

**DATE:** February 28, 2014  
**TO:** Chris Henry and David Nelkin  
**FROM:** The ECONorthwest Team  
**SUBJECT:** SOUTH WILLAMETTE STREET REDESIGN: ECONOMIC LITERATURE REVIEW

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On December 11, 2013, the City of Eugene asked ECONorthwest to conduct a literature review of the effects that the proposed street-design changes to South Willamette would have on nearby businesses. In this memorandum, we<sup>1</sup> summarize the findings from a literature review of existing studies about the economic effects of similar street-design changes in other commercial corridors.

## I. Context

### Project Background

Based on the Draft South Willamette Street Improvement Plan<sup>2</sup> (Draft Plan) the City has concluded that the transportation infrastructure on South Willamette Street from 24th Avenue to 32nd Avenue needs repair. The Draft Plan evaluated several alternative roadway configurations to serve this purpose. The Draft Plan concluded that the 3-automotive lanes plus 2 bike-lane alternative would best serve the wants and needs of the surrounding community without significantly hindering access or travel times through the area.

Some businesses along South Willamette have expressed concern that the proposed configuration would decrease the number of customers and thereby decrease revenues and profits. The City hired ECONorthwest to evaluate how businesses have fared following similar road-reconfiguration projects elsewhere and to judge, to the extent possible, how the proposed South Willamette reconfiguration might affect businesses and property owners along South Willamette.

The 0.8 mile portion of South Willamette currently has 16,500 average daily trips (ADT) by motor vehicle with an average end-to-end travel time of 2.5 minutes. This portion of South Willamette has 5.2 collisions per million vehicle miles compared to the statewide average of 2.9 collisions per million vehicle miles for urban minor arterial streets. More than 15% of motor vehicles on this stretch travel more than 5 mph above the 25 mph posted speed limit.

Local traffic, those making a stop on this portion of Willamette, accounts for 63% of the traffic. The other 37% are through travelers that do not stop on this portion of Willamette. There are over 70 driveways over the 0.8 mile stretch.

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<sup>1</sup> Throughout this memo, the terms “we,” “our,” and “us” refer to Beth Goodman, Matthew Kitchen, Michael Weinerman and Ed Whitelaw, all at ECONorthwest <<http://www.econw.com/>>.

<sup>2</sup> Draft South Willamette Street Improvement Plan. October 2013. <http://www.eugene-or.gov/index.aspx?NID=2055>

## Effects of Road Diets

Transportation planners and professionals use the term “road diet”<sup>3</sup> to refer to roadway configurations similar to that being recommended for South Willamette. Many urban areas across the country have implemented similar “road diet” policies and plans.

Road diets and other traffic adjustments are often accompanied by various studies to describe and explain the effects of the reconfiguration. Most common are analyses that measure changes in motor-vehicle traffic times, congestion, and crashes. Some researchers have also focused on resident, consumer, and business perceptions before and after the reconfiguration; business revenues; customer and delivery truck accessibility; and spending patterns by mode of transportation.

ECONorthwest reviewed the professional literature to find the studies most relevant to the question of the effects of road diets on nearby businesses.<sup>4</sup> We summarize the key points from this literature review in this memorandum.

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<sup>3</sup> The U.S. DOT defines [Federal Highway Administration; “Proven Safety Countermeasures; FHWA-SA-12-013; [http://safety.fhwa.dot.gov/provencountermeasures/fhwa\\_sa\\_12\\_013.pdf](http://safety.fhwa.dot.gov/provencountermeasures/fhwa_sa_12_013.pdf) ] road diets as such: *The classic roadway reconfiguration, commonly referred to as a “road diet,” involves converting an undivided four lane roadway into three lanes made up of two through lanes and a center two-way left turn lane. The reduction of lanes allows the roadway to be reallocated for other uses such as bike lanes, pedestrian crossing islands, and/or parking. Road diets have multiple safety and operational benefits for vehicles as well as pedestrians, such as:*

- *Decreasing vehicle travel lanes for pedestrians to cross, therefore reducing the multiple-threat crash (when one vehicle stops for a pedestrian in a travel lane on a multi-lane road, but the motorist in the next lane does not, resulting in a crash) for pedestrians,*
- *Providing room for a pedestrian crossing island,*
- *Improving safety for bicyclists when bike lanes are added (such lanes also create a buffer space between pedestrians and vehicles),*
- *Providing the opportunity for on-street parking (also a buffer between pedestrians and vehicles),*
- *Reducing rear-end and side-swipe crashes, and*
- *Improving speed limit compliance and decreasing crash severity when crashes do occur.*

<sup>4</sup> In Appendix A we list the sources we reviewed for this memo.

## II. Evaluation Framework

An evaluation of the business effects of a road improvement project is much like other evaluation problems in the social sciences. The standard approach is to

1. Establish one or more hypotheses regarding cause and effect; in this case between the implementation of road redesign and business performance.
2. Seek evidence that either confirms or rejects the hypotheses, ideally with methods that control for other factors that are not being evaluated but nonetheless may influence the outcomes of interest.
3. Review existing literature and if feasible conduct experimentation.
4. Conclude with analysis and communication of results.

