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TO: Grace Blakeslee
FROM: Terry Moore and Philip Taylor
RE: WHITE PAPER ON THE ECONOMICS OF COMPLETE STREETS

I. Introduction

The regional transportation planning agencies in the Monterey Bay Area including the Santa Cruz County Regional Transportation Commission, the Transportation Agency for Monterey County and San Benito Council of Governments, and the Association of Monterey Bay Area Governments, serving as the metropolitan transportation planning organization, are developing regional transportation plans. Complete streets may be recommended as part of these plans. Complete streets are defined by the Monterey Bay Area transportation planning agencies and the professional literature as ones "designed to accommodate all users and all ages and abilities, both along and across the right-of-way." Complete streets are often contrasted to streets that primarily emphasize the speedy movement of motorized vehicles along the right-of-way.

The *purpose* of this white paper is to assemble information about how to evaluate the potential economic impacts of complete streets: (1) what are they, in theory? and (2) what does empirical work, if any, say about their expected values? The *perspective* of the white paper is economic (benefits and costs), but the focus is on a subset of all economic impacts (on impacts on businesses). The *audience* for the white paper includes technical staff involved in some way with the regional transportation plan, but the paper is written for a non-technical audience of interested members of stakeholder groups and the general public. The *methods* for the evaluation are dictated by the limited budget and scope: ECO is reviewing and summarizing the professional literature, not conducting new research.

This white paper has three sections in addition to this Introduction, and two appendices:

- **Section II, Framework and Methods,** describes concepts important to an evaluation of the economic effects of complete streets, key assumptions, and analytical issues.
- **Section III, Findings,** describes the effects (potential benefits and costs) of complete streets, focusing on the potential effects of complete streets on economic activity. It discusses issues raised by what the literature does not address well or at all.
- **Section IV, Interpreting the Findings in the Context of SCCRTC Policy,** contains our conclusions as they relate to the objectives of SCCRTC regarding complete streets.
- **Appendix A, Bibliography,** provides an annotated bibliography of sources reviewed.
- **Appendix B, Framework for Evaluating Public Policy**, provides more detail about how we approached the evaluation.

II. Framework and Methods

By "framework," we mean the concepts and principles that should be part of any evaluation of transportation investment (including in complete streets). Many of those principles are common to an evaluation of any type of public action.[1] By "methods" we mean the specific assumptions and techniques we used in this study—consistent with our framework—to address the study's question regarding the economic impacts of complete streets.

A. Definitions

"Complete Streets are roadways designed to safely and comfortably accommodate all users, including, but not limited to motorists, cyclists, pedestrians, transit and school bus riders, delivery and service personnel, freight haulers, and emergency responders. 'All users' includes people of all ages and abilities."[2] For a street to be "complete" it must address the needs of its relevant service area. As described in the Monterey Bay Area Complete Streets Guidebook,[3] the types of complete streets are:

- **Main Streets** are pedestrian-oriented "destination" streets with mixed, commercial, entertainment, office and civic land uses. They have short blocks with a grid street pattern, and can be used as a flexible space for community events.
- **Avenues (collector)** are bicycle and transit-oriented streets that connect neighborhoods to job centers and commercial areas. They have higher speeds than main streets. Land uses include but are not limited to residential, schools, parks, neighborhood commercial and commercial
- **Boulevards (minor arterials)** have higher speeds and volumes of automobile traffic than avenues, but more pedestrian and bicycle- friendly than parkways
- **Parkways (major arterials)** are auto-oriented and designed to move high volumes of vehicle traffic quickly. Land uses are for major destinations, such as regional commercial, academic institutions, and visitor-serving uses
- **Local Streets** are low-speed and low-traffic shared streets (bicycle, pedestrian, and auto) with on-street parking. Land uses are primarily residential, neighborhood commercial, office, mixed-use, schools, and parks
- **Rural Roads** are mostly auto-oriented with bicycle facilities for agricultural workers and long-distance cyclists.

1Accompanying this memorandum is Appendix B, "Framework for Evaluating Public Policy." For more detail see *The Transportation / Land Use Connection* (American Planning Association, 2007), written by Terry Moore.

[2] Transportation Agency for Monterey County, Santa Cruz County Regional Transportation Commission, San Benito County Council of Governments, in coordination with the Association of Monterey Bay Area Governments. 2013. *Monterey Bay Area Complete Street Guidebook - Draft*. June 1. p.1

[3] Transportation Agency for Monterey County, Santa Cruz County Regional Transportation Commission, San Benito County Council of Governments, in coordination with the Association of Monterey Bay Area Governments. 2013. *Monterey Bay Area Complete Street Guidebook - Draft*. June 1. p.11

- **Scenic Roads** are mostly auto-oriented with bicycle facilities, but have some pedestrian facilities and access to natural resources.

The design elements of complete streets can include:

- **Walking**: sidewalks dedicated or raised crosswalks, road medians, curb bulbs, and crossing signals.
- **Bicycling**: bike lanes, paved shoulders, greenways, and bicycle parking facilities.
- **Transit:** bus pullouts, traffic signal priority, bus shelters, bus lanes, and Bus Rapid Transit.
- **Traffic calming:** road diets, center medians, shorter corner radii, street trees, planter strips, and angled, face-out parking.[4]

The clearer one can be about the essential characteristics of complete streets, the clearer one can be about their unique effects. Our summary conclusions about the purposes and characteristics of complete streets:

- There are at least two key aspects to completeness: (1) modal completeness: streets work for all modes; and (2) network completeness: for any given mode, the system is a connected (complete) network.
- The overarching theme common to both the type and design elements of complete streets is to have *streets that work better for non-auto modes of travel*. A connected grid of collectors, arterials, and highways for automobiles is not the emphasis of the literature on complete streets (but such a grid is not inconsistent with the literature).
- Not explicit in the definitions is the assumption that such improvements may be acceptable even if they mean the travel-time performance of the auto / truck mode may deteriorate (because that reduction in performance is more than offset by other benefits). The hope, of course, is that complete streets could simultaneously improve auto / truck travel times. That is possible in some cases (most likely where conflicts among modes have become so bad that auto level-of-service has become very low, or where automobiles and non-automobiles are served separately on parallel facilities), but it also true that some complete street implementations could increase through-traffic travel times for autos and trucks.

ECO's task is to address the *economic impacts* of complete streets. That term needs definition as well. A broad definition of economic impacts covers most benefits and costs that a transportation project might generate. The conceptual framework and specific method for systematically evaluating those effects is *benefit-cost analysis.* While a full benefit-cost analysis is beyond the scope of this white paper, a description of the conceptual framework is not.

[4] Partners, Gresham Smith and. 2009. *Complete Streets Design Guidelines*. Tennessee Department of Transportation.

B. Scope of the evaluation

The scope of work and definition of economic impacts for this white paper, however, is narrower. ECO's research focuses on a subset of economic impacts that SCCRTC asked us to address: impacts on *business activity* located on complete streets. Specifically, what does economic theory and empirical evaluation suggest complete streets might do to encourage or restrict business activity adjacent or proximate to them?

Our conclusions about the likely difficulties in isolating the economic impacts of a concept as broad and indefinite as complete streets led us to assume at the outset of our research that comprehensive and simple conclusions about complete streets would be difficult. The diversity of complete street types and specific implementations suggests a diversity of effects. Moreover, the effects depend on the development, market, and socioeconomic environment in which a complete street is implemented. The "completeness" of a complete street is not a binary value (complete or incomplete) but a point on a continuum: that makes it hard to define when a street becomes "complete" or to objectively distinguish between a complete street that is more complete than another complete street.

We considered the possibility of disaggregating the concept of "complete streets" into its essential and measurable characteristics (e.g., improved street connective, improvements in the aesthetics of the streetscape, decreased travel time for transit, and so on) and then reviewing the literature related to the impacts of each of those individual improvements to transportation. We did not pursue that strategy because there are many individual components and (1) aggregating their individual impacts to create an overall assessment of complete streets without double counting or missing synergistic effects poses a separate set of methodological challenges, and (2) more important, such work was well beyond what we could accomplish given the modest scope and budget for this project.

Instead, our research approach is more general. We focus on the literature that specifically addresses "complete streets." We evaluate that literature against economic concepts that we describe in the rest of this section. Even with that simpler approach, there are several complications one must keep in mind if one is to evaluate and interpret the literature.:

- *Multiple objectives; multiple criteria.* Even relatively simple personal decisions (e.g., What car should I buy?) usually considers multiple objectives (manufacturer, style, mileage, color, options, price, and more), and those objectives become evaluation criteria. In public policy, typical broad categories of objectives are the economy, the environment, equity (those are the three "Es" of a "triple-bottom-line evaluation), direct costs and fiscal impacts, land use, infrastructure effects (including transportation), public process, and legality. Multiple objectives create the need for multiple measurements, and multiple measurements introduce more cost, complications with interpretation, uncertainty, and the need to make decisions about the relative values to "society" of the different objectives and measurements. Appendix A describes the issues in more detail.
- *Perspective*. People differ in their life experiences, values, and personal situations. They consequently differ on their views on what is important, and on how to interpret whether a specific public action is, on net, beneficial.

- *Relevant geography.* Perspective depends, in part, on geography. Gains to one region or neighborhood can be losses to another. In particular, even if complete streets lead to more jobs in proximity to them, are those new jobs to the region, or a relocation of jobs from one part of the region to another? Moreover, the specific effects of a policy like "complete streets" may vary by region. Would one expect the implementation of such a policy to be the same in Anchorage, Phoenix, New York, and Santa Cruz?
- *Time period*. Effects vary over time. For some policies, there is an initial "honeymoon" benefit and then a "return to normal"; others start slow and ramp up. Though relatively new, complete streets are spreading as a policy—how will that affect the effects of complete streets? Do the effects exhibit some economies of scale, where the returns increase as the quantity of complete streets increase? Or do complete streets exhibit diminishing returns, where the more widespread they are, the less impact they have?[5]
- *Other factors.* Effects can change as a result of forces unrelated to policies relating to complete streets: for example online retail is a growing industry, and captures a growing share of purchases, or increasing fuel prices may lead consumers to increase demand proximity and non-auto travel modes.

As we understand it, the regional transportation plans have adopted measures for the evaluation of transportation investments, including complete streets, and recognizes these issues. The Monterey Bay Area Complete Streets Guidebook also provides examples of performance measures for the evaluation of complete streets. We state them to emphasize their importance, and identify their relevance in our analysis. Though our analysis is to focus on the effects of complete streets on economic measures, we believe that the evidence is strong that any economic effects derive from the transportation and amenity effects of complete streets. Thus, our analysis starts by describing those effects, and then turns to how and to what extent those effects would be expected to have impacts on measures of economic activity.

