of additional research.

The null hypothesis that no difference exists in changes in housing tenure and median household income between Complete Streets and central counties cannot be rejected.

Special Reference to Gentrification

The fact that Complete Streets appear to attract larger shares of the region's population and households suggests, first, that the market responds favorably to them and, second, that increased demand can lead to rising prices and, ultimately, gentrification. Some evidence for these trends appears among the sample during the study period. If the difference in median household income between 2013 and 2019 is applied to only the growth in households along Complete Streets, the median household income of new households in 2019 would be more than $100,000, or much larger than the median household income in 2013. But this suggestion is misleading. Perhaps the higher income is merely spread evenly across new and existing households. Moreover, because of new jobs at higher wages, existing residents along and near Complete Streets have more job opportunities, leading to higher household incomes. Indeed, a previous section of this report shows a shift away from lower wages to moderate and higher ones. Moreover, because the ownership rate along Complete Streets fell at a faster pace than in the central county, whether gentrification in the form of increasing homeownership rates is emerging is not clear. Finally, ACS data do not clearly indicate whether newcomers are displacing existing residents. No clear evidence of this circumstance is indicated based on the minority composition of population change and that rental housing dominates the change in tenure. This subject is clearly an area needing research.

Nonetheless, if Complete Streets are successful, they will attract higher-income households, which could lead to displacement and gentrification. Solutions to moderating adverse gentrification outcomes include increasing the housing supply to meet market demand, increasing the supply of subsidized housing, and preserving existing lower-income housing stock, perhaps through public/private/nonprofit housing and community land trusts. These and other interventions are noted in a subsequent section of this report.

The next section presents an evaluation of changing commuting modes with respect to Complete Streets.

The Association Between Complete Streets and Improved Jobs-Housing Balance Ratios Over Time

By attracting jobs and people, Complete Streets should alter the balance between jobs and households, but in what ways? (The example of the East Boulevard Complete Street in Charlotte is shown in exhibit 19.) A common perception is that commercial streets are job-rich enclaves of nonresidential development with not many people living nearby—at least, people who would work at those jobs. Converting commercial streets into Complete Streets should improve connectivity with workers living nearby and attract new residents, some of whom may work along Complete Street corridors. On the other hand, a Complete Street retrofitted into a residential area should attract jobs that some of the residents would take. A third alternative is one in which Complete Streets attract new residents who work remotely or are self-employed and who seek the Complete Street ambiance.

Exhibit 19

Complete Street Example: East Boulevard Route in Charlotte, North Carolina

Source: Complete Streets route plotted by Eric Carlson using Google Earth image posted 12-14-2021. https://earth.google.com/web/@33.42744969,-111.94092127,3 54.4478887a,1942.08201563d,30y,-27.99876214h,62.2499736t,0r/data=0gMKATA

Theory, Research Design, Research Question, and Hypotheses

In theory, Complete Streets will alter the jobs-housing balance along their corridors, but the direction of change depends on whether the JHB favors jobs or housing at the outset. If the ratio favors jobs, one can theorize that the JHB ratio will adjust toward the household side of the calculation. The reason is that Complete Streets will attract households toward job-rich opportunities. The corollary to this reasoning is that job-rich Complete Streets may attract workers who work remotely or are self-employed and can choose anywhere to live, but they choose Complete Streets for their safety, amenities, accessibility to shops and restaurants, and multimodal options. If the ratio favors households, the JHB ratio will adjust toward jobs because Complete Streets are attracted to where labor is available. The research question is framed as follows:

> Is there an association between Complete Streets and change in jobs-housing balance over time such that job-rich or, alternatively, household-rich corridors become less so?

The research question lends itself to a descriptive longitudinal, quasi-experimental design that compares change over time between the treatment—Complete Street corridors—and the control—central counties with respect to change in jobs-housing balance.

The null hypothesis would assert no change in the Complete Street corridor jobs-housing balance ratio compared with that of the central county during the study period. Its rejection would imply that Complete Streets are associated with changes in JHB ratios.

Data and Method, Results, and Interpretation

ACS data are used for this analysis. The data provide details down to the CBG level in 5-year survey increments. For reasons noted previously, the 2013 and the 2019 5-year ACS surveys are used for analysis. ACS data show the number of people working in the CBG and the number of households. These data provide a direct measure of JHB ratios for Complete Street corridors and central counties. As noted earlier, the descriptive analysis focuses on the first 100 meters along both sides of Complete Streets' centerlines. A nearest-point assignment is used, whereby a census block group (CBG) is assigned to the closest 100-meter buffer.

Exhibit 20 reports total jobs (based on LEHD data) and households (based on ACS data) in central counties and along Complete Street corridors in 2013 and 2019. Figures for central counties established benchmark JHB ratios of 1.40 in 2013, rising slightly to 1.46 in 2019. Considering that for every new household, there were 2.22 jobs (see bottom row of exhibit 20), more jobs than households moved into central counties. By contrast, the JHB for Complete Streets in 2013 was 5.53, which is sensible because many of them are commercial streets with higher densities of jobs than seen throughout central counties. However, in 2019, the JHB ratio for Complete Streets fell about 10 percent to 5.13. The reason is that whereas the number of jobs along Complete Streets increased by 8.27 percent, the number of households increased by 16.68 percent. More interesting is that the JHB considering just new jobs and households was 2.74, indicating a shift in trends toward households being attracted to Complete Street corridors at an increasing rate relative to jobs.

The conclusion is made that the null hypothesis is rejected.

Exhibit 20

Change in Central County and Complete Street Corridor Jobs-Housing Balance, 2013–19

Measure	Central Counties 2013	Central Counties 2019	Central County Change	Central County Percent Change (%)	100-Meter Complete Street Corridor 2013	100-Meter Complete Street Corridor 2019	100-Meter Complete Street Corridor Change	100-Meter Complete Street Corridor Percent Change (%)
Jobs	10,764,699	12,120,993	1,400,121	12.40	529,777	573,604	43,827	8.27
Households	7,688,889	8,303,113	630,201	8.10	95,785	111,762	15,977	16.68
Jobs/ Household Balance	1.40	1.46	2.22	3.41	5.53	5.13	2.74	7.14

Note: The two-tailed t-test comparing central county and Complete Street corridor means rejects the null hypothesis at $p < 0.05$.
Source: Authors' use of ACS data that are sorted into the groups, as described in the text

The Association Between Complete Street Proximity and Change in Commuting Over Time

Complete Streets aim to alter commuting modes away from driving and to transit, walking, biking, and working from home (the Mill Avenue, Tempe, Complete Street is shown in exhibit 21). Using ACS data over the period 2013–2019, the authors will show that compared with central counties, Complete Streets are associated with expected outcomes. Theory, research questions, research

design, and hypotheses are presented below, followed by a review of the data, analytic approach, and method, and concluding with results and interpretations.

Exhibit 21

Complete Street Example: Mill Avenue Route in Tempe, Arizona

Source: Complete Streets route plotted by Eric Carlson using Google Earth image posted 10-31-2022. https://earth.google.com/web/@33.42744969,-111.94092127,3 54.4478887a,1942.08201563d,30y,-27.99876214h,62.2499736t,0r/data=0gMKATA

Theory, Research Design, Research Question, and Hypotheses

In theory, improving the street design by making streets safer, more attractive, and traversable would reduce dependency on automobiles in the journey to work relative to people living in the region—in this case, the central county. One would also expect that more people living along or near Complete Streets would not need to own vehicles relative to people living in the central county. This expectation is consistent with the theory of commuting behavior near TODs noted previously in this article.

The following research question guides research into this issue:

> Over time, are Complete Streets associated with increasing shares of walking, biking, transit use, working from home, and households owning no cars compared with the region?

The research question lends itself to a descriptive longitudinal, quasi-experimental design, in which Complete Streets are the treatment and central counties are the control.

The null hypothesis would assert no change in the commuting mode to work between Complete Streets and central counties in terms of driving, transit, walking, biking, working from home, and not owning cars.