### How Road Redesign Might Influence Business Performance

Changes in the configuration of a road might influence the performance of businesses along that road in a number of specific ways. The literature shows that changes in the road configuration might permanently alter the following:

- Vehicle traffic volumes in the corridor.
- Non-vehicle trips in the corridor.
- Total number of trips with destinations within the corridor.
- Businesses access.

The construction phase of a road reconfiguration may also have impacts that would not be sustained, that may not be related to the type of reconfiguration, and may not remain after construction is completed.

### Evidence and Analysis

An ideal analysis would isolate the effects of a policy or action by controlling for changes in factors unrelated to the policy or action of interest. This ideal is rarely achieved. Reality is too complex for the analytical tools and budget constraints.

In the social sciences the “gold standard” for experiments includes the following:

- An examination of results from settings with and without the policy or “treatment”; an experimental case and a control case.
- An examination of results both before and after the policy or “treatment” is applied.
- The collection of data that represents revealed behaviors.
- In cases where objective data is not available, carefully designed survey methods may be used to understand perceptions, preferences, and other qualitative factors that help establish general magnitudes or relative magnitudes of effects.

In our review of the available literature we have looked for evidence of the means by which road diets might affect business performance while being mindful of the methods used to obtain this evidence.

### III. Findings

#### Summary of Literature Review

Road reconfigurations may affect retail businesses in a number of ways.

If a road diet changes travel times for motorists then shoppers who travel by car may choose to patronize an alternative, more accessible retailer. Likewise, the accessibility of driveways through left turn lanes may increase visits to businesses. The direct empirical evidence for these effects on business performance is virtually nonexistent.

The empirical evidence for road diets' effects on traffic and safety have been more systematically documented. The magnitude of these traffic and safety effects is typically modest for urban arterials with less than 20,000 ADT. There is evidence from the literature that road diets can produce safety benefits.

There is also evidence that supports the use of road diets as tools for traffic flow management, but results are highly context- and design-specific. Traffic flow benefits may come with overall reductions in ADT. The specific design of intersections and management of turn movements will have an influence on traffic patterns.

Adjusting infrastructure and amenities for cyclists and pedestrians may change visits from cyclists and pedestrians. There is some evidence that walking and bike trips are associated with different business patronage and spending behavior than is associated with vehicle trips. In a number of studies bike and walk trips are associated with more frequent business patronage but with smaller per trip expenditures.

If automobile ADT are reduced by a road diet then visits to retailers along the street may also be reduced. Retailers may, however, sustain visits if ADT reductions are primarily amongst through-travelers or if ADT reductions are matched by increases in bicycle and pedestrian visits. The Draft Plan estimates that “[u]p to 500 vehicles per day may reroute to other roadways,” mostly to Hilyard Street and/or Amazon Parkway. The literature we reviewed does not show that a reduction in total ADT is linked to a reduction in visits to businesses or a reduction of business revenues.

Finally, in some commercial leases there is a clause that will require the adjustment of the lease rate if the ADT changes. If ADT decreases then lease rates likely decrease, if the ADT increases then the lease rates likely increase. These economic consequences will accrue to property owners rather than tenants.

## Similar Street Reconfiguration Projects

**Table 1** lists several road diet projects that are similar in scope, ADT, and urban setting to the proposed South Willamette project. This is not an exhaustive list of comparable road diet projects, but the most relevant sites that have thus far emerged from our literature review.

**Table 1 Streets similar to South Willamette with reconfigurations**

City	Street	ADT <sup>1</sup>	Reconfiguration	Area Type (Urban, Suburban, Rural)	Corridor Type (Commercial, Residential, Mixed)	Project Completed Date
Eugene, OR	Willamette Street	16,500	4 to 3-lane plus bike lanes	Urban	Mixed	N/A
Ashland, OR	North Main Street	18,100-20,700	4 to 3-lane plus bike lanes	Suburban	Mostly Residential	2012
Portland, OR	Division St (60 <sup>th</sup> to 80 <sup>th</sup> )	13,000-18,000	4 to 3-lane plus bike lanes	Urban	Mostly Residential	2013 (August)
Portland, OR	Glisan St (60 <sup>th</sup> to 82 <sup>nd</sup> )	18,000	4 to 3-lane plus bike lanes	Urban	Mixed	2013
Portland, OR	NE Multnomah Blvd	?	5 lanes with bike lanes to 3 lanes with bike lanes plus buffers/parking	Urban	Commercial	2013
Portland, OR	SE Holgate (East of Hwy 205)	15,305	5 lanes to 3 lanes with buffered bike lanes	Urban	Mixed	2009
Seattle, WA	Nickerson Street	18,500	4 to 3-lane plus bike lanes plus parking	Urban	Mixed	2010
Seattle, WA	Phinney Ave (N. of 51 <sup>st</sup> )	?	4 to 3 lane plus bike lanes plus parking	Urban	Mixed	2006
Seattle, WA	Stone Way N	13,300	4 to 3 lane plus bike lanes plus parking	Urban	Mixed	2007
Seattle	NE 125th St	16,200	4 to 3-lane plus bike lanes	Urban	Mostly Residential	2011
Vancouver, WA	Fourth Plain Boulevard	17,000	4 to 3-lane plus bike lanes	Suburban	Commercial – nearby residential	2002

<sup>1</sup>ADT figures, where available, are pre-road reconfiguration.