C. Context for evaluating policy related to complete streets

There is a substantial professional literature that supports what one can observe in metropolitan areas: transportation is inextricably tied to economic development. Transportation is a factor of production for both goods-producing and service-producing business. If transportation can be made more efficient, the costs of production decrease and (other things being equal) economic activity increases. Thus, **a key objective of regional transportation policy should be to make the surface transportation system more efficient**. The importance of transportation efficiency extends farther: transportation costs are key determinants of land prices, land prices are key determinants of density, density is a key determinant of urban form; and urban form feeds back to influence transportation costs.

An evaluation of complete streets must be aware of the prevailing context in which investments in roads and modes get considered. The planning, investment, and construction of surface transportation systems in all but the few largest US metropolitan areas has focused on roads and highways. Other modes of surface travel (primarily transit, bicycling, and walking)

[5] Returns to scale is long-run, while diminishing returns is short-run.

are part of the transportation system but generally carry a small percentage of the trips (total trips, person-trips, person-trip miles).

Investments in metropolitan surface transportation facilities are almost always made by the public sector. For the public the biggest problem with surface transportation in metropolitan areas (as measured by public comment) is congestion and the resulting increases in travel time and decrease in travel-time reliability for any given trip.[6]

Congestion is an obvious case of lost efficiency: labor and materials that could otherwise be productively employed are stuck in traffic that has no beneficial side effects. The higher cost of travel increases the cost of shipping, which increases the cost and probably the price of the final product. It increases the cost of commuting (increasing both time and operating costs). Urban transportation planning has been primarily about relieving congestion (subject to minimum requirements for safety and environmental mitigation), and that congestion relief is beneficial for economic activity and the economic well-being of local households and businesses.

There are only a few broad strategies for addressing congestion: (1) get more out of the roadway system that already exists (e.g., better signal timing; ramp metering; roundabouts; higher vehicle occupancy, "intelligent transportation systems"); (2) build more capacity (e.g., add lanes; add transit); or (3) manage demand (e.g., with tolls, parking charges, incentives to change modes or travel time). We find the evidence compelling for the following conclusions: Large metropolitan areas will not be able to "build their way out of congestion," proper pricing is the best solution to the problem of congestion, and one should expect continued investment in transit as a way to deal with this problem.

Proponents of policies that encourage investment in complete streets should understand the above context as the prevailing one for surface transportation investments. The professional literature is clear about the importance of efficient surface transportation to regional economic development. The debate is about the details: about finding systems of surface transportation are efficient (now, and in the future), about tradeoffs between efficiency and fairness, and more.

But the logic and the evidence we cite below suggest that redesigning a few streets in a larger metropolitan is not going to have big and positive effects on metropolitan congestion. The arguments for complete streets is less about congestion and more about "modal equity," safety, and urban amenity. Any of these factors can in theory have an effect on economic activity: in Section III following we look to the literature for evidence of such effects.

D. Application of the evaluation principles to transportation investments

We start with several assumptions:

- An investment in transportation should be made primarily because it is expected to improve the transportation system. In other words, the investment should provide transportation benefits. It should improve some, and perhaps many, aspects of travel (e.g., safety, travel time (mobility and access), and travel-time reliability).

[6] Crashes (and the resulting fatalities, injuries and property damage) are probably in second place.

- A transportation investment may simultaneously or subsequently provide non-transportation benefits. In the context of a triple-bottom-line, transportation can have downstream effect on (1) Economy (business and employment growth; incomes; real estate values; municipal fiscal position); (2) Environment (various categories of environmental impacts, including reducing auto travel and thus reducing emissions, GHG, and impacts on global warming); and (3) Equity (the distribution of all those impacts).
- The *criteria* for evaluating a transportation / transit investment should address that things that people care about (variously called goals, objectives, impacts, effects, outcomes, outputs). When criteria get operationalized quantitatively, they become *performance measurements.* The correct comparison for investment decisions, in concept, is of their net present value (net value meaning benefits less costs; present value mean that future benefits and costs are expressed in their value in today's dollars so that they can be summarized and compared). In concept, all the measurements of all the criteria (which relate to objectives and desired outcomes) get monetized, or at least quantified. In practice, calculations of net present value are rare in the evaluation of public policy, but it is common to display various measurements, in various units, in some type of matrix for public discussion.
- It is common for studies that focus on economic impacts to give credit to a specific project for economic activity from public spending that could have been achieved in hundreds of different ways. It is not the amount of the public spending that should be the focus, but rather the efficiency of that spending (net benefits); in other words, How well do the new facilities or programs perform?

E. Implications for assessing the economic impacts of complete streets

We noted in Section I above the directions from SCCRTC to ECONorthwest: address the effects of complete streets on proximate economic / business activity. The economic benefits of complete streets are difficult to isolate from the travel benefits they provide. The typical presumption of those advocating that a street be redesigned and rebuilt to be a complete street—a transportation change—is that it will have effects (presumably positive on net) on standard measures of *transportation system performance*. Those are the direct effects. Those transportation effects in turn have effects on many *quality of life* variables, some of which overlap with the transportation performance effects (safety, air emissions, the built environment), which then may affect economic activity.

That said, the arguments for complete streets may not be based primarily on the performance of surface transportation in the aggregate, but on (1) modal fairness, and (2) urban amenity / livability. The advantages of complete streets will not be uniform across mode or traveler: any analysis must describe benefits by mode.[7]

[7] But a different distributional argument is less supportive of complete streets: complete streets cannot occur in all areas of a city or region, so the effects of a shift of investment to complete streets may primarily result in a shift of economic advantage and activity from some areas to others.

Any unique economic benefits complete streets might deliver can best be identified by reference to the benefits that streets and urban transportation systems provide in general. Thus, central to our methods is a look to the literature of urban and transportation economics for a description of those benefits: what are they and what is the evidence that surface transportation systems really provide them.

The purpose of this white-paper is not to evaluate a specific application of a complete streets policy, but to educate staff, stakeholders, and the general public about how to evaluate the issues and effects of complete streets. A literature review and general analysis is the scope of this study. Our work is illustrative and representative, but not exhaustive.

III. Findings

Complete streets, as part of a region's transportation system, affect transportation first. Thus, in presenting our findings we begin with *transportation effects*. We then describe the *indirect effects* that stem from the fundamental transportation effects. Finally, we discuss how these transportation and indirect effects can have *economic effects*.

Complete streets are a relatively recent development in planning and transportation. The professional literature about their effects is growing, but small and there has not been sufficient time or experience to create many rigorous evaluations, much less longitudinal studies or meta-analysis. We try to distinguish between what the literature shows and what it does not, and how the effects of complete streets differ (or are expected to) from those of traditional streets.

We note an important limitation of our evaluation: for many of the effects we are investigating, both transportation and non-transportation effects, the effects "depend." They depend on background conditions (of the transportation system, demographics, markets, land use, and more), on the details of the complete street implementation (location, size, design, mitigations, and more), and on the mode of transportation (different implementations affect different modes differently. It is very difficult to make generalizations about the effects of complete streets when every application is idiosyncratic.

That situation is one of the reasons that the literature of complete streets is heavily weighted toward case studies rather than controlled time-series or cross-section studies. The use of case studies increases the variability in procedures (the studies are done by different jurisdictions, for different purposes, at different times, with different budgets), which reduces ones ability to generalize fro the case studies.[8]

[8] Some studies (McCann, B and S Rynne, eds. 2010. *Complete Streets: Best Policy and Implementation Practices*. Chicago, IL: American Planning Association) try to correct for this problem by assembling multiple case studies in a single volume.

A. Transportation effects

Summary: The effects of complete streets on travel differ by mode. Complete streets probably encourage use of non-auto modes, while not changing much total trip volume (non-auto volume is likely to increase; automotive volume may be unaffected or may decrease slightly, depending on the specifics of the background conditions and the design). Complete streets can increase duration for auto trips and improve trip quality for all modes, but the net effects are hard to quantify. There is strong evidence that complete streets bring improvements in safety.

The direct effects of complete streets are on the transportation system. Any change to the transportation system manifests itself as changes in trip mode, volume, duration, quality, safety, or direct monetary costs. Before one can understand how complete streets affect other factors, one must understand how complete streets affect transportation. We also include in this section the direct financial costs of constructing, operating , and maintaining complete streets (relative to other transportation facilities).

Complete streets are generally revisions made to pre-existing traditional streets.[9] To make a street complete, the public usually does not need to buy right of way or construct an entirely new street. Complete streets are generally intended to add value to existing streets. Thus, to discuss the value of complete streets one should generally be focusing on the purported value added. This value-added nature makes it unlikely that complete streets are, in terms of the overall transportation system, transformational. Making a street complete is a change in transportation service and performance, but one not nearly as big as the change that is created by adding access where it did not previously exist.[10]

Mode

Traditional streets prioritize the throughput of automotive traffic above other modes (walking, biking, and public transit).[11] Complete streets are designed to encourage—or at least make more viable—these non-automotive modes. In the *Draft Monterey Area Complete Street Guidelines*, SCCRTC suggests the following as access objectives and measures, all of which relate to non-auto modes:

- Increase number of households within 1/4 mile of a transit stop (as measured by GIS analysis of Census data).
- Increase the percent of people who walk, bike, and take transit (as measured as measured by the American Community Survey).
- Increase transit headways on high quality transit corridors (as measured by the relevant transit agency).

[9] McCann, B and S Rynne, eds. 2010.

[10] Complete streets enable non-motorized travel where none was previously possible, despite there being unmet demand for it. This provides "new" access for non-motorized travel. An extreme example would be adding non-motorized facilities to a bridge that lacks them. Even at the extreme, however, if the new access is just for non-motorized trips to a place already served with facilities to motorized trips, the change is unlikely to be transformational.

[11] LaPlante, J and B McCann. 2008. "Complete Streets: We Can Get There from Here," *Institute of Transportation Engineers* 78 (5): 24-28.

- Improve the quality of walk, bike, and transit trips (as measured by MMLOS or QOS).
- Increase the % of population within a 30 minute walk, bike or transit trip of key destinations (as measured by GIS Street Network and Place Type Designations).[12]

Complete streets and their design elements (by themselves and together) have generally encouraged use of non-automotive modes.[13] That complete streets would have positive effects on the use of non-auto modes of transformation is logical, comports with common sense, consistent with transportation theory, and supported by some case studies (often more anecdotal than rigorous) in the literature. The professional literature is too limited, however, to allow us to estimate magnitudes and elasticities with much confidence.

Trip volumes

We found no rigorous analysis of how complete streets affect traffic volume. We assume that complete streets affect traffic volume the way they are designed to: they allow for total trip volumes to remain constant (or with a slight increase due to those on the margin entering the system), while perhaps decreasing automotive volume and certainly increasing non-automotive volume.[14]

Trip duration

By encouraging other modes and calming traffic, complete streets can, in many situations, increase trip duration (travel time) for automotive modes and certain types of trips.[15] The nature of this change depends, in part, on the design elements used, the extent to which the street is "completed," and the size of the complete street (a one-block complete street will have a different effect than a mile-long corridor of complete streets).