The analytic approach, results, and interpretations are reviewed next.

Data and Method, Results, and Interpretations

Like the analysis reported previously, ACS data are used for this analysis. Data on the mode choice to work are reported at the CBG level in 5-year survey increments. For reasons already noted, the 2013 and 2019 5-year samples of the ACS are used. Central county data exclude data for Complete Street corridors.

Because this is an exploratory analysis that compares changes among several ACS commuting mode choices, descriptive analysis is used that compares changes between 2013 and 2019 along Complete Street corridors as a group and the central counties in which they are located, which are the control. The study area is the first 100 meters along both sides of Complete Streets' centerlines. A nearest-point assignment is used, whereby a census block group (CBG) is assigned to the closest 100-meter buffer. Exhibit 22 presents the results. Notably, the number of workers living along Complete Streets in the sample increased 23.01 percent compared with 14.97 percent for the central counties. Second, driving to work via car increased 15.64 percent for workers living in Complete Street corridors, which was slightly more than the 14.39-percent increase among workers living in central counties.

In all other respects, the increase in the non-auto commute to work is substantially more among workers living along Complete Streets than in the central county. Notably, transit use increased 25.05 percent in Complete Street corridors compared with 15.39 percent in the central county. Walking or biking to work increased 42.17 percent in Complete Street corridors, compared with 20.15 percent in central counties. Working from home increased 64.06 percent (before the pandemic) along Complete Streets, compared with 41.39 percent for central counties. Workers living along Complete Streets accounted for 10.97 percent of the share of change in central county workers walking or biking to work. This statistic is remarkable considering that central counties added more than 1.5 million workers compared with about 31,000 workers for Complete Streets.

Several insights can be drawn from the commuting mode analysis. One is that the number of workers who commuted to work via transit or walking/biking increased 67.22 percent along Complete Street corridors, which is about twice the rate of 35.54 percent in central counties.

Exhibit 22

Change in Commuting Mode Choice Along Complete Street Corridors and as a Share of Central County Change, 2013–19

Measure	Central Counties 2013	Central Counties 2019	Central County Change	Central County Percent Change (%)	100-Meter Complete Street Corridor 2013	100-Meter Complete Street Corridor 2019	100-Meter Complete Street Corridor Change	100-Meter Complete Street Corridor Percent Change (%)	Share of County Change (%)	Ratio of Complete Street Change to Central County Change
Workers	10,097,511	11,608,975	1,511,464	14.97	133,813	164,609	30,796	23.01	1.87	1.41
Drive to Work	8,072,245	9,233,878	1,161,633	14.39	65,305	75,521	10,216	15.64	0.88	1.09
Transit	539,917	623,035	83,118	15.39	14,501	18,134	3,633	25.05	4.37	1.63
Walk/Bike	375,794	451,514	75,720	20.15	22,133	31,466	9,333	42.17	12.33	2.09
Work from Home	525,413	742,872	217,459	41.39	7,555	12,395	4,840	64.06	2.23	1.55
No Vehicles	717,955	722,285	4,330	0.60	24,319	27,093	2,774	11.41	64.06	18.91
No-Drive	1,396,935	1,755,426	376,297	26.94	44,189	61,995	17,806	40.30	4.73	1.50
No-Drive Rate	13.83%	14.95%	22.87%	NA	33.02%	37.66%	57.82%	NA	NA	NA

NA = not applicable.

Note: The two-tailed t-test comparing central county and Complete Street corridor means rejects the null hypothesis at $p < 0.05$.

Source: Authors' use of LEHD data that are sorted into the commuting groups, as described in the text

Another insight is that 64.06 percent of the change in workers living along Complete Streets is attributable to those who work from home, compared with 41.39 percent for central counties. The reasons would seem that Complete Streets are safe and attractive places in which to live and work and have sufficient shopping and services nearby to avoid needing to reach them by car. Although one may surmise that Complete Streets are not for everyone, they are an option for those who seek the benefits and ambiance of Complete Street corridors. This option would be the case for those workers who can live anywhere. But even many of those people want to do business in such "third places" as neighborhood coffee shops or other places that are social gathering spots.

Exhibit 22 shows a no-drive statistic composed of transit, walking, biking, and working at home. For central counties, the number of workers not driving to work increased 26.53 percent between 2013 and 2019 (before the pandemic), but the figure was 40.30 percent for those living along Complete Street corridors. The next statistic, the no-drive rate, shows that for central counties, 24.90 percent of the change in commuting to work was via nondriving modes, which means that nearly 75 percent of the changes were attributable to those who previously drove to work. By contrast, 57.82 percent, or more than one-half of the change in workers living along Complete Street corridors, was attributable to those who did not drive to work. The implication is that more than one-half of the new workers living along Complete Streets do not drive to work but instead use transit, walk, bike, or work from home.

A final trend emerges from the data. The number of households along Complete Streets accounted for 64.06 percent of the increase among all households reporting no vehicles present. This rate of change was 18.91 times faster than for central counties. The implication is that those who live on or near Complete Streets depend on cars to a far lesser extent than those living elsewhere in the central county.

Unfortunately, the data do not allow for estimating the change in vehicle miles traveled per worker living along Complete Streets compared with central counties or the reduction in greenhouse gases or other pollutants. One may surmise from the literature that it would be in the order of one-half (Ewing et al., 2008). Numerous implications for Complete Streets policy and investment are offered in the concluding section of this article.

The null hypothesis that no difference exists in changes in commuting mode between Complete Streets and central counties is rejected.

The association between multifamily rents and proximity to Complete Streets is presented next.

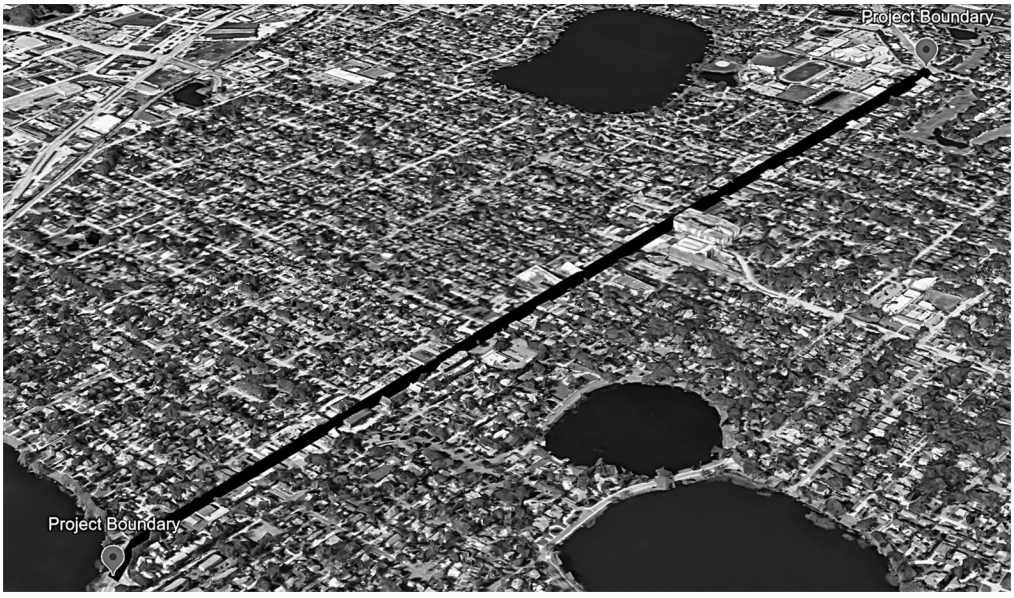
The Association Between Complete Street Proximity and Multifamily Rents

This final analysis addresses the extent to which the real estate market values proximity to Complete Streets (a Complete Street example is illustrated in exhibit 23 for Edgewater Drive in Orlando). The analysis uses commercial real estate data for multifamily rents from CoStar Group. As will be shown, a very positive and robust association exists between Complete Street proximity

and multifamily residential rent. This association leads to several important policy implications that will be addressed at the end of the article.