As a part of this project, we considered developing one or more case studies to describe the economic effects of the street reconfiguration in one of the corridors shown in Table 1. We think the information most likely to result from such a case study is additional qualitative information about the effects of the street reconfiguration on businesses, as well as information and ideas for how to implement a reconfiguration to impact businesses least. Through discussions with stakeholders and City staff, we concluded that this additional information did not justify the cost of conducting case studies.

## V. Literature Review Details

### Traffic and Economic Performance

The relationships between traffic, traffic congestion, and economic performance are well documented. Road reconfigurations may affect business bottom lines in several ways: longer queues and slower travel times may lead some consumers to opt for a more accessible alternative; longer travel times and narrower lanes may make it more expensive for delivery trucks to deliver goods to a business and thereby increase the cost to the business; and traffic delays may increase the cost incurred by employees when traveling to work. As a result, road reconfigurations may lead to increased transportation costs, which could increase the cost of production and decrease the quantities produced.<sup>5</sup> There are a couple of key conclusions from the literature:

- Firm location and performance are linked to transportation costs, which is consistent with the basic principles of location theory.<sup>6,7</sup> In the case of retail firms, transportation costs are borne in part by customers as they access retail businesses.<sup>8</sup>
- Researchers of Chicago and Philadelphia found that traffic congestion shrinks business market areas and reduces the chances of “agglomeration economies,” in turn raising production costs. This research, however, looked at large-scale, highway traffic congestion as opposed to increased traffic on a single, local road like South Willamette.<sup>9</sup>

The general framework that treats transportation costs as an input into the production process is the basis for understanding the potential economic consequences of adopting road diets.

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<sup>5</sup> The economic literature on this topic is summarized in Goodwin, Phil. 2004. "The Economic Costs of Road Traffic Congestion." *ESRC Transport Studies Unit – University College London*.

<sup>6</sup> Thünen, Johann Heinrich von. 1783–1850. *Der Isolierte Staat in Beziehung auf Landwirtschaft und Nationalökonomie, oder Untersuchungen über den Einfluss, den die Getreidepreise, der Reichtum des Bodens und die Abgaben auf den Ackerbau ausüben, Vol. 1.*, and *Der Isolierte Staat...*, Vol II: *Der Naturgeässe Arbeitslohn und dessen Verhältnis zum Zinsfuss und zur Landrente, Part 1* (Partial translation into English by Carla M. Wartenberg in 1966 as *Isolated State*. New York: Pergamon Press.)

<sup>7</sup> Weber, Alfred. 1929. (translated by Carl J. Friedrich from Weber's 1909 book). *Theory of the Location of Industries*. Chicago: The University of Chicago Press.

<sup>8</sup> Hotelling, Harold. 1929. "Stability in Competition." *The Economic Journal*, 39 (March), 41-57.

<sup>9</sup> Weisbrod, Glen et al. 2003. "Measuring Economic Costs of Urban Traffic Congestion to Business." *Transportation Research Record: Journal of the Transportation Research Board* 1839, no. 1.

## Road Diets

Road diets may consist of a wide range of traffic reconfigurations. In general, a road diet will include a reduction of motor traffic lanes along with other traffic calming measures, such as crosswalks. The primary focus of most road diet studies is the effect that a road diet has had on safety, travel times, and traffic speeds. In general, studies in this field conclude that road diets reduce speeds and crashes while increasing travel times. The benefits from speed and crash reductions are typically found to outweigh the costs of increased travel times, but these net gains are typically only realized in situations where total ADT are below 20,000 and are subject to context-specific factors and conditions. An FHWA report<sup>10</sup> links road diets with reductions in crashes and injuries.

Road diet studies that measure the effect of road diets on retail sales are typically survey based and/or have been implemented in large cities. Quantitative studies use sales tax data to measure the effect of road diets on retail performance. For example, recent research in New York City attempted to develop new metrics to measure the economic impacts and effects of street reconfigurations. These studies found that protected bike lanes, dedicated bus lanes, and other “sustainable” traffic reconfigurations were positively associated with sales tax revenues and negatively associated with commercial vacancies.<sup>11</sup> Oregon, unfortunately for research purposes, does not have sales tax data with which to complete this type of research.