Regarding the change in the trip times of other modes. the literature does not provide definitive empirical evidence. Since complete streets encourage greater system connectivity, it is logical to assume that trip times for walking, cycling, and transit could decrease. However, if users shift from the speed of private cars to slower alternatives, many standard measures of trip time (e.g., average travel speed, minutes per mile) are likely to increase.

[12] *Draft Monterey Bay Area Complete Street Guidelines,* p.5

[13] Litman, T. 2013. *Evaluating Complete Streets*. Victoria Transport Policy Institute.; Taylor, BD and CNY Fink. 2003. "The Factors Influencing Transit Ridership: A Review and Analysis of the Ridership Literature." *Earlier Faculty Research,* University of California Transportation Center, UC Berkeley.; Office of Safety, Federal Highway Administration. 2003. *Accessible Sidewalks and Street Crossings: An Informational Guide (FHWA-SA-03-019)*. U.S. Department of Transportation.; Dill, J and T Carr. 2003. "Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Them, Commuters Will Use Them – Another Look." *TRB 2003 Annual Meeting*.

[14] Litman, 2013.

[15] Litman, 2013.

Trip quality

Complete street advocates sometimes promote complete streets as improving the quality of the travel experience.[16] In theory, quality plays a role in determining one's transportation decision,[17] and it is clear that most implementations of complete streets should increase the quality of the travel experience to some degree for most non-automotive modes. The greater quality should increase the number of trips by the mode whose quality has been improved. The literature talks about and demonstrates that relationship in case studies (e.g., more bike travel after improvements to bike facilities), but we did not find anything in the literature of complete streets that directly addressed the effects of the quality of travel on economic activity.

Safety

Through traffic calming complete streets can reduce the number of vehicle collisions, which consequently reduce injuries, deaths, and property loss.[18] Collisions include vehicle-on-vehicle, vehicle-on-cyclist, vehicle-on-pedestrian, and cyclist-on-pedestrian

One would expect traffic calming to have a three-fold safety effect. First, slower travel speeds give drivers more time to process situations and respond in ways that avoid collisions or reduce their severity. Second, if the complete-street implementation results in lower automotive vehicle volumes, the number of high-risk situations will be reduced.[19] Third, the force of a collision of a vehicle at lower speeds is less than that of one at higher speeds. There is an extensive body of literature lending evidence to traffic calming's safety improvements.[20]

Though one could think of these effects as worth pursuing for their moral merits alone, reducing the number of deaths and injuries have tangible economic benefits.[21] For example, the value of a statistical life is $7.4 million ($2006),[22] and one estimate places the average value of a quality-adjusted year of life at $129,090.[23] This estimate does not account for reductions in property loss or damage. Our point is not that these are exact values, but they do suggest an order of magnitude for thinking about safety improvements. Given the documented potential

[16] Litman, 2013.; City of New Haven. 2010. *Complete Streets Design Manual*; Gordon-Koven, L. 2012. *Complete Streets pay off*. Accessed July 6, 2013, from http://www.smartgrowthamerica.org/2012/11/05/complete-streets-pay-off/.

[17] O'Sullivan, A. 2011. *Urban Economics,* 8th Edition. Boston, Mass: McGraw-Hill/Irwin. p. 295.

[18] Litman, 2013.; Federal Highway Administration. 2004. *A Review of Pedestrian Safety Research in the United States and Abroad*. U.S. Department of Transportation.;

[19] Vehicles, by being heavier and faster than bikes or pedestrians, are more able to increase the severity of risk.

[20] See, for example, Institute of Transportation Engineers, Federal Highway Administration. 1999. *Traffic Calming: State of the Practice*.; or Zein, SR, E Geddes, S Hemsing, and M Johnson. 1997. "Safety Benefits of Traffic Calming." *Transportation Research Record* 1578: 3-10.

[21] Though we stated earlier than we would avoid categorizing benefits and costs, in this situation, it is hard to make a case that preventing the loss of life and property is a cost. We consequently categorize this as a benefit.

[22] U.S. Environmental Protection Agency. 2013. *Frequently Asked Questions on Mortality Risk Valuation*. Accessed June 26, 2013 from http://yosemite.epa.gov/ee/epa/eed.nsf/pages/MortalityRiskValuation.html#whatisvsl.

[23] Note that this is an average, and that the value of a quality-adjusted year of life depends on a number of factors. Lee, CP, GM Chertow, and SA Zenios. 2009. "An empiric estimate of the value of life: updating the renal dialysis cost-effectiveness standard." *Value Health* 12 (1): 80-87.

for complete streets improvements to reduce the number and severity of crashes, it is possible that the safety benefits alone justify complete streets as a policy.[24]

Collisions are not products of cars only. Pedestrians and cyclists, and their volumes and speeds, contribute as well.[25] In our opinion, attempts to calculate some of these changes would not be worth the effort. For example, a complete street could increase pedestrian volumes and, other things being equal, greater volumes would lead to more pedestrian falls and collisions. But the severity and frequency of those collisions do not seem something that public policy should turn on. Another consideration would be whether those who enter the transportation system or mode-switch to walking or biking are comparatively high risk—either by their skill level, demographic abilities, or safety precautions (or lack thereof). Again, to us these seems more a theoretical consideration than one that will have much practical relevance to public policy decisions about complete streets.

The above discussion does not address further complications from cyclist-on-pedestrian collisions, or possible changes in crime. Neither topic is addressed substantively in the literature.

In the *Draft Monterey Area Complete Street Guidelines,* SCCRTC suggests the following as safety objectives and measures:

- Reduce collisions involving bicycles and pedestrians (as measured by the Statewide Integrated Traffic Records System).
- Improve speed suitability through street design (as measured by the number of bicycle routes on low speed streets).
- Increase the number of local traffic calming plans (as measured by the number of traffic calming plans adopted by local jurisdictions).
- Decrease the number of citations for jaywalking, reckless behavior or missing helmet (if under 18 years) (as measured by pedestrian and bicycle observation surveys).
- Reduce the number of bicycle and pedestrian hazards (as measured by the number of bicycle and pedestrian facilities repaired). [26]

Construction, operating, and maintenance costs

The creation of complete streets has capital, operating, and maintenance costs. Those costs are different from those of traditional streets. The literature on these different costs is limited. Generally, complete streets create a slight increase in the up-front implementation cost.[27] In a

[24] Possible, but we are not asserting this as even a back-of-the-envelope calculation. A rigorous analysis of the safety benefits would need detailed information on the people involved and the type and severity of collision. Safety is not the focus of this white-paper. This brief discussion should only impress the value of safety improvements.

[25] City of Boston. 2013. *Cyclist Safety Report*.; Tuckel, P and W Milczarski. 2011. *Pedestrian-Cyclist Accidents in New York State: 2007-2010*.

[26] *Draft Monterey Bay Area Complete Street Guidelines,* p.5

[27] National Complete Streets Coalition. *Costs of Complete Streets: What We Are Learning from State and Local Governments*.

2012 analysis, City of Charlotte Department of Transportation staff found that complete street components, specifically bike lanes and sidewalks, only slightly increased the cost of a project (on the order of 3 – 5%).[28][29] Some authors noted that cost increases can be mitigated by "smart planning" and other measures. We note, however, that such cost mitigations do not depend on complete street components, but can be implemented regardless of street type.

Regarding maintenance, the literature is limited and gives no solid, empirical, and controlled answers to the question of whether complete streets cost more or less to maintain. We believe that, in theory, the answer could go either way. A large share of maintenance costs result from automotive wear,[30] and that pedestrians, bicycles, and public transit wear down infrastructure less than cars. If complete streets cause users to shift away from cars, then complete streets could have some maintenance cost savings.[31] However, these cost savings may be minimal,[32] as very heavy vehicles, such as delivery trucks (and buses), cause a disproportionate share of road wear.[33] Moreover, complete streets may create a more complicated environment to maintain, and higher standards for maintenance (because more people are using the street space and for uses and at an intensity that requires more cost for cleaning). As throughout this white paper, ones answer also depends on how one chooses to define measurements. For example, because they have heavier weights per axle, buses cause more roadway wear than cars; but their wear per passenger-trip or passenger mile may be less.

We did not find analysis that tried to standardize cost per person, per trip, per mile, or per passenger mile.

B. Indirect effects

Summary: Complete streets can improve neighborhood identity and livability (which is more likely the greater the off-roadway improvements and external funding for public amenity), and may improve public health and the environment, though such effects are likely to be small relative to the magnitude of the problems.

The transportation system is one part of the urban fabric. Changes in transportation operation and performance (in mode, volume, duration, etc.) will have effects on other aspects of the urban environment. We call these secondary or indirect effects, not because they are less

[28] The magnitude of the increase varied depending on the type of project, but generally, bike lanes added little more than 5 percent, and sidewalks added little more than 3 percent.

[29] Shapard, J. and M. Cole. 2012. "Do Complete Streets Cost More than Incomplete Streets?" *Transportation Review Board 2013 Annual Meeting*.

[30] Victoria Transport Policy Institute. 2012. *Transportation Cost and Benefit Analysis II, Chapter 5.6: Roadway Facility Costs*.

[31] Moser, W. 2011. "Chicago's SUV Tax and Road Damage: Do the Numbers Add Up?". Chicago Magazine. Accessed July 6, 2013, from http://www.chicagomag.com/Chicago-Magazine/The-312/September-2011/Chicagos-SUV-Tax-and-Road-Damage-Do-the-Numbers-Add-Up/.

[32] Beyond if the shift in mode is small.

[33] Viton, PA. 2012. *Understanding Road Wear and its Causes*.

important, but because in the context of this evaluation they stem from a transportation investment intended to have a primary and direct effect on travel.

Environment

Given the environmentally damaging emissions of cars, and the comparative "green-ness" of walking, cycling, and taking public transit,[34] decreasing the number of cars on the road could reduce air pollution and carbon emissions.[35] One study found, "5% increase in walkability to be associated with … 6.5% fewer vehicle miles traveled, 5.6% fewer grams of oxides of nitrogen (NOx) emitted, and 5.5% fewer grams of volatile organic compounds (VOC) emitted."[36] Increased sidewalks and decreased parking have been associated with reducing greenhouse gases.[37]

But if automotive trip times increase, the consequent increase in car emissions could reduce the decreases in emissions from fewer trips.[38] Similarly, if complete streets enable greater consumer consumption (which we discuss in an upcoming section), then the additional goods and services consumed could reduce environmental gains.

As for other environmental effects (e.g., on water quality and habitat), drawing unambiguous conclusions is hampered by the complexity of the transportation system and traveler choices, the tradeoffs among various effects, the relatively small changes compared to background levels, wide variation in complete street design and implementation, and a lack of controlled empirical work.

Amenities

An important claim of advocates of complete streets is that complete streets result in more livable urban environments. Such livability stems in part from attributes we have already covered: e.g., more safety, less air pollution. But the arguments extend further to include aesthetics and functionality, social interaction, and social equity.