Exhibit 23

Complete Street Example: Edgewater Drive Route in Orlando, Florida



Source: Complete Street route plotted by Eric Carlson using Google Earth image posted 11-8-2017. https://earth.google.com/web/@28.56991933,-81.38903658,30.9647673a,2809.79830531d,30y,-38.99514918h,61.735810 52t,0r/data=OgMKATA

Theory, Research Design, Research Question, and Hypotheses

Standard theory of urban real estate values establishes that the more accessible land is to markets, the more valuable it becomes. The study uses multifamily rents as a proxy for the influence of Complete Streets' proximity on real estate values. The proximity of multifamily residential units to Complete Streets should confer a positive benefit that is capitalized in the market in the form of higher value or higher rent, assuming that accessibility value exceeds "externality value." For instance, a form of externality value is proximity to a solid waste dump: the closer a property, the lower its value. If Complete Streets generate externalities such as noise, congestion, exhaust, speeding cars, unsafe pedestrian conditions and so forth, residential values (or rents) would fall the closer residential property is to those conditions. Alternatively, proximity would confer a negative or ambiguous benefit if the externality value exceeds the accessibility value. The research question posed in this respect is thus:

> Do Complete Streets confer a positive or negative premium to real estate value with respect to proximity?

This research question lends itself to a temporal cross-section quasi-experimental design evaluating the association between Complete Street proximity and real estate values, controlling for other influences on real estate value at one point in time.

The null hypothesis asserts simply that no change in real estate value with respect to proximity to Complete Streets would be indicated.

The data, analytical approach, and model are presented next.

Data and Method, Results, and Interpretations

Based on the preceding theory, research question, research design, and hypothesis, the analytic strategy entails measuring the change in real estate values with respect to distance from Complete Street centerlines. An upward-sloping gradient toward Complete Streets would be consistent with the theory in that Complete Streets confer centrality and accessibility value. A downward-sloping gradient would signal that Complete Streets are undesirable because real estate values are higher the farther away a property is from them.

The analysis requires data that reflect real estate value. Studies reviewed previously used local property tax assessor data for individual case studies. However, when evaluating multiple Complete Streets in several states, where the efficacy of assessor data varies on the basis of state and local regulations and the quality of data management, other data are needed. For this analysis, those data are provided by CoStar Group, the nation's largest centralized source of commercial real estate data.[11] CoStar Group data focus on rents for several types of real estate, including multifamily residential properties, which are used for this analysis. Data from 2019 are used because it was the year before the COVID-19 pandemic and the year in which all Complete Streets in this study were finished and functional. Finally, data are converted into metric units such as rents per square meter.

Multivariate ordinary least squares is used to tease out the influence of Complete Street proximity on multifamily rent per square meter. Using theoretical and research design foundations as a guide, the following general model is used for empirical application (Nelson, 2017).

$$\mathbf{R}_i = \mathbf{f}(\mathbf{S}_i, \mathbf{SES}_i, \mathbf{C}_i, \mathbf{M}_i, \mathbf{PT}_i, \mathbf{Db}_i) \quad (1)$$

Where:

R is the asking rent per square foot for property *i*.

S is the set of structural attributes of property *i*.

SES is the set of socioeconomic characteristics of the vicinity of property *i*.

C is a set of centrality attributes of property *i*—in this case, distance to the nearest freeway/expressway ramps because distance to downtown is included as a dimension leading to the Place Typology (**PT**) variable described below.

[11] See https://www.costargroup.com/.

M is the metropolitan area within which property *i* is located—because metropolitan area conditions and markets vary between them, identifying the location of property *i* within its respective market helps control for metropolitan-specific influences.

PT is the Place Typology based on cluster analysis using such factors as measures of urban form of the vicinity of property *i* and distance to downtown.

DB is the distance band (see below for specification details) of property *i* to a transit station.

The dependent variable **R** is the ***Asking Rent per Square Foot*** for property *i* reported by CoStar Group during 2019 for all multifamily properties in its inventory. Because CoStar Group data come from real estate brokerages participating in its network, the data exclude nonparticipating brokerages or entities and properties not for rent, such as owner-occupied properties. By logging the dependent variable, the semi-log model allows for coefficients to be interpreted reasonably as the percent change in rent attributable to a one-unit change in an independent variable, such as an individual distance band (Statistical Data Services, 2018).

The following control variables noted in the equation above are used to control for the influences on rent other than Complete Street distance.

S is the bundle of structure and lease restriction attributes for property *i* reported by CoStar Group, including the following:

Gross Leasable Area in units of 100 square meters, with the expectation that there will be a positive association between office and multifamily building area and rent because larger buildings presumably include more amenities than smaller ones.

Effective Year Built is the later of the year of construction or the year of renovation, as reported by CoStar Group, with the expectation that newer buildings will command more rent than older ones.

Vacancy Rate is reported by CoStar Group, with no expectation as to the association with rent. On the one hand, higher vacancy rates in a multifamily building imply weak markets that would reduce the asking rent, which is the dependent variable. Although that may be the case for some structures, it is the opposite for others. The reason is that higher vacancies can reflect higher turnover that allows landlords to raise rents toward the market rate, perhaps after years of rents being discounted for long-term tenants, which is a common practice. In effect, landlords are holding out for higher-paying tenants. Accordingly, signs may not be predictable, especially considering that the study area is composed of stable to rapidly growing central counties.

The number of ***Stories*** is also included, with the expectation that the taller the building, the higher the mean rent.

The **SES** dimension is composed of ***Median Household Income*** from the 5-year sample of the 2018 American Community Survey for the block group within which a CoStar Group property is located, for which a positive association is expected with respect to rent (Xiao, 2016).

Because the **PT** (Place Typology) variable (see below) includes distance from downtown, one variable includes the C dimension in this application: ***Distance to Freeway***. This phrase is defined as the distance to the nearest freeway or expressway ramp in kilometers. Because freeway ramps can be considered nuisances in addition to accessibility benefits, no signs of association are predicted.

The **M** dimension is composed of the individual metropolitan areas within which the Complete Streets are located. Because these areas are controls that account for idiosyncrasies of metropolitan markets, no direction of associations is predicted.

The Place Typology (**PT**) protocol developed by Nelson et al. (2021) is also used as a control. This protocol is an index variable characterizing the urban landscape milieu that is comprised of the following:

- Jobs per acre.
- Proportion of jobs that are retail and arts.
- Total population per acre.
- Total households per acre.
- Percent of households with no kids.
- Percent of owner-occupied housing.
- Intersections per square mile.
- Proportion of intersections with three to four vertices.

The method uses LEHD (Longitudinal Employment-Household Dynamics) and census data applied at the block group (BG) level, producing these statistically unique place types, which also conform to *a priori* expectations.

- High Mixed-Use/Accessibility (***High-MA***) Centers, such as downtowns, suburban nodes, and other areas with high concentrations of jobs and people, high land use, and high levels of accessibility.
- Moderate Mixed-Use/Accessibility (***Moderate-MA***) areas, such as large combinations of BGs with modest mixes of jobs and people and lower connectivity between land uses, often surrounding High-MA centers.
- Low Mixed-Use/Accessibility (***Low-MA***) areas, which are usually low-density residential areas that some might characterize as urban sprawl and which are usually found between Moderate-MA and Poor-MA areas.
- Poor Mixed-Use/Accessibility (***Poor-MA***) areas, which are dominated by very low-density residential development, with no employment centers and the lowest levels of accessibility between land uses. *Poor-MA* will be used as the referent in analysis, meaning

that the variation in rents attributable to Place Typology will be estimated with respect to this variable, all other factors considered.

Controlling for all factors, rents along a continuum are predicted to be highest in the *High-MA* places and lowest in the *Poor-MA* places.