## Before and After Studies

Most studies of road diets focus on the traffic statistics on a stretch of road before and after road diet implementation. These studies sometimes describe the effects that the road diet had if all other things are held constant.

In one study qualitative and quantitative data allowed researchers to determine the effects from road diet adjustments on York Boulevard in Los Angeles. They found that there were no “meaningful linkages between the presence of a road diet and changes in economic conditions.”<sup>12</sup>

A report on the performance of Main Street in Ashland, Oregon found that the road reconfiguration outperformed what was projected in terms of traffic speeds, queue lengths and intersection LOS and in many instances represented an improvement over the baseline conditions.<sup>13</sup>

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<sup>10</sup> US Department of Transportation - Federal Highway Administration. 2004. "Evaluation of Lane Reduction "Road Diet" Measures and Their Effects on Crashes and Injuries."

<sup>11</sup> New York City Department of Transportation. 2013. "Measuring the Street: New Metrics for 21st Century Streets."

<sup>12</sup> McCormick, Cullen. 2012. "York Blvd: The Economics of a Road Diet." University of California Los Angeles.

<sup>13</sup> Faught, Mike. 2013. "Re: Post Road Diet Assessment - January through October." City of Ashland - Public Works.

Stantec consulting collected economic data of businesses along two corridors in downtown Vancouver, BC where single bike lanes were converted to separated bike lanes. In each case business owners reported reductions in sales (-10%, -4%) and customers reported similar reductions in visits to the area. The reasons customers reported for the reductions were traffic congestion, less parking, turning restrictions, and reduced pedestrian safety.<sup>14</sup> The dense Vancouver downtown area is likely not comparable to South Willamette.

Of the three DKS case studies<sup>15</sup> only the Vancouver, WA study attempted to describe the economic impacts or effects of the road diet project. The Vancouver study found that businesses along the road diet street “faired [sic] no worse than its peer areas” in 2002-2003, when the city experienced a general recession. The reconfigured Fourth Plain Street had a 4.7% decrease in “taxable retail sales” compared to 9.8% and 25.0% reductions at two comparison commercial zones. The only two customer complaints to the city that referred to the reconfiguration concerned traffic signal timing.

Based on data from two bicycle lane installations in Seattle, Rowe used paired comparisons to show that the addition of bike lanes had, in one case, a negligible effect on business revenues and in the other a positive impact on business revenues.<sup>16</sup> The limited number of cases and the aggregation of sales tax data within each business district, however, seriously limit the strength of the conclusions.

## Surveys and Opinion Research

Other studies attempt to understand businesses performance through the use of business or consumer surveys. Surveys can be used to understand a respondents’ impressions of the usefulness of road improvements, business performance, and consumer behavior.

A survey study of North Main Street in Ashland found that ¾ of businesses said that the road reconfiguration had no effect on their business. The majority of the remaining ¼ mostly reported that deliveries to their location were negatively affected.<sup>17</sup>

Eisele and Frawley found that business perceptions of what the effects of a new raised median would be before the addition were larger than the actual effects of the new median.<sup>18</sup>

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<sup>14</sup> Stantec Consulting Ltd. 2011. "Vancouver Separated Bike Lane Business Impact Study."

<sup>15</sup> 2004. "Nickerson Street Rechannelization before and after Report."; City of Orlando - Transportation Planning Bureau. 2002. "Edgewater Drive before & after Re-Striping Results."; City of Vancouver - Transportation Services, "Fourth Plain Boulevard Demonstration Re-Striping Project - Post Implementation Report."

<sup>16</sup> Rowe, Kyle. 2013. "Bikenomics: Measuring the Economic Impact of Bicycle Facilities on Neighborhood Business Districts."

<sup>17</sup> Faught, Mike. 2013. "Re: Post Road Diet Assessment - January through October." City of Ashland - Public Works.

<sup>18</sup> Eisele, William and William Frawley. 2000. "A Methodology for Determining Economic Impacts of Raised Medians: Final Project Results." Texas Transportation Institute, Texas A & M University System.



A survey study completed in the Portland area found that cyclists spent more than automobile consumers at restaurants, drinking establishments, and convenience stores. Motorists spent more than cyclists at supermarkets.<sup>19</sup>

Similar survey research completed in New York's East Village found that pedestrians and cyclists spent more per capita per week than motorists.<sup>20</sup>

A survey study of Polk Street in San Francisco found that motorists spent more per *trip*, but pedestrians and cyclists spent more per *week* by taking more trips to retailers than drivers.<sup>21</sup>

## Property Access and Business Performance

The literature related to how property accessibility and access management influence business performance is also limited. The report by Eisele and Frawley, referenced earlier, found that business perceptions of the effects of a new raised median were larger than the actual effects.<sup>22</sup>

A report prepared for the Washington State Transportation Commission examined the relationship between business perceptions of access management and business perceptions of their own performance.<sup>23</sup> Findings from this study include:

- Retail services establishments are less inclined than other retail establishments to see a relationship between access management and business performance.
- Businesses that already have good access from the main corridor are more likely to perceive a relationship between access restrictions and business performance.
- Larger businesses (more than 10 employees) are more likely to see a relationship between access management and business performance. Larger businesses are also more likely to be concerned about access restrictions.
- Two-way turn lanes, as compared with factors that directly effect site accessibility, are not perceived to have an influence on business performance.
- The overall level of congestion within the corridor is perceived to have a more significant influence on business performance than site accessibility and access management.