Regarding aesthetics and design, it is often hard to separate the effects of complete streets (the transportation component) from the effects of investment in the public realm (parks and open space) and from changes in land use policy (e.g., allowing higher density and mixed use). We do not need rigorous studies to conclude that large public investments in well-designed

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[34] U.S. Environmental Protection Agency. 2013. *On the Road*. Accessed June 26, 2013, from http://www.epa.gov/climatechange/wycd/road.html.

[35] We write "could," because it's possible—though seems unlikely—that the increase in automotive trip times, and the consequent environmental costs, imposed by complete streets could be great enough to outweigh any environmental benefit from decreased automotive volume.

[36] Frank, LD, JF Sallis, TL Conway, JE Chapman, BE Saelens, and W Bachman. 2006. "Many Pathways from Land Use to Health." *Journal of the American Planning Association* 72 (1).

[37] Frank, LD, MJ Greenwald, S Kavage, and A Devlin. 2011. *An Assessment of Urban Form and Pedestrian and Transit Improvements as an Integrated GHG Reduction Strategy*. Washington Department of Transportation.

[38] Vehicle speed consistency is an important factor in greenhouse gas emissions. Though we do not discuss it in detail here, we recognize its role in evaluating emissions.

elements of the public realm will make places more livable. More difficult questions, however, are whether such investments are efficient, whether the public is willing to pay for the benefits they deliver, and whether the costs and benefits of those investments are fairly distributed. Answering those questions is beyond the scope of this literature of complete streets, and something that can probably only be answered case by case for a specific project.

People are mobile; they choose to live in a certain area, in part, because of the amenities it offers.[39] Such amenities can include the effects we discuss in this report. If people value the effects of complete streets they are more likely to choose to live in or near complete street areas.[40] We cannot as part of this paper sort out the details of the demographic and socioeconomic profiles that would have a greater propensity to select the kinds of "smart growth" areas that would be consistent with a complete-street transportation system. We can say, however, that if smart growth centers are desired by households, then complete streets are a compatible and supporting arrangement for surface transportation.

Regarding social interaction, the results are mixed. Single-occupant cars do not foster social interaction, but for two or more occupants they can encourage and provide space for discourse. Alternative modes, by virtue of them being more open, less demanding of traveler attention (not always true for cycling), less expensive, and with fewer other barriers to use (e.g., licenses), at least make wider social interaction possible.[41] Theoretically, if complete streets lead more people to use other modes of transportation—either by not using their cars or entering the transportation system—and these users interact more, then wider social engagement would be increased.[42]

Regarding equity, if complete streets enable certain groups (low-income, the elderly, the disabled) of transportation users to use the transportation system closer to the same level as the average user,[43] then equity would increase. Measuring the distribution of use (and, thus, benefits and costs) among different classes of users, though analytically challenging and time consuming, is theoretically possible. Measuring "equity" however is not: what is equitable requires a normative judgment that must be made by elected officials, not policy analysts.

In the *Draft Monterey Area Complete Street Guidelines,* SCCRTC suggests the following as equity objectives and measures:

- Increase the number of improvements completed near key destinations for transportation disadvantaged populations such as near schools, hospitals, transit stops

[39] O'Sullivan, A. 2011. *Urban Economics,* 8th Edition. Boston, Mass: McGraw-Hill/Irwin. pp. 7, 71, 202.

[40] While those who demand traditional streets will migrate elsewhere.

[41] In our review of the literature, we could not find something to support this point. Regardless, we think it intuitively sound.

[42] Although the nature of these interactions—positive, friendly, combative, wary, etc.—probably matter.

[43] Place-holder citation

(as measured by GIS Project Location and Key Destinations for Transportation Disadvantaged using Census Data). [44]

Health

Beyond the health improvements resulting from gains in safety, complete streets could facilitate other health improvements.

Residents who mode-switch away from cars to walking or cycling would have increased activity levels. Physical activity can reduce a number of health problems, including obesity, heart disease, diabetes, and mental illness.[45] One study found, "a 5% increase in walkability to be associated with a per capita 32.1% increase in time spent in physically active travel, [and] a 0.23 point reduction in body mass index."[46] If complete streets contribute to healthier people, the economic benefits of that improved health could be measured as longer life expectancy (as in the Safety section above), improved productivity, and reduced costs for health care.[47]

That said, these benefits ultimately depend on the magnitude of any changes in physical activity, which likely depend on the extensiveness of complete street implementation. For example, if a complete street is only a block long, any resulting increase in physical activity would likely be small, difficult to measure, and have little effect on health.

Moreover, economists tend to be suspicious about claims that policies that force new behavior are economically advantageous. The arguments here can be complex, ideological contentious, and extensive. But key issues are whether decisions (in this case about travel) are being made in a world where all private and costs are being consider (a world in which "externalities" are small), and whether a new policy is offering opportunities that people do not now have, want, and are willing to pay for. For example, an economist might support a policy that raises the price of sugar because it is subsidized or its external costs are not reflected in its price, but might not support a policy that bans or rations sugar.

Complete streets may reduce noise (certainly from motor vehicles),[48] which has been associated with impaired communication, loss of sleep, increased stress.[49] As described previously, complete streets may reduce air pollution, which is also associated with a number of

[44] *Draft Monterey Bay Area Complete Street Guidelines,* p.5

[45] Nemours Health & Prevention Services. 2009. *Counties and Municipalities in Delaware Can Develop Complete Streets to Combat Childhood Obesity*.

[46] Frank, LD, JF Sallis, TL Conway, JE Chapman, BE Saelens, and W Bachman. 2006. "Many Pathways from Land Use to Health." *Journal of the American Planning Association* 72 (1). Though an interesting result, we not that the authors used a straightforward linear regression, and that correlation is not causation. Any correlation can run both directions, so a per capita increase in time spent being physically active is associated with an increase in walkability.

[47] Trust for America's Health. 2011. *Healthier Americans for a Healthier Economy*.

[48] Litman, 2013.

[49]World Health Organization. 2000. *Transport, Environment, and Health*.

health problems.[50] Complete streets have a number of paths through which they can theoretically improve health.

But automotive users who remain automotive users could have marginal decreases to their health, because their trip times—and thus time spent in their cars—could increase. For example, one study found that "each additional hour spent in a car per day is associated with a 6% increase in the likelihood of obesity." Health outcomes could also worsen from any injuries that result from switching to the other modes.[51] Complete streets could improve health outcomes for some and worsen health outcomes for others.

Ultimately, all of the effects will vary depending on the magnitude of the changes, the type of the complete streets, other demographic factors, geography, perspective, etc.

In the *Draft Monterey Area Complete Street Guidelines,* SCCRTC suggests the following as health objectives and measures:

- Increase the percent of people who walk, bike and take transit (as measured by the American Community Survey or local survey).
- Increase the number of students walking, bicycling or taking transit to school (as measured by bicycle and pedestrian counts and surveys).
- Increase the number of events that promote alternative transportation (as measured by the number of events held in Santa Cruz County that promote alternative transportation). [52]

C. Economic development effects[53]

Summary: This section addresses economic activity as measured in four categories: through investment, business activity, property values, and fiscal impacts. The measures are probably highly correlated. There are some good theoretical reasons for believing that complete streets can have positive effects on a regional or local economy, but (1) there is little empirical work on the topic, (2) what research there is tends to be anecdotal and not controlled for other causal variables, (3) there is no discussion of "net" impacts on the economy, nor of the distributional impacts (whether any gains of economic activity near complete streets are offset by losses elsewhere in the region). The literature neither supports nor fails to support the causal argument (i.e., but for complete streets, observed increases in economic activity would not have occurred), it does support the correlational argument (in some instances where complete streets have been implemented, various measures of economic activity have improved).

Given the primary (transportation) effects and secondary (indirect, non-transportation) effects of complete streets, what are the likely effects on the urban economy?

[50] Word Health Organization, 2000.

[51] e.g., beyond their collision risk, pedestrians could injure themselves by spraining an ankle, succumbing to heatstroke, etc.

[52] *Draft Monterey Bay Area Complete Street Guidelines,* p.5

[53] Note that most of the effects discussed previously—like those on transportation system performance, health, and the environment—have economic value. This section is addressing only a subset of total economic value: effects on economic activity in an urban area.

To make that question more answerable, and the answer more clear, we start by defining the "urban economy" in some measurable way. For the purposes of this evaluation we define urban economy to mean "economic activity." Standard measures of economic activity include employment, output, value added, sales, payroll / income, and property values. Thus, our objective is to see if the literature gives any evidence about how the transportation and indirect effects of complete streets would affect any of these measures of economic activity.

The economic effects depend on many variables that we have already described. For example: What are the exact elements of the complete street policy? What are the existing conditions? How is transportation affected? What are the other non-transportation effects? What is the relevant geography? What is the relevant time period? What are the relevant perspectives? Are the effects net regional benefits, or a redistribution of a fixed amount of regional activity? What role do exogenous trends play? If complete streets are implemented, how does one isolate the unique impacts of complete streets from all the other causal variables?

These kinds of distinctions may seem fussy and academic, but they have real implications for public policy. There are all manner of studies purporting to show the net economic benefits of some public expenditure supported by some interest group. We have seen studies of light rail, for example, that measure all the development that occurred within ¼ mile of a light rail line (not a station) and implied that all of it was a result of the light rail investment. But (1) there is no rider access to the line; the access is to the station; (2) the line was selected to connect centers, and the centers were already connected by an extensive highway grid: probably most of the development that occurred would have occurred even without light rail. Another example: recent studies have made the case that smart growth (denser, mixed use) patterns of development are fiscally superior because they generate more property tax per acre. But property tax is only one source of revenue, net fiscal impacts cannot be estimated without a thorough evaluation of cost, and of course higher-density and mixed use development pays more property tax per acre, but that does not mean that there is an economic demand for all land to develop at high densities.

In short, it is no surprise to us that that literature does a poor job of sorting out net economic impacts over the long run of any type of public investment, including those in complete streets and the smart-growth development patterns that they would support.

We organize the rest of this section to address four different (and often overlapping) ways to measure economic activity: through investment, business activity, property values, and fiscal impacts.

Investment

The research question is, Do the levels and composition of public and private investment change with the introduction of complete streets?

It is reasonable to presume that as a street's safety, health, and amenities improve, private and public entities will be more willing to invest in development in the area the street serves.

Some of the literature reports that complete streets do increase investment.[54] But most of those reports we anecdotal and did not control for other factors that contributed to that investment.

For example, the case studies we reviewed typically discussed complete street implementations in the context of larger projects to develop or redevelop a center or corridor. Though many other funding sources contributed to some new development, the studies do not separate out the unique effects of complete streets. On one hand, it is possible that decisions to invest in complete streets make areas more competitive for the awarding of such development funds. On the other hand, that may not be true or, if it is, it may be true for any type of transportation project, whether a complete street or not.[55]

In fairness, separating the effects is difficult. Moreover, it is almost certainly true in most cases that surface transportation improvements are critical to the redevelopment of a center or corridor. But do those improvements have to be complete streets, or would other transportation improvements deliver similar effects?