Although all the above variables are the controls, **DB**, or distance band, is the treatment or dependent variable. The literature indicates that about two-thirds of transit riders walk 400 meters or less to access transit (Guerra, Cervero, and Tischler, 2012). Accordingly, the study area extends to 400 meters from Complete Streets' centerlines. Cases and associated distances beyond 400 meters are called the referent because DB coefficients are measured with respect to those cases. DBs of 100-meters are used because they are roughly the width of typical urban blocks, although the range varies from one-half that distance (such as for downtown Portland, Oregon) to more than double (such as for downtown Salt Lake City, Utah). However, another DB is used that is a proxy for being on the front of Complete Streets, which is defined as less than or equal to 30 meters (about 100 feet). DBs are thus—

- Less than or equal to 30 meters, which is the proxy for fronting Complete Streets.
- More than 30 meters to 100 meters.
- More than 100 meters to 200 meters.
- More than 200 meters to 300 meters.
- More than 300 meters to 400 meters.
- More than 400 meters, as the referent.

Exhibit 24 summarizes the control and treatment variables, sources of data, measures, and predicted signs.

With nearly 14,000 cases, the model includes many times more data than used in most prior studies (Higgins and Kanaroglou, 2016). Although there are no a priori expectations of goodness-of-fit outcomes, the literature suggests that ordinary least squares regression analysis usually explains about one-fifth to two-thirds of the variation in the observed rent for cases. Note is made that whereas some analysts may be preoccupied with achieving high levels of regression model explanation, too many variables can lead to overspecification. It is best to emphasize that the variables most relevant to the question and the relevant controls are sufficient to avoid serious omitted variable bias (a form of endogeneity) in the model.

Exhibit 24

Variables, Data Sources, Measurement Type, and Predicted Rent Associations

Variable	Data Source	Measure	Predicted Sign
Dependent Variable			
Rent			
Monthly Rent per Square Meter (logged)	CoStar Group	Continuous	NA
Control Variables			
Structure Controls			
Gross Leasable Area (100 m^2)	CoStar Group	Continuous	+
Mean Unit Size (100 m^2)	CoStar Group	Continuous	+
Stories	CoStar Group	Continuous	+
Effective Year Built	CoStar Group	Continuous	+
Vacancy Rate	CoStar Group	Continuous	+/-*
Socioeconomic Control			
Median Household (HH) Income ($1,000 units)	Census ACS	Continuous	+
Location Control			
Distance from Freeway Ramp (per kilometer)	Computed	Continuous	-
Metropolitan Control			
Metropolitan Area Location	Assigned	Binary	NA
Place Typology Control			
High Mix/Accessibility	Computed	Binary	+
Moderate Mix/Accessibility	Computed	Binary	+
Low Mix/Accessibility	Computed	Binary	+
Poor Mix/Accessibility	Computed	Binary	Referent
Treatment Variables			
Distance Band			
<=30 frontage Bands of 30–100, >100–200, >200–300, >300–400 meters	Computed	Binary	See text
Beyond 400 meters	Computed	Binary	Referent

** See text for explanation.*
ACS = American Community Survey. NA = Not applicable.
Sources: American Community Survey; CoStar Group

Exhibit 25 presents regression results. All the control variables conformed to expectations. For instance, the larger the multifamily residential project, the higher the rent per square meter overall (larger projects can afford to provide more amenities), whereas the larger the individual dwelling unit, the lower the average rent per square meter (indicating diminishing returns to size). Moreover, the taller the building, the higher the rent per square meter, presumably because higher floors command better views, which raises the overall average rent. The effective age of the building, measured as the year of opening or recent renovations, shows that the newer the structure, the higher the rent per square meter. The coefficient for vacancy suggests that higher vacancy rates in the structure are associated with higher rents per square meter compared with the rest of the structure. Although initially counterintuitive, this suggestion makes sense for the reasons noted previously. Higher neighborhood incomes are also associated with higher rents. Lastly, the farther the structure is from the nearest freeway intersection, the lower the rent will be because of reduced automobile accessibility to the larger region.

Exhibit 25

Complete Street Proximity Multifamily Rent Regression Results

Variables	Coefficient	T-Score
Constant	– 3.647000	– 15.869
Gross Leasable Area (100 m^2)	**0.000015**	6.591
Mean Unit Size (100 m^2)	**– 0.000000**	– 32.993
Stories	**0.023000**	23.09
Effective Year Built	**0.002000**	18.394
Vacancy Rate	**0.004000**	10.813
Median HH Income	**0.003213**	31.67
Freeway Distance (km)	**– 0.017776**	– 12.253
Atlanta	– 0.440000	– 24.552
Charlotte	– 0.480000	– 24.55
Cleveland	– 0.579000	– 31.598
Dallas-Fort Worth	– 0.529000	– 30.188
Denver	– 0.173000	– 9.966
Eugene	– 0.353000	-10.531
Minneapolis-St. Paul	– 0.352000	– 21.226
New Orleans	1.812000	5.774
Orlando	– 0.358000	– 16.858
Phoenix	– 0.431000	– 26.939
Portland	– 0.249000	– 16.708
Reno	– 0.377000	– 15.04
San Diego	– 0.025000	– 1.668
Seattle	– 0.039000	– 2.623
Tampa-St. Petersburg	– 0.439000	– 22.365
Low MA	**1.4%**	1.09
Moderate MA	**5.7%**	4.237
High MA	**12.7%**	8.517
<=30 meters	**16.4%**	4.36
>30 meters to <=100 meters	**11.8%**	2.578
>100 meters to <=200 meters	**6.8%**	1.817
>200 meters to <= 300 meters	**10.0%**	3.195
>300 meters to <= 400 meters	**4.4%**	1.312
Model Performance Metrics		
Mean Monthly Rent per Square Meter	$17.95	
Cases	13,736	
Adjusted R^2	0.499	
Standard Error	0.313	
F-ratio	442.781	

Notes: Bold coefficients are $p < 0.05$. No significance determination is made for metropolitan controls because signs of association are not predicted. Coefficients for Place Typology and Distance Band variables are converted into percentages for ease of interpretation.

Source: Authors

Place Typology control outcomes are considered next. As previously stated, they are an index of the milieu of urban areas, ranging from the most integrated and mixed (High-MA) to the least (Poor-MA). Multifamily rent premiums within High-MA places clearly dominate, commanding 12.7 percent more than the mean for Poor-MA places, the referent. Indeed, the High-MA premium is also considerably higher than that for Moderate-MA places. One can imagine the premium the market is willing to pay to rent a residential unit in an area rich with amenities, services, and mobility options compared with a more sterile one. The role of Place Typologies in influencing rents will be revisited.

Of principal interest is the association between multifamily rents and Complete Street proximity. Controlling for all other factors, rent premiums are 16.4 percent higher in the 30-meter DB, the one fronting Complete Streets, than the mean for central counties, and they are 11.8 percent higher in the 30- to 70-meter distance band, which is essentially the rest of the Complete Street frontage block. The premium falls to 6.8 percent in the 200-meter distance band, rises anomalously to 10.0 percent in the 300-meter distance band, and then falls to 4.4 percent in the last distance band.