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<sup>19</sup> Clifton, Kelly et al. 2013. "Consumer Behavior and Travel Mode Choices." Oregon Transportation Research and Education Consortium.

<sup>20</sup> Transportation Alternatives. "East Village Shoppers Study."

<sup>21</sup> San Francisco Municipal Transportation Agency. 2013. "Polk Street Intercept Survey Results."

<sup>22</sup> Eisele, William and William Frawley. 2000. "A Methodology for Determining Economic Impacts of Raised Medians: Final Project Results." Texas Transportation Institute, Texas A & M University System.

<sup>23</sup> Vu, Patrick et al. 2002. "Economic Impacts of Access Management." Washington State Department of Transportation and TRAC.

## Appendix A: Literature Reviewed

This appendix presents the articles reviewed by ECONorthwest in this project. It includes a brief summary of the report and an assessment of how the article fits into the economic analysis. Our review of articles focused on economic issues directly related to the effects of street redesign on businesses.

Title	Author(s)	Year	Summary	Notes	Relevant to the Economic Study?
Complete Streets Spark Economic Revitalization	Complete Streets Steering Committee Organization		2-page summary of the economic revitalization that many areas have experienced after implementing complete streets programs.		Yes
Consumer Behavior and Travel Mode Choices	Clifton et al	2013	Research based in the Portland metro area. Supermarkets had the highest share of private vehicle use, 86%; drinking places had the lowest, 43%; high-turnover restaurants, 64%; and convenience Stores, 59%. Automobile consumers were found to spend more per trip, but not statistically different amounts on a monthly basis (ie, they took fewer trips than other modes). Bikers spend more each month than automobile drivers at restaurants, drinking establishments, and convenience stores. Directness and connectivity were a significant predictor of someone choosing bicycle mode of transportation.		Yes
Re: Post Road Diet Assessment - January through October	Faught, Mike	2013	The road reconfiguration was found to outperform what was projected in terms of traffic speeds, queue lengths and intersection LOS and, in many instances, represented an improvement over the baseline conditions.		Yes

Title	Author(s)	Year	Summary	Notes	Relevant to the Economic Study?
The Economic Benefits of Sustainable Streets	NYDOT	2013	Follows up on the 2012 Measuring the Street study to update metrics to accurately measure the impacts of street revitalization. Has a lit review and makes the case that street improvements and traffic calming increase the number of shoppers, revenue, and property values. Also points out that businesses are typically opposed to projects beforehand. Provides a summary of the biases present in the 2011 Stantec report. NYDOT, with consultants, developed their own metric which includes retail sales tax filings, commercial leases and rents, and city-assessed market value. Methods included paired comparisons between sites and boroughs, and other comparisons between sites other similar sites within the neighborhood. Evaluated the addition of street corridors and plaza on retail trade and food businesses over two years before and after a project. Offers several lessons for doing this type of research in the future. Includes 3 Manhattan, 2 Bronx, and 2 Brooklyn Case studies.	The setting is not comparable to S Willamette, but the methods and results are useful. Oregon doesn't have a sales tax so that data would not be available.	Yes
Bikenomics: Measuring the Economic Impact of Bicycle Facilities on Neighborhood Business Districts	Rowe, Kyle	2013	Concludes that the addition of bicycle lanes did not have a negative impact on business districts.		Yes
Polk Street Intercept Survey Results	SFMTA	2013	Focuses on consumer spending by mode of transportation to the region. Cars spent more per trip than cyclists, peds, and transit, but motorists also had lower per week spending than all three other travel types.		Yes
Rethinking Streets: An Evidence-Based Guide to 24 Complete Streets Transformations	Rowell & Schlossberg	2013	Includes numerous qualitative results, mostly from survey data, about the effect that road diets have had on traffic and businesses. Provides some theoretical guidance on how street design and traffic speed affects business placement relative to the street and other business choices. Includes some discussion of sales tax revenues and property values in a before-after context, but only provides summary results; no detailed metrics. Offers several potential case-study sites.		Yes