Issues of scale and perspective are critical in evaluating whether transportation investments for projects as modest as complete streets can be expected to change the net amount of investment in development in a region, or whether they simply change the location of that investment in a region. Complete streets, by themselves, would not stop the decline of Detroit or the growth of San Jose. But theory and the case studies in the literature support the conclusion that complete streets can be an important part of a public investment policy that can change the distribution of economic activity within a region. That is often the purpose of local and regional policy.

Business activity

The research questions are (1) Do measures of business activity (e.g., business creation, employment, wages / income, sales, revenues) change around complete streets? (2) Do consumers spending patterns change because of complete streets; Are businesses outside of the complete street affected by its implementation?

The only literature we found detailing business effects were case studies. These case studies consistently depicted robust business and job growth around complete streets.

- In Barracks Row, Washington D.C., District Department of Transportation "made $8 million public investment in streetscape improvement in 2003–2004. [Through 2005], an additional $8 million in private investment has been made in the corridor. Thirty-two

[54] See, for example, National Complete Streets Coalition. *Complete Streets Spark Economic Revitalization.*; Rush, N, L Actman, P McMahon, H Renski. *Street Redesign for Revitalization: West Palm Beach, FLA*. Accessed June 27, 2013, from http://www.walkinginfo.org/pedsafe/casestudy.cfm?CS_NUM=16.; Lockwood, IM and T Stillings. 1998. "Traffic Calming for Crime Reduction and Neighborhood Revitalization." *Annual Meeting of the Institute of Transportation Engineers* 68.

[55] For different views see Michigan Department of Transportation. 2011. *Complete Streets Frequently Asked Questions*. from http://www.michigan.gov/documents/mdot/CS_FAQ_6-22-11_356262_7.pdf.," and "Seskin, S., Smart Growth America. 2010. *U.S. DOT Announces TIGER II Grant Program*. Accessed June 26, 2013, from http://www.smartgrowthamerica.org/2010/05/04/us-dot-announces-tiger-ii-grant-program/".

new business establishments, including nine new outdoor cafes, have opened since the completion of the street enhancements."[56]

- In Lancaster Boulevard in Lancaster, CA, after a nine-block revitalization project, the area saw "50 new businesses" and "800 new jobs."[57]
- In San Diego, after complete street initiatives, "a survey of tax receipts among 95 businesses along the corridor showed a 20 percent boost in sales. Numerous new businesses opened during construction, including a CVS with a 40-year lease[58]"
- A recent study found that pedestrian and bicycle infrastructure projects created more design and construction jobs that automotive-focused projects, as pedestrian and bicycle projects have a higher labor intensity (the ratio of labor to capital).[59].[60]
- We found no studies that tried to document a link between complete streets and changes in regional incomes. Such changes are a standard measure used by regional economists to measure the health of a regional economy.

A cautious conclusion of these largely positive results is that complete streets have been shown to be part of development initiatives that have ultimately led to more economic activity around them. To go farther is to go beyond the data and the standard admonishment to policy evaluators: "Correlation is not causation." Urban economies are complex and dynamic environments. An increase of jobs and businesses after the implementation of complete streets does not, by itself, give any indication of how much of that increase is attributable to complete streets. For example, (1) were the market forces and location. (2) was the amount of new public investment in land, infrastructure and amenities, or (3) were pre-redevelopment losses of business such that any new development would have increased measures of business activity?

A further caution: many of the case studies focus on only post-implementation benefits (e.g., new jobs or sales) and fail to describe the net benefits (is the value of the benefits greater than the value of the costs). The net-benefits question, however, cannot be answered without rigorous analysis (if then) so it is not surprising to us that most case studies do not address it well if at all.

While case studies are excellent tools to confirm or challenge a theory, or to investigate phenomenon with limited literature,[61] to generalize their results into implementable policies comes with risk. One case study's conditions may or may not be comparable to another.

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[56] Transportation Research Board. 2006. *Linking Transportation and Land Use*. Transportation Research Circular, Number E-C100.

[57] National Complete Streets Coalition. 2013. "The Many Benefits of Complete Streets."

[58] McCann, B, A Meyer, J Wood, C Morfas. 2012. *It's a Safe Decision: Complete Streets in California.* National Complete Streets Coalition, Local Government Commission.

[59] Garrett-Peltier, Heidi. 2011. *Pedestrian and Bicycle Infrastructure: A National Study of Employment Impacts*. Political Economy Research Institute, University of Massachusetts, Amherst.

[60] Some jurisdictions prioritize job creation, and would see this as benefit. Others would see the additional jobs as a additional costs. In either case, these results are primarily distributional.

Regarding consumers and consumption patterns, for complete streets to change aggregate consumption, they would need change the number of consumers, their incomes, preferences, rates of spending/saving, or the cost of goods. Given our definition of a typical complete street project, some of these factors are likely to be unaffected, none is likely to be affected in a big way, and the one most likely to be affected is cost of goods. On the one hand, the cost of goods may decrease because the transportation cost to the consumer of purchasing the good may decrease. On the other hand, higher densities and land values will work in the direction of higher rents and higher prices.

There is evidence of increased consumption after complete street implementation,[62] In several surveys, merchants who operate businesses on complete street areas agree, and reported that complete street-type policies had improved their bottom lines—although these feelings were not unanimous.[63] consumers may respond to forested urban streetscapes by viewing stores and products more positively, traveling and staying longer at stores, and by being willing to pay more for parking and products.[64] A study that moved from the hypothetical behavior of surveys to observed behavior relating to street improvements[65] in New York City found that "assessed collectively, street improvement projects do not detract from commercial activity at the site of implementation. They may contribute positively."[66] This study, however, did not answer whether these contributions were net increase or distributional.

In our opinion, unless complete streets alter the variables noted earlier, these kinds of changes were, are, and will be primarily distributional. Areas that have been redeveloped (either with or without complete streets) will see more consumer spending, but the total spending in the region will not change in any measurable way.

It is unlikely that complete streets decrease consumption. "When demographics and socioeconomics are controlled for, mode choice does not have a statistically significant impact on consumer spending at convenience stores, drinking establishments, and restaurants."[67] In fact (excluding supermarkets) pedestrians and cyclists may consume more. "When trip

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[61] Tellis, W. 1997. "Application of a Case Study Methodology." *The Qualitative Record* 3 (3).

[62] See, for example, the case studies of Transportation Research Board. 2006. *Linking Transportation and Land Use*. Transportation Research Circular, Number E-C100.; National Complete Streets Coalition. 2013. "The Many Benefits of Complete Streets."; Bleier, A, K Ferrier, A Hamilton, G Konar, B Peterson, D Sorenson, and S Torma. 2012. *Implementing Complete Streets in the San Diego Region*. American Planning Association, WalkSanDiego.

[63] Drennen, E. 2003. *Economic Effects of Traffic Calming on Urban Small Businesses*. Department of Public Administration, San Francisco State University.; Forkes, J and NS Lea. 2010. *Bike Lanes, On-Street Parking and Business - Year 2 Report: A Study of Bloor Street in Toronto's Bloor West Village*. Clean Air Partnership.

[64] Wolf, KL. 2005. "Business District Streetscapes, Trees, and Consumer Response." *Journal of Forestry* 103 (8): 396-400.

[65] Though not complete streets, the improvements share much in common with complete streets.

[66] Lee, ES and B Sprung. 2013. *Bike and pedestrian street improvements and economic activity in NYC*. State Smart Transportation Initiative, New York City Department of Transportation.

[67] Clifton, KJ, C Muhs, S Morrissey, T Morrissey, K Currans, and C Ritter. 2012. *Consumer Behavior and Travel Mode Choices*. Oregon Transportation Research and Education Consortium.

frequency is accounted for,[68] the average monthly expenditures by customer modes of travel reveal that bicyclists, transit users, and pedestrians are competitive consumers and for all businesses except supermarkets, spend more, on average than those who drive."[69]

Holding household characteristics constant, one should expect more economic activity the denser the housing and the better the access. If complete streets deliver on their objective—making access by transit, bike, and walking better; and not deteriorating auto travel time too much (and perhaps even make it better)—then we would expect the direction of their impact to be toward increased consumer spending in centers and corridors with complete streets. The term "green dividend" was coined as shorthand for the idea that shorter automotive trips and more non-automotive trips leave individuals with more money to spend in the local economy[70]

Regarding how businesses outside of a complete street area were affected by the implementation of complete streets (the distributional issue), we found nothing in the literature we reviewed. Our conclusion, based on a substantial literature in urban economics is that unless regional economic conditions are changed in a sudden and big way (e.g., fracking in Wyoming, a new military base), then local policies that affect business create effects that are primarily distributional. If, for example, if an entrepreneur in a town had been planning to start a business, and ultimately decided to start it on a complete street, one cannot conclude that the complete street caused the business to start, or that without the complete street the business would not be there or some place else in the region. The effect of the complete street on location is the *difference* is that entrepreneur's revenues and costs relative to his alternative location, and not the *total* value of these variables.

A related distributional issue is that money for redevelopment projects and complete streets is scarce, and such projects will happen slowly, in a few places at a time. Places that get the investment will probably do better economically. Unless the new development is of a scale and type that it gains a reputation that it draws tourists from outside the region (that can happen), then the business it gets will be business that would otherwise have gone elsewhere in a region. That point suggest that smaller, more isolated cities in recreational areas could increase the regional economic activity if they can create "Main Street" environments that are attractive to tourists.

Property values

The research question is, Do property values change (increase) with the introduction of complete streets?

[68] Previous studies that did not control for trip frequency found that automotive-based consumers spent more per trip. Though automotive consumers spend more per trip, non-automotive consumers have greater frequencies of trip. Clifton et al., 2012.

[69] Clifton, KJ, C Muhs, S Morrissey, T Morrissey, K Currans, and C Ritter. 2012. *Consumer Behavior and Travel Mode Choices*. Oregon Transportation Research and Education Consortium.

[70] Cortright, J. 2007. *Portland's Green Dividend*. CEOs for Cities.

One can find case studies that claim that complete streets increase property values,[71] but the analysis tends to be simple before-and-after with little control for alternative causal variables. Like other indicators of economic activity, it is logical to presume that if complete streets increase amenity and travel by non-auto modes, and do not penalize through auto trips and the ability to park too much, then when coupled with market forces and public policy that aims at encouraging development and redevelopment, complete streets should be correlated with increased property values.

Advocates argue that one way complete streets raise property values is by improving walkability. An report[72] cited often examined the relationship between the sale prices of houses and their walk scores[73] in 15 different cities: after controlling for housing and neighborhood characteristics, found that property values rose with walkability. One needs to be careful, however abut inferring that complete streets, by improving walkability, will increase property values. It seems likely, for example, that an the underlying demand for access to a certain location drives a demand for density, and that higher walkability scores will inevitably be correlated with higher density.