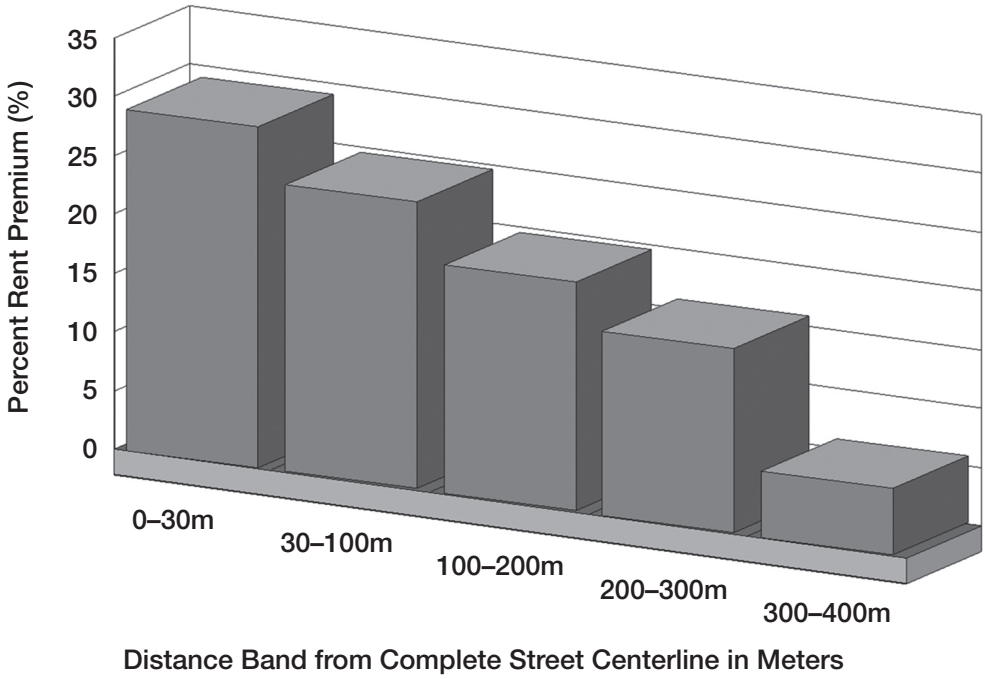
The market effect of Complete Street proximity can be estimated on the basis of the median rent of $17.95 per square meter. For the first DB of less than or equal to 30 meters from the Complete Street centerline, rents would average $20.89 per square meter, which is 16.4 percent, or $2.94, higher than the sample mean. For an apartment of 100 square meters (a little less than 1,100 square feet), the rent premium for fronting on a Complete Street would be $294.38 per month, or $3,533 per year.

Because both the type of area that contains a Complete Street and the distance to Complete Streets matter, both elements can be combined to aid in interpretation. Suppose a given Complete Street is classified as being within a High-MA area. Suppose also that a rental unit fronts along a Complete Street. Based on the median rent of $17.95 per square meter, the High-MA location adds 12.7 percent to the rent, whereas being in the closest DB adds another 16.4 percent. The combined place and location rent premium would be 29.1 percent, resulting in the mean rent increasing from $17.95 to $23.10, or $5.22 more per square meter. Rent for the 100-square-meter apartment noted previously would increase from $1,795 to $2,317 per month, a difference of $6,268 annually.

Exhibit 26 illustrates a hypothetical construct of rent premiums with respect to place and Complete Street proximity. Suppose the first three DBs are within the High-MA Place Typology, the fourth DB (200–300 meters away) is within the Moderate-MA Place Typology, and the fifth DB (300–400 meters away) is within the Low-MA Place Typology. Rent premiums based on place and distance from Complete Streets would be 29.1 percent, 24.5 percent, 19.5 percent, 15.7 percent, and 5.8 percent, respectively, as illustrated in exhibit 26. Annual rents based on the 100-square-meter apartment example used previously would range from $27,808 in the closest DB (30 or fewer meters from the Complete Street) to $22,789 in the fifth DB (300–400 meters from the Complete Street).

Exhibit 26

Place and Location Rent Premiums With Respect to Distance From Complete Streets



m = meters.

Notes: In this illustration, the first three DBs are within the High-MA Place Typology, the fourth DB (200–300 meters) is within the Moderate-MA Place Typology, and the fifth DB (300–400 meters) is within the Low-MA Place Typology (see text for details).

Source: Authors

The conclusion is drawn that the null hypothesis asserting no change in real estate value with respect to proximity to Complete Streets is not supported. Indeed, one can conclude further that proximity to Complete Streets makes a difference in influencing multifamily residential rents in expected ways.

These results and those from previous sections lead to the concluding discussion on implications for Complete Street policy and land use planning.

Outcome Assessments, Leveraging Complete Street Value Added, and the Redevelopment Role

The research suggests that Complete Streets are associated with attracting jobs and people, improving the jobs-housing balance, reducing dependency on automobiles for commuting, and increasing multifamily rents with respect to proximity to the Complete Streets. This concluding section summarizes key findings and assesses the role of Complete Streets in meeting market needs. The section then frames the role of Complete Streets in advancing the jobs-housing balance (JHB) as a desirable outcome of attracting jobs and households and identifying associated benefits.

The discussion continues with the potential for capturing the value added from Complete Streets and reinvesting that value into expanding the supply of them. This section also discusses how the return on investment in Complete Streets compares with economic development efforts. This discussion is followed by identifying potential gentrification concerns and policy options to mitigate adverse outcomes, including the role of value-added capture to do so. The article closes with a call to expand Complete Streets, in part by leveraging the benefits that value-added Complete Streets generate to the local economy and fiscal base.

Outcome Assessments

This article presents the first comprehensive assessment of whether Complete Streets can be a redevelopment strategy. Statistical analysis is applied to 26 Complete Streets in 16 central counties of their respective metropolitan areas. The authors estimate that these Complete Streets total 47.9 kilometers in length. Complete Street corridors were initially defined as 100 meters, but they also include all census blocks using LEHD data or census block groups using ACS data within or touching that distance. The LEHD study area was 15.8 square kilometers, or 0.1 percent of the total urbanized area of central counties, whereas the ACS study area was 97.1 square kilometers, or 0.6 percent of central counties. In other words, with respect to jobs, the Complete Street study area excluded 99.9 percent of their central counties, whereas, for people, households, income, and commuting, it excluded 99.4 percent of their central counties.

What follows is a summary of outcomes in terms of the extent to which Complete Streets attract jobs and households in a manner that improves the jobs-housing balance, with the potential for gentrification, reducing dependency on automobiles in the commute to work, and increasing the attractiveness of Complete Street proximity to multifamily rental housing. This discussion is followed by an expanded policy discussion of the role of Complete Streets in improving jobs-housing balance and how capturing the value added by Complete Streets helps mitigate adverse outcomes, especially those related to gentrification.

Complete Streets as a Redevelopment Strategy to Attract Jobs

With respect to associations between Complete Streets and changes in jobs and jobs by wage group, on the basis of LEHD data at the census block level compared with central counties between 2013 and 2019, these highlights are offered:

- Overall, Complete Streets accounted for about 3.13 percent of the change in central county jobs despite making up just 0.1 percent of the urban land area based on census blocks, which accounts for about 31 times the proportionate share of growth in the central counties. This statistic is impressive because, nearly by definition, Complete Streets serve substantially built-out urban places. The implication is that Complete Streets are an important source of infill and redevelopment for employment expansion.

- Perhaps confirming the role of Complete Streets as places of improved accessibility and amenities, they added jobs in the office economic group at a much faster pace than central counties, increasing 21.56 percent compared with 12.20 percent. Followup is needed to

establish whether and to what extent offices located along Complete Streets have been more resilient to the pandemic shock than offices in other locations. Thus, a collateral area of future research could explore the extent to which Complete Streets are more economically resilient than other areas (see Nelson, Stoker, and Hibberd, 2019).

- Perhaps also confirming the role of Complete Streets as places of amenities, jobs in the leisure economic group grew by 13.12 percent, compared with 11.62 percent for central counties.
- Complete Streets also added jobs in the industrial economic group at a healthy pace of 7.44 percent, compared with 8.21 percent for central counties.
- On the whole, Complete Streets lost jobs in the institutional economic group. One may surmise that the reason is that development in this group requires large areas of land for buildings, campuses, and parking.

Although no explicit expectations are indicated about the kinds of jobs by lower-, middle-, and upper-wage categories that would be attracted to Complete Streets, research found that both Complete Streets and central counties lost lower-wage jobs, perhaps because they migrated to suburban areas outside central counties. On the other hand, middle-wage jobs accounted for 59 percent of the share of job growth along Complete Street corridors, compared with 72 percent for central counties. Upper-wage jobs accounted for 41 percent of the share of job growth, compared with 28 percent in central counties.