Title	Author(s)	Year	Summary	Notes	Relevant to the Economic Study?
York Blvd: The Economics of a Road Diet	McCormick, Cullen	2012	A study of York Blvd, Los Angeles. Relies on qualitative and quantitative data. Most businesses presumed that their customers arrived by car, but these notions were mistaken. Business turnover road diet v non-road diet 55% v 62%; did not find statistically different property values; non-road diet areas had a higher growth rate in revenues, but road diet portions had a higher absolute increase in revenues. In sum, "The quantitative analyses in this report do not reveal meaningful linkages between the presence of a road diet and changes in economic conditions."		Yes
Measuring the Street: New Metrics for 21st Century Streets	NYDOT	2012	For the first protected bike lane in the US, 8th and 9th avenues in Manhattan, found that locally-based business on 9th from 23rd-31st had "up to 49% increase in retail sales" compared to a 3% increase borough wide. There was also "49% fewer commercial vacancies" compared to 5% borough-wide. In regards to dedicated lanes for buses and bike on 1st and 2nd Avenues in Manhattan: 47% fewer commercial vacancies compared to 2% borough-wide.	Seemingly useful measures, but the source of data and methods are unclear.	Yes
Vancouver Separated Bike Lane Business Impact Study	Stantec Consulting	2011	Collected business economic data to measure the impacts of 2 bike lanes. The net impact on sales at businesses adjacent to the bike lanes was -10% and -4%, respectively. Business owners estimated losses to be between -6% to -9%. These losses were found to be insufficient to create persistent vacancies. Customers reported comparable reductions in visiting the two areas; the reasons for these reductions were traffic congestion, less parking, turning restrictions, and reduced pedestrian safety. Provides a list of recommended mitigation measures, but many of these are specific to a dense downtown area.	This is a different type of conversion than that proposed for S Willamette. Downtown Vancouver is not be comparable to S. Willamette.	Yes
Fourth Plain Boulevard Demonstration Re-Striping Project - Post Implementation Report	City of Vancouver - Transportation Services	2004	DKS Case Study. Estimated "taxable retail sales" in the area. The study found that the area fared no worse than its peers and in 2002-2003, the last year of the study, the area faced a 4.7% decline in revenues versus 9.8% and 25.0% declines in other nearby commercial zones. 2 consumer complaints were made that regarded traffic signal timing.	The source of the data was the Washington State Department of Revenue.	Yes

Title	Author(s)	Year	Summary	Notes	Relevant to the Economic Study?
The Economic Costs of Road Traffic Congestion	Goodwin, Phil	2004	Summarizes the academic literature on the relationships between traffic, traffic congestion, and economic performance.		Yes
Evaluation of Lane Reduction "Road Diet" Measures and Their Effects on Crashes and Injuries	USDOT - FHWA	2004	Looked at 24 comparison sites in California and Washington. "On average, crash frequencies at road diets in the after period were approximately 6 percent lower than at the corresponding comparison sites." Road diets, however, did not have an effect on crash type or crash severity, but this study did not account for speed at the time of crash.	Cited on the 4 lanes 4 Willamette Facebook page.	Yes
Economic Effects of Traffic Calming on Urban Small Businesses	Drennen, Emily	2003	Drennen interviewed 27 merchants in the Mission District about Valencia Street bike lanes. 44.4% said economic revitalization was "Better", 0% said it was "Worse." 46.2% said reduced auto speeds had a "Better" effect on sales, 7.7% said it was "Worse." 37% said sales were "Better," 0% "Worse" .... and several other useful results (page 46). Categorizes the benefits that small businesses get from "traffic calming" efforts and provides examples for each: Economic Revitalization and Property Values; Attractiveness and Safety; Sales and Attracting Customers; Parking; Impact on Employees; Construction and Costs. Customers who drive less also have more disposable income.	This neighborhood in San Francisco is likely not comparable to S Willamette.	Yes
Measuring the Economic Costs of Urban Traffic Congestion to Business	Weisbrod et al	2003	Found that each sector if affected in different ways by congestion, as each relies on freight, customers, etc. road use to different degrees. Impacts also depend on location (e.g., industrial v. downtown). Losses are not put in a per-minute drive time or per-day metric.	Findings are specific to "large urban areas," such as Chicago and Philadelphia	Yes
Economic Impacts of Access Management	Vu et al	2002	Examined the relationship between business perceptions of access management and business performance. Has various interesting results, including that retail services establishments are less inclined than other retail establishments to see a relationship between access management and business performance.		Yes