The basic point is this: for increases in walkability to increase property values, people must demand that walkability. Such demand is not uniformly distributed, and its nature is not well documented in the literature. There is survey evidence that, in general, many people report a desire for walkability,[74] but such surveys fail to answer *where* people want this walkability. It seems unlikely that increases in walkability will increase property values everywhere. Since complete streets can be implemented anywhere, this seems to be an important point. For example, making a five-lane road servicing commercial strip complete and walkable may have little affect on walking, transit, and auto travel, while making a desirable shopping district more walkable could raise property values.

Ultimately, if people demand complete street components (bicycle infrastructure, street trees, traffic calming), then one should expect properties served by complete streets to have somewhat higher property values compared to properties other identical but served by a traditional road system. To state the case simply: if complete streets provide more safety, amenity, and modal diversity without costing much more or decreasing the effectiveness of the automobile, many people will pay more for housing in a location that provides those benefits. One study found that when traffic calming restraints reduced vehicle volume by several

[71] See, for example, National Complete Streets Coalition. *Complete Streets Spark Economic Revitalization*.; Rush, N, L Actman, P McMahon, H Renski. *Street Redesign for Revitalization: West Palm Beach, FLA*. Accessed June 27, 2013, from http://www.walkinginfo.org/pedsafe/casestudy.cfm?CS_NUM=16.; National Complete Streets Coalition. *Economic Development*. Accessed June 26, 2013, from http://www.smartgrowthamerica.org/complete-streets/complete-streets-fundamentals/factsheets/economic-revitalization.

[72] Cortright, J. 2009. *Walking the Walk: How Walkability Raises Home Values in U.S. Cities*. CEOs for Cities.

[73] A "walk score" is one index of walkability. It awards points based off the distance between a property and nearby destinations. Shorter the distances produce higher the walk scores, and, as the logic goes, greater walkability. For more information, see http://www.walkscore.com/methodology.shtml

[74] Spivak, J. 2011. *Walkable Communities Surveys*. http://urbanland.uli.org/Articles/2011/June/SpivakWalkable.

hundred per day, property values increased by 18% on average.[75] Other studies have found similar results.[76] In our opinion, it seems likely that these increases are the result of changes in multiple neighborhood attributes that are correlated with complete streets.

.If we take this relationship as given, then the effects specific to complete streets depend on the extent to which complete streets change vehicle volume. Similarly, several studies suggest consumers are willing to pay more for properties that are walkable, low-traffic, quiet, have bicycle infrastructure, etc.[77]

Some analyses make inferences about the unique effects of complete streets difficult by not controlling for other public funding.[78]

Note that any increase in property values—unless they occur with equal changes in incomes—would not occur in a vacuum. Were consumers to shift demand toward properties on complete streets, property values elsewhere would decrease. Additionally, increases in property values are a mixed bag: a benefit to some, a cost to others. Increased property values would likely be benefit to landowners, as their incomes would increase. Increased property values could be a cost to businesses and residents already operating and living there, as the increase could make the area unaffordable to them. This kind of effect is not discussed in the literature of complete streets, which claims increases in equity based primarily on the provision of more facilities and services for non-auto travel modes.

Government fiscal health

The research question is, What is the net fiscal effect of complete streets on local governments and agencies?

ECONorthwest has done extensive work on fiscal impact analysis, and recently reviewed the literature on the effects of "Smart Growth" on local fiscal health. [We would classify complete streets as a policy consistent with the ideas of smart growth.] That literature is replete with the kinds of methodological problems we have identified in this report. A lot of what gets cited is anecdotal information, some of it based on poor assumptions. There are certainly some solid theoretical arguments for why smart-growth patterns could improve fiscal health, and some empirical work for specific cases in support of that theory.[79]

In our review of the complete-streets literature, we only found only case studies on this topic.:

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[75] Bagby, DG. 1980. "The Effects of Traffic Flow on Residential Property Values." *Journal of the American Planning Association* 1: 88-94.

[76] Litman, T. 1999. *Traffic Calming Benefits, Costs and Equity Impacts*. Victoria Transport Policy Institute.

[77] Synder, R. *The Economic Value of Active Transportation*.

[78] See, for example, *Street Redesign for Revitalization: West Palm Beach, FLA*. Accessed June 27, 2013, from http://www.walkinginfo.org/pedsafe/casestudy.cfm?CS_NUM=16.

[79] Some of the best empirical work comes from StrongTowns.org. See, for example, *Curbside Chat*. 2011. http://www.strongtowns.org/companion-booklet/ for examples of how "smart growth" development patterns and infrastructure decisions can reduce public cost and improve fiscal health.

- In Barracks Row, "[The new] businesses are bringing in $80,000 in sales tax annually [as of 2006].[80]
- In Lancaster Boulevard, sales tax revenue increased by 26%.[81]
- In La Jolla Boulevard, San Diego, "Tax receipts from businesses spiked immediately after the reopening of the road."[82]

Readers that have got this far already know what we are going to say: (1) correlation is not causation, (2) without some control, there is no way to tell what part of these changes complete streets were uniquely responsible for; many other factors certainly contributed to the results reported and in some cases most the effects might have been observed with investments in new development and redevelopment that included transportation improvements that did not adhere strongly to a complete-street framework, and (3) simple statements about tax revenue increases do not address the more critical issue of net fiscal impacts (e.g., what if sales tax increases $80,000 annually, but the cost of municipal facilities and services (debt service and O&M costs) increase $2 million per year?).

IV. Interpreting the findings in the context of SCCRTC policy

Our most important concluding remark is that our conclusion—that the literature does not rigorously document[83] the positive economic effects that complete streets uniquely deliver—does not mean that complete streets are not a good idea. We could just as well state our conclusion as a mirror image: the literature does not rigorously document that complete streets do not deliver the positive economic effects that many proponents believe they do.

The conclusion we draw is not that complete streets are bad public investments. In fact, in cases where conditions are such that they can deliver (as we believe they can) on their several promises (more safety, modal equity, and neighborhood amenity), and where they support and enhance other public objectives regarding the pattern, mix, and density of development, they should probably be pursued. Complete streets need not solely rest on a demonstration of economic effects for their justification and implementation.

Our conclusion is also, however, that the local and regional governments should be cautious about over-extending their financial capacity to create complete streets with the expectation that there will be great economic gains. In an ideal sense, every street should be a complete street. Section II.A, Definitions, shows that the idea of complete streets can apply at many different scales, and the standards for "completeness" would differ by street type and scale. But no local

[80] Transportation Research Board. 2006. *Linking Transportation and Land Use*. Transportation Research Circular, Number E-C100.

[81] National Complete Streets Coalition. 2013. "The Many Benefits of Complete Streets."

[82] Bleier, A, K Ferrier, A Hamilton, G Konar, B Peterson, D Sorenson, and S Torma. 2012. *Implementing Complete Streets in the San Diego Region*. American Planning Association, WalkSanDiego.

[83] "Rigorous documentation" for us usually means that tan explanatory model of cause and effect has been described in theory and that data have been collected and analyzed, with appropriate controls, to test the impact of the cause of interest (complete streets) on the effect of interest (some measure of economic activity).

or regional government has the capacity to retrofit every street now. It will work incrementally on completeness: adding a bike lane here, a transit line there, and, occasionally, doing a corridor or subcenter retrofit as part of a larger development project. That makes sense to us.

Though the literature on the economic effects of complete streets is limited, they are still a relatively recent idea. As they are implemented and mature, a technical understanding of their effects and the literature documenting it will grow. But even here we advise caution. Not all of the purported effects of complete streets lend themselves to identification and valuation. Measuring and valuing gains in quality of life is complicated: values vary with people's preferences. We expect it will be years before one sees something approaching a peer-reviewed, journal-level article that establishes a casual relationship between specific complete street features and the net economic effects of complete streets.

For local and regional agencies considering complete streets investment, our advice is:

- Consider complete-street implementations in a few places that have the characteristics suggesting complete streets would provide benefits at a reasonable cost (e.g., "main street" location, modal conflict, safety problems, short length rather than extensive corridor, higher density), in locations where market forces and public policy want redevelopment to occur.
- Use a list of potentially significant benefits and costs as criteria for ranking possible complete-street implementations. Add to that list of criteria (1) the ability of other public agencies, property owners, and developers to contribute to a redevelopment project (the ability to leverage both outcomes and cost), and (2) the ability of the project to provide a quasi-experimental evaluation of complete-street implementation. For example, a jurisdiction implementing a complete street project would find a separate traditional street that is as comparable to the complete street project as possible (the desire to find a comparable could even inform stakeholders' decision on where to implement complete streets) to serve as a control. Such an area should not be so close to the complete street so as to receive any spillover effects. As and after the jurisdiction implements the complete streets, it can monitor the effects on evaluation criteria along the complete street and along the traditional street. While this is not the strictest of controls and leaves much to be desired, it would be an improvement over the before-and-after treatment in most case studies we reviewed.[84]
- Get regional agreement on a few projects that the jurisdiction or agency can afford to implement, and implement them.
- Monitor, evaluate, and report the results. This white paper provides what we believe is a solid framework of evaluation methods, categories of criteria (benefits and costs), and possible measurements.
- Use the results to make decisions about the next round of complete-street implementations.

[84] Taking this before & after viewpoint fails to capture if and how the street would have changed should the complete street policy not been implemented.

Appendix A: Bibliography

Bleier, A, K Ferrier, A Hamilton, G Konar, B Peterson, D Sorenson, and S Torma. 2012. *Implementing Complete Streets in the San Diego Region*. American Planning Association, WalkSanDiego.

This report uses several complete street case studies in the San Diego region to reach conclusions about the effects of complete streets. The catalogue of effects is fairly comprehensive. In its discussion consumer behavior, it describes complete streets leading to greater consumer spending. The authors, however, fail to control for other factors.

City of Boston. 2013. *Cyclist Safety Report*.

This report is the most current analysis of cyclist safety in Boston. It describes the types of collisions, their frequencies, and relevant factors—including volume, speed, and behavior. We cite is as demonstration of the cyclist-side role in collisions and safety.

City of New Haven. 2010. *Complete Streets Design Manual*

The function of this design manual is much like the guidebooks cited earlier. It is indented to inform the design and implementation of complete street policies. Throughout it, the City of New Haven regularly emphasizes that complete streets improve the quality of travel.

Clifton, KJ, C Muhs, S Morrissey, T Morrissey, K Currans, and C Ritter. 2012. *Consumer Behavior and Travel Mode Choices*. Oregon Transportation Research and Education Consortium.

In this article, the authors explore how spending patterns change depending on one's primary transportation mode. They find that, excluding supermarkets, when demographics and socioeconomics are controlled for, pedestrians and cyclists may spend more than drivers.

Cortright, J. 2007. *Portland's Green Dividend*. CEOs for Cities.