Complete Streets in the sample added jobs in most economic groups at a faster pace than in their central counties despite being in areas already substantially built out and where infill and redevelopment are often more expensive and time consuming than conventional development elsewhere in the central county. Research provides evidence that Complete Streets can be an effective redevelopment strategy.

Complete Streets as a Redevelopment Strategy to Attract People and Households, with Some Evidence of Gentrification

Using 2013 and 2019 5-year ACS data (covering the periods 2009–2013 and 2015–2019, respectively), analysis shows the following associations between the presence of Complete Streets and changes in people, households, tenure, and income compared with central counties.

- Between 2013 and 2019, Complete Streets added population at a faster pace of 16.89 percent, compared with 9.38 percent for their central counties. The share of the minority population along Complete Streets also grew 26.28 percent, faster than the 16.52-percent growth in their central counties.
- Between 2013 and 2019, the number of households along Complete Street corridors grew 16.68 percent, more than twice the 8.10-percent rate for central counties.
- Households with children along Complete Street corridors grew at a rate more than double that of central counties: 7.14 percent compared with 3.41 percent. Consistent with expectations,

Complete Streets attracted single-person households at more than twice the rate of central counties: 13.78 percent compared with 6.61 percent. Somewhat surprising, however, is that growth among households without children (excluding single persons) substantially outpaced that of central counties, increasing 18.39 percent compared with 10.29 percent.

- By contrast with central counties, which lost 14.11 percent of householders younger than 25 years of age, Complete Streets added them at a rate of 5.01 percent. At the other end of the age spectrum, Complete Streets added householders older than 65 years of age at about the same pace as central counties, 25.93 percent compared with 24.67 percent. The findings were surprising, however, in that the growth rate along Complete Streets among householders between 45 and 64 years of age was about twice that of central counties: 9.06 percent compared with 5.44 percent. The rate of growth along Complete Streets among householders between 25 and 44 years of age was also surprising, growing nearly four times faster than in central counties: 21.32 percent compared with 5.35 percent.

- Although the number of homeowners living along Complete Street corridors increased by 6.59 percent during the study period—about the same rate as central counties, at 6.21 percent—the share of homeowners went down by 8.65 percent, in contrast to central counties, where the reduction was 1.74 percent. Moreover, the homeownership rate along Complete Streets fell from 36.5 percent in 2013 to 33.3 percent in 2019. Rent households increased by 22.47 percent along Complete Streets, compared with less than one-half that rate, at 10.94 percent, for central counties.

- Finally, although the median household income along Complete Streets rose at a higher rate than in central counties, 19.65 percent compared with 11.24 percent (adjusted for inflation), median household incomes along Complete Streets remain lower than in central counties. On the other hand, growth in households implies that the average income of new households located along Complete Streets is substantially greater than that of existing households, perhaps as much as twice the income.

- Inasmuch as Complete Streets attracted 2.05 percent of all new households in their host central counties on only 0.6 percent of the urban land area, they attracted 3.4 times more households than what was proportionate to their land area.

The evidence suggests that Complete Streets are an effective strategy to increase population and households. Although Complete Streets added proportionately more minorities and households with children, homeownership rates fell, and median household income remained below that of central counties. Yet median housing incomes are rising faster along Complete Streets than for central counties as a whole, which indicates that some level of gentrification is occurring. The solutions to moderating adverse gentrification include increasing supply to meet market demand, increasing the supply of subsidized housing, and preserving existing lower-income housing stock, perhaps through public/private/nonprofit housing and community land trusts. That topic is discussed later in this article.

Complete Streets as a Redevelopment Strategy to Improve Jobs-Housing Balance

This subsection highlights the analysis mentioned previously relating to associations between Complete Streets and change in jobs-housing balance with respect to central counties. The 5-year ACS samples for 2013 and 2019 are used for analysis.

In 2013, the United States had about 144 million employed workers[12] living in about 122 million households,[13] representing a national jobs-housing balance ratio of 1.18. As seen previously, the central counties in the sample had a JHB ratio of 1.50 in 2013, indicating that they were relatively job-rich compared with the nation. This conclusion is sensible because central counties are the economic centers of regions. For their part, Complete Streets had a JHB ratio of 5.53 in 2013, indicating that they were even more job-rich than central counties.

During the study period, 2013–19, the JHB for central counties increased to 1.56, indicating that they had become more job-rich. By comparison, the JHB for Complete Streets fell 7.14 percent to 5.13. Although Complete Streets remained job-rich, they attracted proportionately more households than jobs. Implications of this finding are elaborated later in this article.

Complete Streets as a Strategy to Change Commuting Patterns

As discussed previously, this study uses ACS data to assess the association between Complete Streets and changes in commuting patterns over the period 2013–19 with respect to central counties. Key findings include the following:

- Although the number of people in households living along Complete Street corridors who were working increased 23.01 percent, those who commuted to work via automobiles increased by considerably less, at 15.64 percent. By contrast, the increase in central county workers (14.97 percent) roughly matched the increase in those commuting via automobiles (14.39 percent).
- The use of transit by workers living along Complete Street corridors increased 25.05 percent, compared with 15.39 percent for central counties.
- Even more dramatic, the number of workers walking or biking to work who lived along Complete Street corridors increased 42.17 percent, twice the 20.15-percent increase for central counties.
- Even before the pandemic, the number of people working from home was increasing. Between 2013 and 2019, the number of workers in central counties increased 41.71 percent, but the increase for Complete Streets was 64.06 percent.
- Overall, 40.30 percent of the change in workers living along Complete Streets did not drive to work, compared with 26.94 percent in central counties.

[12] See https://www.bls.gov/opub/mlr/2014/article/unemployment-continued-its-downward-trend-in-2013.htm.

[13] See https://www.census.gov/data/tables/2013/demo/families/cps-2013.html.

- Finally, whereas the number of central county households without any vehicles increased by only 0.60 percent, that attribute was an order of magnitude higher at 11.41 percent for households living along Complete Streets, and they accounted for 64.06 percent of the entire change in the number of central county households without vehicles.

The implications of changes in commuting patterns in the context of Complete Streets to advance jobs-housing balance are offered later.

Complete Street Proximity as a Positive Influence on Multifamily Residential Rents

One of the promises of Complete Streets is improving real estate value along and near them. Evidence of this benefit is assessed by evaluating the variation in multifamily rents with respect to Complete Street proximity. A previous section of this article indicated that for properties within 30 meters of Complete Streets, the rent premium is 16.4 percent. For properties between 30 and 100 meters of Complete Streets, the rent premium is 11.8 percent, controlling for other factors. Adding the urban milieu increases the rent premium considerably. Where Complete Streets have high mixed-use/accessibility features, rent premiums with respect to Complete Street proximity increase another 12.7 percent. The implications of this finding are provided in the value-added discussion later.

Assessing the Attraction of Jobs and Households Through the Jobs-Housing Balance Lens

The literature on Complete Streets is devoid of any connection to the jobs-housing balance literature and research. This omission is a mistake because Complete Streets are a critical element of advancing jobs-housing balance policies, and jobs-housing balance is also an objective of urban redevelopment efforts.

The JHB findings, presented earlier in this article, have important policy implications. The analysis of commuting modes indicated that Complete Streets fared much better than their central counties with respect to increasing use of transit, walking, biking, and even working at home. Could it be that once job-rich Complete Streets become safer and more attractive and that households who work in or near Complete Streets move to them? This topic is an area in need of future research.

For the most part, Complete Streets do not appear to be gentrifying much in the popularly construed sense (see Hwang and Lin, 2016), at least not yet. Instead, homeownership rates have declined (as rates increased in central counties), new residents are mostly minorities, and incomes have remained below the average of central counties. But median household incomes are inching up, and multifamily rents are rising, so these factors may be indicators of impending gentrification. Some approaches to minimizing gentrification outcomes were discussed previously, and this section will explore them more in the context of value-added capture.