Title	Author(s)	Year	Summary	Notes	Relevant to the Economic Study?
A Methodology for Determining the Economic Impacts of Raised Medians: Final Project Results	Eisele & Frawley	2001	Survey-based research. Found that business perceptions of business impacts prior to the project were worse than actuals. Negative impacts were found during the construction phase.		Yes
Traffic Calming Benefits, Costs and Equity Impacts	Litman, Todd	1999	Provides a framework for doing a cost benefit analysis or road diet projects. Monetizes many costs and benefits that aren't monetized elsewhere. Provides an example of Bridgeport Way where tax revenues increased in the years after a road diet relative to tax revenues from the whole city.		Yes
East Village Shoppers Study	Transportation Alternatives		Surveyed 420 pedestrians. Peds and bikers spend more per capita per week at local businesses and visit the neighborhood more often than car and subway users. Recent additions of bike lanes increased bike use dramatically. 73% of respondents said the lanes had a positive or very positive impact on the neighborhood.	East Village New York is not comparable to S Willamette.	Yes
Trends in Local Business Sales, Building Values, and Office Rents at NYCDOT Street Improvement Project Sites	Bennett Midland		Evaluated the effects on business sales following various types of street improvements including medians, bike lanes, traffic pattern alterations, and creation of new public spaces. At 8 of 11 sites (73%) business sales increased at a greater rate than at comparison areas. At 9 of 11 sites sales increased in the first year after improvements. The projects may have promoted economic growth. Commercial building values increased at 4 of the 6 sites with available data.		Yes
Nickerson Street Rechannelization Before and After Report	(see DKS report)	(see DKS report)	DKS Case Study. Speeding and collisions down significantly after the road diet. Change in total average weekday volume was negligible, about a 1% reduction. No business impacts are discussed.		Yes, but mostly because DKS cited this
Edgewater Drive Before & After Re-Striping Results	City of Orlando - TPB	2002	DKS Case Study. 34% reduction in crashes. 68% reduction in injuries. Significant reductions in speeding. And other traffic results. No business impacts are discussed.		Yes, but mostly because DKS cited this

Title	Author(s)	Year	Summary	Notes	Relevant to the Economic Study?
Bike Lanes, On-Street Parking and Business	The Clean Air Partnership	2009, 2010	Survey research of drivers, pedestrians, and cyclists to a commercial neighborhood in Toronto. Found that most businesses and customers consider the shift towards more walkability and bikability to be advantageous.	Downtown Toronto is not comparable to S Willamette.	No
The Path to Complete Streets in Underserved Communities	Clifton et al		Conducts four case studies about getting complete streets in underserved communities.	Advocacy - complete streets implementation guidance	No
Road Diet Seminar	Daisa		Provides an overview of road diet practices, where the policies are most suitable, and the typical effects on traffic patterns and crashes. Not much on business impacts.		No
Road Diet Handbook - Overview	Rosales, Jennifer		Provides a number of case studies of road diets. Does not include much information on effects on businesses, but does cite a Vancouver case where sales increased when compared to similar, non-road diet sites in the area.		No
Transportation and The Economy	SACTRA		Provides a lot of theoretical guidance. Euro-centric. Chapter 7 focuses on how traffic reductions may affect economies. Focuses on taxation and other policies as means to reduce congestion.		No
RE: Fire/EMS Input on "Road Diet" Projects	Kingsbury, Dwight	2013	Kingsbury is the FDOT Safety Officer in Tallahassee, FL. This memo argues that a 3-lane reconfiguration may <i>improve</i> EMS response over 4-lane configurations.	A contribution to the discussion of EMS delays.	No
Evaluating Complete Streets	Litman, Todd	2013	Mostly advocacy, but Table 7 provides a guide to quantification of often overlooked impacts.		No
From Policy to Pavement: Implementing Complete Streets in the San Diego Region	Bleir et al	2012	Mostly advocating for Complete Streets in San Diego, but this article does lay out the range of benefits that stem from Complete Streets including branding and revitalization of commercial districts		No
Walk this Way: The Economic Promise of Walkable Places in Metropolitan Washington, DC	Leinberger & Alfonzo	2012	Found that a 1-level increase in the walkability index (IMI) resulted in higher average office and retail rent per sq ft, higher retail sales, higher res rents, and average home values.	DC neighborhood is not comparable to S Willamette.	No

Title	Author(s)	Year	Summary	Notes	Relevant to the Economic Study?
Safety and Operational Analysis of 4-lane to 3-lane Conversions (Road Diets) in Michigan	Lyles et al	2012	Finds that diets for areas with ADTs over 10K face significant delays, but this mostly applies to sites with peak hour volumes above 1000 (which doesn't appear to apply to S. Willamette). One appendix has a detailed literature review.	Cited on the 4 lanes 4 Willamette Facebook page. There are several appendices that compliment the report, which may require further attention. Not applicable to question of business revenues.	No
38th Avenue Corridor Plan Implementation	Showalter, Sarah	2012	Includes a simple before and after measure of sales tax revenue		No
Methodology for Determining the Economic Development Impacts of Transit Project	TCRP - TRB	2012	Focuses on travel time savings, costs of construction, environmental impacts, effects on land development, and effects on agglomeration economies. It is one of the first studies to look at the later, or so it claims. Does not focus on business impacts		No
New Tool for Estimating Economic Impacts of Transportation Projects: Transportation Project Impact Case Studies	TRB	2012	Focuses on highway expansion. Not applicable to impacts of changes to city streets.		No
Valencia Street traffic poses risk to cyclist	Huet, Ellen	2012	Cars veering for parking spots or to double-park force cyclists to swerve into traffic. "Enforcement seems to be lacking when it comes to double-parking in bike lanes along Valencia Street, where bicyclists sometimes are forced to take potentially dangerous evasive action."	Parking and double-parking are not and would not be issues on S Willamette.	No
The Relationship of Transportation Access and Connectivity to Local Economic Outcomes: A statistical Analysis	Alstadt et al	2011	This article asks many useful questions: how does transportation infrastructure affect delivery of product inputs, labor market access, and customer access. But the analysis is on a county-level rather than a street or neighborhood level.	Presented at a conference, appears to be unpublished.	No