In this article, Cortright argues that consumers who use transportation modes besides private cars are left with extra disposable income—a "green dividend"— and improved overall well-being.

Cortright, J. 2009. *Walking the Walk: How Walkability Raises Home Values in U.S. Cities*. CEOs for Cities.

In this report, Cortright linearly regresses property values against a measure of walkability, and finds that properties with higher walkability scores are associated with higher property values. As explained in our white paper, though this is an encouraging finding, we are reluctant to rely on it to understand the potential effects of complete streets. We bring it up, in part, because in our survey of the literature, Cortright's article was widely cited.

Dill, J and T Carr. 2003. "Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Them, Commuters Will Use Them – Another Look." *TRB 2003 Annual Meeting*.

This article improves upon previous research by providing cross-sectional analysis across 35 large cities across the U.S. It concludes that implementing bicycle lanes has led to an increase in bicycle commuting. We cite it to justify that complete street design elements would likely encourage use of non-private vehicle modes.

Drennen, E. 2003. *Economic Effects of Traffic Calming on Urban Small Businesses*. Department of Public Administration, San Francisco State University.

In this study, Drennen surveys merchants four years after the implementation of bicycle infrastructure. Sixty-six percent of the merchants believed that the bike lanes had a generally positive impact on their business or sales. The same percentage would have supported more traffic calming.

Federal Highway Administration. 2004. *A Review of Pedestrian Safety Research in the United States and Abroad*. U.S. Department of Transportation.

This report provides a comprehensive catalogue of factors that affect pedestrian safety. These factors include traffic calming—a factor shared by complete streets. We cite this report as justification that complete streets reduce accidents and improve safety.

Forkes, J and NS Lea. 2010. *Bike Lanes, On-Street Parking and Business - Year 2 Report: A Study of Bloor Street in Toronto's Bloor West Village*. Clean Air Partnership.

In this report, the authors surveyed local merchants and consumers about their feelings toward bicycle infrastructure and sidewalk improvements. More than half of the merchants believed that such improvements (which came at the cost of reduced on-street parking) would improve or have no impact on their businesses. Consumers reported that the improvements would lead them to spend more money in the area.

Frank, LD, MJ Greenwald, S Kavage, and A Devlin. 2011. *An Assessment of Urban Form and Pedestrian and Transit Improvements as an Integrated GHG Reduction Strategy*. Washington Department of Transportation.

This report describes several factors in transportation that affect an area's output of greenhouse gasses. Among those relevant to complete streets, increased sidewalks and decreased parking was associated with reduced greenhouse gasses. Among the factors examined, parking cost had the strongest association to greenhouse gas output.

Frank, LD, JF Sallis, TL Conway, JE Chapman, BE Saelens, and W Bachman. 2006. "Many Pathways from Land Use to Health." *Journal of the American Planning Association* 72 (1).

In this article, the authors describe various ways land use affects health. This includes insights like, "each additional hour spent in a car per day was associated with a 6% increase in the odds of being obese" and, "a 5% increase in walkability [was] associated with a per

capita 32.1% increase in time spent in physically active travel, a 0.23-point reduction in body mass index, 6.5% fewer vehicle miles traveled, 5.6 fewer grams of oxides of nitrogen (NOx) emitted, and 5.5% fewer grams of volatile organic compounds (VOC) emitted." (p.1)

Garrett-Peltier, Heidi. 2011. *Pedestrian and Bicycle Infrastructure: A National Study of Employment Impacts*. Political Economy Research Institute, University of Massachusetts, Amherst.

In this article, Garrett-Peltier uses IMPLAN to evaluate the direct, indirect, and induced employment that is created through the design, construction, and materials procurement of bicycle, pedestrian, and road infrastructure. She found that these projects created more design and construction jobs than automotive projects, and attributed this to pedestrian and bicycling projects' higher labor intensity.

Gordon-Koven, L. 2012. *Complete Streets pay off*. Accessed July 6, 2013, from http://www.smartgrowthamerica.org/2012/11/05/complete-streets-pay-off/.

This article describes some of the transportation effects of complete streets, but acknowledges the "aesthetic" motivation as well.

Gresham Smith and Partners. 2009. *Complete Streets Design Guidelines*. Tennessee Department of Transportation.

Much like the guidebook for Monterey Bay area, this guidebook is intended as a guide to jurisdictions and lay people alike to help them understand, create, and implement complete street policies. We cite it to describe the design elements of complete streets, each of which, this guidebook discusses in detail.

Institute of Transportation Engineers, Federal Highway Administration. 1999. *Traffic Calming: State of the Practice*.

This report is a comprehensive analysis of aspects of traffic calming and their effects. A primary effect described is safety improvements. We cite this report to demonstrate the established body of literature that link safety to traffic calming.

LaPlante, J and B McCann. 2008. "Complete Streets: We Can Get There from Here." *Institute of Transportation Engineers* 78 (5): 24-28.

In this article, LaPlante and McCann argue for the greater implementation of complete streets to combat transportation challenges, particularly safety. Their argument includes a discussion of complete streets and their transportation effects as compared to traditional streets.

Lee, CP, GM Chertow, and SA Zenios. 2009. "An empiric estimate of the value of life: updating the renal dialysis cost-effectiveness standard." *Value Health* 12 (1): 80-87.

In this article, Lee, Chertow, and Zenios find that the value of a quality adjusted year of life, as implied by the practice of dialysis, is $129,090, on average. We note that this is one

estimate and that putting dollar values on life has met criticism. We use this value, and cite this article, only to demonstrate the economic value of safety improvements.

Lee, ES and B Sprung. 2013. *Bike and pedestrian street improvements and economic activity in NYC*. State Smart Transportation Initiative, New York City Department of Transportation.

In this study of New York City street improvements, Lee and Sprung find that the improvements—which included bicycle infrastructure, street trees, sidewalk improvements—in some cases led to higher sales tax revenues, which indicates greater consumption. In other cases the revenue was lower or was not significantly different than it was previously.

Lockwood, IM and T Stillings. 1998. "Traffic Calming for Crime Reduction and Neighborhood Revitalization." *Annual Meeting of the Institute of Transportation Engineers* 68.

This case study attributes transformative economic and crime changes to traffic calming (a major aspect of complete streets). Though the case study is encouraging, it fails to control for other factors (i.e., it does a before/after analysis, where a with/without would be more telling).

Litman, T. 2013. *Evaluating Complete Streets*. Victoria Transport Policy Institute.

In this article, Litman attempts a comprehensive catalogue of the effects of complete streets. Litman is generally unable to describe the exact value of each effect, but he does describe their directions. Though this is a good resource, a reader should be aware that Litman is actively advocating for complete streets.

Litman, T. 1999. *Traffic Calming Benefits, Costs and Equity Impacts*. Victoria Transport Policy Institute.

In this article, Litman describes the effects of traffic calming. One area he examined was traffic calming's relationship to property values. In his review of the relevant literature, he concluded there is positive relationship between the two.

McCann, B, A Meyer, J Wood, C Morfas. 2012. *It's a Safe Decision: Complete Streets in California*. National Complete Streets Coalition, Local Government Commission.

This report compiles complete street case studies in California to argue that their implementation should be more widespread. The case studies collectively provide a fairly comprehensive picture of the effects of complete streets. However, in discussing economic activity, other factors are not controlled for.

McCann, B and S Rynne, eds. 2010. *Complete Streets: Best Policy and Implementation Practices*. Chicago, IL: American Planning Association.

This book describes the "best policy and implementation practices" by generalizing principles from specific case studies. This book is to inform readers looking to understand,

create, or improve complete street policies. We cite it to reinforce that complete streets generally come as revisions to existing streets.

Michigan Department of Transportation. 2011. *Complete Streets Frequently Asked Questions*. http://www.michigan.gov/documents/mdot/CS_FAQ_6-22-11_356262_7.pdf.

We found this source in trying to answer whether complete streets make an area more competitive for grants. According to it, "Complete Streets is not a grant program and does not offer or entitle any community to funding for infrastructure improvements. Complete Streets is a concept in which multiple modes of transportation are considered and, when appropriate, addressed in some form as part of transportation projects."

Moser, W. 2011. "Chicago's SUV Tax and Road Damage: Do the Numbers Add Up?". Chicago Magazine. Accessed July 6, 2013, from http://www.chicagomag.com/Chicago-Magazine/The-312/September-2011/Chicagos-SUV-Tax-and-Road-Damage-Do-the-Numbers-Add-Up/.

In this article, Moser steps the reader through the calculations of the road maintenance costs imposed by vehicles. He cites established literature, explains the methodological assumptions, and contrasts them to the political rhetoric. His analysis demonstrates that costs come primarily from heavy vehicles and the lack of continuity between the analytical and political issues. His analysis also demonstrates that decreases in maintenance costs resulting from complete streets—if existent—could be small.

National Complete Streets Coalition. *Complete Streets Spark Economic Revitalization*.

This brief on complete streets argues that complete streets lead to transformative economic changes. Though much of it is informative, it operates as advocacy, and not rigorous analysis. We cite it as such.

National Complete Streets Coalition. *Costs of Complete Streets: What We Are Learning from State and Local Governments*.

In this fact sheet, the National Complete Streets Coalition highlights several case studies of complete streets project to conclude that the costs of complete streets are minimal. This fact sheet confuses the issue, however, by including a discussion of the benefits, and information on financing complete street projects.

National Complete Streets Coalition. *Economic Development*. Accessed June 26, 2013, from http://www.smartgrowthamerica.org/complete-streets/complete-streets-fundamentals/factsheets/economic-revitalization.

In this article, the National Complete Streets Coalition argues that complete streets lead to transformative economic development, raising property values and investment. We cite it as advocacy, and not as rigorous analysis.

National Complete Streets Coalition. *Green Streets*. Accessed June 26, 2013, from http://www.smartgrowthamerica.org/complete-streets/implementation/factsheets/green-streets/.

This article describes the environmental affects of complete streets and asserts that complete streets are sustainable. We cite it as an example of the "sustainability" rhetoric that sometimes appears around complete streets.

National Complete Streets Coalition. 2013. "The Many Benefits of Complete Streets."

This slideshow is a somewhat comprehensive presentation of the purported benefits of complete streets. These purported benefits include increased consumer activity. We take this slideshow with a grain of salt, however, as it functions primarily as advocacy.

Nemours Health & Prevention Services. 2009. *Counties and Municipalities in Delaware Can Develop Complete Streets to Combat Childhood Obesity*.

This brief article describes how physical activity and the built environment relate to one another. This includes a discussion of how physical activity combats obesity, heart disease, diabetes, and mental illness. The authors argue that complete streets would encourage physical activity and bring the benefits of increased physical activity.

Office of Safety, Federal Highway Administration. 2003. *Accessible Sidewalks and Street Crossings: An Informational Guide (FHWA-SA-03-019)*. U.S. Department of Transportation.

This report functions largely as a guide for the design and implementation of pedestrian improvements. We cite it to justify that complete street design elements would likely encourage use of non-private vehicle modes.