The jobs-housing balance benefits of Complete Streets are missing from the research literature. This subject should be another area of future research. Blumenberg and King (2021) and Blumenberg and Siddiq (2023), for instance, worry that the lack of affordable housing may push households

away from job-rich urban areas into areas where housing is cheaper, making commuting to work more expensive. In the view of those researchers, one solution is to advance policies and investments that increase the supply of housing in job-rich areas. Research indicates that Complete Streets could be such an opportunity. Although the challenge is to match job skills with housing prices, research suggests that it might already be occurring, at least among the sample of Complete Streets.

Another consideration is that households living along Complete Street corridors tend to save on transportation costs. In the United States, the typical household spends about 20 percent of its budget on transportation and 30 percent on housing, for a total of about 50 percent. Much of that cost is owning and maintaining cars. But if living along Complete Streets means no or fewer cars need to be owned and commuting via other modes occurs at a higher rate than elsewhere in central counties, transportation costs are lower, perhaps significantly lower. These savings can be used to buy or rent larger homes or in other ways improve the economic well-being of households. To the extent that households moving into Complete Street corridors save on their transportation costs—Complete Streets accounted for 39.05 percent of the entire change in central county households without a car—their economic well-being likely improves. This topic is another area in need of further research.

The preceding findings have important planning implications. Local efforts are needed to increase land use diversity, especially in terms of broadening allowable residential land uses. One of the authors of this article (Nelson) has been a land use planner spanning 6 decades, from the 1970s into the 2020s. Over this period, he has found that most land use plans he reviewed allocate more land for commercial and industrial development than the market needs. Much of the oversupply of office and retail land is found along commercial corridors, where multifamily residential uses are not allowed. Oversupplied commercial land and undersupplied multifamily residential land are the consequences. Values fall because of oversupplied commercial land, which leads to reduced property tax revenues. Unfortunately, some local governments have a sinister reason for undersupplying multifamily zoning along commercial corridors and elsewhere in the community: to use zoning to socially engineer the demographic composition of cities. The authors' review of Complete Streets literature, however, shows that this was not the case because commercial and residential zoning are prevalent. It also found that most of these commercial corridors already have transit or are transit-ready for new or expanded transit services. Once residential development occurs, new residents increase the local demand for retail and offices, thereby absorbing some of the otherwise oversupplied commercially zoned land (Nelson and Hibberd, 2019a). This trend leads to more walking and biking between different land use types (Koschinsky and Talen, 2015) and more transit use. Moreover, with a mix of commercial and residential uses along a walkable or bikeable corridor with transit, Complete Streets attract people who choose to work from home or work in "third places," such as coffee shops, further reducing automobile dependency.

This leads to a key conclusion of this article that the value added from Complete Street investments should be used to help mitigate adverse outcomes and expand their supply to meet market demand.

Value-Added Capture to Invest in New Complete Streets to Meet the Market Demand

This article has asserted that Complete Streets are an important redevelopment strategy. The introduction showed that the market demand is high for living where stores and restaurants are accessible by walking and where the commute to work is shorter. Surveys by the National Association of REALTORS® (NAR) show that roughly one-half of America's urban households want these benefits, but only 13 percent or so enjoy them now. Subsequent sections of this article showed that Complete Streets are associated with attracting jobs and people. Although gentrification may become a concern, adverse impacts can be addressed. Indeed, expanding the supply of Complete Streets can also moderate gentrification pressures. This article later indicated that Complete Streets are associated with improving the jobs-housing balance and that they reduce automobile dependency. The article further showed that renters are willing to pay more to live near Complete Streets, perhaps about one-quarter more when part of a mixed-use/accessible urban milieu. Indeed, the NAR survey reviewed previously revealed that about three-quarters of households would be willing to pay more for accessibility to the kinds of opportunities that Complete Streets offer.

Given how the market responds to the presence of Complete Streets, one can surmise that the market needs more of them. But how can they be paid for? This concluding discussion explores how value-added benefits associated with Complete Streets can be used to leverage more redevelopment along new Complete Streets and, at the same time, help moderate potential adverse effects associated with gentrification.

A large body of literature shows how the value added from public investments can be calculated and then captured to expand infrastructure, mitigate impacts, invest in new ventures, and so forth (see summary by Germán and Bernstein, 2018). The authors' research suggests that new jobs and new households along the sample of Complete Streets generate about $6 billion in new property value. The calculation follows. With about 44,000 new jobs at 35 square meters per job and a construction cost of about $1,300 per square meter,[14] excluding land, new nonresidential development along Complete Streets is estimated to have cost about $2 billion in 2023 dollars; adding 25 percent for land brings the cost to $2.5 billion. On the residential side, 16,000 new households living in attached units averaging 100 square meters at $1,000 per square meter[15] are estimated to cost about $1.6 billion; adding 25 percent for land brings the cost to $2 billion. These figures exclude mark-up to market value. Adding one-third for profit and overhead to the $4.5 billion total to estimate market value results in a $6 billion value added to Complete Streets. If one assumes a 1.6-percent average annual effective property tax rate to this value,[16] the value-added development generates about $100 million in new property tax revenue annually.

[14] Estimated from https://www.buildingjournal.com/construction-estimating.html: national average in 2023 for four- to seven-floor office buildings of 50,000 square feet, of moderate quality, with conversion into square meters.

[15] Estimated from https://www.buildingjournal.com/construction-estimating.html: national average in 2023 for four- to seven-floor apartments of 50,000 square feet, of moderate quality, with conversion into square meters.

[16] This is a rounded average of all urban properties included in an analysis by the Lincoln Institute of Land Policy in its *50-State Property Tax Comparison Study*.

An economic value is added as well. At an average wage of $60,000 per year,[17] the 44,000 new jobs located along Complete Streets increased wages along them by $2.6 billion annually. Of the 16,000 new households, household incomes rose by about $1.2 billion annually along Complete Streets. Census data do not reveal how many workers at these new jobs live in the new households, so one cannot know the net increase in new jobs and households along Complete Streets. One also cannot know how many of those jobs or households would have located elsewhere; thus, one cannot know how many of them are attributable purely to Complete Streets. Future research can build from these research findings to tease out these refinements.

What is the cost? Using cost data from the NCSC (2021) adjusted to 2023, the authors estimated that the Complete Streets in the sample cost about $600 million to build.[18] The value-added benefit to cost ratio is thus 10:1 ($6 billion value-added benefit compared with $600 million cost).[19] These outcomes reflect only the period 2013–19. One could extrapolate results many decades into the future to estimate the total potential magnitude of people and jobs that could be attracted to them over a planning horizon. This calculation excludes the extent to which Complete Streets leverage new investments outside the corridor, such as along feeder routes leading to them. These are areas in need of formalized economic analysis.

To the extent that redevelopment can be viewed as a form of economic development, how does the sample of Complete Streets returns compare with economic development investments? Economic development analysis often uses return on investment as a performance metric. As applied previously, it is defined as the ratio of total returns over time to initial costs incurred. Ratios of more than 1.0 indicate that returns exceed costs, returns of 1.0 indicate a break-even investment, and returns of less than 1.0 indicate that costs exceed benefits. This calculation is different from rate-of-return metrics that measure the average annualized return of investments over time, such as internal rate of return and capitalization rates (Nelson, 2014). How does the return on investment among the Complete Streets compare with other economic development efforts? An example comes from Florida, where returns to several economic development investments were compared, such as the Capital Investment Tax Credit (CITC), Qualified Target Industry Tax Refund (QTI), Brownfield Redevelopment Bonus Tax Refund (BFRD), and Enterprise Zone (EZ) Program.[20] Of these investments, the QTI generated a return on investment of more than 6.0, whereas the CITC ratio was about 2.0. Among the redevelopment programs, BFRD generated a return of 4.0, whereas the EZ program showed negative returns. Although this is just one set of comparisons from one large, rapidly growing state, the implication is that the return on investment from the Complete Streets in the sample compares favorably.