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Washington's Complete Streets and Main Street Highways Program: Case Studies and Practice Resource	Nicholls et al	2011	Mostly advocacy and general description of what the WA Complete Streets program does.		No
Complete Streets	American Planning Association	2010	Has excerpts about complete streets programs from several sources.		No
Final Report for Secretary Department of Transportation and Development	Burk-Kleinpeter, Inc.	2010	Summarizes the costs and benefits of complete streets.	No empirics. Sites included are not comparable to S Willamette.	No
Evaluating Transportation Economic Development Impacts	Litman, Todd	2010	Mostly theoretical guidance on how to measure the economic impacts of transportation projects.		No
Generated Traffic and Induced Travel	Litman, Todd	2010	See other Litman articles. This is mostly about how to value consumer surplus of transportation shifts and does not touch on businesses impacts.		No
Maximizing the Economic Returns of Road Infrastructure Investment. Chapter 3: The Relationship Between Road Infrastructure Investment and Economic Development	Joynt, Hubert	2009	Theoretical guidance.		No
Economic Impact of Traffic Incidents on Businesses	Khattak et al	2008	Focused on North Carolina's interstate highways. Found a significant cost per hour of delay for crashes, but this cost varied by type of business. Did not focus on demand-side delays, just supply-side. Retail cost was \$156/hr. of delay.	Not comparable to S Willamette.	No

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Portland's Green Dividend	Cortright - CEOs for Cities	2007	Makes the argument that Portlanders save money by not using cars as frequently as others, which leaves them with more money to spend in the local economy. Car and gas money also leaves Oregon immediately. No other business impact discussion.		No
Economic Impact of the Public Realm	ECOTEC	2007	Includes several case studies of public realm projects and their economic impacts in Europe.		No
New York City, New York Municipal Forest Resource Analysis	Peper et al	2007	Mostly non-applicable - cited in NYDOT 2013 paper - but p. 59 has a discussion of the effect that additional trees have on property values and other factors. People are willing to pay 3-7% more for properties with ample trees versus no trees.	If significant planting happens along S Willamette then this can add value to properties	No
Progress and Challenges in the Application of Economic Analysis for Transport Policy and Decision Making	Weisbrod & Alstadt	2007	Discussion paper on the interaction between transportation and economic modeling.		No
Curbing Cars: Shopping, Parking and Pedestrian Space in SoHo	Schaller Consulting	2006	Conducted 1,000 interviews of pedestrians and motorists. Concluded that most wanted less parking space and more pedestrian space. Also asked about spending patterns.	Not comparable to S. Willamette.	No
Hawthorne may not pass three-lane test	Shearer, Lee	2005	Hawthorne drive in Athens Georgia failed traffic tests. "By 2015, a three-lane design would cause longer than desirable traffic delays ... although traffic delays also will be unacceptably long if the road remains four lanes..." because traffic is expected to increase from significantly by 2015.	This article is about how a specific context is not suitable for a 3-lane conversion.	No
The Economic Impact of Investments in Bicycle Facilities: A Case Study of the Northern Outer Banks	Lawrie et al - NCDOT	2004	Survey research to measure the impact of significant investment in bicycling infrastructure. Mostly focuses on tourists and found that bicycle access was much of the reason some tourists visited an area. Investment in bicycling infrastructure was found to pay dividends.	Not applicable, but might be useful in determining the money cyclists bring to an area.	No
How Much Do You Lose When Your Road Goes on a Diet?	Huang et al	2003	Focuses on crashes. Finds no significant impact of road diets on crash rates.		No

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Urban Minor Arterial Four-Lane Undivided to Three-Lane Conversion Feasibility: An Update	Knapp et al	2003	Researches the traffic effects of 4-3 lane conversion. Based on simulations, recommends that areas with peaks under 750 vphpd will see few impacts. Those from 750-875 require caution in implementing a conversion. The authors express a lot of concern for those above 875 vphpd. Most simulations had a significant reduction in speeders.		No
Willamette Street Traffic Analysis	McKenney Engineering	2001	Previous evaluation of improvement alternatives for same stretch of Willamette	May be a useful comparison to DKS report.	No
A Comparative Analysis of Bicycle Lanes Versus Wide Curb Lanes: Final Report	USDOT - FHWA	1999	Summarizes the trade-offs between wide sidewalks and bike lanes.	Useful in comparing alternatives 3 and 5 of DKS report.	No
PPS Right Sizing Case Studies			There's several case studies here. None address economics. They all address volumes, crashes, etc.		