Rush, N, L Actman, P McMahon, H Renski. *Street Redesign for Revitalization: West Palm Beach, FLA*. Accessed June 27, 2013, from http://www.walkinginfo.org/pedsafe/casestudy.cfm?CS_NUM=16.

This case study of West Palm Beach Florida attributes the area's transformative economic change to complete streets, but fails to control for other factors (i.e., it does a before/after analysis, where a with/without would be more telling).

Seskin, S., Smart Growth America. 2010. *U.S. DOT Announces TIGER II Grant Program*. Accessed June 26, 2013, from http://www.smartgrowthamerica.org/2010/05/04/us-dot-announces-tiger-ii-grant-program/

In contrast to the Michigan Department of Transportation source, this article seems to imply that complete street policies will make an area more competitive for DOT TIGER II grants.

Shapard, J. and M. Cole. 2012. "Do Complete Streets Cost More than Incomplete Streets?" *Transportation Review Board 2013 Annual Meeting*.

In this article, Shapard and Cole use their experiences as City of Charlotte officials to analyze the costs of implementing complete streets. They describe the exact additional costs of complete streets (generally, bike lanes added little more than 5 percent, and sidewalks added little more than 3 percent), but conclude that these costs are minimal in comparison to the overall transportation budget and the general market fluctuations of construction costs.

Snyder, R. *The Economic Value of Active Transportation*.

In this fact sheet, Snyder reviews the literature and finds that homeowners are willing to pay more for walkable, bikable, low-traffic, quiet streets. The author supports his conclusions largely with case studies. Since this is a fact sheet, it does not lend itself to great scrutiny.

StrongTowns.org. *Curbside Chat*. 2011. http://www.strongtowns.org/companion-booklet/

Examples of how "smart growth" development patterns and infrastructure decisions can reduce public cost and improve fiscal health.

Taylor, BD and CNY Fink. 2003. "The Factors Influencing Transit Ridership: A Review and Analysis of the Ridership Literature." *Earlier Faculty Research,* University of California Transportation Center, UC Berkeley.

In this article, Taylor and Fink analyze the literature to describe factors that affect transit ridership. The factors they analyzed include demographics, the quality of services, and the availability of parking. Some of these factors, such as services expansion and optimization, are shared with complete streets. We cite it as justification that complete street design elements encourage use of modes besides private vehicles.

Tellis, W. 1997. "Application of a Case Study Methodology." *The Qualitative Record* 3 (3).

This article describes the best practices for designing and implementing case studies. We cite it to explain the usefulness of case studies.

Transportation Agency for Monterey County, Santa Cruz County Regional Transportation Commission, San Benito County Council of Governments, in coordination with the Association of Monterey Bay Area Governments. 2013. *Monterey Bay Area Complete Street Guidebook - Draft*. June 1.

This is the draft of the Monterey Bay Area complete street policy guidebook. The metropolitan transportation planning organization intends it to help jurisdictions to understand, create, and implement complete street policies. Our white paper will help inform the economic section of this guidebook.

Transportation Research Board. 2006. *Linking Transportation and Land Use*. Transportation Research Circular, Number E-C100.

This report is essentially a compilation of case studies of transportation and land use projects. Though none of the projects examined are explicitly complete streets, the projects share many things with complete streets (traffic calming, streetscape improvements, etc.). Many of the case studies describe increased retail and consumer activity after a project, though these descriptions are too brief to lend themselves to greater scrutiny.

Trust for America's Health. 2011. *Healthier Americans for a Healthier Economy*.

In this report, the Trust for America's Health explains the effects of health improvements. This discussion includes frequent assertions of the cost savings that come with improved health.

Tuckel, P and W Milczarski. 2011. *Pedestrian-Cyclist Accidents in New York State: 2007-2010*.

This is a very unique article. Tuckel and Milczarski analyze pedestrian-cyclist collisions, which, in general, receives little attention. We cite this article to demonstrate that these collisions do, in fact, happen.

U.S. Environmental Protection Agency. 2013. *Frequently Asked Questions on Mortality Risk Valuation*. Accessed June 26, 2013 from http://yosemite.epa.gov/ee/epa/eed.nsf/pages/MortalityRiskValuation.html#whatisvsl.

Here, the EPA answers questions about the statistical value of a life, including the reasons behind doing so, the methodology, and the current value.

U.S. Environmental Protection Agency. 2013. *On the Road*. Accessed June 26, 2013, from http://www.epa.gov/climatechange/wycd/road.html.

In this article, the EPA discusses ways to reduce the environmental impact of driving a private car. Some of the ways discussed include public transportation, cycling, and walking.

Victoria Transport Policy Institute. 2012. *Transportation Cost and Benefit Analysis II, Chapter 5.6: Roadway Facility Costs*.

In this report, the Victoria Transport Policy Institute provides an extensive catalogue of the sources of transportation costs. Though this analysis is in the context of traditional streets, we cite this report for its general insights about maintenance costs--specifically that heavier vehicles impose much greater maintenance costs than lighter vehicles.

Viton, PA. 2012. *Understanding Road Wear and its Causes*.

In this presentation, Viton explains that road wear comes primarily from heavy vehicles like delivery trucks and buses. Therefore, other users (smaller vehicles, pedestrians, bicycles, etc.) have a negligible impact.

Wolf, KL. 2005. "Business District Streetscapes, Trees, and Consumer Response." *Journal of Forestry* 103 (8): 396-400.

In this study, Wolf surveyed consumers to examine how they respond to forested urban streetscapes. She found that on forested streetscapes, consumers viewed stores and products more positively, travelled and stayed longer at stores, and were willing to pay more for parking and products.

World Health Organization. 2000. *Transport, Environment, and Health*.

This report describes the relationship between transportation, environment, and health. Besides reaffirming the health and environmental effects of complete streets described elsewhere in our white paper, this report includes a discussion of how noise pollution contributes to negative health outcomes, including impaired communication, loss of sleep, increased stress.Zein, SR, E Geddes, S Hemsing, and M Johnson. 1997. "Safety Benefits of Traffic Calming." *Transportation Research Record* 1578: 3-10.

This article attempts to see whether the safety effects of traffic calming were "measurable and significant." In examining traffic-calming projects in the Vancouver area, they found that the projects brought, on average, a 40 percent reduction in collision frequency and a 38 percent reduction in the annual claims costs." (p.3) In examining international case studies, they found that decrease in collision frequency ranged from 8 percent to 95 percent. (p.3)

Appendix B: Framework for Evaluating Public Policy

ECONorthwest makes basic assumptions about policy evaluation that underlie all its evaluations in general, and its transportation evaluations (including the one in this white paper) in particular. This appendix documents those assumptions.

Fundamental principle

Fundamental to policy evaluation is that the public sector has choices about policies and investments, and that it should compare the pros and cons (benefits and costs) of a few likely and possible actions so that it can identify the most advantageous one (the one with the greatest net benefits). A corollary of that principle is that policy evaluation should compare what can reasonably be expected to happen *with* a new action to what can reasonably be expected to happen *without* a new action.

Definitions

People base decisions on internal models of cause and effect that are usually simple and incomplete. Most of the facts that go into those mental models are based heavily on *assumptions* (some testable empirically, some not). Any technical (as opposed to ideological or emotional) discussion of public policy must focus on assumptions, and that discussion will get derailed if it does not start with some clarity about definitions.

There is difference between *ends* and *means*: in other words, between the *desired outcomes* and the *actions* intended to achieve those outcomes.

- Terms related to *outcomes* (from broad to specific): goals, principles, fundamentals, objectives, impacts, measures, indicators, evaluation criteria. Logically, since goals and objectives are categories of things people care about, they are roughly synonymous with the term impacts: the objectives are about good impacts that a community wants to increase, and bad impacts that it wants to reduce.
- Terms related to *actions*: strategies, policies, implementation tools, programs, regulations, investments. There are several ways actions can be classified (by where they get applied; by who implements them; by the area of development they affect).

Support for public actions presumably derives from a belief or assumption that thinking about and taking collective action now can lead to a better future than failing to do so. Implicit in that idea is one of *alternative futures* (sometimes called *scenarios*).

Purposes

What is public policy trying to achieve? At the broadest level, decisionmakers and their constituents want policies that make everybody happy: all people, in all locations, now and in the future. Policy evaluation does not, however, use the term "happiness." It typically defines good policies as those that are more effective, more efficient, and more fair than the alternatives at achieving desired ends. At the broadest level, *public policy aims at achieving better quality of life by achieving a more efficient or more fair distribution of economic, environmental, and social benefits,*

subject to the constraints of cost. That goal is variously referred to as social welfare (for economists), the public interest (for political scientists), or quality of life (for planners).[85]

Evaluation criteria

For systematic evaluation, broad goals like "quality of life" or "efficiency" get specified as sub-goals, which become objectives, which become performance measurements (which are similar, and often identical, to evaluation criteria). The categories for evaluating regional planning efforts are generally the same across regions, across disciplines, and over time. They relate to delivering economic prosperity, environmental quality, and urban amenities. Typical labels used to categorize the effects of public policy are:

Economy	Environment
Land Use	Infrastructure
Social	Fiscal
Public Process	(Legal: usually implied)

These categories, more or less, show up in everyone of dozens of regional plans that ECO has worked on or reviewed. The exact names and number of categories may differ a little, but there is general agreement that every effect that matters to stakeholders and the public can be fit under one or more of these headings.

Technical problems and (partial) solutions

The links among causes and effects are hard enough identify in the physical sciences. In the social sciences, the introduction of people and their decisionmaking and actions makes prediction complex and uncertain. In a typical mid-sized US metropolitan area, people make millions of trip choices every day.

Moreover, what might be true on average is not true for all people or even groups of people, so any evaluation is complicated by the need to disaggregate the results of the analysis. Further, even if one could predict with a high degree of accuracy and certainty what the impacts of public actions would be on all groups now and into the future, there is still the messy issues of valuing the impacts*:* no amount of mathematics or computer power is ever going to yield a technical result that all parties agree appropriately weight their values. Policy evaluation addresses these problems by ignoring the ones it can simplifying the ones it cannot.

Practical solutions to these problems are both incomplete and hard to improve on:

- Acknowledge the limitations of any technical evaluation: the public discussion will be better for it.
- Focus on the tradeoffs: there are always many objectives and not all can be maximized simultaneously.

- Frame the analysis to consider a future without the action under consideration, and with the action.
- Do not confuse "No Action" with "No Change": changes will occur even without new actions (new facilities, programs, and policies).
- Focus on differences among alternatives at the margin: if all alternatives perform the same on some objective, they theoretically have no effect on the decision, no matter how important that objective.
- Evaluate not just the aggregate net benefits a policy, but the distribution among different groups as well.
- Design any evaluation modularly and hierarchically so that detailed impacts can be logically and consistently rolled up into an overall evaluation.
- Tell a clear story about cause and effect; put the statistical analysis in a supporting role.