According to Shapard and Cole (2013), Complete Streets do not cost appreciably more than the cost that would be incurred to upgrade "incomplete" streets during their normal facility life cycle reinvestment process. From this perspective, a local government could sequence the conversion of

[17] Forbes uses the figure $59,428 for early 2023, which is rounded to the next $10,000 as a reasonable estimate for average U.S. wages at the end of 2023. See https://www.forbes.com/advisor/business/average-salary-by-state/.

[18] Cost data are provided for about one-half of the Complete Streets used in this study. The figure is based on the 2023 cost per kilometer and then multiplied by the total kilometers in the sample to estimate the total cost.

[19] Although investment and cost figures are rounded, the 10-to-1 ratio calculation is circumstantial.

[20] See http://edr.state.fl.us/content/returnoninvestment/ROI-SelectEconDevIncentives.pdf.

selected incomplete streets for redevelopment into Complete Streets during the normal rehabilitation and upgrade process with only modest incremental costs. This action could raise the value-added benefit-cost ratio even higher because value-added investments along those new Complete Street corridors would be mostly net of public investment that would have occurred anyway.

Addressing Potential Gentrification Concerns

Finally, the authors addressed implications for gentrification along with some ways in which to mitigate adverse outcomes. First, existing residents and new, lower-income ones benefit from the cost-of-living advantages of living along Complete Street corridors.[21] These advantages include transportation cost savings and lower housing costs, at least until market demand exceeds supply and pushes housing costs up. The principal danger of gentrification is that existing lower-income households would be pushed out of their homes and replaced by higher-income households. This circumstance can occur if existing housing stock is bought by investors and repurposed for higher-income households or demolished altogether and replaced with more expensive housing.

Second, lower-income residents provide much of the ridership that transit needs to be financially feasible. This observation is important because nearly all Complete Streets in the sample are served by buses, bus rapid transit (BRT), light rail, and streetcars. Typically, as household income increases, the use of public transit falls. Research is needed to determine the extent to which new residents along transit-served Complete Streets use transit compared with existing residents with respect to income.

Complete Streets raise supply and income concerns. The supply side includes the need to expand the number of Complete Streets and expand the housing supply along them. As previously noted, expanding the Complete Street supply can occur substantially through the normal cycle of street reinvestment (see Shapard and Cole, 2013). Expanding housing for lower-income market segments may be more challenging, but there are important options, including, but not limited to, the following:

- Instituting inclusionary zoning policies such that new residential development would be required to add housing that is dedicated to lower-income households.[22]
- Encouraging housing agencies to give additional weight to applications for Low-Income Housing Tax Credits (LIHTC) that are located along Complete Streets.[23] An example would be

[21] Several perspectives of Boarnet et al. (2017) are applied here.

[22] For a review if inclusionary housing generally and a suite of effective examples, see https://www.lincolninst.edu/sites/default/files/pubfiles/inclusionary-housing-full_0.pdf.

[23] For details about how LIHTCs work, see https://www.huduser.gov/portal/datasets/lihtc.html. Generally, each state receives an annual tax credit allotment. These allotments are used to leverage other private and nonprofit funds to build affordable housing. Because tax credits are in demand, many housing agencies cannot fund all proposals. Indeed, some states give additional or preferential points to projects located near transit stations. The same concept can be adapted to Complete Streets.

giving extra points for LIHTC projects located along, say, HUD-approved[24] Complete Streets, thereby increasing the odds that those projects would be built.

- Expanding local public, private, nonprofit, and philanthropic lower-income housing efforts into Complete Streets. Because the Complete Street concept is relatively new and its benefits are unknown, until such research as reported in this article becomes known, many existing lower-income housing providers might not know how Complete Streets can advance their mission.

- Leveraging Community Reinvestment Act (CRA) resources to expand housing supply along Complete Streets. The CRA requires federally chartered financial institutions to use a portion of their revenue to improve local communities.[25] These institutions could be made aware of Complete Street benefits to target populations, allowing them to leverage other funds to expand housing supply along them.

- Adjusting local fee structures to reflect cost savings associated with Complete Street development. For instance, transportation impact fees[26] are among the highest. They are often based on regional highway needs serving distant suburban communities. However, closer-in areas already have the transportation capacity needed to serve new development, or new development's impact on transportation facilities is reduced because of such multimodal facilities as Complete Streets. Impact fees should be adjusted accordingly. Likewise, more compact developments, such as those found along Complete Streets, do not have the same water and wastewater impact as lower-density development, meaning that those impact fees can be reduced.

Demand-side approaches are also an option, principally increasing the income of target households living along or near Complete Streets, thereby enabling them to afford to live there. These approaches include but are not limited to the following:

- Creating rental housing subsidies in which participating landlords receive supplemental income from the local community for renting to qualifying households along Complete Streets. The authors suggested earlier that Complete Streets may generate new tax revenue, part of which can be used for the rental supplement. These rental subsidies are a form of income supplement for tenants.

- Exempting qualifying housing from property taxes. Under certain conditions, nonprofit housing providers in some states are exempt from local property taxes. Inasmuch as property taxes are often the single largest budget item for rental housing, exemptions enable local housing agencies to serve more households. The reduced rent effectively increases tenant income.

- Considering applications of the basic income concept.[27] Conceptually, qualifying households receive a supplement to their incomes, without strings attached, to be used as they wish. The

[24] This approval would be done through a rule-making process linking what would be considered a qualifying Complete Street for HUD purposes with the LIHTC program, which is managed by the U.S. Department of the Treasury.

[25] See https://www.federalreserve.gov/consumerscommunities/cra_about.htm.

[26] For a review of impact fee theory, practice, law, and applications, see Nelson et al., 2023.

[27] See https://basicincome.stanford.edu/about/what-is-ubi/.

concept is not broadly used but is gaining support among local governments and, in one case, the state of California.[28] For instance, Cambridge, Massachusetts, pays qualifying households $500 per month.[29] Its program is applied citywide. A version of this concept can be applied to targeted Complete Streets in a community, perhaps financed in part from new taxes generated from Complete Streets.

To the extent that gentrification may be a concern along particular Complete Streets, the preceding offers several approaches to address it. No one approach will be appropriate for all situations, and some situations will likely require new approaches. Where gentrification may be a concern, perhaps programs can be created in advance so that potential adverse outcomes can be addressed before becoming a crisis.

Complete Streets as a Redevelopment Strategy

In review, accounting for only 0.1 to 0.6 percent of central county urbanized land areas, based on LEHD census block and ACS census block group study areas, respectively, between 2013 and 2019 (after the Great Recession but before the COVID-19 pandemic), the research shows that Complete Streets account for disproportionately large shares of central county growth in jobs, people, and households. Complete Streets also improved local jobs-housing balance, reduced automobile dependence, and increased property values, as reflected in multifamily rents, albeit with some potential for gentrification outcomes that may need to be addressed in the ways outlined above. A key to their success is that Complete Streets help meet the unmet demand for walkable communities with multi-mobility options. Although the Complete Streets in the sample cost about $600 million to build—much of which would have been spent anyway in the normal course of street upgrading—research indicates that they leveraged about $6 billion in total redevelopment investments. As also noted, few economic development programs match this return on investment. It is difficult to imagine a more cost-effective redevelopment investment than Complete Streets.

Acknowledgments

The authors are indebted to Ken Dueker, emeritus professor of urban studies and planning at Portland State University, for reviews of earlier drafts. The authors are also indebted to Eric Carlson for using Google Earth to plot Complete Street routes in KML. The authors are especially indebted to an anonymous reviewer who provided an extensive, constructive review that helped refine the analysis. The authors also acknowledge Laura Jensen for editorial assistance. The authors remain responsible for the content. Lastly, the authors also acknowledge the assistance of the National Institute for Transportation and Communities through funding from the U.S. Department of Transportation and the University of Arizona. The views presented herein do not necessarily represent those of the sponsors.

[28] See https://www.cdss.ca.gov/inforesources/guaranteed-basic-income-projects.

[29] See https://www.cambridgema.gov/riseup.

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